FORESTRY QUARTERLY

VOLUME X

PUBLISHED UNDER THE DIRECTION
OF A
BOARD OF EDITORS

With Seven Plates, Five Cuts and Three Diagrams

ITHACA, N. Y.
1912

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

To offer an organ for the publication of technical papers of interest to professional foresters of America.

To keep the profession in touch with the current technical literature, and with the forestry movement in the United States and Canada.

Manuscripts may be sent to the Editor-in-Chief at the University of Toronto, Toronto, Canada, or to any of the board of editors.

Subscriptions and other business matters should be addressed to Forestry Quarterly, Ithaca, N. Y.

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Volume X No. 1

FORESTRY QUARTERLY

A PROFESSIONAL JOURNAL

Subscription Two Dollars per Annum

CAMBRIDGE (BOSTON), MASS.
1912
Entered as second-class matter September 28, 1909, at the post office at Boston, Mass., under the Act of March 3, 1897.

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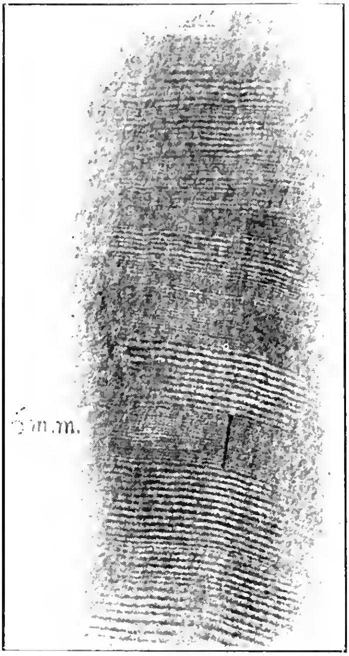
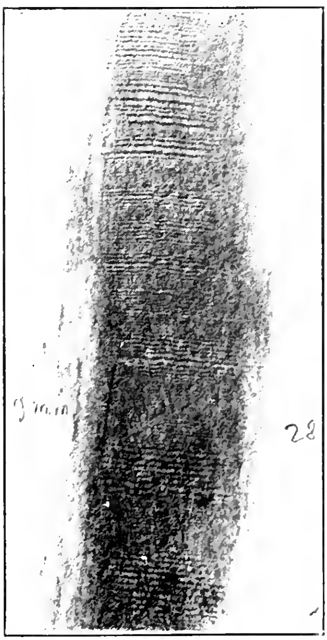
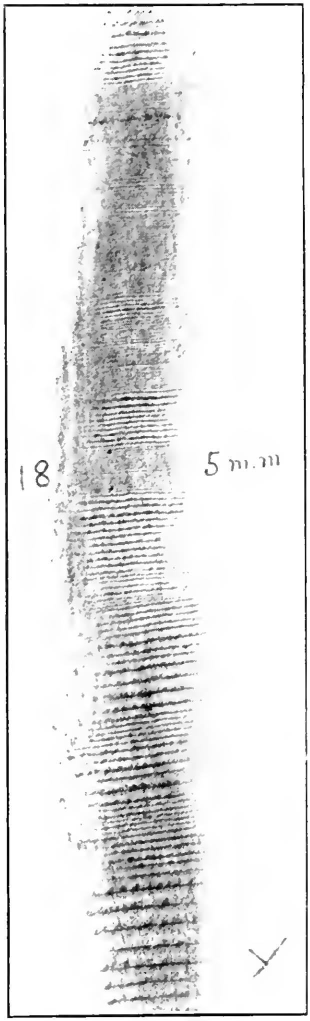
Press of
WATCHMAN PRINTING HOUSE
Bellefonte, Pa.
1911







Studies in Definition by Higgs Process.

FORESTRY QUARTERLY

VOL. X] MARCH, 1912. [NO. 1.

METHOD OF TAKING IMPRESSIONS OF YEAR-RINGS IN CONIFERS.

BY L. S. HIGGS.

This method, developed by the writer, is easy, quick, and efficient in field-work. The articles required are a little soft graphite, a stencil-brush, and some strips of heavy white blotting-paper with a fine grain, and a hammering tool. The writer ordinarily uses Rising Sun Stove Polish and the Nestor brand of paper. The pole of the cruising-axe, if kept smooth, may be used as a hammer.

A rule is laid upon the mean radius of the section, and a line is scratched lightly along it with the point of a knife. This line will show on the back of the paper as a guide to the direction of the hammering. Graphite is now rubbed lightly along the line to the required width, and brushed in. It is useful as a lubricant to prevent the paper sticking to pitch or sap, and to give definction to the records by daylight. If neatness of execution be desired, all superfluous graphite must be carefully blown or brushed away.

A strip of paper is laid upon the line, held firmly in place, and tapped with the hammer, preferably from the centre towards the circumference. Care must be taken to proceed and finish in one direction, and not to return upon finished work, because the paper stretches a trifle with the tapping, and among rings of fifty or sixty to the inch, a second blow is apt to blur the definition. The scratched line will appear under the hammer as the tapping proceeds, and will give the desired direction. Two minutes work will give an excellent impression of a thirty-inch section.

The records are most easily read by artificial light, incident at as oblique an angle as possible, and with the centre of the tree nearest to the source of light.

In Douglas Fir the writer has obtained in this manner an excellent definition of rings as close together as eighteen to five millimeters, or nearly one hundred to the inch. And records quite good enough for ordinary work may, if necessary, be taken with blotting-paper and a smooth stone.

With artificial and correctly oblique illumination, graphite, as an aid to definition, may be dispensed with, there being nothing to better the effect of the contrast of light and shade upon the white paper.

If it should be desired to make the records permanent they may be dipped in diluted shellac and dried, when they become as hard as the wood of the original, and from them any number of carbon copies may be taken. The shellac destroys a higher definition than from sixty to seventy rings to the inch, and it is to be supposed that a finer varnish, such as copal or mastic, would be preferable. These the writer has not had an opportunity of trying.

Thus all the data necessary to enable one to compute the growths of diameter, height, and volume, may be taken from an ordinary tree, (say 24 inches by 100 feet) in 10-foot sections, in fifteen or twenty minutes; and the curves may be blotted in the office directly from the impressions.

The records of each tree, or group of trees, may be filed away in an envelope; and the impressions of the ideal or average tree of his age, height, and diameter, may be made permanent and filed for reference.

Impressions of full sections may be made, if needful or desirable, in an ordinary copying press.

If the method should come into general use, a paper with an inclastic, and perhaps water-proof backing rolling on to it would seem to be indicated.

NEW TOOLS FOR TRANSPLANTING CONIFERS.

By Wm. H. Mast.

Owing to the increasing interest in forest planting with the consequent demand for great numbers of trees for planting on private and National Forest land there comes a pressing need for improved tools and methods for producing and planting trees.

For several years the writer was in charge of the Halsey Nursery on the Nebraska National Forest where hundreds of thousands of coniferous seedlings and transplants were handled annually. To insure the most rapid and effective handling of these trees he was on the constant lookout for ways of improving the tools and methods used.

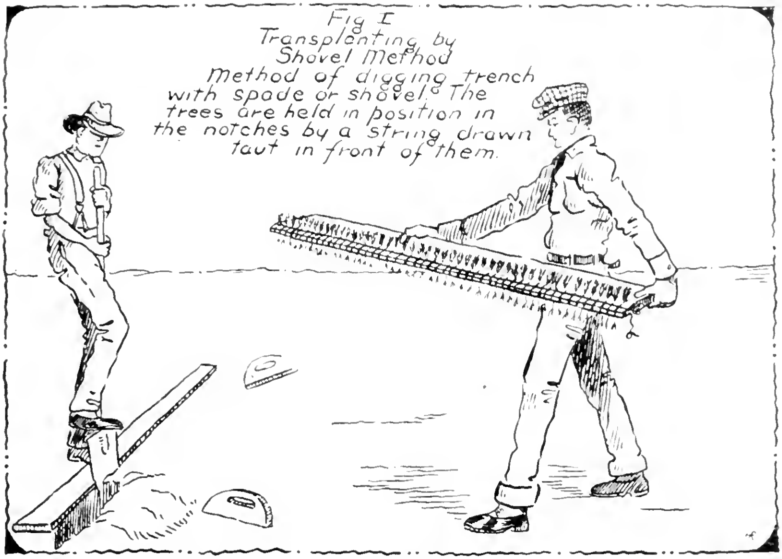
In the summer of 1907 he visited several of the largest commercial nurseries in the middle west for the purpose of collecting information in regard to methods of growing and handling coniferous nursery stock. It was found that in some nurseries large numbers of one and two year old conifers were pricked out of the seedbeds and set in transplant beds with the dibble. At some places trenches were dug with one side vertical, the seedlings placed against the vertical side and the dirt shoveled in against them, the proper spacing being effected either by the laborer placing the trees with his fingers, or by setting them in notches in a board on the surface of the ground at the vertical side of the trench. Sometimes the trees were threaded into a notched board two or three feet long and a narrow slat or lath held against the front of the board to prevent them from falling out while it was carried and placed on the edge of the trench. Large trees were lined out into nursery rows by the slit method.

At this time there was in use in the Halsey's Nursery a planting board of the German pattern. This board consisted of two notched slats hinged together in such a manner as to allow one slat to be drawn a couple of inches away from the other with a sliding motion giving the operator space to thread the trees into the notches after which he closed the slats together again to hold the trees in position while the board was placed on the edge of the trench. The digging of a trench by hand was slow and laborious; so a sled-like implement consisting of one deep runner nosed with iron to make a trench and one shallow runner to serve as a marker, was made and drawn by a horse. This reduced the labor of digging the trench, but necessitated the planting of long nursery rows, and precluded the possibility of placing these in neat compact beds. In connection with the sled-trencher planting boards about 5 feet long and made similar to that described below were used.

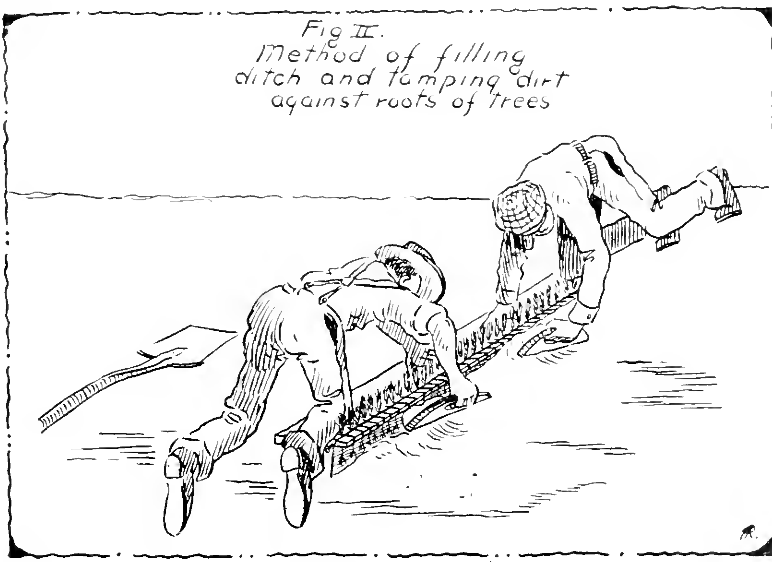
In the spring of 1908, there was an unusually large number of trees to be transplanted and the advisability of putting these into a small area that could be easily watered made the use of the implements and methods formerly employed wholly unsatisfactory. The attempt to devise better tools resulted in those described below.

The Trencher.—The trencher is commonly spoken of at the Halsey Nursery as the "hand trencher" to distinguish it from a trencher drawn by horses and devised for field planting. The hand trencher consists of two plates of steel seven inches wide and 26 inches long welded together along one edge and drawn out to a thin cutting blade. The opposite edges of these plates are separated about 1 inch allowing space into which three pieces of three-fourth inch pipe slightly flattened are inserted and rivetted. One piece of pipe is inserted in the center and the other two at two and one-half inches from the ends of the plates. All are brought together in a cross or 4-way pipe-connection, 8 inches above the plates. Into the upper opening of the cross, a piece of pipe 20 inches long is fitted supporting a tee into which 6 inch pieces of pipe are screwed forming a complete T-handle. To obviate a second bending of the pieces which extend from the ends of the blade to the handle, nipples and angle connections may be used as shown in the drawing and photograph. The trencher weighs from 18 to 24 pounds depending on the thickness of steel used in the blade and should be made by any blacksmith at a cost of from $3.00 to 5.00.

To make a trench the trencher is put in proper position and weight put on it by placing the foot on the top of the blade. The operator then works the handle to and from his body as the blade sinks into the soil making a trench about two and one-half inches



Use of Transplanting board for transplanting one & two year old seedlings.



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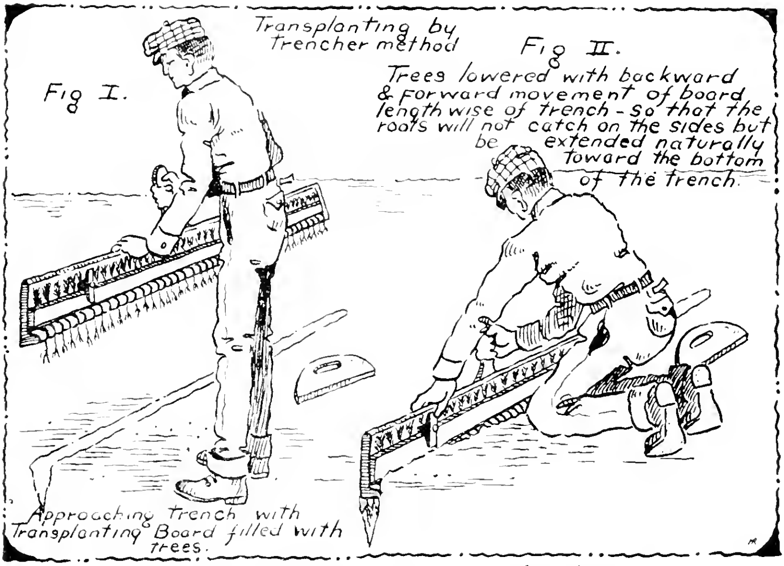

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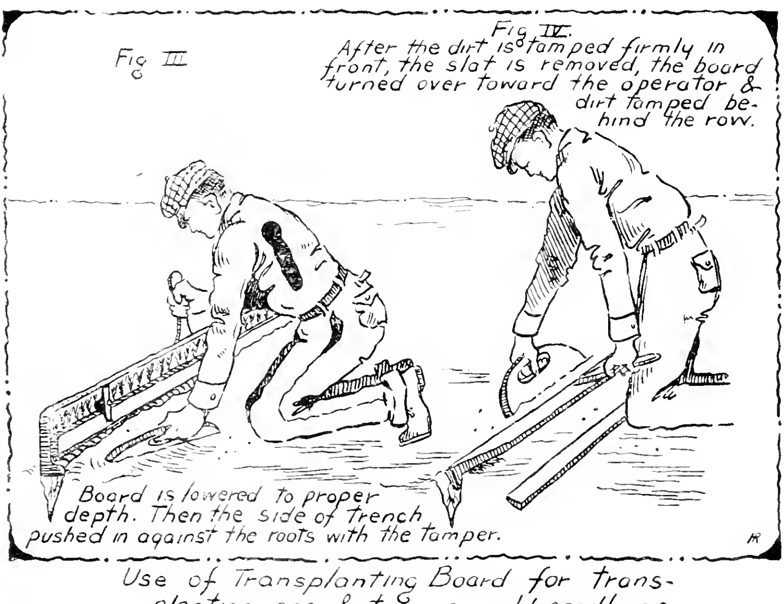


Use of Transplanting Board for transplanting one & two year old seedlings wide at the top and any desired depth depending upon the length of the roots of the seedlings to be transplanted. For a planting board 6 feet, or 6 feet 3 inches long the trencher must be set into the bed three times in the same line. A 36 inch trencher has been used, but it requires two men to handle it while one man can handle a 26 inch implement all day long. This implement leaves a trench with smooth sides, and can be used very satisfactorily in almost any nursery soil.

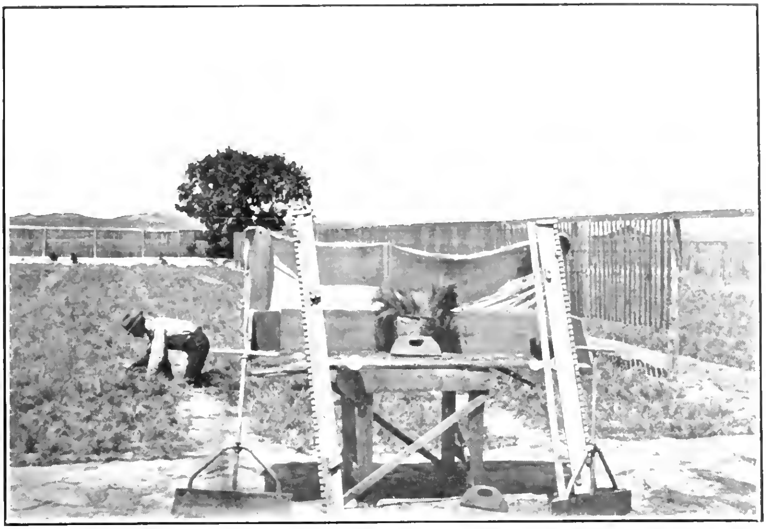
Planting Board.—The planting board used in connection with the trencher consists of a 5 inch board 6 feet 3 inches long with handle attached in the middle. On the lower edge a piece $1\frac{1}{2}$ inches wide is nailed flush with the back of the first board, the front edge of this piece should be beveled to about $\frac{1}{2}$ inch in thickness. Into this edge 50 notches are sawed $1\frac{1}{2}$ inches apart, one notch falling $\frac{3}{4}$ inch from either end of the board. These notches are slightly wider at the bottom than double the saw kerf, or about $\frac{1}{8}$ inch, and should be made smooth with emery cloth or a sharp knife and rounded at the outer edge to admit of threading the trees into them easily. The parts between the notches should be strengthened by driving one or two $1\frac{1}{4}$ inch brads through them. The inner parts of the notches are flush with the face of the vertical board, so that when the trees are threaded into the notches they lie flat against the face of this 5 inch board; a slat placed over them and fastened by two buttons holds the seedlings in place while the board is being carried from the threading table to the trench. A loop or binding of tin over one end of the board forms a pocket into which the end of the slat is placed before being buttoned down. This helps hold it and prevents it from being slipped past the end of the board when placed on the trees. The slat fits loosely enough so that it does not crush the stems of the seedlings when it is buttoned down. The buttons are made with a slight bevel so that when turned only partially over the slat they do not hold it so closely as when turned at right angles to it. This allows for handling both large and small stemmed seedlings with the same degree of efficiency.

When planting, the operator keeps the notches toward him and lowers the board into the trench with a back and forward movement lengthwise of the trench so that the roots will not catch on the sides, but will be extended naturally toward the bottom of the trench. An advantage of this board over one which must be laid on the surface of the ground comes from the fact that the planter is able to partially overcome mistakes made in threading trees too high or too low in the notches by simply lowering the board into the trench until the crowns of the trees are at the proper height.

The Tamper.—For closing the trench a tamper made of $1\frac{1}{2}$ inch board 12 inches long and 5 inches wide with hand-hold cut in one side is used. By giving the proper amount of pressure on the ground with the tamper at an angle and about 3 inches away from the trench the whole side of the trench is broken in against the roots of the trees. After the soil is firmly tamped on the side nearest the operator the slat is loosened, moved away, the board turned over toward the operator and the soil firmly tamped at the back. The board holds the trees out of the way while this is being done and when the tamping is completed, is lifted, and the trees allowed to straighten up.

Laying Out Transplanting Beds.—When transplanting is done by this method, 4 to 7 parallel beds should be layed out and all carried forward together. With a squad of 5 or 6 men this allows one man to be kept busy with the trencher. As soon as the first trench is made in bed No. 1, the trencher man passes to the second, then to the third and so on, the planters following him. By the time he has made the trench in the last bed the planters are away from the first and he returns to it to make the second trench, continuing as before. The trenches are made 6 inches apart. While a trench is being made the 6-inch block of soil between the trencher and the last row planted is often entirely moved so that in case the planters have not completely closed the soil against the roots the trencher forces it over.

When the beds are laid out, a string stretched across the block insures all beds being started on the same line. A board marker with cross lines 6 inches apart is laid in each path between the beds, with the first line in each case beneath the string. These lines guide the trencher without further use of the string. A chalk line or small wire, preferably the latter, stretched at the left side of each bed serves as a guide for the planting board so that the edges of the bed may be kept even. If it is desired to place transplants in long rows for convenient cultivation with wheel



THE MAST TRANSPLANTING TOOLS.

Consisting of trencher, planting board and tamper. The trencher is 26 inches long with a blade 1 inch thick at top. The planting board holds 50 trees.

Patent Applied For

TRANSPLANTING CREW CONSISTING OF SEVEN MEN.

One man makes trenches, two men put trees in the trenches and tamp the dirt against them, four men thread the trees into the boards and carry them to the planters. Six beds are carried forward together. Marks on the boards in the paths guide the trencher across the beds in parallel lines. Wire stretched at the left edges of the beds enable the planters to make the borders of the paths even. A crew of this number can plant 30 to 40 thousand trees per day of 8 hours. Area raked and flooded at close of each day's work.

hoe instead of in compact beds the trencher and planting board may be used with equal advantage and efficiency.

Threading Tables.—The planting boards are filled with trees at threading tables. These threading tables should have wind shields and preferably sun shields. A small tent on a frame that can be easily moved by two or three men makes a very desirable shelter for the threading tables.

In nurseries where the soil is likely to be too much packed by the men walking over it when carrying the planting board to and from the planting tables, 12-inch boards may be laid down for them to walk upon.

As soon as a small block is finished it should be raked over with a long-toothed rake in order that the surface of the ground be made as smooth as possible before water is applied. The rake teeth should be 6 to 9 inches long and may be made of No. 10 steel wire. Teeth of this size are sufficiently strong and being round and somewhat flexible do not injure the trees or pull them out.

At the end of each day's work the beds should be flooded or sprinkled until they are thoroughly soaked. This insures the closing of any openings that may have remained unclosed during the process of planting, and brings the soil in close contact with the roots.

A six-man squad can work to best advantage with one man trenching, two men planting, and three men threading. Until the men become accustomed to the work the planters and sometimes the trencher man exchange places with the threaders at the end of every hour. Such a squad when transplanting seedlings of a convenient size for handling, preferably 2 years old, can transplant from 25 to 35 thousand trees per day of 8 hours.

The use of the above tools reduced the cost of transplanting at the Halsey Nursery approximately 50 per cent. A small trial in 1910 by W. H. Schrader of the Monument Nursery, Monument, Colorado, resulted in a saving of 30 per cent over other methods and he states that this year by the use of these tools he expects to reduce the cost of transplanting to one half that of former years.

Other Implements and Methods.—Transplanting has been done extensively in the Government nurseries at Monument, Colorado and Ft. Bayard, New Mexico, by the methods described below.

A 6 inch board is laid on the transplant bed just in front of the last row planted. This board is used as a guide for the next trench which is dug with a vertical side, the dirt being thrown out with a spade or shovel. The planting board consists of a 6 inch board, 6 feet long, one edge of which is beveled to about ½ inch in thickness and has notches sawed in it approximately 1 inch deep and 1½ inches apart. This board is hung on hooks with the notched edge up, on one side of a threading table, the notches extending above the surface of the table. Trees with roots extending toward the center and tops toward the edges of the table are drawn from beneath a wet burlap cover and threaded into the notches. A heavy string is then drawn taut on top or in front of them to hold them in place while the board is carried to the trench. The board is then put down in place of the one which guided the spade when the trench was dug, and the roots of the trees hang against the vertical wall of the trench. Dirt is shoveled or scraped in against the roots and tamped, the ground smoothed, and the next trench dug. Usually two men work together digging the trench and planting the trees while a third threads the boards and brings them to the planters. Additional help is required for the third man occasionally.

Sometimes instead of digging a trench by throwing the dirt out, a trench is simply pried open with a spade. This method, however, does not make a trench with sides sufficiently smooth to let the roots of the trees in easily and usually is not as satisfactory as digging the dirt out.

It has been suggested that perhaps by the use of the above method a better developed root system will be obtained than when the trencher is used, but experiments have not proven this and it appears that the development is about the same in one case as in the other. Since the very decided advantage in speed gained through the use of the trencher means a considerable reduction in the cost of transplants especially where labor is high, it is believed that the trencher should commend itself for extensive use.

SCIENTIFIC MANAGEMENT AND THE LUMBER BUSINESS. A POSSIBLE FIELD FOR FORESTERS.

By Edward A. Braniff.

What constitutes a fair day's work for a man, or pair of men, performing a specific task in a logging camp? Take, for example, a saw crew engaged in felling timber and cutting it into lengths. How many trees of specified diameters and species should such a saw crew handle?

Nobody knows, precisely, the answer to this question. Some foremen may be able to answer it in a vague, general sort of way, but nobody knows how to answer it precisely, and that is the only answer that is worth while for our purpose.

It was the custom in the Long-leaf Pine district in East Texas a few years ago to pay the saw crews 40 cents per thousand feet for felling and sawing into lengths. This piece-rate system resulted in a wide variance of wages earned, and some men earned as much as $5 to $6 per day, others not more than $3. This piece-rate system was very crude, because it was not adapted to changing conditions. In a good stand of larger timber where conditions were favorable some extra good crews might average 25,000 to 30,000 feet per day, but they were obliged to work at the same piece-rate when compelled to saw in small, scattered timber where the best they could do was 15,000 to 18,000 feet per day. The piece-rate plan resulted in speeding up the men, and induced them to increase the amount of work they did, but when that result had been accomplished the rate was cut to 35 cents, and again to 30 cents. At present, I am inclined to believe the men are working at regular wages by the day.

In no logging camp with whose methods I am familiar have there ever been collected any data sufficiently detailed to answer the question: What constitutes a day's work in the woods? Where men work by the day the foreman is expected to keep them from soldiering, but the foreman has so many responsibilities, and his presence is needed at so many points at the same time that it is an impossibility for him to keep his men at their highest efficiency.

The percentage of time-killing, or soldiering, indulged in by woods workmen is surprisingly great. I hasten to admit, of course, that many of their tasks are so heavy as to require frequent rest periods. Nevertheless, it is a fact that there are few occupations in which the opportunity for soldiering is so great as it is in logging. There are many jobs in which the principal part of the men's time is occupied in "resting" and "waiting for something to do." The foreman cannot be ubiquitous, and must content himself in keeping things moving as best he can. The workmen are scattered, too often they are irresponsible, and the chances for soldiering are most attractive.

Within the past few months great interest in Scientific Management as developed in the remarkable work of Mr. Frederick W. Taylor, has been displayed among manufacturers. The possibilities of the Taylor system in its application to the various manufacturing industries has been given considerable study.

Very little has been said or done, however, with reference to trying out the system in the woods. In a recent address the assistant treasurer of the Berlin Mills Company endorsed his doubt as to whether scientific management could accomplish much in a logging camp, mainly for these reasons:

1. The generally unreliable character of the men employed, dut to the fact that they are not men with families, but men with the "floating" habit.

2. The fact that in woods work the men are scattered about a great deal, so that it is impossible to maintain a very close supervision over them.

It is admitted, however, that if Scientific Management were established in logging operations the results would be no less astounding than in other industries where it has been tried. It does not seem to me that the two difficulties above cited are insuperable. I purpose to outline some ideas as to methods of procedure in taking up the problem in a logging camp. Before doing so it may be well to point out that such work requires a different kind of training and intelligence than the ordinary woods foreman possesses, and seems peculiarly within the province of the trained forester. Therefore, graduates of forest schools, who should always be alert for chances to show the usefulness of their training to lumber companies, would do well to inform themselves concerning the Taylor System and the results of Scientific Management in a great conservation of human energy. The forester, as well as the lumberman, can meet on this common ground with mutual interest in, and no prejudices concerning the problems to be solved. The forester who can demonstrate the efficiency of this system will have won the confidence and enthusiastic backing of his employer, and will then be in a much better position to advocate measures dealing with the conservation of the forest. Therefore, it seems extremely desirable that forest schools should encourage original investigations in the application of the Taylor System of Scientific Management in the woods.

The first step to be taken is that of determining what constitutes a fair day's work for each man employed, that is, a standard task is determined after an exhaustive time study of its various component parts. Let us take for illustration the task referred to in the beginning of this article, namely, that of determining the amount of work which a saw crew should do in a day.

We will assume that a camp is selected in the southern pine woods where sawyers are employed at $3 per day each, to fell Long-leaf Pine and saw into lengths. The observer will equip himself with a stop watch, paper and pencil, and first analyze the operations performed. The work may, it is suggested, be divided as follows:

1. Time required to make the undercut (give depth of undercut);
2. Time required to fell the tree (give species and diameter);
3. Time required to trim the tree of limbs;
4. Time required to saw off each length (give diameters).

Each of the above processes may, if desirable, be subdivided still further, as:

1. Number of strokes of saw required to cut through a certain diameter;
2. Length of stroke;
3. Number of strokes per minute;
4. Time spent in wedging, and in oiling saw, etc.

One of the best of the saw crews is selected for observation, and what is being done should be thoroughly explained. With a little study and experiment a satisfactory form may be ruled for making stop-watch observations. The form for observation in wheelbarrow work (see Taylor p. 151, "Shop Management") will afford valuable suggestions.

The difficulties of working stop-watch observations that are really useful are admitted, but it seems that the above skeleton outline of an analysis of a saw crew's work should not be too difficult to follow.

A large number of observations of several saw crews, carried on for two or three months, should enable the observer to formulate a standard "task" for this kind of work. This information should be very detailed in its nature, and should show what a good crew of sawyers can accomplish in a day of ten hours, allowing a definite percentage for rest and necessary delays, as determined by the study. It should enable the management to know in a precise way the time required to perform any one of the processes required in the saw crew's work, per day, diameter and species.

With this information, the management is able to assign its tasks to the saw crews. Mr. Taylor advocates that when the point has been reached where the system is to be applied, the greatest caution should be exercisd not to force it too rapidly on the men. In this instance, we will assume the saw crews are earning $6 per day ($3 per man), and are averaging 18,000 feet per day of timber felled and sawed into lengths. The time study has determined that in the character of timber handled these saw crews should fell and saw into lengths not 18,000 feet, but from 30,000 to 40,000 feet. The management singles out a pair of extra good sawyers, and makes the proposition to them that, if they will follow its instructions implicitly and perform within the schedule time each of the operations assigned, it will increase their wages from $3 per day per man to, say, $4. It will be explained that the task assigned is quite possible of attainment without extraordinary exertion and that the pace may be maintained indefinitely. The efforts of the management are concentrated on this saw crew in order to demonstrate the possibilities of the system.

The management knows in a precise way how much time is required to perform each of the operations of its saw crew. The observer lays out the work. A bunch of timber being selected, a number of trees are carefully measured. The diameter at the butt where the first cut is to be made is measured, then the diameter of the first, second and third logs estimated. The tree is given a stump blaze and numbered with a crayon. When the time units for the trees marked aggregate a certain figure, and this added to a certain percentage allowed for rest and necessary delays, makes a day's work,—the observer makes out his "task" card. This card indicates that the saw crew must fell Tree No. 27 in, say, 10 minutes; the butt log must be cut in 5 minutes; the second log in 5 minutes; the third log in 4 minutes; time for trimming limbs 10 minutes; total time 34 minutes.

The foreman accompanies this crew for the first few days, times each operation, indicates the rest periods, and thoroughly demonstrates to this crew the possibilities of the system. The advantage of separately timing each tree is that the observer and the men then know whether or not they are keeping up to their schedule.

It is not possible to discuss in this brief article the further steps required in introducing the system generally among the workmen. All this is thoroughly discussed in Mr. Taylor's book on "Shop Management," to which the reader is referred. It is sufficient here to say that once it has been demonstrated that a saw crew, by making little additional effort, can increase its wages from $3 per man to about $4, sentiment in favor of the system should grow rapidly. It is not, of course, possible to time each saw crew and inform it during the day whether it is keeping up to its schedule, nor is such close inspection probably necessary. The main thing necessary, it seems to me, is that definite cards of instructions be given the crews each morning when they go to work, informing them what trees they must cut and the time allowed for each tree. It should be insisted that the work be done exactly in the order indicated and in the time given. Rests may be taken whenever the crew is ahead of its schedule, such rests being allowed for.

The crews should be informed each day by means of card reports whether or not they have performed their task of the second day previous in a satisfactory manner, and are entitled to their bonus, or whether they must be content with regular wages.

The success of the experiment having been determined with the saw crews, it may be inaugurated in other operations, such as the work of the steam skidding crews, loading crews, swampers, etc.

The above remarks are only suggestions for an outline of procedure that must be made by any one who is so fortunate as to have an opportunity to take up this exceedingly interesting and profitable work. The amazing results accomplished in many industries where the Taylor system has been established give us high hopes that its benefits will soon be felt in the lumber industry. Unfortunately, I know of no precedents that will aid in the slightest degree in assisting the man who attempts to establish the Taylor system in logging operations. This is a virgin field for investigation. That its possibilities are very great will be readily admitted.

BOOM AREAS.

By Augustus M. Carter.

Surveyor for the Berlin Mills Company, N. H.

A number of tables were made on the basis of actual trials for the purpose of ascertaining the number of pieces of timber of various lengths and diameters, and the amount of board feet contained in them, which can be floated within a given area of still water, under the premise that they are forced together by the current of a river, or by the tension of towing upon a lake, into a compact body, but not hard enough to submerge any individual stick.

The tables also show the number of lineal feet of boom sticks necessary to surround a certain number of thousands of board feet. In the case of chain booms a distance of one foot for play is allowed between sticks, and should be added to the length of each stick to arrive at the theoretical circumference.

The logs in these tables were measured by the Blodgett Caliper rule, and show the number of feet which this rule gives. The conclusions arrived at, which have been figured out into board feet, are on the basis of 115 cubic feet of the Blodgett Caliper Rule equaling 1,000 board feet.

A general table containing logs of all sizes, from 5 inch to 20 inch middle diameter and 6 to 44 feet in lengths gives the area which each of the logs occupies in cubic feet and in Blodgett feet. From this, by selection, other tables containing given sizes can be constructed, giving reasonably accurately the water area covered by the logs.

The following is a resumé of the General Table, and is sufficient to show the method of procedure and results:

Number of pieces,	111	
Total length,	2,519	feet.
Average length,	227	feet.
Total middle diameter,	1,046	inches
Average diameter,	9.4	inches
Area of space occupied,	3,210	sq. ft.
Area of total logs,	2,111	sq. ft.
Area of void,	1,099	sq. ft.
Per cent. of voids,	34.2	
Average per piece,	19	sq. ft.
Scale, board feet, total,	9,611	feet.
Average per piece, board feet,	86.6	feet.
Area of 1 thousand board feet,	220	feet.
Area occupied by 1 thousand board feet,	334	feet.
1 acre will hold,	130,420	feet.
1,000,000 board feet will occupy,	7 2/3	acres

Circumference and Number of 30-foot boom sticks for

Feet, B. M.	*Feet, circumference*	*Number, sticks.*
500,000	1,451	48
1,000,000	2,048	68
1,500,000	2,484	83
2,000,000	2,896	96
2,500.000	3,232	108
3,000,000	3,546	118
3,500,000	3,832	128
4,000,000	4,096	137

By selecting different sets of logs and tabulating them, different relations are found as follows:

	A	B	C	D
Number of pieces,	32	51	44	16
Total length, feet,	490	1,046	1,083	480
Average length, feet,	15.3	20.5	24.6	30
Total middle diameter, inches,	188	340	457	249
Average diameter, inches,	5.9	6.7	10.4	15.6
Total area of logs, square feet,	251.1	554.8	940.8	613.7
Average area per log, square feet,	7.85	10.9	20.9	38.4
Scale, board feet,	654	1,620	3,993	3,998
Scale, per piece, feet,	21.4	31.8	9	249.8
Area, actual, of 1 thousand board feet, square feet,	384	342	236	153.5
Area occupied by 1 thousand board feet, square feet.,	584	520	359	233
Area of void, per cent.,	35	30	34	35
1 acre will hold, feet,	74.589	83,770	121,337	186,996
1,000,000 board feet will occupy, acres,	13.41	11.94	8.15	5.34

Circumference and Number of 30-foot boom sticks for

Feet	A		B		C		D	
B. M.	Feet	No.	Feet	No.	Feet	No.	Feet	No.
500,000	1913	64	1806	60	1493	50	1209	40
1,000,000	2707	90	2532	84	2106	70	1709	57
1,500,000	3301	110	3131	104	2685	89	2092	70
2,000,000	3832	128	3612	120	2987	100	2415	81
2,500,000	4296	143	4042	135	3339	111	2701	90
3,000,000	4689	156	4425	147	3656	122	2958	98
3,500,000	5066	169	4770	159	3954	130	3198	107
4,000,000	5405	180	5110	170	4221	141	3417	114

REPRODUCTION OF LODGEPOLE PINE IN RELATION TO ITS MANAGEMENT.

By Nelson C. Brown.

The region from which the data for this paper have been drawn, is southwestern Montana where Lodgepole Pine is probably the most valuable and important tree as well as the most common one. This is one of the most rapidly developing and potentially productive regions from both a mineral and agricultural standpoint, in the Northwest. It is therefore an important question which timber will grow best and most rapidly to supply the great coming needs of the industries in this region. The data secured in this study were taken chiefly from the Gallatin, Absaroka, and Madison National Forests, but the field of observation also includes the Helena, Deerlodge, Beaverhead, and Jefferson National Forests. This is in the heart of the so-called northern Lodgepole Pine region and the characteristics of the types in regard to growth, density and associated species will vary somewhat from those in the southern part of the Lodgepole Pine region.

The elevation of the National Forests covered in this study, ranges from about 4,500 up to 11,000. A distinct gradation of types seems to occur, closely related to elevation: On the lower elevations, along lower slopes, and streams, occurs the Douglas Fir, *(Pseudotsuga taxifolia)* in a somewhat narrow belt. Above this comes a broad belt of Lodgepole Pine growing principally pure. Above this type and growing along streams or along seepage lines where sufficient moisture is afforded, occurs the Engelmann Spruce. Still above this species and growing up to the timber line, at 9,000 to 9,500 feet, occurs the Alpine Fir *(Abies lasiocarpa)* and Limber Pine *(Pinus flexilis)*. Between the Douglas Fir and the Lodgepole Pine types, there is a distinct transitional meeting ground where the two grow in admixture and where there seems to be a strong competition as to which will occupy the soil. It is here that the mixed Douglas Fir type occurs.

For the purpose of estimating and taking silvicultural observations five types were differentiated, namely, pure Lodgepole

Pine, pure Douglas Fir, mixed Douglas Fir, mixed Spruce, Alpine Fir. These types are based purely on composition of species. Wherever at least 80 per cent. of the merchantable trees on a sample acre were of one species, the type was considered pure.

Methods of Taking Observations.

In estimating the method of strips, one chain in width was used, calipering the trees 10 inches and above in diameter. At the end of each acre or at the end of every 10th chain, observations were taken of the density on the scale of 10, and of the condition of reproduction, in square rod plots at mechanical intervals; notes were also taken of the ground cover, aspect, degree of slope, and condition of the timber. Much better results were obtained by making the intervals mechanically than if they had been taken by some irregular method, since the presence or absence of reproduction is always liable to prejudice one in the choice of the plot and prevent arriving at a fair general average. The survey strips were run at right angles to the contours in each main stream valley or principal canyon at one half mile intervals and were run across every class of land and forest type up to the alpine growth. Any seedling up to three feet in height was considered reproduction.

Reproduction in Open.

It is well known and generally conceded that Lodgepole Pine is perhaps of all important trees in the country, the most prolific seeder, and reproduces especially abundantly on burned areas. Whether Lodgepole Pine grows upon this particular class of soil as a result of the peculiar physical composition of the soil or because of its chemical constituents as a result of the fire is not known, but the important fact is that on burned areas a dense reproduction of from 45,000 to 150,000 per acre is commonly secured. On a few plots of reproduction taken in the open, young growth up to 20 feet in height was found to contain about 60,000 trees to the acre. Under such conditions competition for light is too keen, and as a result both height and diameter growth suffer.

So much has been written about Lodgepole Pine reproduction in the open that it does not seem necessary to supplement the information (See Forest Service Bulletin 79, 1910, etc.) by further reference to this class of reproduction. Suffice it to say that re-

Lodge Pole Pine Reproduction.

production in the open whenever the ground is burned over, is sufficiently abundant to restock the ground, and is only too commonly more abundant than necessary for normal stocking.

Reproduction under cover.

In the *pure Lodgepole Pine type* the average of about 100 calipered sample areas gave approximately 9,000 board feet per acre and the per cent of volume composition was Lodgepole Pine 88 per cent, Douglas Fir and Engelmann Spruce, 12 per cent. The average number of trees per acre was 93, of which Lodgepole Pine 86, and of incidental species 7. The average height was 76 feet; the maximum height was 110 feet. The average diameter at breast height of the merchantable trees was 12 inches; the maximum diameter was 26 inches.

The observations on aspect show this type to occupy chiefly northern slopes, the next in numerical frequency being the northeast and east slope. The aspect least occupied by this type was the south slopes. The result of measurement of sample plots of *reproduction* show the following per acre enumeration:

	No. per acre	Per cent.
Douglas Fir,	79	6.30
Lodgepole Pine,	188	15.00
Engelmann Spruce,	95	7.57
Limber Pine,	278	22.17
Alpine Fir,	614	48.96
Total per acre,	1254	100.00

The average density was 6.95 on a scale of 10. This seems to indicate that the reproduction of Lodgepole Pine under its own cover is very poor and that the majority of it is of other species. Limber Pine and Alpine Fir reproduction seems to be most frequent at the higher elevations, and both re-seed the ground at considerable distance from the parent tree.

An average of nearly 1,000 calipered acres in the *mixed Douglas Fir type* showed about 7,000 board feet per acre. The volume composition by species is as follows, expressed in per cent.:

Douglas Fir,	52%
Lodgepole Pine,	36%
Engelmann Spruce, Alpine Fir & Limber Pine,	12%
Total,	100%

The total number of trees per acre was 71 of which Douglas Fir 33, Lodgepole Pine 29, and the others 9. The average height of merchantable trees in this type was 60 feet and the maximum height 110 feet. The average diameter of all the trees was 15 inches, but the maximum diameter of Douglas Fir was 7 feet, which is very uncommon in this region, while that of Lodgepole Pine was only 27 inches.

Reproduction under cover in this type was found from several hundred sample plots to be as follows:

	No. per acre	Per cent.
Douglas Fir,	376	44.18
Lodgepole Pine,	67	7.87
Engelmann Spruce,	143	16.80
Limber Pine,	61	7.16
Alpine Fir,	204	23.99
Total per acre,	851	100.00

This seems to indicate that wherever given any chance Douglas Fir will dominate in the reproduction and will advance under a fairly dense cover. The average density of this type was found to be 6.68. The principal aspects occupied by this type were found to be on the north, northeast and east slopes, in order of their importance; while the southern slopes are most rarely so occupied in this respect the type behaving identically as the Pure Lodgepole Pine type. A close observation of local conditions, such as soil, moisture, slope, aspect, etc., develops that the Pure Lodgepole Pine and mixed Douglas Fir types grow on practically the same kinds of soils and other site conditions. These statistics seem to indicate that as is commonly supposed, Lodgepole Pine soil is adapted to either pure Douglas Fir or the Fir in mixture with Lodgepole Pine and Engelmann Spruce.

Other Silvicultural Characteristics.

Lodgepole Pine grows uniformly in even-aged stands and reaches its highest development in the pure type. It does best on northerly and protected, moist, yet well drained fertile slopes. While here it attains its greatest development, it grows on a wide range of soil and site conditions and will withstand considerable drought, although refusing to grow on warm southern slopes in association with Western Yellow Pine. If atmospheric moisture is present in sufficient quantities, it will stand considerable drought in the soil. It is rather susceptible to windfall on account of its shallow root systems. It is particularly subject to windfall east of the continental divide and on exposed sites where severe windstorms are prevalent. In tolerance, it varies between intermediate and the intolerant class, depending upon the local conditions such as altitude, soil moisture and fertility, and vigor of the trees. In youth it is most tolerant, while at maturity it will not endure any shade. This accounts for the rapid thinning out of the older stands. In resistance to fire, it is probably the poorest of any of the more important trees of the west, not excluding Western White Pine. Even a light ground fire will frequently kill the trees, particularly the younger poles with their thin flaky bark. The resinous character of the bark is in a large degree responsible for this condition.

The strong reproductive power of this tree, however, is in a large measure the secret of its success in occuping the soil and this alone insures it an important place among the trees for future management of western National Forests. It produces a large crop of seeds nearly every year and through the agency of wind and gravitation on steep slopes, the seed is commonly carried to considerable distances, up to one-half mile. Perhaps the most wonderful feature of Lodgepole Pine reproduction is the fact that seeds will retain their germinative power as long as fifty years or more. (?) As soon as a fire prepares the mineral seed bed it proceeds to spring up and occupy the soil.

Management.

In the past, Lodgepole Pine has been managed on the selection system using a minimum diameter limit on most of the small timber sales on the Forests mentioned above. This has been necessary because of the fact that the smaller material could not be utilized in the markets. Another reason was that it was thought that Lodgepole Pine could be successfully managed on this system. But in many cases the remaining trees blew down and it was found that reproduction would not come up sufficiently on the humus and vegetable seed bed of the forest floor. Both, this fact as shown in the above data, together with its comparative intolerance and shallow root system indicate that this system can not be successfully applied with this species. However, stands are frequently found in even-aged groups and a modification of the selection system by clear cutting in small groups when the age classes reach maturity can be used. This is now being adopted on the Deerlodge Forest, where clear cutting and leaving solid bodies in wide strips is being used with pronounced success.

Brush has fomerly been disposed of by lopping and scattering the tops on some of the forests and by piling and burning during the fall and winter on others. Winter burning in piles is now successfully used on the Deerlodge Forest. Burning in numerous piles scattered evenly over the clear cut areas should give the best results since reproduction will be encouraged in them and not so much on the areas between. This will preclude somewhat the danger from overcrowding of seedlings with a resultant loss both in height and diameter growth.

Yield table investigations have shown that under advantageous conditions, it is possible to have a normally stocked stand of pure Lodgepole Pine of from 25,000 to 40,000 board feet per acre.

Conclusions.

1. Under an established forest cover, Lodgepole Pine does not reproduce satisfactorily owing to its intolerance of shade and to its requirement of a mineral seed bed for germination.

2. Lodgepole Pine is a transitional type and its general presence is due to widespread and frequent fires.

3. Under ordinary conditions Lodgepole Pine should be favored even as against Douglas Fir on account of its quick reproductive possibilities, comparatively rapid growth, high yield per acre in normally stocked stands, and ease of handling in the forest.

4. In a region requiring all kinds of timber for mining and smelter, as well as fencing material and saw timber, Lodgepole Pine will give more satisfactory results than a mixture of it with its common associates Douglas Fir and Engelmann Spruce, in spite of the fact that these latter trees yield a wood of a higher technical value.

5. Clear cutting in groups and strips should be used rather than the selection system with a diameter limit. An adaptation of the selection system could be used when numerous age classes are re-

presented, but this should assume the form of clear cutting in groups.

6. Burning of brush after logging should be done in evenly scattered piles rather than by the broadcast method. In no case should lopping and scattering be used on account of the fire risk.

PROGRESS IN SALES OF FIRE-KILLED TIMBER IN IDAHO AND MONTANA.

By W. B. Greeley.

The fires of 1910 left on the hands of District No. 1 of the Forest Service approximately 6,000,000,000 feet of timber on burned areas, the greater part of which was dead and in danger of rapid deterioration. Much of this timber is so inaccessible as to be beyond the possibility of salvage. From one to two billion feet, however, are so located as to be within the range of practicable logging operations. The sale of this material within the duration of its merchantability immediately became the most urgent administrative question of the District.

Hardly had the smoke cleared when reconnaissance parties began estimating the burned timber by logging units and compiling data on logging conditions required for the preparation of contracts and the information of purchasers. A systematized campaign of advertisement was conducted in order to place the opportunities for the purchase of this material before the lumber trade.

In spite of depreciation in the lumber markets which has seriously affected the demand in this locality, substantial results in the disposal of this timber have been already accomplished. Nearly 300 million feet has been contracted for sale. Advertisements and personal canvas have stimulated a large number of inquiries and applications are pending for several additional blocks. It is probable that within two or three months the total amount sold will reach the half billion mark.

The preparation of contracts for such sales and their administration present a number of new and important questions. Many of the stands contain mixtures of Western White Pine with other species relatively inferior under present market conditions. Chief among these are Western Larch, Douglas Fir, and White Fir. In the administration of ordinary sales of green timber the removal of all of the inferior species is required both in the interests of close utilization and the restocking of the ground with the most valuable timber.

In the sales of fire-killed material other factors have controlling weight. White Pine, by far the most valuable species, is much more generally killed outright than its associates, and deteriorates at a far more rapid rate. It is to the interests of both the Government and the purchasers to remove as large a proportion of the White Pine as practicable before it becomes unmerchantable through decay. The less valuable Larch and Douglas Fir will probably exceed White Pine by four or five years of merchantable life. It will be possible in many cases to secure the removal of these species in subsequent or secondary operations particularly as many of the larch and fir stands contain tie material and are within easy reach of railroads. In the large sawlog operations now progressing, therefore, the cutting of White Pine mainly is permitted, leaving the mixed timbers for subsequent utilization.

Other modifications of the usual practice have been found advisable, particularly in the handling of debris. Since all young and middle-aged stuff was killed by the fires, the piling and burning of slash will be handled, as a rule, by clearing strips along all routes of fire danger and around the cuttings of the sale areas. Wherever practicable the slash within these cleared strips will be burned clean without piling.

A recent decision rendered by the Attorney-General will greatly facilitate the removal and use of the fire-killed timber in these States. The burned areas contain a large acreage of railroad grant lands, scrip locations, and homestead entries to which the grantees or entrymen have not perfected title. These lands of clouded status are in effect "no man's land." The Government has no jurisdiction over them and the private claimant not having perfected title has no authority to dispose of their timber. Since many such holdings are interspersed with National Forest lands and should be included with the Forest areas in systematic logging operations, this situation has been a serious drawback in the disposal of some tracts. By his recent decision the Attorney-General permits lumber operators to remove timber upon lands in this condition by filing a bond to indemnify the Government for the value of the stumpage taken in the event that such areas revert to the United States. It also will be necessary for such operators to take similar action to protect the inchoate interests of the claimants. This decision expands and amplifies an arrangement already reached with the Milwaukee Lumber Company at St. Marys, Idaho, approved by the District Federal Court, under which timber is being removed from unperfected railroad lands under bond, the railroad company having accepted this arrangement. The decision is an extremely broad and far-sighted one of the sort which makes practical conservation under such tangled conditions of ownership possible.

RESULTS OF DIRECT SEEDING IN THE BLACK HILLS.

By John Murdock, Jr.

The first work in direct seeding in the Black Hills of which there is any record was done in 1905, on the Custer Peak Experiment Area, near Roubaix. Approximately 28 acres were broadcasted, and 12 sown with corn planters, with seed from the Pecos National Forest, New Mexico, of the crop of 1903. The season was an exceptionally wet one, and although the work was done late in May, the results were very good by both methods. Even here the results were uneven, adjacent plots, sown with equal amounts of seed and with apparently exactly similar conditions of ground cover showing great differences in the resulting stand. One remarkable feature is, that in many instances the best stands are in the heaviest sod.

Work was continued at Roubaix in 1906, 1907 and 1908 with Black Hills seed of the crop of 1905. The results in 1906 were quite poor. In 1907 they were again good, almost equalling those in 1905. In 1908 the results were again poor. Additional sowing in 1908 with some old seed collected at Glenn, Nebraska, gave very poor results, as did the experiments that same year with Douglas Fir. One acre was broadcasted after harrowing, half with pine and half with fir. The germination here was much better than on the rest, but only a few of the resulting seedlings survived the winter.

In 1909, approximately 650 acres were broadcasted with Yellow Pine from the Black Hills, of the crop of 1908. The bulk of the work was done in four plantations, at Redfern, Dumont, the Fair Grounds, and Savoy.

The results at Redfern were extremely poor, giving a stand of not over 100 or 200 seedlings per acre on most of the area. At Dumont, the results were much better, but by no means satisfactory. At the Fair Grounds and at Savoy, the results were also unsatisfactory. In view of the discoveries of 1910, it seems probable that rodents were largely responsible for the poor results, since the weather conditions appeared perfect.

Five experimental areas were sown in 1909, but with the exception of a portion of the Base Line area, included in the Redfern plantation, they were complete failures. On the Base Line area, three strips were sown with seed from the Coconino, Boise and Medicine Bow Forests respectively. The greater portion of each of these strips is in the bottom of a grassy draw, and here the germination was more than satisfactory. It is probable that the rodents did not work among the grass to any great extent.

In the spring of 1910 some 844 acres were sown at Redfern, in the Bald Hills, and at Savoy. The extraordinary drought of the season caused a total failure. Comparatively few seeds germinated at Redfern, and these were practically all in the draws, where the ground was comparatively moist in the early spring. At the Bald Hills, no seedlings have yet been found. At Savoy, a few germinated, but none of these at the usual time, in June or July, but about the first of September, following a fall of two or three inches of snow on August 24.

In the fall of 1910, approximately 330 acres were sown near Roubaix, in the vicinity of the previous experiments there. This work was done by various different methods, and it is hoped that the results will give some indication as to the best methods to be followed in future work.

No conclusions can be drawn from the work in the Black Hills as to the technical advantages of the different methods. From the point of cost, they rank as given below (the figures given are all for Austrian Pine seed, at 35 cents per pound).

The most expensive method yet tried is that of "careful seed-spots," in which the sod is removed from an area about a foot square, and the earth stirred up to a depth of four or five inches. Five acres which were planted in this manner cost $31.66 per acre, $25.60 of which went to the preparing of the spots.

Next in cost are the "modified seed-spots", prepared with a considerable degree of care, but with much less than the "careful". The cost of these is about $12 per acre, varying according to the degree of care. One small block sown in the fall of 1910 cost $11.32 per acre.

These first two methods obviously introduce too great an initial expense to be employed if any of the others can be made to give satisfactory results.

The third method is sowing in furrows. The cost is from \$5.50 to \$5.60 in fairly favorable ground. On one unfavorable block in the Bald Hills it went up to \$8.35, \$4.50 of which was for plowing as against \$2.90 on the other two. This method should give good results in a good season, since it removes all danger of competition for several years.

The fourth—omitting the corn planter work of 1905, in which the hills were spaced only two feet by two—is the method of "simple seed-spots," in which the seeds are sown in a hole prepared with one or two strokes of the mattock. The cost of this method is generally from \$3.65 to \$4.00 per acre, though at Savoy the cost ran to about \$9.00. "Raked seed-spots," in which the spots are prepared with a potato hook or other stout rake, cost about the same. The figure of \$2.28 per acre which was obtained in the fall of 1910 was due to the spots being wider spaced than were those prepared with mattocks.

Broadcasting, with four pounds of seed to the acre, costs from \$2.05 to \$2.65 per acre. Harrowing, either before or after sowing, cost 50 cents per acre for reasonably good ground.

Sowing with the corn planter costs from \$1.49 to \$3.80 in the three blocks thus sown in 1910. The first block at Redfern cost \$3.80, making allowance for the higher cost of the seed used, and the second block \$3.49. These figures include charges of approximately \$1.50 for supervision and camp expenses. The work on the first block was at the rate of 1¾ acres per man per day. In the fall, 26 acres were sown at an average cost of \$1.49, including a charge for supervision of 14 cents. The camp expenses, which were nearly 80 cents per acre at Redfern, were eliminated at Roubaix, the total charge for supervision was less, and was shared by the other classes of work. The work was done at the rate of 2 9/10 acres per man per day, although an entirely new crew had to be broken in.

It is clearly evident that, given an efficient crew and no camp expenses, the corn planter is much the cheapest method of sowing, even with seed as cheap as 35 cents per pound. With higher priced seed, the difference increases at the rate of four for the broadcasting to one for the corn planter. Where a camp must be maintained, the difference is much less, and may even be in favor of the broadcasting. The camp expenses at Redfern amounted to approximately $1.33 per man per day. This comes to from 50 cents to 75 cents per acre for the corn planter, and less than 10 cents per acre for the broadcasting.

Extremely poor results with the corn planter are reported from an experiment station in Colorado. These contrast strongly with the good results obtained at Roubaix in 1905. The total failure caused by drought prevents any conclusion being drawn from the 1910 work. It seems reasonable, however, to suppose that any method which places the seed in direct contact with the mineral soil, and secures a slight covering, will be better than haphazard scattering which leaves all the seed uncovered and many of them in unfavorable situations with regard to the ground cover.

No conclusion can be drawn from the work on the Black Hills as to the relative advantages of spring and fall sowing, since it has all been done in the spring, with the exception of that in 1910, the results of which are of course unknown. Experiments in District 1 seem to indicate that a heavy precentage of the seed sown in the fall fails to survive the winter. Although fall sowing is the natural method, yet nature is commonly much more wasteful of her material than we can afford to be. It is certain that seed will retain a higher degree of vitality if carefully stored than it can when it is exposed to the elements all winter.

Summary by Seasons.

1909.

Block	Species	Method	Area acres	Pounds per acre	Cost per acre
2 A	Yellow Pine.	broadcast,	127	6.30	$4.43
2 B	Yellow Pine.	broadcast,	35	7.30	5.91
3 A	Yellow Pine.	broadcast,	185	7.80	5.01
4 A	Yellow Pine.	broadcast,	50	8.50	5.91
5 A	Yellow Pine.	broadcast,	120	7.60	5.12
5 B	Yellow Pine.	broadcast,	12.5	8.00	5.37
		Total,	629.5		

Spring of 1910.

Block	Species	Method	Area acres	Pounds per acre	Cost per acre
2 C	Yellow Pine.	simple spots,	72	1.33	
		corn planter,	6	0.90	6.80
2 D	Austrian Pine.	corn planter,	317	1.00	
		simple spots,	25	0.64	3.49
5 C	Douglas Fir.	simple spots,	28	1.00	10.84
5 D	Lodgepole Pine.	simple spots,	15	0.33	10.00

Block	Species	Method	Area acres	Pounds per acre	Cost per acre
5 E	Austrian Pine.	broadcast,	50	4.00	2.27
5 F	Yellow Pine.	broadcast,	36	4.00	3.66
6 A	Austrian Pine.	simple spots,	158	1.25	3.96
6 B	Austrian Pine.	careful spots,	5	2.25	31.66
6 C	Austrian Pine.	furrows,	5	1.25	8.35
6 D	Yellow Pine.	simple spots,	76	2.24	5.81
6 E	Yellow Pine.	furrows,	15	2.00	7.09
6 F	Austrian Pine.	furrows,	36	1.25	5.61
		Total,	844		

FALL OF 1910.

Block	Species	Method	Area acres	Pounds per acre	Cost per acre
1 A	Austrian Pine.	simple spots,	30	1.00	$3.64
1 B	" "	harrowed,	30	5.00	2.63
1 C	" "	raked spots,	29.5	1.50	2.28
1 D	" "	corn planter,	26	1.00	1.49
1 E	" "	broadcast,	366	4.46	2.05
1 F	" "	modified spots,	3	2.00	11.32
1 G	" "	simple spots,	4	1.00	4.98
1 H	" "	simple spots,	15.5	1.00	3.78
1 I	" "	simple spots,	35.5	1.00	2.99
1 J	" "	simple spots,	18	1.00	2.91
1 K	Yellow Pine.	simple spots,	5	1.50	3.92
1 L	" "	broadcast,	69	7.07	7.38
		Total,	631.5		

CUSTER PEAK EXPERIMENTAL AREA NO. 1.

1905.

1	Yellow Pine P	broadcast,	1	7	$3.24
2	" " "	broadcast,	1	7	3.24
3	" " "	broadcast,	1	7	3.24
4	" " "	broadcast,	1	10	4.13
5	" " "	corn planter,	1	4	?
6	" " "	corn planter,	1	4	4.62
7	" " "	corn planter,	1	4	4.63
8	" " "	corn planter,	1	4	4.62
9	" " "	corn planter,	1	4	4.63
10	" " "	corn planter,	1	4	4.62
11	" " "	corn planter,	1	4	4.63
12	" " "	corn planter,	1	4	4.62
13	" " "	broadcast,	3	12.67	4.92
14	" " "	broadcast,	3	10	4.13
15	" " "	broadcast,	3	10	4.13
16	" " "	broadcast,	3	5	2.64
17	" " "	broadcast,	3	6	2.94
18	" " "	broadcast,	3	6	2.94
19	" " "	broadcast,	2.6	7.68	3.44
20	" " "	broadcast,	6	8	3.53
21A	" " "	broadcast,	1	5	2.64
		Total,	39.6		

1906.

Block	Species	Method	Area acres	Pounds per acre	Cost per acre
24	Yellow Pine.	broadcast,	5	11.80	$7.22
25	" "	broadcast,	5	6	4.18
26	" "	"	5	7	4.70
27	" "	"	5	7.20	4.81
28	" "	"	5	7.60	5.02
29	" "	"	5	8	5.23
30	" "	"	5	9.20	5.86
31	" "	"	5	8.40	5.44
32	" "	"	5	9.80	5.73
33	" "	"	5	6.20	3.84
34	" "	"	5	7.30	4.57
35	" "	"	5	7.30	4.57
		Total,	60		

1907.

36	" "	"	5	12.40	$6.88
37	" "	"	5	8.60	4.89
38	" "	"	5	8	4.57
		Total,	15		

1908.

39	" "	"	5	6.40	$4.41
40	" "	"	5	6	4.20
41	" " N	"	8	8	3.17
42	" " N	"	5	12	4.24
43	" " N	"	5	16	5.39
44	Douglas Fir.	harrowed,	0.50	12	23.45
45	Yellow Pine, N	harrowed,	0.50	16	7.93
46	Douglas Fir.	broadcast,	0.50	8	$13.65
47	" "	"	0.50	8	10.55
48	" "	"	0.50	8	13.65
49	" "	"	0.50	8	13.65
50	" "	"	0.50	10	16.65
51	" "	"	0.50	8	13.65
52	" "	"	0.50	8	13.65
53	" "	"	0.50	8	13.65
54	" "	"	2	5.50	9.63
		Total,	146.60		

Base Line Experiment Area No. 2.

1909.

1	Yellow Pine C	broadcast,	2	5	$6.28
2	" " B	"	2	10	12.33
3	" " MB	"	2	5	16.88

The other experiments in 1909 were a complete failure.
Total area 17 acres.

OPERATIONS UNDER THE WEEKS LAW IN THE SOUTHERN APPALACHIANS AND WHITE MOUNTAINS.

The Weeks Law, approved March 1, 1911, provides for the purchase of land for the protection of the navigability of navigable streams. The Act provided for a total appropriation of eleven million dollars for the purchase of land. Of this, one million dollars available for the fiscal year 1910, had lapsed before the passage of the Act. Owing to the shortness of time between the approval of the Act (March 1) and the close of the fiscal year 1911 (June 30) no purchases of land were made from the two million dollars appropriated for that fiscal year. However, a considerable amount of land was examined and there is every reason to suppose that the remaining eight million dollars of the appropriation can be expended advantageously in connection with the examination and purchase of land as provided by the law.

Up to January 1, 1912, a total of approximately 515,000 acres of land have been examined by the Forest Service, for the determination of land and timber values. Of this area 134,000 acres are located in the White Mountains and 381,000 acres in the Southern Appalachians. The examinations made by the Geological Survey, as provided by law, to determine the influence upon stream flow, cover approximately 980,000 acres of land, of which approximately 650,000 acres have been offered for sale to the Government under the Weeks Law.

The National Forest Reservation Commission, consisting of the Secretaries of War, Interior, and Agriculture, Senators Gallinger, of New Hampshire and Smith of Maryland, and Representatives Hawley of Oregon and Lee of Georgia, has approved for purchase a total of 161,583 acres located as follows:

30,000 acres in Fannin and Union counties, Georgia, on the watershed of Toccoa River, a tributary of the Tennessee River;

18,751 acres in McDowell county, North Carolina, on the watershed of the Catawba River, a tributary of the Santee;

33,619 acres in Sullivan and Johnson counties, Tennessee, Washington county, Virginia, on the watershed of the Holston and Watauga rivers, tributaries of the Tennessee;

79,213 acres in Blount and Sevier counties, Tennessee, on the watershed of Little River, a tributary of the Tennessee.

The report of the Geological Survey has not yet been submitted with regard to the White Mountain area, but this report is expected to be submitted in the spring after completion of the detailed study which is now being made in that section.

Owing to the complexity of the situation, involving particularly the difficulties of surveys and titles, the work of purchase is necessarily progressing slowly. However, distinct progress is being made and the way now seems definitely clear for the establishment of considerable areas of National Forest land in the Eastern States.

The following extract is from a report submitted by the Geological Survey with regard to conditions in a specific section of the Southern Appalachian Mountain region. The report is based primarily upon field work by Mr. F. B. Laney, Assistant Geologist.

Erosion in Natural State.

In this region south-facing mountain slopes are always drier, carry a scantier growth, have much less protection by leaf mould or forest mat, and are more susceptible to the action of frost than the north-facing slope of the same mountains. Because of these facts alone south slopes are always more readily washed and consequently are more in need of protection from the active agents of erosion than are north slopes.

Rainfall.—This area is one in which the annual rainfall exceeds sixty inches. The months of June, July and August are marked by the heaviest while October and November show the lightest rainfall. The summer rains are generally heavy and frequent downpours of short duration, while the fall rains are likely to be slow and steady and to extend over periods of from one to three days. These facts are worthy of consideration from their effects upon erosion of the land and the silting of stream channels. The custom of the mountain people is to burn the woods in the spring, and as a result the soil, stripped of its protecting cover of leaves and vegetable mould in the beginning of the season of heaviest rainfall, is left loose and bare and in excellent condition to receive the maximum damage from the hard, beating downpour. Soil, loosened on the hillside, is carried down into the swift little stream at the base of the slope and finally comes to rest in the channel of the main stream to which the mountain brook is tributary. It is always the short, heavy showers that do the greatest amount of washing. The mountain slopes are so steep, and the rain falls so rapidly during such downpours, that only a small proportion of the falling water can sink into even the loosest of soils. The water, therefore, unless held by the sponge-like leaf mould, rushes down the steep slope carrying its maximum load of soil and sand. The truth of these statements is evident to anyone who has ever been in these mountains during one of these heavy rains.

It is also worth nothing that the season of heaviest rainfall in these mountains is usually the season of lightest rainfall in the low country. To conserve this summer water and give it to the streams evenly and regularly means an even and regular supply of water to the rivers during their season of low water.

Erosion as Affected by Man.

Among the ways in which man's work accelerates erosion may be mentioned lumbering, clearing and cultivating the soil, burning the forests, and pasturing. The effects of all these agencies are presented to even the casual observer in the area under discussion. They all tend materially to increase erosion regardless of the type of soil or the geological formation of the region. The greatest amount of damage is done to the soil, and consequently the greatest amount of danger comes to the streams if the slopes are steep and the soil loose and sandy. In this area the most extensive formation is the Carolina gneiss, which makes high mountains and ridges with very steep slopes, and produces a very loose, micaceous and sandy soil. This is therefore a region which should be protected from agencies which tend to accelerate erosion.

Man's activities have less effect upon overcreep than upon any other type of erosion prominent in the mountains, but it appears that by killing out the roots, and by tilling the steep slopes, he greatly accelerates even this type. As to his effect upon the other types, hundreds of bare and fallow and cultivated washed and gullied mountain slopes, and many sediment-laden streams throughout the region give unmistakable evidence of the disastrous results of his activities.

Of all man's activities, lumbering the mountain slopes has the least effect in accelerating erosion, and, indeed, if the work be done with reasonable care and without burning, every stick of marketable timber may be removed from a mountain slope without any danger of excessive erosion. In this region it is the undergrowth that holds the soil, and any agency that does not destroy this will have little or no tendency to bring about increased erosion.

Fire is a notable agent of waste in this region, since it not only increases erosion but wantonly destroys the marketable timber, the young trees and the undergrowth. As far as could be determined from observations in the field there is a marked increase in the amount of wash, and a decrease in the regularity of water-supply, from a burned slope during the first year. There is much improvement during the second and third years, and normal conditions will ensue not earlier than the fourth year after burning. Of course the damage done by a single fire is somewhat proportional to the amount of leaves and rubbish on the land.

Pasturing, especially of hogs, sheep and goats, is decidedly injurious to mountain lands. Hogs, in addition to making numerous trails which may become channels for excessive washing, are continually rooting up and loosening the soil, and thus tend decidedly to increase surface movement of the soil. They also kill out the undergrowth. Sheep and goats, if run long or in large numbers upon the mountain lands, almost completely kill out the undergrowth, and thus tend materially to increase erosion and to diminish the amount of rainfall transmitted to the sub-soil. From observations thus far made the only conclusion is that the mountain lands of this region can stand only a minimum of pasturage without serious damage. This is especially true of south- and southwest-lying slopes.

The factor producing the greatest disturbance of all is clearing the land and cultivation of crops. The habit of the mountain farmer is to deaden the trees of a patch of mountain side or top and to cultivate it until the fertility of the soil is exhausted, which usually takes from four to eight years. The patch is then abandoned and another patch deadened, cultivated, and in turn, abandoned. This process is continued until all the available land has been used up, when the farmer must move to a new locality. To understand how rapidly these steep cultivated slopes wash, one has only to visit them during and immediately after a heavy rain. The water coming from them is so heavily laden with sediment that it resembles a mud-flow rather than a stream of the usually clear water of the mountains. Land which has been cultivated until exhausted recovers very slowly, and thus the fallow slopes with bare surface and deep-cut gullies continue to wash and to menace the lower land and the streams with their waste. A large number of such slopes that have lain fallow for periods of from 1 to 15 years were visited and studied. All were only scantily protected by secondary growth of vegetation, and were thus subject to excessive erosion. Such old fields furnish surprisingly great amounts of sediment to the swift-flowing streams which carry it to the main rivers. It seems clear that the logical way to prevent excessive erosion and dangerous silting of the channel in the lower courses of the Savannah River, is to protect the still forested slopes of its tributary streams, and to do everything possible to restore a cover of vegetation to fallow areas which exist.

The streams from this area furnish a supply of water to the

Savannah fairly free from sediment, depending upon the condition of the drainage basin of the individual stream. This supply of water is fairly uniform and regular, and is most abundant at the season of low water of the river. It is therefore clear that protection of the forests of this area will tend toward preserving and promoting the navigability of the Savannah River.

Summary.

1. Within the Savannah Reserve forest-covered slopes, if protected from fire, do not contribute enough sediment to streams to endanger their navigability.

2. The soils of the area are for the most part sandy and loose and are thus susceptible to rapid erosion. Much active erosion is now in progress, due largely to burning and clearing forest lands, to cultivation of steep slopes, to pasturing the mountain lands, and to the presence of fallow fields.

3. In this area the vegetal covering afforded by the forests undoubtedly tends to conserve the rainfall by increasing the delivery to the sub-soil and thus promoting regularity of stream flow.

4. Forest control within the area examined will lessen the sediment which is at present being contributed to the Savannah, and will prevent future increase of such sediment.

Conclusion.—From the examination of the proposed Savannah Reserve, as outlined at the beginning of the present report, it is concluded that Federal control of lands comprised therein will tend to protect and promote the navigability of the Savannah River.

PERMANENT SAMPLE PLOTS.

BY THEODORE S. WOOLSEY, JR.

As early as 1906 the need for a systematic study of cut-over areas on the National Forests was keenly felt. It was impossible to predict to any degree of accuracy the net increment of the trees left after cutting, the height and diameter growth of individual trees, the death rate of some of the older trees nor was it possible to foretell the actual effect on reproduction and on the remaining stand of the different methods of marking, brush disposal, or grazing. Preliminary instructions were drawn up by the writer in cooperation with Mr. G. A. Pearson in 1909. These early instructions have since been amplified and amended chiefly through the efforts of Mr. Pearson and Mr. H. D. Burrall. While the exact methods cannot perhaps be applied directly to other parts of the United States, chiefly on account of the larger number of trees per acre, yet the instructions undoubtedly contain many points that will be of interest professionally. As issued on December 1, 1911 they are as follows:

The general object of these "intensive" reproduction plots is to secure accurate data along the following lines as a foundation for a system of management:

1. Actual increment in feet board measure or cubic feet.
2. Height and diameter growth of individual trees.
3. Death rate in different age classes.
4. Effect of the different degrees of cutting, methods of brush disposal, ground cover, soil, exposure, grazing, fires, insects, etc., upon seeding reproduction or the growth of individual trees.
5. Accurate photographic record to supplement paragraph 4.

LOCATION AND AREA.

Areas should be selected on which a timber sale has occurred not more than five years before the establishment of the plots. Where a sale area exhibits only slighly varying degrees of forest density, type, exposure and slope, reproduction plots covering five per cent. of the total area will usually suffice. In broken country or where the stand or types are irregular ten per cent. is often necessary. It is desirable that large plots of from 10 to 15 acres be established where one general density, exposure, type or slope would be included, otherwise areas of from 5 to 10 acres should be selected which embody a single feature. No plot of over 15 acres or under 5 acres should be established; the major dimension should not be more than 13 chains and the minor not less than 5.

Plots should be established and designated so that major plots can include them, if necessary, in the future. Plots on the same section or those within one-half mile of each other, when not separated by private land, should be designated by the same major plot arabic numeral.

ESTABLISHMENT.

Withdrawal.—Formal withdrawal is usually not necessary* but the following form should be used in writing to the Ranger on whose district the plots are located.

Corners and Boundaries.—All corners** should be either of very durable wood or of some semi-durable species which has been seasoned for some time or creosoted. Forest Order No. 23, Part 4, should be followed with following changes:

In marking corners the letter "S" should be used instead of the letter "R", so as to indicate a silvicultural area. Each plot should be designated by a serial letter in addition to the arabic number of the major plot, i. e., the marking S-2-B-4 indicates corner number 4 of reproduction plot number B of major sample plot number 2.

All plot corners should be set 2 feet in the ground where possible; the smaller stakes should be driven in until firm.

MEASUREMENTS.

Diameter.—All merchantable species having an average diameter at breast height, outside the bark, of an even 4.0 inches or over should be measured and numbered. All stumps should be measured outside the bark and their diameters and location placed upon the map of the plot.

All trees whose crowns extend for at least half of their width into the plot should be measured and mapped.

All diameter measurements should be recorded to the nearest tenth of an inch, the first measurement being taken 4.5 feet from the ground or six inches above the copper nail with which the number tag is fastened, and the second taken at right angles to it; both figures should be recorded separately. Where a measurement can not be taken at breast height it should be taken at the nearest practical point above and below and an average obtained; where a fork occurs below breast height each fork should be numbered and recorded separately; where the fork is too high for this the main stem of the tree should be measured below and where the swelling (from the fork) is not appreciable. Care must be taken that swellings or small limbs are not measured on the opposite side of the tree from which the caliper man is standing. Notes should be made of any irregularities in the form of the tree which visibly affects the figures obtained such as large burns, deep scars, swellings, etc. In using the calipers they should be always held at right angles to the bole of the tree for both of the readings. The first diameter reading should be taken directly over the copper nail so that the trees diameter (at that point) divided by two will appear directly above the nail i. e., for a reading of 20 inches the 10 inch mark on the calipers should appear directly above the nail. The points 4′ and 4′ 6″ above the ground at which the number is placed and the diameted measurements are taken should always be measured, preferably with the 51 inch calipers.

Height.—All trees having a diameter breast high of 4 inches or over outside the bark should have their heights recorded with the Klaussner hypsometer; the distance from the tree to the instrument should in all

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*Any conflicts with mineral locations, special or other uses, Forest Homestead applications, etc., should be avoided.

*Where the danger from fire is great the plot corners should be surrounded by large mounds of earth or rocks or both.

cases be measured with a steel tape.* In measuring leaning trees the hypsometer should be set for a horizontal distance measured from a point directly under the top of the tree and a note should be made in the individual tree records to that effect.

NUMBERING.

Nails.—Number 12, 6 d, copper nails should be used. They can be purchased upon application to the District Forester.**

The numbered metal tags are attached to the trees at four feet from the ground, or 6 inches below the diameter measurement, with the copper nail. On mature trees or those having a thick bark the nail should be driven in its entire length but on small growth or where the bark is thin they should be driven in to only about one-half inch from the head to allow for the growth of the next five years.

Tags.—The tags should always be placed on the same side of the trees for a single plot.

Both the common tin and zinc numbered tags have been tried in the field and found unsatisfactory, the former rusting badly and the latter turning white upon exposure to the air so that the numbers could hardly be read. The galvanized iron tags are the most satisfactory. These can be obtained upon application to the District Forester in accordance with the following specifications:

"Of first class galvanized iron, at least 16 gauge, rolled flat into discs of one and three-quarters inches in diameter, consecutive numbers one-half inch in height, from 1 to 5,000* to be deeply stamped on each tag one-half inch from the base, a hole one-eighth inch in diameter to be punched at the top of the tag at one-eighth inch from the outside edge; all tags to be wired with strong wire in bunches of one hnudred each, the bunches to be placed in consecutive order in a strong box and to be securely packed with excelsior or some other good packing material."

INDIVIDUAL TREE RECORDS.

Form 333, Valuation Survey Book should be used in keeping the records of the measurements of the trees on the plots. Each sheet should be marked with the reproduction plot number, the Forest, the date, and the serial page number. The following data are to be recorded:

1. Consecutive tree number.
2. Species.
3. D. B. H. two measurements.
4. Height in feet to base of crown.
5. Height of tree in feet.
6*. Volume in feet board measure or cubic feet.
7. Health of tree.
8. Description of the length, width, vigor and top of crown.
9. Damage to the tree or crown by insects, fires, etc.
10. Seeding of tree at time of measurement.

1. Use consecutive numbers on those Forests which are measured in one season. No numbers over 5,000 should be used because of the large space taken up by them in mapping and the making of tree records.

2. The distinction between "yellow pine" with its light colored bark and high form factor and "black jack" with its dark bark and lower form factor should be used in these records. Where a tree has begun to form

*By fastening a wooden handle on the 100 foot steel band tape it has proved to be the best for this work.

**Cost about 25 cents per pound.

*Cost $2.00 per M. in lots of 50 M.

*Computed in the office.

light colored flakes on at least one side, the tree should be classed as a yellow pine.

3. The diameter taken first, whether on the south, north, east or west side of the tree, should be just over the numbered tag; the second measurement taken at right angles to this should be entered above it in the records. An explanation of this fact should appear on the first page of the typewritten sheets of each plot. The numbers on all plots, up to the present time, have been placed on the south side of all trees; they should always be placed on one side of the trees for a single plot.

4. In many instances the first live limb on a tree is not indicative of the height of the base of the crown from the ground; in such instances the base of the crown should be taken and not the limb. This measurement should be taken with the hypsometer, except where the limb is very close to the ground, and the reduction from the instrument reading in meters be made later on in the office rather than in the field at the time the measurement is taken.

5. This should be reduced from the field reading in meters to feet in the office, like the clear length reading. In the Klaussner hypsometer the screws controlling the horizontal movement of the sliding weighted upright should be kept tight since in using a 100 foot tape the horizontal distance has to be changed only at long intervals for trees over 100 feet or under 50 feet high. The measured horizontal distance should always be as much as the height of the tree.

6. In ascertaining the volume of the trees by volume tables interpolations must often be made to include the smaller or larger growth; a record should be made of these in the typewritten copies of the reports. Wherever possible tables should be used in which the volume is based on both D. B. H. and total height of tree. Where cubic feet tables for different heights and diameters are available for all of the species on a plot the contents should be ascertained by this method also.

8. The following classification has been used under this heading:

   A. Length—long, medium or short.
   B. Breadth—broad, medium or narrow.
   C. Vigor—full, medium, narrow or one-sided.
   D. Top—pointed, medium or flat.

MAPPING.

Reproduction Plots.—Stakes 2" x 2" x 18"* should be set a distance of one chain (66 feet) apart when the outside lines of the plot are run out and also in the division of the plot into squares measuring one chain each way. After the outside lines have been run a start is made at one of the small stakes and a line of stakes set across the small dimension of the plot at intervals of one chain. The stakes can be lined in with a Forest Service compass where the distance does not exceed 5 or 6 chains; for longer distances a telescope sight should be used on the compass. In western yellow pine ordinarily a scale of one inch to the chain should be used in mapping in the field; where the growth is dense a scale of 4 inches to the chain can be used.

A traverse board 16" square should be set up over a stake one chain in each direction from a corner of the reproduction plot, on this board a sheet of mapping paper ruled four squares to the inch should be fastened with thumb tacks.* The map should be orientated by sighting with a Forest Service compass on one of the nearby stakes (it is preferable that a stake be used for this purpose which was set in line from two stakes on opposite sides of the plot and not one which was set by measuring along).

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*Stakes should be 24" long where the ground is soft.

*It is advisable to place heavy paper beneath sheet to avoid pricking through with the hard pencil.

When the board has been orientated all the features to be mapped can be located from this set up for the four surrounding squares. The pacing should be carefully done and figured to the nearest link. When a tree or other feature is near the set up it should be paced to from that point otherwise the stakes bounding the surrounding squares can be used and the number of links, north, south, east, or west to the object can be given. If a scale of one inch to the chain is used the entire plot can be mapped on one sheet, if a larger scale is used the map will have to be divided into two or more parts; a 6 or 7 H pencil should be used. After all of the four squares have been mapped from a single set-up the traverse board is moved two chains in any direction within the plot; the board orientated and that set-up mapped. Where a plot is an odd number of chains in width a strip 3 chains in width will, of course, have to be mapped from one of the lines of set-ups.

The following features should appear on the map:

1. Corners and winesses.
2. All trees (of commercial species) over 4 inches in diameter breast high outside bark with appropriate symbols (where the tree species are not too numerous) and their corresponding numbers.
3. Seedlings over one foot in height and over 15 feet apart as individuals and with appropriate symbol.
4. Seedlings over one foot in height, between 8 and 15 feet apart as groups of fair reproduction indicated by a symbol.
5. Seedlings over one foot in height, less than 8 feet apart, as groups of good reproduction, indicated by a symbol.
6. Brush piles, burned or unburned, burned or scattered brush, all indicated by separate symbols. Down trees, similarly.
7. Seedling count strips or plots.
8. Contours, roads, fire lines, drainage, etc.
9. Prevailing wind direction.
10. Area of plot.
11. Local compass variation.
12. Stumps with corresponding diameters, outside bark. Each species should be mapped separately.
13. Legend.
14. Areas covered with brush or non-commercial species. In some instances where tree growth is dense this has to be made on a separate map.
15. Location and direction of photographs taken.

Seedling Count Strips.—Strips five feet (or 8 links) in width should be laid out across the major dimension of each reproduction plot and all of the growth located and measured; such a strip includes about 8% of the total plot area. By making the length of these strips 33 feet only 3 additional stakes are needed to mark their boundaries on each one-chain square and a 50 foot tape can be used for the locations; if the seedlings are not dense a strip 66 feet long can be measured with a 100 foot tape. It is preferable to make notes of the size, species and location of each seedling, including those one year old. All growth, including one year seedlings, should be mapped to the nearest tenth of a foot two ways from a stake and their height taken to the nearest inch.

Injuries to seedling from browsing of stock should be noted in every case.

Where seedlings were fairly common a scale of 4/10 inch to 1 foot has been used but in most instances a scale of 8/10 inch to 1 foot will be found satisfactory. In making the map in the office from the field notes, a piece of co-ordinate paper (ruled 10 squares to the inch) will aid materially in plotting positions of objects on the tracing line.

PERSONNEL.

The crew should consist of three men preferably all with technical training. The work on the plots should be divided and done in the following order.

1. Surveying. Placing the large corner posts and the stakes along the outside lines. Any small error in closure on the last line should be proportioned between all of the stakes on that line; where the error of closure is over 1 in 100 the lines should be re-run. After the outside lines have been adjusted the stakes across the narrow side of the plot should be set sub-dividing the area into one chain squares.
2. Measurements of individual trees. One man should place the numbers on the trees and do the calipering, the second man taking the heights and the man in charge writing the data as they are given to him and writing the trees description and health.
3. Mapping. The man in charge of the party should do the mapping with the traverse board while the two assistants locate the various features by pacing.
4. Contours. These should be mapped last since the position of the trees, brush piles, etc., greatly assists in their location on the map. Unless the topography is unusually steep, a 5-foot contour interval should be used.
5. Seedling counts. These can be made after the one chain squares have been established.
6. Reports. The reports should be made after all of the other work on the plots (including the photographing) has been done, usually in the field.

PHOTOGRAPHS.

In making a photographic study of the plots at the time of measurement it must be understood that these photographs show the condition of the plot only during its dormant period and another series should be made during the growing period.

OUTLINE FOR REPRODUCTION PLOT REPORT.

1. *Date Established.*
   Sale Area. Name and date in designation; when closed.
2. *Location.*
   Section, township, range, meridian. Field notes of boundaries. Field notes of tie into nearest land corner. Discrepancy in local variation. Order of setting one chain stakes. Stakes out of line.
3. *Withdrawal.*
   Copy of Supervisor's letter to District Ranger.
4. *Fire Protection.*
   Copy of suggestions to Supervisor embodying (a) size of burned strip, (b) inform District Forester of any accidental fires that occur with their location on blue print map of plot, with date and intensity.
5. *Area.*
   Acres. Dimensions.
6. *Elevation.*
   Relative and above sea level.
7. *Topography.*
8. *Soil.*
9. *Exposure.*
   Protection from winds, character of surrounding lands, private, Government, cut-over or virgin.
10. *The Forest.*
    a. *Original stand,* composition, relative importance of species.
    b. *Cutting,* date and character, brush disposal, etc.
    c. *Remaining stand,* composition, density, occurrence.

Reproduction, density, occurrence, size, age, rate of growth, health.
d. *Seed crop* (periodicity of seed years). An accurate record of the seed crop of each tree on each plot should be kept by the local Forest Assistant.
Underbrush.
Ground cover.

11. *Damage.*
    a. Fire, date, intensity, character, amount of damage.
    b. Grazing, period, kind, effect on ground cover and reproduction.
    c. Disease, fungus, mistletoe.
    d. Insects, lightning, etc.
12. *Method of Work.*
    a. Date of instructions, followed with modifications.
    b. Personnel of party with names, salaries and dates worked.
    c. Instruments used.
13. *List of Photographs.*
14. *Cost.*
    Include salaries, subsistence for days actually worked on plot. Include stakes and other material.
15. *Record of trees.*
    a. Total number with inclusive numbers.
    b. Lists of trees and shrubs
16. *Seedling or tree growth tables* or curves made on the same forest.

OUTLINE FOR SEEDLING COUNT STRIP REPORT.

1. Consecutive strip number.
2. Slope and exposure.
3. Shading on east, southeast, south, and southwest, overhead shading.
4. Nearby seed trees.
5. Litter, rock, soil, brush.

OFFICE WORK.

Six typewritten copies (on thin white paper) should be made.
1. Original and one carbon to Supervisor of Forest.
2. Two carbons to District Forester.
3. Two extra carbons.

The following copies of maps should be made:
1. Original (on tracing linen) and two blue prints to District Forester.
2. Two blue prints to Forester Supervisor.

MISCELLANEOUS.

Thin white paper 8 x 9½ inches should be used; the last dimension should be parallel with the platen of the typewriter.

All original notes, maps, and records should be placed in the files of the Supervisor on which the plots are established.

All records should be twice checked for errors.

SOME NEEDS IN FORESTRY EDUCATION.

By Hugh P. Baker, Ph. D.

That our present ideas of what constitutes the right education of the forester in this country are in a very unsettled state and that there is a wide divergence of opinion as to whether our courses in forestry should be strengthened along lines of natural science or engineering, was brought out strongly by the papers and discussions presented at the recent reunion of the Yale Forest School at New Haven and the Conference of Forest Schools in Washington.

The freest and broadest discussion of this most important problem confronting the profession of forestry in this country should be had, and that by both practitioner and teacher, before any sort of understanding can be reached as to reasonable standards. In a way, the profession is passing through a very critical stage because Mr. Pinchot's statement that much of the forestry practiced at present in this country is not in the woods, is all too true. As in few other lines of work the practitioner and educator should get together and remain together until real forestry is well under way, not only in the comparatively small forest areas belonging to the government and the states but over extensive private holdings from which much of the wood used in the country will be cut during the next half-century.

If the development of forestry education in Germany is at all indicative of what we are to pass through in this country we are just at the beginning of the struggle to evolve the ideal forestry school. In 1910, Bavaria concluded finally that the University was the best and most economical place to train foresters, and closed the Forest Academy at Aschaffenburg. Prussia, on the contrary, believes in the strength of the small Academy where stress may be laid upon practice and is developing her Academy at Eberswalde. They are yet far from agreement as to either the school or curriculum. Whatever our present progress toward standardization of courses in forestry it seems probable that for some time our schools will be controlled largely by the personality of the men in charge and local or sectional needs. Without doubt we shall and should have schools preparing men for special lines of work or the solving of local or sectional problems. That is, the logical development of a school in the Pacific northwest is along lines of utilization. There is unquestionably need for a school especially strong along similar lines in the northeast.

The tremendous development of the Forest Service, carrying with it the development of state and private work from 1900 to 1911, made it possible for almost any man with some practical sense, and a little more silviculture and mensuration to get a position in forestry. Many of these earlier foresters were misfits, but thanks to our American optimism and adaptability more found their places and are doing a splendid pioneer work in the introduction of forestry in this country. Last year, however, more men came from the schools than there were places for, and this will undoubtedly continue to be so until there is a fairly definite idea of the number of men to be needed each year. This condition of over-supply is having already a healthy influence both upon the attendance and scholarship in institutions giving instruction in forestry. Fewer students will enter courses in forestry from now on but those who come will be stronger because determined to succeed in spite of increasing competition.

Up to last year also, many men from undergraduate courses entered the government service through the same channel, the Civil Service examination, as the men from the post-graduate schools and are given apparently the same opportunity for development. In a sense, a man with a favorable personality, who has had four years of work in science, including from two to three years of forestry subjects, who has worked during the entire four years under the same men and with the idea of preparing himself for forestry should be as well if not better prepared for practical work in the profession than a man who has spent four years in an arts course or even in an agricultural or scientific course, where the goal has not been forestry, and then spends two years in a post-graduate school. In another sense, of course, there is no reason to expect that a man who has had but four years of training and who has perforce neglected certain important cultural subjects, is as ready for the practice of his profession as a man of more maturity coming from a post-graduate school. The addition of a year to the four year training, keeping the students under the same environments and inspirations for five years, as has been done so successfully at Ann Arbor, should prepare men as efficiently as can be done in the post-graduate schools of to-day.

The fact that all men from either four or six year courses have been placed upon nearly the same basis upon entering practical work has produced an attitude, a condition that it will be difficult to change and yet which must be changed somewhat before the problem of filling the gap between the practically untrained guard and ranger of to-day and the technical assistant is solved. The importance of this problem was brought out at the recent Conference of Forest Schools in Washington. The solution suggested there is the establishment of a series of well equipped Ranger Schools giving from two to three years of intensely practical work and fitting men for work in specific regions rather than for the entire country. One or two such ranger schools have been established in the west, and the New York State College of Forestry, at Syracuse University will open such a school in the fall of 1912 on its working forest in the Adirondacks.

The results of a similar system in Germany, that is, the Academy or University—which are of the same grade—for the training of the technical man, and the "försterschule" for the lowest grades have not been such as to assure us that the successful carrying out of the same scheme here will give us men fitted for all grades of work. A complaint heard often among foresters in Germany is that the technical man in the higher grades has his time so taken up with the routine work of administration that little or no time is left for proper application of the right methods of management, to say nothing of opportunity for trying out new methods to meet changing conditions or advancing knowledge. The men in the lower grades know so little of technical work that they are unable to supervise more than the simplest operations and, therefore, simple methods only, such as clear cutting and planting, are used where other methods would probably give better results. There exists a gap between the higher and lower grades which is not now filled satisfactorily. There is every reason to believe that a similar gap will exist in this country between the higher and lower grades and largely for the same reasons.

It may be that the above problem could be solved by the government, which will be the chief market for men from the forest schools for a number of years, creating a grade between that of Ranger and Forest Assistant into which men from four year courses may go. Meritorious service or further training would make it possible for these men to advance to the higher grades. Many men would, however, be satisfied probably to remain permanently in such a position and gradually a permanent force of great effectiveness between the ranger and the highly trained technical man be created.

Up to this time, it has been somewhat difficult for the post-graduate schools to give real post-graduate work. This difficulty is being overcome every year by increased entrance requirements and higher standards and the departments and schools giving undergraduate work are urging more and more that their strongest men go on to the post-graduate schools. The first mentioned schools have great opportunities for raising the standards of the whole profession and for training highly efficient specialists. There is every reason to believe from their present work that they will more than live up to their opportunities.

There is no disagreement among foresters in this country that whatever the especial trend of the training and wherever it may be given, we must turn out men with the right attitude toward hard work and responsibility and men who can do the work they are given without having to lean on the reputation of the school from which they come or the degree received. The splendid development of work on our National Forests has shown that whatever the training of a man, he must be adaptable, intensely practical and with good business sense. Past work has demanded a knowledge not only of the flora and the principles of growth but of surveying and mapping and sufficient work in mechanics to understand thoroughly the principles of lumbering. The immediate future promises to demand much the same of the forest school graduate. The schools which wish to have their men succeed in practice must prepare them to meet immediate demands and yet through it all there should be emphasized the ideals of the profession. Not only should a man understand plane surveying enough to run lines and prepare maps but he should be so grounded in the principles of silviculture and management that he can formulate an ideal for the forest or the waste placed in his hands and be able to work with patience toward the forest that will produce in the most efficient way.

Because much of the early work of the government was investigating and exploring work, there has been a tendency perhaps to place weight upon the natural sciences to the exclusion of a proper amount of surveying and mechanics. The past overdevelopment of courses in the natural sciences is being very generally recognized and in our anxiety to be intensely practical, there lies the danger that we may swing too far toward a training that will prepare our men for the simpler work of the civil and mechanical engineer only without making real foresters of them.

Might we not go far toward bridging the present gap between the ranger and the technical assistant, and helping the undergraduate school to define its present uncertain sphere if we were to agree that the function of the under-graduate forest school is a training especially strong in civil and mechanical engineering, that the graduates may fit immediately into such work as reconnaissance surveying as practiced in the National Forests, or estimating and surveying as now carried out in the Appalachians, or the planning and carrying out of logging operations. We might agree also that a man so trained and with a bachelor's degree only should not be called a forester until he had taken one or two years of advanced work in technical forestry, after a year or two of experience. It is difficult with present demands and ideals to train a forester fully in the ordinary four year forestry course. Yet, the undergraduate school has a field and its graduates must be recognized and why may we not agree as to what that field is, as suggested above.

NOMENCLATURE.

With reference to Mr. Barrington Moore's article: "Nomenclature of Divisions of Area in Working Plans", in Volume IX, No. 3 of "Forestry Quarterly", wherein he calls for a discussion of his suggestions in order that an acceptable terminology may be established:

In view of the rapidly growing interest in working plans, Mr. Moore's article is very timely. I quite agree with him in the desirability of the terms "Block" and "Compartment" (in fact it was my privilege to push the official use by the Forest Service of these terms while in charge of the Section of Reconnaissance during 1907 and 1908). However I stand with the Editor in my objection to the use of "working circle". Mr. Moore himself seems to feel that it is rather a cumbersome term; for he says (p 424): "A working circle thus formed should be called a "Division" and given a suitable local name". The Editor (p. 428) suggests the substitution of "block" for "circle." But this would make it impossible to retain the word "Block" as a division of the working circle (p. 425). I would like to suggest, instead of "working circle" or "working block," the term "working figure." This word is frankly translated from the German "Wirtschaftsfigur". It is not a cumbersome term, e. g. "Capitan Figure of the Lincoln National Forest", at the same time it avoids a further use of the word "Division" which is now used for distinctive administrative purposes.

A. B. Recknagel.

Eberswalde, Germany.
December, 1911.

MANAGEMENT OF WESTERN YELLOW PINE IN THE SOUTHWEST.

BY BARRINGTON MOORE.

The Region.

The largest continuous body of pine in the world is found in the Southwest, in Arizona and New Mexico, covering the Colorado Plateau. This body is of western yellow pine *(Pinus ponderosa)*, and is of immense importance for timber production and watershed protection; the management of this forest is a correspondingly large and important problem. A brief sketch of the region is essential for a proper understanding of this problem and its solution.

The rainfall is from 20 to 30 inches, most of which comes in July and August in the form of thunder showers. The beginning of the growing season, April and May, is generally very dry, and hence unfavorable to tree growth. Early frosts in the autumn and late frosts in the spring kill a considerable number of the yellow pine seedlings.

The region is, in general, a plateau of approximately 7,000 to 8,000 feet elevation, cut deeply by streams but not yet thoroughly dissected. Occasional volcanic cones, such as San Franasio Peak near Flagstaff, Arizona, rise out of the plateau to a height of sometimes 14,000 feet. On other parts of the plateau are block uplifts, from 10,000 to 12,000 feet in elevation, precipitous on one side and sloping gently on the other. The gentle slopes are, however, generally deeply cut into by streams. The result of this topography is an extraordinary combination of logging conditions. Parts of the plateau, notably the Coconino National Forest in the vicinity of Flagstaff, Arizona, offer throughout an exceptionally easy proposition; other parts offer easy logging conditions, but no outlet except by flumes or by roads which would be difficult to build; while still other parts are both difficult to log and practically impossible to access.

The market is composed of small scattered communities dependent on irrigation, grazing, and mining. It can not, for the present at least, absorb the entire amount which the forests of the region are capable of producing. But what it needs it needs badly; for many of these communities are remote from a railroad; and some which are on a railroad are such distances from the large lumber centers of the Pacific Coast and Gulf States that freight rates make the cost of imported lumber excessive. Hence some of these communities depend for their very existence on a sustained yield of forest products. A certain amount can be reserved for each local market, allowing for an increased demand due to the growth of the community, and the rest be cut off in large sales. The opening up of the region due to the first cut may stimulate settlement.

The Forest.

Three main silvical factors stands out conspicuously above all othērs and determine the management of western yellow pine. The first two are external factors, the second is inherent in the character of the tree, or at least a well established characteristic which may for the present be considered inherent. The first point is lack of moisture, the second frost, and the third the distribution of age classes. The first two points will determine the method of securing reproduction in each individual instance, the third will determine the general nature of the silvicultural system over broad areas.

The drought is most felt in April, May and June, just when the seed requires moisture for germination. The result is that except in favorable seasons, reproduction can not be depended upon without the shelter of trees or of a covering of brush. (See Circular 174 "Reproduction of Western Yellow Pine in the Southwest".) Frost also, greatly hinders reproduction. Many of the seedlings in opening do not start till after the July rains have come and then are killed back by early frosts in the autumn before they have had time to form woody tissue. Frost injury, as well as the effect of drought, is very much lessened by the protection afforded by trees or by a covering of brush. These two factors point to the need of shelter in securing reproduction.

The distribution of age classes is into *small even-aged groups* of from two to twenty acres. These groups are so well distributed that often a single acre will contain every age class, each represented by its group. Though occasionally one broad age class, such as saplings or seedlings, may be different over a section or two, the proportion of the different age classes is on the whole very satisfactory. This distribution into small groups renders the stand analagous to an uneven-aged stand, the group in this case corresponding with the single tree in the uneven-aged stand.

Silvicultural Systems.

The foregoing conditions point to two distinct requirements. First, reproduction must be secured by maintaining the shelter as much as possible; this shelter can generally be secured, except in the case of large groups, by the immature trees surrounding the group. Second, the silvicultural system *over broad areas* must be one of *periodic cuttings*, removing the mature groups in the manner of mature trees under a selection system.

The system required is, therefore, a form of the selection system which can be called the "group selection system;" but it will not always be possible to treat each group as a single tree. If a group is very large its removal might make too large an opening; or a group may be surrounded by trees too small to produce sufficient seed, or to provide the necessary shelter against drought and frost. In either case one or two of the most vigorous members of the group may be left; but, unless the group occurs on a sheltered spot, the trees left must have grown on the side exposed to the wind and therefore be windfirm. They must also possess good crowns. Otherwise, unless the period between cuttings is short, leaving them will be merely a waste of money. Whenever a group containing mature and overmature trees is found, it is generally good policy to cut the entire group unless by so doing reproduction will fail. The groups which are not cut should be left intact except for the removal of the merchantable over-topped or otherwise defective trees which are performing no useful functions in protecting the group, and will probably not increase in value. The guiding principle in deciding upon the groups to cut, at least for the first cut, should be the length of the felling period or cutting cycle. For example, if the felling period is 40 years all groups which will not live 40 years, or which, at the end of 40 years will be of no greater or of less value than at present, should be cut.

The advantages of the above method are: (1) Its elasticity; the cut can be made as light or as heavy as is desired (up to the limit of securing good reproduction) by merely adjusting the length of the period. It is therefore equally practical for large sales in regions of difficult accessibility and for small sales in easily accessible country. (2) The forest can, if desired, be cut over to utilize all the overmature material without regulation of the cut and then be put on a sustained yield basis without a long wait. (3) It lends itself more readily to regulation by rough methods. (4) It is the only system which, over large areas, will work out in practice with the distribution of age classes actually found.

The large even-aged groups covering an acre or more, which form the exception, will be treated separately within the above method without altering its principle. The system for these groups will have to be one adapted to even aged stands, either clear cutting with seed trees, or the shelterwood method. The shelterwood method is preferable, but not always practicable. If the felling period is long, 40 years or over, and the stand so overmature that it will greatly deteriorate before next felling period, it will be necessary to make a clear cutting with seed trees, and the difficulty here will generally be to find enough vigorous seed trees to leave. Often most of the trees left will be lost before the next cut, and will constitute an investment in reproduction. If, on the other hand, the group is mature but still vigorous, and the felling period not over 40 years, the shelterwood method will be feasible. Here approximately half to two-thirds of the stand is to be removed, and the more vigorous trees left for growth and seed production; at the next cut these trees will be utilized. Under either method the space occupied by the group will be left covered with an approximately even-aged young stand, which can not be cut again till the end of the rotation.

Rotation and Felling Period.

Under the silvicultural system recommended the important consideration is not the rotation but the felling period. Under a clear cutting system* the stand is cut when it has reached ap-

*The shelterwood system is properly speaking a clear cutting system, because, although the stand is removed in two or more fellings, the system secures an approximately even-aged reproduction just as much as does clear cutting with seed trees.

proximately the age prescribed in the rotation. Under the selection or group selection system the age at which the different trees are cut will vary widely in spite of all efforts to the contrary. The rotation is, however, of considerable importance in regulating the cut; and, considering large areas, the average age of the trees cut (after the first period) should not differ greatly from the rotation.

In deciding upon a rotation the accuracy of the growth figures will have some weight. Thus if the figures are rough the rotation will generally have to be longer than the figures indicate, so that if a mistake is made it will be on the safe side. If the figures are fairly accurate they can be used directly. In the southwest a rotation of about 200 years will be best for the present. Later on this may be shortened. Any rotation, it must be remembered, will give trees larger than the average on good sites and smaller than the average on poor sites. Thus on the Gila National Forest a rotation of 160 years will give trees 26.6 "D. B. H. on Quality I, and trees 19.85" on Qualities II and III. Although these diameters are large enough for good saw timber, a rotation of 200 years has been used.

With the felling period the important point to remember is that the shorter the period the lighter will be the cut, and vice versa. Hence the length of the period must depend almost entirely on market conditions and the accessibility of the area. Obviously, the more remote the area the heavier must be the cut, and consequently the longer the felling period. The maximum length will be governed by the maximum cut which can be made without injuring the chances of reproduction. In the Southwest a felling period of about 30 years will be about right where the area is readily accessible, and 50 years where it is of difficult accessibility.

The number of felling periods in the rotation will eventually determine the number of broad age classes into which the groups will be divided; e. g. with a rotation of 200 years and a felling period of 40 years the stand will eventually be composed of groups each representing one of five age classes.

Methods of Regulation.

Regulation should generally be by volume with an area check; regulation by area with a volume check is, just now, at least, unnecessarily intensive for most conditions in the Southwest. The two methods recommended for the present are therefore Von Mantel's formula and the Austrian formula; the former to be used with rough data before a detailed reconnaissance has been made, and the latter when sufficient data have been secured. In any case a preliminary reconnaissance is essential, for it will show the method of regulation required, and from this method the data needed will become known; then, according to the data required some method of field work which will secure that data can be devised.

CURRENT LITERATURE.

Forest Physiography: Physiography of the United States and Principles of Soils in Relation to Forestry. By Isaiah Bowman, Ph. D. New York, 1911. John Wiley & Sons. Pp. I-XXII—579; plates 5, figures 292. Price $5.00.

As stated in the preface, the title "Forest Physiography" does not imply a book on forestry but rather a book on physiography for students of forestry. And again, on page 108 we find the statement that the single object of the book is to acquaint the forester with the geographic basis of his work with such references to the forests as point the direction of his special studies. No attempt is made to discuss regional ecology or the principles of ecology, the ecology of the forest being regarded as a subject possessing a body of facts and laws of its own. The book, however, is full of data useful to the student of forest ecology.

The contents of the book are divided into two parts. Part One—The soil; Part Two—Physiography of the United States. The point of view of the discussion of soil relations may be expressed by such statements as: * * * "the physiographic features and related soil types are of more local development than the broad forest type which they support. The finer distinctions between soil types are of little value in understanding the range of a given forest type, however directly they may affect the welfare of the individual by modifying its habitat. In short, it may be said that the conditions which limit either the growth or the distribution of most forest species are so extreme that they embrace or overlap a large number of physical sub-divisions. The forester requires a scientific knowledge of soils and climates, but in the final application of his knowledge to the distribution and growth of forests, it is often necessary for him to employ somewhat broader generalizations than those employed by the geographer and the botanist for the special purposes of their sciences."

In the table on page 25, we find that the North American continent may be divided as follows: Alluvial regions; (1) loam predominating, 17%, (2) laterite, 9%. Equality of destruction and transportation, 4%. Denudation predominating; (1) eolian denudation, 2%, (2) glacial denudation, 25%. Accumulation predominating; (1) glacial accumulation, 23%, (2) stream and lake accumulations, 1%, (3) fine eolian accumulations 13%, (4) volcanic accumulations 1%. Dissected loess deposits 5%. One-fifth to one-sixth of the total area of the United States is now undergoing alluviation; all the rest is being eroded. Shaler is quoted in his statement that the soils of about 4,000 square miles have been impoverished through wasteful agricultural methods, representing a loss of food resources sufficient to support a million people. The author adds that this figure seems gratifyingly small besides the figure that would express the deplorable ruin of the past quarter of a century of reckless timber cutting. Unless the idea is included in the statement, he might better have added the deplorable ruin of forest fires.

In the ground covered, in the emphasis of the essential facts, not to mention the clearness and crispness of statement, the chapters (106 pages) on the soil constitute an excellent soil text-book in themselves.

The discussion of physiography is introduced by a chapter on the physiographic, climatic and forest regions of the United States as a whole, accompanied by numerous charts showing the mean annual precipitation, percentage of rainfall in the growing months, summer and winter temperatures, dates of killing frosts in autumn and spring, the annual humidity of the air and the forest regions. The necessity of the study of physiography for a forester is emphasized by such expressions as these: "Physiography is indispensable to the environmental study of organisms of every kind, whether trees, men or bacteria. Soil, topography and climate are positive forces in the development of forests and the harvesting of forest products. They underlie the main possibilities as well as the main limitations of nature."

The author describes the topography, drainage, soils, rainfall and forests of twenty-five physiographic regions, including some broad subdivisions. Twelve of these are west of the Great Plains. The lowlands of central and eastern United States constitute six, and the highlands of the same region seven physiographic types. The greater space is given to topographic description, with special reference to the geological history and the position of each topographic form in the erosion cycle. Each chapter is accompanied by charts, maps and half-tones to represent relief, drainage, geological structures, and so forth. In fact, every third page, on the average, has an illustration of some kind.

It is seldom that a book on an auxiliary science appears which will be more useful to a forester in the United States than this one. It is also seldom that facts are presented more clearly and concisely than in this book.

C. D. H.

Types of British Vegetation. By Members of the Central Committee for the survey and study of British vegetation. Edited by A. G. Tansley. University Press, Cambridge, England; G. P. Putnams' Sons, New York. 1911. Pp. 366, plates 16, figures 21. Price 6/.

We find from the book with the above title that in England 5.3%, Wales 3.9%, Scotland 4.6%, and in Ireland 1.5% of the total area is covered with woodlands and forest plantations. The percentages of the area under natural or semi-natural plant communities, including pastures not manured, is, however, much larger, as the following figures show: England 15-20%, Wales 40%, Scotland 70-75%, Ireland 70-80%.

The authors believe that the most widespread and rapid destruction of the forests of the British Isles was incidental to military operations beginning with the Roman invasion and continuing through the Middle Ages. The mild winters which permit grazing throughout the year also contribute to the general failure of forest reproduction. The cool and wet climate in the western and northern portions leads to the formation of bogs on areas originally occupied by forest. On the steeper and drier slopes, grassland developes on the better, and heath on the poorer soils. In the drier and warmer east and southeast portions, the better soils were used for tillage and pasturage, while the poorer soils from which the trees were removed, became heaths which in time were partially or completely re-invaded by the forest.

The best forested portion of England is in the southeast corner where there are approximately 450,000 acres of woodland equal to 11.5% of the area and constituting more than one-quarter of the whole area of English woodlands. With a few exceptions, this is not under management, but the system of cutting has led to the coppice under standard type. These woodlands are maintained chiefly for the preservation of pheasants. The woods of the west and north are mostly in a less artificial condition, but practically no virgin forest remains. As a whole, the woodlands of the country, at any rate of England, may be regarded as semi-natural woods, retaining the essential characters and the flora of the primitive forests from which they are derived.

The classification of the plant formations of the British Isles is based upon the character of the soil. The fifteen formations thus segregated are described through 207 of the 366 pages of the book. In England the clays and loams are very extensive, particularly in the Midland and in the southeastern portion, and they are now very largely under permanent pastures. These soils are supposed to have been originally covered with the Pedunculate Oak association. Where now existent the association is reduced almost entirely to coppice. The soils of the coarser sands and sandstones occur almost exclusively in the southern, eastern and Midland portion of England. The characteristic vegetation of these soils is indicated by the Calluna heath and by the Grass heath (heath pasture). When trees occur on the Calluna heath, the dominant species are the Pedunculate Oak, the Sessile Oak and the Beech. Birches often associate with these and sometimes they alone dominate considerable areas. In England the Scotch Pine has escaped from plantations and established itself on the heath, while in Scotland it is a natural inhabitant of the formation. It is not definitely known that the heath was originally forested, but in some cases it is certain that it represents the climax vegetation.

The siliceous soils derived from the older, metamorphic, non-calcareous rock are separated from the sands of more recent geological periods, such as those on which the Calluna heath is the most extensive. The older siliceous soils contain less silica, are frequently of finer texture and, when well aerated, form mild humus in contrast to the acid humus of the Calluna heath. They are particularly well developed in the north of England, and are characterized by the Sessile Oak association in which *Betula tomentosa* is the most common associate. The Ashwood association is characteristic of the calcareous soils of north and west England. It merges off into the limestone scrub from which in turn every transition may be traced to limestone grassland. The later chalk uplands, the "downs" of the south and the "wolds" of the north, support the same associations as the older limestones indicated above, but they have in addition the pure Beech association on the steep slopes of the escarpments and valleys. The soil is very thin and the roots of the trees are largely embedded in the chalk itself. The summits of the downs when free from superficial deposits are chiefly covered with pasture. The Yew is apparently confined to the chalk.

The discussion of the moors of various kinds occupies about eighty pages.

This first attempt at a scientific description of the British vegetation is very successful since the authors give one a remarkably clear survey of the vegetation of the British Isles, and of England in particular. The book is in the manual form and may be easily carried in the pocket. The text is illustrated by numerous excellent photographic reproductions and by charts and maps.

C. D. H.

The Forests of Northern Russia. By M. T. Katschenko, Imperial Russian Forest Supervisor. St. Petersburg. 1911. Pp. 104.

This interesting work is the result of a reconnaissance in the primeval woods of the Archangel District of Northern Russia. The stands are described as either pure Scotch Pine or mixed pine, spruce, larch and birch in various percentages. The following sample acres show clearly the character of the stands.

Soil.	I. *Diluvial Sand.*	II. *Sandy Loam.*	III. *Clay.*	IV. *Chalk.*	V. *Gypsum.*
	Pine 100%.	Pine 40%. Larch 30%. Spruce 30%. Scattered Birch.	Pine 80%. Spruce, 20% Scattered Larch. Scattered Birch.	Larch 60%. Spruce, 30%. Pine 10%. Scattered Birch.	Larch 60%. Pine 30%. Spruce 10%. Scattered Birch.
Average age,	177	192	235	156	200
Total No. trees,	531	988	1,601	1,618	986
Average height, feet,	70	78	72	112	65
Average diameter, breast high, inches,	10	11	12	10	8
Total volume, feet b. m.,	20,709	43,214	43,707	80,903	29,070
Volume increment, feet b. m. per annum,	122	224	185	519	136

The pine and the larch are of the same age, or belong to two or three generations of the same age. But in the age of the spruce there is much variety. This is due to the origin of the stand. Most of the present stands started on fire-swept areas. Thus in this region one frequently finds stands now (1908) 165 to 170 years old—i. e. originating between 1738 and 1743. These dates agree with those of the great drought-period of the seventeenth century; the Russian historical documents show that in this period extensive forest fires devastated much of middle and northern Russia.

The rivers, brooks, swamps, etc., caused brakes in the spread of these fires; nevertheless many stands can be traced in their origin to this fire-period. On one Oberförsterei (National forest) 33 per cent. of the area, in another 50 per cent., is covered with stands of practically the same age.

Since, after the forest fires, pine, larch, and birch were left alive singly or in groups, whereas the spruce was usually killed, the natural reproduction is generally made up of pine, larch, and birch of the same age, according to the condition of the remaining seed trees and the length of time elapsing before the next seed year. But the spruce can only be seeded in from such parts of the original stand as were untouched by the fire. Therefore spruce enters into the mixture of pine and larch some ten to fifty years after the establishment of these species, depending on the distance from the original unburned stand.

Later seedlings of pine and larch are rare, but the spruce continues to spread gradually, sometimes achieving 97 per cent. of the stand with pine, larch, birch and aspen constituting the remaining 3 per cent. In the selection cutting of the pine and larch these species are still further reduced in numbers, sometimes none remain, whereas the spruce being younger and hence of smaller diameter, secures entire control of the stand.

It is characteristic in stands from 150 to 200 years of age to find spruce seedlings on decayed tree trunks; about 95 per cent. of the spruce seedlings grow there and only 5 per cent. on the forest floor proper. Pine and larch are not able to do this, hence only 3 per cent. of all the seedlings are of these species. Complete decay of a log requires well into the second century after the tree's death. On the remains of an old spruce log an 81 year old spruce was found, part of the old tree was still sound. Nevertheless the current opinion that so rich a humus is favorable for reproduction, is not substantiated when the suppressed growth of the seedlings in virgin forest is contrasted with the growth of the same species on similar soils whose cover, be it trees or grass or both, has been removed, exposing the mineral soil and allowing the seedling full light. Since it is practically impossible for pine and larch to reproduce themselves within the virgin forest, the natural regeneration of mixed stands is only possible by means of larger openings which let in sufficient light and expose the mineral soil.

Pure stands of pine on diluvial sand soils reproduce themselves naturally after forest fires as well as without their agency.

A. B. R.

New England Trees in Winter. By A. F. Blakeslee and C. D. Jarvis. Bulletin 69, Agricultural Experiment Station. Storrs, Connecticut. 1911. Pp. 307-576.

This bulletin has been issued to meet the special need of a general work upon American trees dealing with their identification in the winter condition.

It opens with a general explanatory discussion of the descriptive headings used in the text, followed by keys to the genera and to the species. The succeeding text is in the form of a page of description to each species with a page of illustrations opposite. Each description covers the habit, bark, twigs, buds, fruit, wood and distribution, together with comparisons with similar species. The illustrations are excellent, particularly the bark studies, on excellent paper, and easily the best of their kind we have seen. They are photographic entirely and original, those of the twigs and fruit mostly to the one scale throughout; in addition there is given the habit and bark, and, in the case of conifers, the foliage.

Despite the authors' explanation one wishes the foliage had been included. The publication would have been no less useful in the winter and would have been more acceptable to teachers and students generally. One would have preferred, too, the illustrations of foliage and fruit of the conifers on a somewhat larger scale, even at the sacrifice of uniformity.

The bulletin is a valuable and useful one, and it is to be hoped that the authors will issue it in book form. A similar work on shrubs is a desideratum.

J. H. W.

The National Forest Manual. U. S. Forest Service. Washington, D. C.

Much of the time of Forest Service administrative officers during the past few years has been spent in perfecting routine methods and in solving new problems of policy that are continually arising in every day work. As instructions were issued in the Field Program, in Service orders, or in circular letters it proved increasingly difficult for new men entering the Forest Service to find out what the latest policy and procedure was without hunting through a mass of material. In order to correlate all instructions for the use of the National Forest resources, a National Forest Manual is now being issued. The sections now in print are as follows:

1st. Water Power. Pages 86. Issued to take effect December 28, 1910.

2nd. Grazing. Pages 100. Issued to take effect May 1, 1911.

3rd. Especial Uses. Pages 35. Issued to take effect May 1, 1911.

4th. Trespass. Pages 23. Issued to take effect September 1, 1911.

5th. Forest Plans, Forest Extension, Forest Investigation, Libraries, Co-operation, Dendrology. Pages 45. Issued to take effect November 1, 1911.

6th. Timber Sales, Administrative Use, Timber Settlement, Free Use. Pages 90. Issued to take effect December 1, 1911.

It is understood that the Claims and Forest Settlement (Act of June 11) section is now in proof.

The first four sections enumerated above are confined chiefly to administrative routine and policy. Possibly the trespass section is too brief and it certainly can be vastly improved before it is re-issued.

The Forest Plans section contains a great deal of valuable technical information based on the results of actual experience;

a good example is "Protection against rodents", which recites in detail methods of poisoning rodents, formulae to use under varying conditions and a note of warning against the use of red lead and coal tar because of its ineffectiveness as a protection.

The modified sale regulations in the Timber Sales section are due in part to a different legal interpretation of some of the organic acts affecting the Service. For example, it is now necessary that timber be formally appraised "Upon the character of the timber, the cost of logging, transportation, and manufacture, and the sale value of the manufactured products at practicable markets." The Secretary now prescribes the maximum cut on each Forest, the maximum and minimum stumpage prices, a maximum limit for the approval of sales by supervisors (2,000 M. ft. board measure) and district foresters (20,000 M. ft. board measure), and the authority for approving the cutting in emergency cases in advance of advertisement is now vested solely in the Secretary. Provision is made in Regulation S-13 for contracts in excess of five-year periods. This will facilitate the sale in large quantities of over-mature timber far from the ordinary market where heavy initial investments are required.

The procedure for appeals from a decision of the supervisor, district forester, or a forester, is prescribed in Regulation S-15. This also is an innovation in timber sale routine.

The data on marking, brush disposal and scaling will be particularly interesting to lumbermen and professional foresters. The instructions allowances for rot, or defects are very complete.

The completion of the National Forest Manual has resulted in systematizing much of the routine. For example, it was formerly the custom to have permits for grazing issued subject to the approval of the Office of Grazing, saw-mill permits under Silviculture, and other uses under Lands; now all uses are combined under the latter office.

T. S. W., Jr.

"Columbian Mahogany" (Cariniana pyriformis): Its Characteristics and Its Use as a Substitute for True Mahogany (Swietenia mahagoni). By George B. Sudworth, Clayton D. Mell and Henry Pittier. Circular 185, U. S. Forest Service. Washington, D. C. 1911. Pp. 16.

The great demand for true mahogany has so depleted the supply that full twenty other woods of varying resemblance are being substituted for it. "Colombian mahogany" affords one of the best imitations for true mahogany now on the market, though botanically the trees are widely separated.

The "Colombian mahogany" is an excellent cabinet wood. When properly seasoned it does not warp, check or shrink; much of the lumber is handsomely figured and of good color. The wood is hard, heavy, strong, tough, susceptible of high polish and takes a filler readily. It works well but dulls the saws and other tools very quickly.

Much of this publication is devoted to the botanical characters of the tree and to the minute anatomy of the wood. The important features distinguishing this wood from that of true mahogany are emphasized in the text and illustrated by drawings.

S. J. R.

A Visual Method for Determining the Penetration of Inorganic Salts in Treated Wood. By E. Bateman. Circular 190, Forest Products Laboratory Series, U. S. Forest Service. Washington, D. C. 1911. Pp. 5.

This method has been devised to enable a determination of the depth of penetration without the tedium and expense of a wood analysis.

Where zinc chloride is used in the preservative treatment the freshly cut surface of a disk of the treated wood is dipped for not longer than ten seconds in a one per cent. solution of potassium ferrocyanide. After the excess is removed by blotting paper the disk is dipped into a one per cent. solution of uranium acetate and allowed to dry. Since zinc chloride will decolorize the dark red uranium ferrocyanide (which is formed as a result of the two dippings) the disk face will be dark red where the treating fluid has not penetrated, and elsewhere slightly whiter than the natural wood. This visual method of detection can be used except with woods whose natural color masks that of the uranium ferrocyanide.

In the case of metals whose salts are characteristically colored the detection is simple. Thus, in the case of copper or iron the disk may be tested by merely dipping in potassium ferrocyanide, and for mercury by dipping in hydrogen sulphide solution, the compounds formed being respectively dark red, blue and black in color.

J. H. W.

Scrub Pine (Pinus virginiana). By W. D. Sterrett. Bulletin 94, U. S. Forest Service. Washington, D. C. 1911. Pp. 27.

Scrub Pine has a natural range from Staten Island in New York to Blount and Winston Counties in northern Alabama and from the Atlantic coast to southern Indiana. It is not adapted to a very sandy soil but thrives best on clay or loam or a sandy loam. It will make fair growth on sterile soils where other species can barely exist. Within its optimum range Scrub Pine is very abundant, reproduces readily and prolifically, and in several eastern States, especially in Maryland and Virginia it has taken possession of many thousands of acres of idle fields. It grows fairly rapidly in youth but the tree is short-lived and does not reach large dimensions.

It is seldom possible to cut clear lumber, or lumber fit for planing from Scrub Pine, since the wood is usually knotty and will make only common and box grades of rough lumber. The principal uses of the wood are fuel, pulp and charcoal. It can also be employed for railroad ties if properly creosoted.

Scrub Pine may be considered desirable for forest management on lands of little value for agriculture and not adapted to tree growth of more valuable kinds. Wherever associated with Shortleaf or with White Pine it tends to replace them in the second growth after lumbering. In such cases it is advisable to eradicate the Scrub Pine by cutting out all of the trees of the species which are bearing or are likely soon to bear seed, and by leaving seed trees of the more desirable kinds to restock the cut-over area.

To obtain a sustained annual yield in pure Scrub Pine forests is comparatively easy. A short rotation of 30 to 40 years is silviculturally and financially preferable to a long one. The trees should be grown in dense stands since Scrub Pine is inferior to most other yellow pines in self-pruning ability. Improvement thinnings are advisable where they can be made to pay for themselves.

S. J. R.

Grazing and Floods: A Study of Conditions in the Manti National Forest, Utah. By Robert V. R. Reynolds. Bulletin 91, U. S. Forest Service. Washington, D. C. 1911. Pp. 16.

This bulletin is the result of a careful survey of the conditions on the Manti National Forest in central Utah and deals primarily with the effect of forest grazing on the frequency and severity of floods. This history of the settlement of the region, of grazing and of floods is described in sufficient detail to throw light on the relation of excessive and injudicious grazing to the destructiveness and increasing frequency of the more recent floods.

Perhaps nowhere in the inter-mountain region of the west are conditions so clearly illustrated as in the portion of the Wasatch Mountain region embraced by the present Manti Forest. Grazing is at the maximum and the usual range war between cattle and sheep interest was fought to a finish on this narrow plateau which is the chief field of interest in the bulletin. The demand for water and consequently watershed protection is equally keen but only recently realized. The populous San Pete Valley at the western foot of the range is but one-third utilized, directly as the result of an insufficient and unregulated water supply. The Forest is not a timber forest, its chief value lying in the grazing and watershed protection which the forest vegetation affords. The need of water from the surface streams is still further increased by the fact that on the east side the formation is of such a character that neither wells nor cisterns can be constructed.

It is stated that this region was first settled in 1850 and that cattle grazing reached its climax in 1880 when sheep grazing began. From 1888 to 1905 occurred the most severe sheep grazing, since the war between this industry and the cattle was then at its height. The usual tactics in such range wars were employed, such as rapid travelling, close herding and bedding long in one place, with numerous fires set each year to improve the range and remove brush areas to facilitate the handling of sheep.

In treating of the past floods the writer emphasizes the fact that no serious floods occurred prior to 1888 and draws attention to the point that sheep grazing had been under way for about six or seven years at that time. The following are the dates of the serious floods: 1888, 1889, 1893, 1896, 1901, 1906, 1908, 1909, and 1910.

In August, 1909, it is worthy of note that a severe flood occurred in Ephraim and Six Mile Canyons, while Manti Canyon, which has been protected from grazing since 1903, was not flooded, although its previous record before exclusion of grazing was a bad one. Some space is given to the explanations offered for the absence of flood in this particular canyon and the author concludes that it can be ascribed alone to the improved condition of the forest cover, as a direct result of a period of protection. Rain guages have since been set up at the heads of these three canyons which are expected to show in the future whether the rainfall is distributed equally throughout the three watersheds and that the figures obtained will show to what extent the condition of the forest cover reduces the severity or eliminates entirely floods in the canyons.

It is surprising to note the amount and variety of damage and the large area over which it is distributed. The total loss caused by the floods during the last twenty years from this region is estimated at $225,000. It is stated that the town of Manti alone has suffered damage variously estimated at from $75,000 to $125,000. Other towns in the San Pete Valley and a number on the east side have also had heavy losses. In 1909, Emery County found it necessary to make a bond issue of $35,000 to be used for the sole purpose of reconstructing and repairing damages done to roads and bridges. The damage to irrigation ditches and reservoirs has been equally great, though not so readily apparent. On account of the heavy expenses for repairing irrigation ditches entailed by the floods, many ranches in Castle Valley have been abandoned. It is also stated that these streams were formerly stocked with trout but since the floods have caused the flow to be so muddy the fish have disappeared.

The conditions affecting the floods are described in considerable detail, such as topography, soil, ground cover, rainfall, and torrential run-off. The influence of limestone and sandstone formations in shaping the topography is pointed out. The mathematical laws governing the transporting and eroding powers of water are set forth and their application shown very clearly under the existing conditions.

Based on the conditions as found the writer recommends that in future regulations of grazing a reduction of 2,000 head of cattle and 27,000 head of sheep should be made in the number allotted to graze on the Forest at the time the examination was made. The reasons for this reduction seem to be well stated and the whole description indicates that their foundation is no less secure.

The bulletin is provided with an admirable summary which states the case in a nutshell. Another feature is the photographs which picture typical portions of the Forest and range clearly. One, in particular, is a most forceful illustration of the relation of the vegetation cover to erosion.

Altogether this bulletin is a good write-up of the observed facts, the conditions, and the statements of various Forest users in regard to the influence of forest cover as it affects water conservation and floods. The only thing regretted is the absence of measurements and figures showing the rainfall in various parts of the watershed and the resultant flood discharge through a period of years. This, of course, was obviously impossible because of the short time and the condition under which the report was prepared. Future detailed measurements will doubtlessly be made and it would seem could only reinforce the conclusions drawn in this publication.

E. R. H.

Utilization of Osage Orange. By Hu Maxwell of the U. S. Forest Service. Published by the Farm Wagon Department, National Implement and Vehicle Association of United States of America. 1911. Pp. 14.

The natural range of Osage Orange *(Toxylon pomiferum Raf.)* embraced little more than ten thousand square miles in northeastern Texas and southern Oklahoma, and probably half of that area produced no trees of commercial size. From this restricted region it has been artificially propagated over most of the United States, chiefly for hedges and ornamental planting.

The wood is very heavy, hard, strong and externally durable in contact with the ground. Its many virtues are offset by so many disadvantages such as small size, crooked growth, knottiness, defective heart, difficulty of working, liability to split, as well as meagre supply, that for only a few uses is it well adapted. The principal use is for fence posts which consumes about 4,000,000 annually. Its only virtue for this purpose is its durability, since most of the posts are undersized and so crooked that it is difficult to adjust them to a fence. Their use is confined almost exclusively to wire fences. The demand for them exceeds the supply and a region of 30,000 to 40,000 square miles in northeastern Texas and southern Oklahoma has few posts of any other wood.

About 10,000 to 12,000 wagons with Osage Orange felloes are manufactured annually. The demand for such wagons is largest in dry, warm localities with roads comparatively free from stones. The wood swells and shrinks but little under climatic changes and long, hot seasons and dry sandy roads constitute conditions where the Osage Orange rim gives best service and where it is reputed to be superior to all other that have been tried. Tires do not work loose, but will sometimes wear out without need of resetting. The wood is hard to shape, dulls the tools very quickly, is usually available only in short pieces and is unsuited for use on rough roads where the shock of jolting will split felloes made of it. There appears to be little future for the felloes business in this timber for it is estimated that the present rate of cutting will exhaust the wagon material in three or four years.

Other products of the timber are bridge piling, house blocks, telephone poles, insulator pins, policemen's clubs, canes, rollers, parquetry, tobacco pipes, and wagon spokes. The total annual consumption for all purposes is estimated to be 26,000,000 feet B. M. A drain much smaller than this will soon deforest the remaining areas of standing timber which if grouped in one body, would probably not exceed 400 square miles in area. Even if every tree of the species in Texas and Oklahoma were cut, it is doubtful whether there is enough to hold out ten years at the present rate.

S. J. R.

Report on Cöoperative Forestry. By E. J. Zavitz, in Thirty-Second Annual Report of the Ontario Agricultural and Experimental Union, 1910. Legislative Assembly, Toronto, Ontario. 1911. Pp. 46-48.

Of the 400,000 trees distributed or planted during 1910 by the Forestry Department of the provincial Department of Agriculture, about one-half went to private planters, the remainder being planted at the Norfolk Forest Station. The private planting embraces waste lands and depleted woodlots. The aim of the Department is the introduction of the more valuable hardwoods, with an eye to the coming scarcity. During the last five years some two million forest trees have been sent out to coöperative planters or planted on Government land, with a high percentage of success. Already plantations have been started in forty counties. The more important work of the department, however, is the conducting of a forest station in Norfolk county, comprising some 1,300 acres. The work at the station consists largely of experiments in the reclamation of waste land by forest planting, and nursery work to produce planting material. At present (1910) the nursery contains some 800,000 transplants and double that number of seedlings.

The importance of the work under the Department can be appreciated only by a realization of the considerable percentage of waste land included in agricultural southwestern Ontario.

J. H. W.

Waterpowers of Canada. By Leo G. Denis and Arthur V. White. Commission of Conservation, Canada. Ottawa. 1911. Pp. 396.

The Commission of Conservation, Ottawa, has issued this valuable report on Canada's Waterpower Resources. It represents the first inventory ever taken of the waterpowers of the Dominion. The investigation shows that there are 1,016,521 horsepower developed from waterpower in Canada. Every phase of the subject from the laws governing the disposition of waterpowers in the various provinces, to the actual physical data regarding each individual waterpower concerning which information was obtainable, is treated. In addition, there is a very full bibliography of 30 pages, and appendices giving, among other things, the text of the laws concerning the export of power and also of the treaty recently concluded with the United States regarding the establishment of an International Joint Commission.

The volume opens with two chapters of an introductory nature that are concerned mainly with the general economic bearing of waterpowers on national development. The relation of water to agriculture, mining, navigation, domestic supply and so forth, is dealt with, and the principles to be used in the interpretation of waterpowers data are stated and discussed critically. The broad and optimistic statements very often made on the platform and in the press regarding our vast waterpower resources are deprecated.

A chapter is devoted to the waterpowers of each province in which the general features of the province as regards waterpower development are discussed, and an outline given of the law whereby powers are granted or leased to private individuals or corporations. The larger developments are also described. The statistical data given in tabular form includes the height of the fall, the horsepower that may be developed, the present development and the main uses to which the power is applied, such as lighting, pulp and paper making, etc. Reference is also made to the possibility of increasing the amount of power developed by storage reservoirs and dams where such are feasible.

The power situation in Ontario is treated very fully, special attention being given to the power possibilities at Niagara and the conditions affecting development there. The report states that the low-water flow of the Niagara River would yield at the Falls, about 2,250,000 horsepower, of which Canada's share (one-half), would be 1,125,000 horsepower. Franchises have already been granted and plants partially completed, for the development on the Canadian side of the river, of about 450,000 horsepower. In other words, instead of "millions" of horsepower being available, as has been sometimes stated, it appears that about half, and by all odds the better half of Canada's usable share of Niagara Falls power has already been placed under private control.

The volume embodies all the useful information regarding the waterpowers of Canada that has heretofore been collected, and this has been supplemented and, in many cases, verified, by field surveys, conducted by the engineers of the Commission. In fact, all the information regarding the Maritime Province powers was obtained in this way last year by the experts of the Commission. A valuable supplement to the work is a series of maps showing the waterpowers in the various provinces and the irrigation canals in Alberta.—From Pulp and Paper Magazine of Canada.

OTHER CURRENT LITERATURE.

Avalanches and Forest Cover in the Northern Cascades. By T. T. Munger. Circular 173, U. S. Forest Service. Washington, D. C. 1911. Pp. 12.

A discussion of the character of the region, character of avalanches, relation of forest cover to the formation of slope slides, effect of forest in checking avalanches, protection of forests in the Alps, and preventive measures in the Northern Cascades.

Manufacture and Utilization of Hickory, 1911. By C. F. Hatch. Circular 187, U. S. Forest Service. Washington, D. C. 1911. Pp. 16.

Strength Values for Structural Timbers. By McGarvey Cline. Circular 189, Forest Products Laboratory Series, U. S. Forest Service. Washington, D. C. 1912. Pp. 8.

Modification of the Sulphonation Test for Creosote. By E. Bateman. Circular 191, Forest Products Laboratory Series, U. S. Forest Service. Washington, D. C. 1912. Pp. 7.

The Prevention of Sap Stain in Lumber. By H. F. Weiss and C. T. Barnum. Circular 192, U. S. Forest Service. Washington, D. C. 1911. Pp. 19.

Progress Report on Wood-Paving Experiments in Minneapolis. By F. M. Bond. Circular 194, Forest Products Laboratory Series, U. S. Forest Service. Washington, D. C. 1912. Pp. 19.

The Influence of Age and Condition of the Tree upon Seed Production in Western Yellow Pine. By G. A. Pearson. Circular 196, U. S. Forest Service. Washington, D. C. 1912. Pp. 11.

Coyote-Proof Inclosures in Connection with Range Lambing Grounds. By J. T. Jardine. Bulletin 97, U. S. Forest Service. Washington, D. C. 1911. Pp. 32.

Reforestation on the National Forests: Part I—Collection of Seed; Part II—Direct Seeding. By W. T. Cox. Bulletin 98, U. S. Forest Service. Washington, D. C. 1911. Pp. 57.

The Crater National Forest: Its Resources and Their Conservation. By F. Burns. Bulletin 100, U. S. Forest Service. Washington, D. C. 1911. Pp. 20.

Western Yellow Pine in Arizona and New Mexico. By T. S. Woolsey, Jr. Bulletin 101, U. S. Forest Service. Washington, D. C. 1911. Pp. 64.

The Identification of Important North American Oak Woods. By G. B Sudworth and C. D. Mell. Bulletin 102, U. S. Forest Service. Washington, D. C. 1911. Pp. 56.

Distinguishing Characteristics of North American Gum Woods. By G. B. Sudworth and C. D. Mell. Bulletin 103, U. S. Forest Service. Washington D. C. 1911. Pp. 20.

Pulpwood Consumption, 1910. Forest Products, No. 1, Bureau of the Census. Compiled in co-operation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 10.

Veneers, 1910. Forest Products, No. 5, Bureau of the Census. Compiled in co-operation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 6.

Wood Distillation, 1910. Forest Products, No. 7, Bureau of the Census. Compiled in co-operation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 5.

Record of Wholesale Prices of Lumber. Based on actual sales made F. O. B. mill for July, August, and September, 1911. U. S. Forest Service. Washington, D. C.

Washington's Secondary Wood-Using Industries. By H. B. Oakleaf (U. S. Forest Service). Reprint from The Pacific Lumber Trade Journal. Seattle, Washington. 1911. Pp. 8.

The Wood-Using Industries of Louisiana. By Hu Maxwell, under the direction of H. S. Sackett. Reprint from The Lumber Trade Journal. New Orleans, La. 1912. Pp. 15.

The Wood-Using Industries of Illinois. By R. E. Simmons, under the direction of J. C. Blair and H. S. Sackett. 1912. Pp. 164.

The Control of the Chestnut Bark Disease. By H. Metcalf and J. F. Collins. Farmers' Bulletin 467, Department of Agriculture. Washington, D. C. 1911. Pp. 24.

Annual Report of the Smithsonian Institution, 1910. Washington, D. C. 1911.

Among the many interesting papers contains one on Forest Preservation by Henry S. Graves, (pp. 433-445).

Report of the Secretary of Agriculture, 1911. Washington, D. C. Pp. 150.

Wood Turpentine: Its Production, Refining, Properties and Uses. By F. P. Veitch and M. G. Donk. Bulletin 144, Bureau of Chemistry. Washington, D. C. 1911. Pp. 76.

Third Annual Report of the State Forester of Vermont, 1911. By A. F. Hawes. Burlington, Vt. 1912. Pp. 44.

A Leaf Key to the Genera of the Common Wild and Cultivated Deciduous Trees of New Jersey. By Mary F. Barrett. Upper Montclair, New Jersey. 1911. Pp. 7.

Practical Botany. By J. Y. Bergen and O. W. Caldwell. Boston, Mass. 1911. Pp. 545.

Trees and Forestry—An Elementary Treatment of the Subject Based on the Jesup Collection of North American Woods in the American Museum of Natural History. By Mary C. Dickerson. American Museum of Natural History, New York. 1910. Pp. 104.

American Society for Testing Materials: Yearbook, 1911, containing the Standard Specifications. Philadelphia, Pa. 1911. Pp. 385.

Contains standard classification of structural timber (pp. 166-169); standard specifications for yellow pine bridge and trestle timbers (pp. 170-172).

Fourth Annual Report of the Missouri State Board of Horticulture, 1910. Jefferson, Missouri. 1911. Pp. 394.

Chestnut in Tennessee. By W. W. Ashe. Extract (B) from Bulletin 10, Forest Studies in Tennessee. State Geological Survey, in co-operation with the U. S. Forest Service. Nashville, Tenn. 1912. Pp. 35.

Proceedings of the Forest Fire Conference of the Western Forestry and Conservation Association at Portland, Oregon, December, 1911. Compiled and issued by The Timberman, Portland, Oregon.

The Uses of Philippine Woods. Bulletin 11, Bureau of Forestry. Manila, P. I. 1911. Pp. 50.

Annual Report of the Director of Forestry of the Philippine Islands for Year Ending June 30, 1911. By Major G. P. Ahern. Manila, P. I. 1911. Pp. 42.

Customs Tariff of Cuba. Department of Commerce and Labor. Bureau of Manufactures. Tariff Series No. 27. Revised to November, 1911. Pp. 89.

The laws relating to wood and other vegetable materials employed in paper and other manufacturing are of special interest.

Forest Products of Canada, 1910: Poles Purchased. By H. R. MacMillan and W. G. H. Boyce. Bulletin 21, Forestry Branch. Ottawa, Canada. 1911. Pp. 8.

Forest Products of Canada, 1910: Cross-Ties Purchased. By H. R. MacMillan and W. G. H. Boyce. Bulletin 22, Forestry Branch. Ottawa, Canada. 1911. Pp. 7.

Forest Products of Canada, 1910: Timber Used in Mining Operations. By H. R. MacMillan, B. Robertson and G. Boyce. Bulletin 23. Forestry Branch, Ottawa, Canada. 1911. Pp. 12.

Wood-Using Industries of Canada, 1910: Agricultural Implements and Vehicles, Furniture and Cars, Veneers. By H. R. MacMillan, B. Robertson and W. G. H. Boyce. Bulletin 24, Forestry Branch. Ottawa, Canada. 1911. Pp. 42.

Forest Products of Canada, 1910: Lumber, Square Timber, Lath and Shingles. By H. R. MacMillan, B. Robertson and W. G. H. Boyce. Bulletin 25, Forestry Branch. Ottawa, Canada. 1911. Pp. 39.

Forest Products of Canada, 1910: Pulpwood. By H. R. MacMillan, B. Robertson and W. G. H. Boyce. Bulletin 26, Forestry Branch. Ottawa, Canada. Pp. 14.

Forest Products of Canada, 1910: Tight and Slack Cooperage. By H. R. MacMillan, B. Roberston and W. G. H. Boyce. Bulletin 27, Forestry Branch. Ottawa, Canada. 1911. Pp. 11.

A Study of Maple Syrup. Bulletin 228, Laboratory of the Inland Revenue Department. Ottawa, Canada. 1911. Pp. 41.

Experimental Farms: Appendix to the Report of the Minister of Agriculture for year ending March 31, 1911. Ottawa, Canada. 1912. Pp. 548.

Among the contents of the reports of the various officials at the several experimental farms and stations are to be found the conclusions drawn from the forest belt plantations begun in

1887, data regarding the Spruce Budworm and Larch Sawfly and the projected work of controlling them by parasites, and an account of some plant diseases of trees. The Arboretum and Botanic Garden which in the past has been mainly a trial ground for ornamental trees and shrubs is to be developed along broader lines.

A Critical Revision of the Genus Eucalyptus: Part 13 (Volume 2, part 3). By J. H. Maiden. Sydney, New South Wales. 1911. Pp. 101-133, plates 57-60.

Australian Plants Suitable for Gardens, Parks, Timber Reserves, etc. By W. R. Guilfoyle. Melbourne, Australia. Pp. 478.

Trees of the Tasmanian Forests of the Order Myrtaceae: the Genus Eucalyptus. By L. Rodway. Bulletin 17, Agriculture and Stock Department, Tasmania. 1911. Pp. 15.

Extracts from a Report on Forestry in Southern Rhodesia. By James Sim. Bulletin 71, Rhodesia Department of Agriculture. Salisbury. 1911. Pp. 44.

The Virgin Forests of Kamerun. By Jentsch. Tropenpflanzer, Beihefte 12, No. 1-2. 1911. Pp. 199.

This report embodies the results of investigations made relative to the composition and character of the areas examined in Kamerun and Togo and gives the author's conclusions relative to the utilization and conservative exploitation of the forests, together with considerable information of value in the establishment of private wood-working industries.

The Tree Species of Java: Contribution No. 12. By S. H. Koorders and T. Valeton. No. 10. Meded. Dept. Laudb. Dutch East Indies. 1910. Pp. 782.

This is the twelfth of a series of reports on the tree species of Java which have been published from time to time, and the first of which appeared in 1894. The present report gives the contents of the previous volumes and deals specifically with the species and genera of Buxaceae, Euphorbiaceae, Ulmaceae, and Urticaceae.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forest Conditions in Belgium and Holland.

Belgium has a total area of 11,324 square miles, of which 18 per cent is forest. Of this the State owns 76,000 acres; municipalities a little over 411,000 acres; other public institutions 15,800 acres; or altogether 503,000 acres under State supervision, leaving in private ownership without State control 818,350 acres. Belgium having a population of over 600 per square mile, it requires a large importation of wood materials, which in 1909 amounted to nearly 40,000,000 dollars. Lately the derivation of this import has considerably changed for while in 1896 the importation from Russia was one-half of what came from Sweden and Norway, in 1909 four times as much was imported from Russia as from the other countries. Russia evidently has become the main exporter among the European countries.

The composition of the forest under State control shows 13 per cent broadleaf high forest, 23 per cent coniferous, 22 per cent coppice, 39 per cent coppice with standards, and 3 per cent young plantations. Until 1884 the policy of selling State lands had prevailed. Since then the State began a policy of purchasing waste lands for reforestation, of which the large amount of 350,-000 acres exists.

The net yield from the State forests for 1905 was only $1.72 per acre on account of the large area of waste lands included. The communal forests yielded $1.81, the other public forests $3.45.

Holland has a forest of 628,516 acres, or 7.9 per cent of its total area; of this 328,628 acres is coniferous, which, however, furnishes only small sizes, mainly mine timber. Of the broadleaf forest about 55,000 is high forest and 260,000 acres coppice, mostly tanbark oak. The State forests comprise a little less than 200,000 acres. Neither municipal nor private forest is under state control. Only three educated foresters with 20 guards form the administrative personnel of the state administration. In spite of the absence of state control the forest area of this ownership grows continuously, especially through reforestation of heaths, of which there are 22 per cent of the total area in existence. This is largely due to the "heidematschappy" association. The State gives subventions, if the plantation is placed under State supervision.

In the Colonies Holland possesses very valuable forest properties, especially some million and a half of steep forest in Java, which have been mapped and divided into eleven districts, a director and three inspectors forming the administration.

A forest school is to be found at Wageningen. The course is three years for those remaining at home, four years for the colonial service, in order to secure knowledge of the colonial dendrology, colonial politics and the native languages.

The importation here, too, is very considerable, and especially that from Russia, which has quintupled since 1899.

Der Holzmarkt von Belgien und Holland. Forstwissenschaftliches Centralblatt. December, 1911. Pp. 262-265.

Forests of Roumania.

The forest area of Roumania contains 6,817,027 acres (21 per cent of total area), of which 3,687,315 are under private ownership, 2,642,166 are state forests, and the small balance communal or crown forests. The most valuable part is in State ownership. It is claimed that due to devastation and reforestation the water conditions of the country have been considerably changed, destructive droughts being not infrequent. The first thorough reorganization was legislated in 1881, when State control began to be exercised. Plantations on sand dunes, distribution of plant material for reforestation formed part of this legislation.

The distribution of the forest area in the different districts is given. The composition of the forest is almost entirely of broadleafed trees, oak, elm, ash, beech, with poplar, basswood, alder. The coniferous forest (spruce, pine, larch) in the state property comprises only 370,000 acres. The method of exploitation is mainly by selection. The yearly net income per acre per tree, etc., are given. A table of exports and imports through the years from 1882 to 1907 shows that there is a considerable excess of exports. In 1907 the exports, however, were five million dollars, while the imports reached hardly 1,800,000 dollars. Most of the exports go to Austria and Holland.

Der Waldreichtum Rumäniens. Zeitschrift für Forst- und Jagdwesen. November, 1911. Pp. 858-862.

Forestry in Holland.

The forest area of Holland has been increased by 30 per cent in the last twenty years in spite of the fact that the country is level, and the protective functions of forests which so clearly reveal themselves in a mountainous region are here less readily recognized. Of course none but waste lands are forested and wood production has been the leading motive; protection from high winds and from shifting sands have nevertheless been recognized as secondary advantages. The region along the west coast and the sterile country south and southeast of the Zuider Zee has been the scene of the mose active planting. Plantations dating back to 1870 may be seen in Gelderland and Utrecht. The largest forest nursery is at Zundert near Breda.

A mutual betterment association of owners of heath land, the Heath Society, was the only organization interested in forestry during the nineteenth century. It carried on a campaign of education and encouraged forest planting until in 1898 a state forest service was organized. Now both work hand in hand. There is danger that before their work stops the last picturesque Dutch heath will be reclaimed.

Waldwirtschaftliche Notizen über Holland. Silva. August, 1911. Pp. 252-4.

BOTANY AND ZOOLOGY.

Weight and Surface Area of Beech Foliage.

In a study on the nutrition of different stemclasses of forest trees, Dr. Ramann had occasion to ascertain the foliage conditions of the different stemclasses, as well as the weight of different parts of the wood. The leaves were gathered from felled trees on September 18 before any leaf-fall had taken place, the size being ascertained by cutting out sizes on paper and weighing them, then referring to unit measure.

Since such data are rarely collected we reprint the full series:

I. Polewood.

1. Codominant stem. Height, 14.45 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	63,016g	35,426g	73.9
Brushwood,	19,970g	11,309g	23.6
Foliage,	2,323g	1,151g	2.4
		47,886g	

The leaves consisted to the amount of around two-thirds of "light" leaves, and one-third of "shade" leaves. A light leaf weighs .1385 *g,* and measures 19.78 *qcm;* a shade leaf weighs .0717 *g,* and measures 21.27 *qcm.* The number of light leaves was 5,590; leaf surface 11.06 *qm;* number of shade leaves 5,360, leaf surface 11.39 *qm.* Total number of leaves 10,950; total leaf surface 22.45 *qm.*

2. Subdominant stem. Height, 13.51 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	24,300g	15,880g	89.8
Brushwood,	2,600g	1,507g	8.5
Foliage,	604g	308g	1.7
		17,695g	

One leaf weighs .090 *g.* and measures 17.92 *qcm.* Number of leaves 6,710; surface 12.08 *qm.*

3. Oppressed stem. Height, 13 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	27,110g	16,234g	91.9
Branches,	2,120g	1,200g	6.7
Foliage,	565g	261g	1.4
		17,695g	

Number of leaves 3,145; leaf surface 8.62 *qm.*

This tree had numerous water sprouts and nearly reached the crown height of the stand; evidently overgrown only in the last few years.

The stem classes are characterized by the decrease of the brushwood and foliage per cent, and especially of number of leaves and surface.

II. Closed Stand, 25 years old.

1. Predominant stem. Height, 9.1 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	40,438*g*	22,240*g*	74.7
Branches,	10,420*g*	6,200*g*	20.8
Foliage,	2,458*g*	1,327*g*	4.4
		29,767*g*	

One light leaf weighs .175 *g,* measuring 25.45 *qcm;* one shade leaf weighs .0635 *g,* measuring 19.56 *qcm.* Number of light leaves 9,090, weighing 2,591 *g;* shade leaves 13,650, weighing 867 *g* (fresh). Surface of light leaves 23.1 *qm,* of shade leaves 16.9 *qm.*

2. Slightly codominant stem. Height 8.1 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	9,150*g*	5,250*g*	87.0
Branches,	1,012*g*	612*g*	10.1
Foliage,	349*g*	172*g*	2.8
		6,034*g*	

One leaf weighs .192 *g,* measuring 30.9 *qcm.* Number of leaves 896; leaf surface 2.77 *qcm.*

3. Subdominant stem. Height 7.29 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	7,360*g*	3,826*g*	85.9
Branches,	830*g*	464*g*	10.4
Foliage,	355*g*	168*g*	3.7
		4,458*g*	

One leaf weighs .074 *g,* measuring 13.93 *qcm.* Number of leaves 2,270; leaf surface 2.96.

4. Oppressed tree. Height 6.3 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	1,405*g*	796*g*	83.9
Branches,	260*g*	127*g*	13.8
Foliage,	447*g*	246*g*	2.6
		1,169*g*	

One leaf weighs .042 *g,* measuring 14.9 *qcm.* Number of leaves 586; leaf surface .87 *qm.*

III. Beech Thicket.

1. Predominant stem. Height 4.95 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	3,920g	2,212g	64.4
Branches,	1,535g	880g	27.7
Foliage,	615g	330g	9.6
		3,422g	

2. Codominant stem. Height 4.65 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	1,950g	1,083g	73.2
Branches,	328g	295g	19.9
Foliage,	215g	102g	6.9
		1,480g	

3. Slightly codominant stem. Height 3.4 *m.*

	Fresh.	*Dry.*	*% of Tree.*
Bodywood,	590g	350g	65.3
Branches,	235g	136g	25.3
Foliage,	105g	58g	9.3
		544g	

The close relation between the organs of assimilation and the stem classes is apparent; not only the absolute number of leaves but their relative amounts show this relation. Weight and surface of the single leaves as well as of the totality, show unmistakably their relation to light. These observations as well as others by the author, lead to the conclusion (long ago assumed) that the light conditions at least with tolerable species affect mainly the suppression of the lower stem classes.

Blättergewicht und Blätterflächen einiger Buchen. Zeitschrift für Forst- und Jagdwesen, December, 1911. Pp. 916-919.

SOIL, WATER AND CLIMATE.

Water Movement.

In connection with the discussions on forest influence on waterflow, the following general data of water distribution on the earth, furnished by Meinardus, with reference to various authorities, is of interest.

The amount of water evaporated annually from the oceans is 384,000 km^3, equal to a depth of 106 *cm*. The precipitation over the land area is calculated at 112,000 km^3, equivalent to 75 *cm* rainfall. The amount of water carried to sea by rivers is figured at 30,640 km^3 (the flow of groundwater into oceans being neglected). This is the surplus of precipitation over evaporation. Adding the first two figures and deducting the last, 465,000 km^3, equivalent to 91 *cm* in height, is the amount of water which during the year makes the circuit from earth and sea into the air and back. There is a certain unmeasured addition of water vapor which evaporated on land, contributes to the sea outside the river-flow. This must be compensated for by a corresponding water vapor inflow from the sea.

The time which during this circulation a water particle in the average ocupies in sea, air and land is speculated on. For the maritime stage, the relation of the annually evaporated quantity to the total water contents of the ocean can be used to figure. The volume of ocean waters has been calculated at 1330 mill km^3. Of this evaporates the 3460th part; hence 3460 years in the average pass before any given water particle in the ocean passes into the air. This is, of course, an average value; while some particles remain only a short time in the ocean, others may remain over 3,000 years before they come to be evaporated.

To determine the time of suspension in the air, the air humidity values may be used, with the use of Hann's formula of the vertical distribution of humidity. The water contents of the total atmosphere are then found to be 12,300 km^3, equivalent to a precipitation of 24.2 *mm*. This, compared with the actual precipitation, (465,00 : 12,300) brings us to the conclusion that during the year the atmosphere must discharge all the water it contains 38 times during the year to furnish this precipitation, i. e., a particle would have to return in the average in 9 to 10 days to the earth; those in the lower strata in a very much shorter time, those in the upper strata in so much longer time.

For the terrestial stage of the circulation, which interests us the most, unfortunately the data are lacking. It would require knowledge of the amount of water maintained in the soil, in addition to the amounts of snow and ice, which in that form retard the water movement.

All we know is that these water masses are returned to the sea in a very much longer time than is often believed, while the surface waters remain only a short time in this stage of the circulation.

Ueber den Kreislauf des Wassers. Centralblatt für das gesammte Forstwesen. November, 1911. Pp. 534-536.

Water Absorption and Tree Species. Since trees make very little demand upon the chemical constituents of the soil, improvement from the forester's standpoint is mainly betterment of the physical conditions. Among these latter the capacity for absorbing water is the most important in a forest soil. Increases in this capacity are followed in almost every case by better tree growth. Moreover, a soil with great capacity for retaining moisture is of advantage not only to the individual growing trees, but also to the whole community, since it exercises a steadying influence upon the local climate and stream flow.

In order to determine the degree of improvement in water absorbing capacity resulting from growing different tree species sample plots were taken in stands of beech, fir, spruce, oak, larch, and White Pine. Using the stands of beech as the basis of comparison the soil in pure stands of the other species was found to bear the following relations, expressed as percentages of the water capacity of soil in stands of beech:

Fir,	95%
Spruce,	95%
Oak,	84%
Larch,	81%
White Pine,	79%

From these figures it is readily seen that the shade enduring species exert the greatest influence upon the water capacity of the soil. On the average this capacity is one-sixth greater on sites covered with shade enduring species.

Studien über das Bodenbesserungsvermögen unserer wichtigsten Holzarten. Centralblatt für das gesammte Forstwesen. October, 1911. Pp. 447-458.

Bog Soils.

Recently completed research by Hesselmann at the Swedish forest experiment station indicate that a boggy soil is inimical to tree growth on account of the lack of oxygen in the soil rather than because of an excess of moisture. Stands growing near springs, streams, or ponds where the water is in motion enough to become thoroughly aerated grow thriftily. On the other hand boggy soils are saturated with water which is practically free from oxygen, and tree growth is retarded.

Mitteilungen aus der forstlichen Versuchsanstalt Schwedens.. 7. Heft. Centralblatt für das gesammte Forstwesen. October, 1911. Pp. 485-486.

SILVICULTURE PROTECTION AND EXTENSION.

Silviculture on Heath Lands.

Whoever has to deal with waste lands, where heather and raw humus afford difficulties will read with interest the chronicles by Frômbling, written in most readable style, of a district in the Luneburg Heath, under management of the author's ancestors since 1801.

Originally covered with a rich hardwood forest of beech and oak, which, as long as the humus cover and full shade was preserved, thrived on the loamy sand in spite of the total absence of lime, mismanagement (clearing) turned the country into a waste.

First come in raspberry and rose, using up the humus, then *Aira flexuosa,* and finally *Calluna vulgaris* remains the sole proprietor of the soil; even good farmland which with proper treatment would produce any crop, left to itself soon falls a victim to this small plant.

Pine and Spruce have been used to recover the ground, and by the middle of last century the district in question had been mostly planted up, generally by sowing cones on plats, 2 feet square, 4 feet spaced, pine being used in the open heath, spruce in the open coppice stands, where the presence of huckleberry augured still better soil conditions. Later, for spruce, transplants were used.

Such large quantities of seed were used (10 lbs. per acre) that the stands were overcrowded, but, the author states, out of such stands of pine on raw humus were produced the excellent results here recorded. "Dry turf is a most improper designation for this raw humus."

The leaf-fall of the dense sowings fertilized the soil bountifully, and the heather vanished. After 15 years the first thinning for bean poles, etc., took place in the pine stands, large quantities of dead material being downed at the same time. Later, insects and fungi, especially the latter, did the thinning, but the remarkable improvement in soil conditions by the pine needles exhibited itself in the appearance of such a soil flora, as Stellaria, Oxalis, Anemone, Fragaria, where formerly all was Calluna, and oak and beech began to return, planted by birds, and throve in spite of the "dry turf." In some parts this return has given rise to excellent hardwood stands and at the same time has produced improvements in the health of the pine. Underplanting has become the practice. Where this was done too late and the return to heather threatened, spruce was resorted to.

In the old dense spruce sowings the battle with the heather continued longer than in the pine sowings. With the removal of the coppice, the heather had thrived and made matters difficult for the slow spruce, which in 10 years had not yet overtopped the heather. Then, when the supervisor had almost given up hope, gradually some few trees on each seed plot developed dominancy and, gradually increasing in rate, in a short time the spruce had caught up, and far outgrew the pine; excellent longbodied clear sound stands are the result; not a trace of the needy years of early life are visible.

In comparison, the author cites a plantation with four-year old transplants, an innovation at the time which from the very start left the sowings behind and despised, growing at a most rapid rate. After 60 years, however, the difference is quite the other way. In vain do you look for an advantage of the plantation. The sowings, left entirely to themselves, exceed the planted stands in height, the value of the smooth boles is greater, the soil is in better condition and volume production is visibly larger.

After further derogatory remarks on the results of planting at 4-foot spacing with 4-year transplants, the success of planting with ball is extolled. This planting is done by using the hollow spade, setting in couples, 6 inches apart on one-foot square plots, which is done cheaply with plants from the sowings, and in spite of the apparently poor plant material excels the more expensive plantation and comes near in results to the sowings.

Indications are that natural regeneration of the spruce may on these recovered soils be the proper method in future.

In another part of the district, broadleaf forest, oak and beech, was to be, and was continued.

Interesting is the author's explanation that lack of distinction of the two species of oak, *petiolata* and *pedunculata,* which were then still supposed to be one species. The original growth had been mainly *pedunculata*, but the ease with which seeds of *petiolata* could be secured from the planted trees around farm yards led to the use of the latter, especially as it is a much more abundant seeder. But it so happens that it is also more choice of soils and was not adapted to the run-down soil of the heath. However, when the unpromising development had apparently doomed a 100-year old stand as a failure, under Burkhardt's direction 5/6 of the trees were cut out and the rest underplanted with beech with a view of changing to that species. The result has been marvelous. The oaks lost their lichen cover, their boles became smooth, the influence of the beech cover stimulated the old trees to vigorous height growth and promising first-class material production —an indication how this oak must be treated.

Larch and White Pine also were tried, the first with greatest promise at the start, eradicating the heather, but later falling victim to its enemies.

White Pine planted widely in the sixties as a stop gap, begins to fail on account of the woolly aphis, which threatens to exterminate it.

The very interesting account accentuates that in silviculture the short time experiences may be very misleading and that it is dangerous to run off readily into new theories, and condemn too early apparently faulty practices, which may secure ultimate success.

Bestandesgeschichtliches aus der Oberförsterei Harburg. Allgemeine Forst- und Jagdzeitung. November, December, 1911. Pp. 813-831; 899-907.

Light Measurements in Spruce

Prof. Ramann has constructed a photometer in which the fact is utilized that the electric conductivity of the metal selenium is increased by increase of light intensity. The author admits that for the higher and lower light intensities the apparatus may not be reliable, but for low and medium intensities, which are those mostly concerned in practical work, he has found it to all intents and purposes satisfactory. The description of the instrument and of a series of test measurements is promised for a later date.

The light intensity for a given area is called *lux*, i. e., the amount of light which one square centimeter area receives from a normal candle at one meter distance; a lamp of 15-40 candle power at 1*m* distance furnishes 15 to 40 *lux*. As very low degrees of light are ranged those of 150 to 200 *lux;* as low, 250-300 *lux;* as medium, 450-550 *lux;* higher degrees could not be measured with the apparatus.

In the forest the influence of low degrees is very noticeable. much less so the higher degrees. The illumination in the forest changes continually, light and shade vary with the position of the sun and give rise to the fascinating play of "sunspots." Measurements of the light degrees of these sunspots of various size developed that there was more difference than had hitherto been believed, and that the idea that their intensity did not deviate much from that of the general light intensity and had no meaning for the forest floor is a mistaken one. A number of measurements are given, e. g., 60-80 year oak stand, showed a light intensity in the shade of the stand, measured in different places of 140-150-168 *lux;* in sunspots 168-179-225-245 *lux*.

After pointing out that the light rays are always accompanied by heat and admitting that, on account of the constant change of sunspots, locally the influence is only small, the author suggests that the total effect must nevertheless be considerable and imparts to the forest soil characteristics with reference to plant life different from the open.

The measurements were made from May to August on days of even cloudiness, when light intensities between 9 A. M. and 4 to 5 P. M. do not vary very much.

A series of measurements in planted dense spruce stands gave on an average lower intensities than 60 to 70 *lux*.

A stand of natural regeneration mixed with fir gave in the average 74 *lux;* a 90 to 100-year-old stand of same description with soil cover of needles and occasional Hypnum and without any reproduction, gave 84 *lux;* a 75-year-old spruce stand with a soil cover of Oxalis, Hypnum and occasional Carex, gave 56-88 or 72 *lux* in the average.

A series of measurements in stands with natural regeneration developed the difference in relative shade-endurance of spruce and fir. Fir reproduction was found to come in with 95 *lux* and could persist with 95 to 105 *lux*, while spruce for permanent success required at least 120-140 *lux*.

That other than light influences play a part, the author well recognizes, and cites various examples.

Most interesting are the measurements of light intensities found under various degrees of thinnings. Here, average figures would be misleading, hence the detail of a long series of measurements and their ranges are needed to give an insight. The experimental areas at Grafrath were used, the measurements made in medium strong daylight.

In the severely thinned stands the minimum was 88 *lux*, the maximum 235, and the higher intensities were more frequent than the lower, half the number of measurements lying above 112 *lux*. The medium grade shows a range of 76 to 168, half the measurements lying between 84 and 102. The light thinning grade shows a range of 68-108, and more uniform conditions, over 80 per cent lying between 68 and 80 *lux*, and rarely any over 120 *lux*. From three different series of measurements the author averages the relative intensities for the three degrees of thinnings as 80.4, 96.4, 125 *lux* respectively. The series given permit the recognition of a regular lawful progress of light intensity from the closed, planted stand to the severely thinned and open stand.

Highly interesting are the reflections which the author makes on the practice of thinnings. He points out that natural regeneration and artificial reproduction differ in their continued effects on the stand. In the natural regeneration, the plants differ considerably in age, standing room and inherent growth capacity, hence an early differentiation of the favored individuals, the élite, but also of undesirable "money bags" or "wolves" results. In the plantation, the individuals are more nearly of equal development, and since they do not know from early youth the need of room they remain for a time under equal growth conditions, hence the struggle for room when it comes, lasts longer, the trees need assistance from outside, if they are not to suffer in the struggle. Here then is needed a kind of thinning which the stand originating from natural regeneration can dispense with until middle life. Man must by his labor compensate for the interference with Nature.

The thinning of planted spruce stands then has for its object to restore to some extent growth conditions of the natural forest, which is best done by a severe thinning.

The old rule "early, moderate, often" is a measure of education; its object is to aid the work of nature and direct it into orderly channels; it requires more intelligence and more labor than the severer thinnings.

Although light is not the only factor influencing development, there are many reasons for seeing in the degree of light a measure for most of the other favorable or unfavorable factors. (This coming from a soil chemist and soil physicist is a notable utterance!)

Lichtmessungen in Fichtenbeständen. Allegemeine Forst- und Jagdzeitung. December, 1911. Pp. 401-406.

Waste Land Planting.

From the report of the Commission for the reforestation of the "Karst" lands—limestone wastes—in Krain, one of the provinces of Austria, we extract a few statis-years.

The area to be recovered comprised about 9,000 acres. By the end of 1910, 6,300 acres had been planted or 252 acres per year in the average. There were expended altogether $160,000 or nearly $24 per acre, of which, however, only $111,000 are chargeable to actual reboisement work, making the planting cost about $17.50 per acre.

The funds for this work were to the largest extent furnished by the General Government, the Province contributing $20,000. and other incomes, fines, contributions, interest, etc., amounting to nearly $20,000.

Protection against pasturing and fire is afforded by walling in plantations with loose stone walls and ditches, as well as having guards.

Centralblatt für das gesammte Forstwesen. November, 1911. Pp. 526-533.

Growing Stout Wood.

Heavy thinning late in the life of stands for the production of large diameters has been studied by Dr. Wimmenauer in Hesse for the three species there grown, oak, pine, and beech. These studies reveal a favorable response to such treatment by each of these species, the increment per cent rising with the diameter.

For oak the very largest trees should be left excepting only those of markedly inferior form. No attempt to preserve a suppressed growth should be made. An understory of beech or basswood introduced at the proper time is a better practice. The best rotation for growing oak for saw timber is 150 to 160 years, and such rotations yield about 2½ per cent on the investment.

Pine forests should be thinned with less regard for diameter than for form of boles. A rotation of 120 years gives best results in saw timber.

Beech is to be handled in much the same way as oak, but greater attention must be paid to the form of the bole. The heavy thinning should not be deferred beyond the hundredth year in beech stands.

Erfahrungen im Lichtwuchsbetrieb zum Zwecke der Starkholzzucht Silva. June, 1911. Pp. 190-1.

Forestry and Farming.

As a general rule the intermittent use of forest soils for farm crops (Waldfeldbau) is now-a-days seldom met with in Germany. Under certain conditions it still flourishes being employed to advantage for instance in the sandy plain south of Darmstadt.

The forests of the Eberstadt revier cover some five thousand acres in the heart of this region. The annual cut comprises about forty acres. The wood is removed in winter and the ground lies fallow until the following November when it is thoroughly grubbed over. One-year pine seedlings are set out in the early spring in rows one meter apart. In May potatoes are planted between these rows and about half of a full crop grown. They are sold in the ground the purchaser removing the crop from a definite area. The following year a little cultivation is given and the grass cut out where necessary. Cropping more than a single season does not yield enough to pay for the seed potatoes. Yet the crop does not impoverish the soil nearly so much as the current practice of raking up the litter for removal and use. The proceeds from the potato crop reduces the cost of restocking the cut over areas by one-third. Beech seedlings are set out in the fall or spring following the potato harvest. The plants are best set in the same rows with the pine because here they are less subject to browsing by deer. Usually the plantations are fenced for protection against rabbits and deer, the cost of such protection being paid by a part of the income from hunting licenses.

Pine seedlings from Halstenbek grown on heavily fertilized soils gave much better results than those grown in the poor soil near by. Excellent plant material was, however, produced in the rich mountain valleys a little farther to the eastward.

Rabbits, blight and the white-spotted weevil *(Pissodes notatus)* are the chief enemies in plantations. Carbon disulphide, grubbing, trapping, ferreting and shooting are used to keep rabbits in check. Spraying is used for the blight. The weevil is hardest to reach, the only effective method of combatting it is to pull up and burn trees infested with egg masses. These can be readily distinguished.

Waldfeldbau im Flugsandgebiet. Silva. August, 1911. Pp. 258-61.

Telephone Wires for Use in Fire Protection.

The lightest type of wire practicable is a three strand, one copper and two steel, insulated with cotton rubber. It weighs 20 pounds per mile and costs $10.40 per mile in half-mile reels at the factory. The leading electrical companies manufacture it. The wire will stand 67 pounds tensile strain and will transmit telephone messages with 16 ohm instruments 12 to 15 miles. Recommended for temporary lines to be connected with main lines merely laid on the ground for the season and reeled up for the winter.

A No. 18 insulated copper wire had been used enough to demonstrate its feasibility for field lines laid on the ground. This is worth about $13.00 per mile and weighs 58 pounds per mile. If reeled up in the fall it has a life of 6 to 7 years while if left over winter it will last about 4 or 5 years.

These wires are recommended for temporary patrol or lookout points and for connection with two or three day camps in fire season.

Timberman, 1911.

MENSURATION, FINANCE AND MANAGEMENT.

Averaging.

The forester is continually dealing with average figures; he should therefore know the principles of averaging, for this is not always as simple as it appears, the volume per cent formula $\frac{400}{nd}$ applied to stands being a case in point.

Dr. v. Lorenz develops with considerable mathematical apparatus the proper methods of averaging diameters, cross-section areas, comparisons of diameter and area averages, and of stand volumes after Hartig's sample tree method.

In the last case he shows that not less than five more or less rational formulæ can be developed to average the sample trees, giving, of course, five different results.

We cannot afford to reprint the 71 formulæ and their development, which are given to show which averages are correct or the conditions under which different averages are correct. But those who are in the position of teaching forest mensuration should consult the original source.

Zur Bildung von Mittlezahlen. Centralblatt für das gesammte Forstwesen. December, 1911. Pp. 541-558.

Forest Loans.

In the continuation of Tafel's discussion of the principles of loaning on forest property, (briefed in F. Q. vol. IX, p. 638) a few of the incidental data are of interest. For instance, the statement that in spruce the value increment per cent (which includes volume and price per unit measure) on site I has already sunk to 3.8% in the 50th year, on site II to 3.9% in the 60th year, on site III to the same rate in the 70th year; on site IV, it is 3.2% in the 80th year, on site V only 2.1% in the

90th year, so that if 4.25 to 4.5 per cent is the rate at which loans are given, it pays better at those ages to cut, than to borrow. According to Lorey when the average d. b. h. is 7 inches the value increment per cent is below the loan rate.

He concludes that therefore, forests in intermittent management (stands) are not fit for credit loans, except on their soil value.

Discussing the position of forests under sustained yield management, when a yearly income can be derived, he quotes Bernhardt to the effect that the lowest limits for the possibility of such management lies for coppice with 20 year rotation at 3 acres, for timber forest with 60 year rotation at 15 to 20 acres, with 120 year rotation at 35 to 40 acres.

The Prussian soil credit banks make, however, 125 to 250 acres the lowest limit. In Prussia, 66% of the total forest area outside of state and crown forests is held in parcels over 250 acres in extent, and in Bavaria only 32 per cent. Other banks are satisfied with a limit of 40 acres; others again require a proper organization of executive and protective service which premises an extent of probably 5,000 acres.

If the yield is properly determined it furnishes undoubtedly the best basis for loans. The valuation is based on local average prices, and 10 to 15% is deducted to insure against fluctuation of prices, damage from insects or fire, etc.; with broadleaf forest the deduction is only 4 to 8%, and in both cases less if good protection against fire is assured. The capitalization is usually figured at 5%.

Die Beleihung von Waldungen. Forstwissenschaftliches Centralblatt. November, 1911. Pp. 565-576.

Damage Calculation.

In a case of damage for the destruction by fire of a small parcel of a larger stand, Heun points out that, in addition to the cost of producing the 10-year old stand and the capital value of the annual soil rent and administration costs, there is also due the damage which comes from the necessity of eventually having to cut the parcel ten years younger than the rest of the stand, which from managerial reasons would be required, i. e., if the rotation was placed at 60 years, the whole stand would be cut at that age and the parcel would be cut with the rest when only 50 years old, with a loss which is expressed by the difference of the sale value and the expectancy value of the 50-year old stand.

Berechnung von Waldbrandschäden. Forstwissenschaftliches Centralblatt. December, 1911. Pp. 632-634.

Use of Reserves.

The acceptance of the rent theories of forest management by German foresters has according to Stoetzer quite generally resulted in a lowering of rotation and a reduction of the stock of wood in hand. The removal of this excessive wood has given rise to a period of abnormally high incomes from the forest—higher incomes than can be permanently maintained. A strong argument against accepting these theories has been put forward by conservative practitioners who point out that the present generation by merely adopting a new theory of management has acquired no moral right to use this capital accumulated in the past. The point is well taken but the solution lies not in adhering to past practices but in removing the excess capital tied up in the forest and using it not as current income, but as capital to be reinvested. Proper ways of using it are in the purchase of forest lands, permanent improvements in the existing forest such as roads, tramways, canals, houses for the personnel, etc.

This procedure is not new but is shown to have been practiced at least as early as the forties of the last century. How far it obtains in Germany to-day is not really known but notices of its use in the most widely scattered localities have appeared from time to time. The setting aside of a part of the income from prosperous years to eke out the deficit of poor years is not exactly the same thing.

Reservefonds in des Waldwirtschaft. Silva June, 1911, IV. Pp. 187-190.

Timberland Values.

The Louisiana Board of Equalization has given the following classifications and values for assessment of timber lands:

Pine Lands.	*Stumpage feet B. M.*	*Assessed value per acre.*
Class A,	14,000 and more,	$25.00
Class B,	10,000 and under 14,000,	20.00
Class C,	6,000 and under 10,000,	13.20
Class D,	1,000 and under 6,000,	6.00
Denuded,	under 1,000.	
Cypress Lands.		
Class A,	15,000 and more,	$26.00
Class B,	10,000 and under 15,000,	18.00
Class C,	6,000 and under 10,000,	10.00
Class D,	1,000 and under 6,000,	5.00
Denuded,	under 1,000.	
Hardwood Lands.		
Class A	6,000 and more.	
Class B,	4,000 and under 6,000.	
Class C,	2,000 and under 4,000.	
Denuded,	under 2,000.	

Lumber Trade Journal.

Costs of Yellow Pine.

The following table presents statistics read from a series of diagrams which were prepared for the Hearing in the Missouri ouster cases in Kansas City, relative to the Yellow Pine industry.

	Price per acre	Production billion feet		1897	Increase 1911	in Costs.
1897	$3.00	9.0	Steel Rails	$17.75	$30.50	71.
1898	4.50	9.1	Mules	140.00	275.00	90.6
1899	6.00	9.3	Hay	8.25	22.00	167.
1900	11.00	9.8	Realization	7.75	13.70	78.
1901	18.00	10.00	Manufacturing cost	5.50	9.90	88.
1902	23.00	10.30	Price per Acre	3.00	85.00	
1903	26.00	10.80	Labor	1.40	2.05	46.
1904	28.00	11.3	Corn Chops	.65	1.40	
1905	35.00	11.6	Stumpage	.20	5.00	2500.
1906	50.00	11.7	Carrying Charges	.10	2.50	
1907	52.00	12.5	Taxes	.06	.40	666.
1908	58.00	11.6	Lumber No. 2 & 3			19.
1909	64.00	14.2	Lumber No. 1 and better			—23.4
1910	70.00	17.0				
1911	85.00					

St. Louis Lumberman.

UTILIZATION, MARKET AND TECHNOLOGY.

Electric Compared to Steam Logging.

Following a more or less detailed description of an outfit for logging by electricity, a tabulated statement of the cost compared to that of a steam method where the skidding is done by donkey engines, is given in The Timberman of October, 1911:

Power Plant.

Intake and dam,	$50.00
Pipe line, 18 inch wood stave (continuous), laid,	640.00
Water wheel, installed (200 h. p. capacity),	300.00
Power house, shed construction,	150.00
Electric generator and station instruments (D. C.),	950.00
Wiring (say ½ mile),	400.00
Total cost, ready to operate,	$2,490.00
Electric donkey, complete, with 50 h. p. motor geared 8 to 1, with same drums and equal to 9 x 10 inch steam outfit and guaranteed to do the same class of work,	950.00
Electric falling and bucking saw, takes one man to run it; will do the work of 5 men,	150.00
Complete equipment up to roader point in logging operation,	$3,590.00
To this amount should be added for 65 h. p. "roader" donkey,	1,150.00
Extra line construction for same,	250.00
Making the total outlay for a complete electric outfit to skid logs, 3,000 feet,	$4,990.00

To operate this outfit will require the following fixed costs, to get an output of 80,000 feet of logs per day:

Interest on investment, at 10%, to cover contingent extras, $490.00 per year, or per day of 300 working days in year,	$1.66
Depreciation, 5%,	.84
1 Electrician at power house,	4.00
2 Electricians at donkeys ($4.00 each),	8.00
2 Choker men ($3.00 each),	6.00
1 Sniper,	3.00
1 Chaser,	2.50
3 Rigging slingers ($3.50 each),	10.50
1 Signal man,	3.00
1 Faller and bucker to operate electric saw,	3.50
	$39.00
To this add another $2.00 for repairs especially chargeable to the electric equipment,	2.00
And we have as the total daily cost of operating,	$41.00

Or a cost of 51¼ cents per thousand from the tree to the water, on 3,000 foot delivery.

Opposed to this is the average cost of logging by steam given by a Portland engineer:

4 Fallers at $3.00,	$12.00
3 Buckers at $3.00,	9.00
Yarder crew—1 driver, 1 fireman, 1 bucker, 1 chaser, 1 hook-tender, 2 rigging slingers, 1 swamper and sniper,	26.00
Roader crew—1 engineer, 1 fireman, 1 bucker, 1 chaser, 1 grab man,	16.00

Yarder upkeep (½ estimate),	5.00
Roader upkeep (½ estimate),	8.25
Total daily cost, 3,000 foot haul for 50,000 to 75,000 feet B. M.,	$76.25

Per one thousand feet of logs:
Electric, ... $0.51
Steam, ... $1.00 to $1.50

Logging Costs.

At a meeting of Southern Logging Superintendents Association the following maximum and minimum costs of logging was given:

Cost per Thousand Log Scale.

	Arkansas.		*Texas.*		*Louisiana.*		*Mississippi.*	
	Min.	*Max.*	*Min.*	*Max.*	*Min.*	*Max.*	*Min.*	*Max.*
1. Cutting right of way, breaking ground, grading and building bridges,	.146	.16	.30	.47	.27	.59	.32	.75
2. Taking up, laying steel and repairs to track,	.51	.55	.282	.30	.21	.38	.21	.25
3. Cutting logs,	.336	.37	.23	.45	.14	.59	.28	.35
4. Hauling or skidding to tracks,	.353	.63	.45	1.61	.49	2.09	1.60	1.80
5. Cost of loading logs on cars,	.219	.22	.176	.50	.17	.58	.28	.31
6. Feed,	.16	.22	.126	.374	.12	.36	.14	.18
Total stump to pond,	$2.53	$4.00	$1.43	$4.57	$2.10	$4.75	$2.30	$2.70

Lumber Trade Journal.

Endless Chain Saw.

A saw blade with a sprocket wheel at each end and a sprocket chain with teeth on the outside constitutes the endless chain saw. Any sort of power may be used to run the chain. A three and one-half foot saw requires about seven horse-power; a two foot saw, about four horse-power. The saws may be turned at any angle so that trees may be felled or logs cut to shorter lengths either on land or in the pond. A 20-inch tree can be felled in 20 seconds. The portable felling outfit weighs 500 pounds.—St. Louis Lumberman, September, 1911.

Hill Climbing Locomotive. A locomotive has been developed in Oregon to haul a loaded train on a grade as great as 25 per cent. Propelling power is by cable giving a speed of 4 to 20 miles per hour. This engine does away with expensive road construction, saving cuts, fills and bridges. The engineer has control of his engine through three sets of brakes and the reverse. The boiler is of a marine type hung in a cradle to allow for adjustment on grades.—West Coast Lumberman, July, 1911.

Shrinkage in Seasoning. The following percentages were determined by actual tests and reported to the Hardwood Manufacturers' Association:

Wood	*2 months dry per cent*	*4 months dry per cent*	*6 months dry per cent*
Ash,	3 ⅓	6	6
Basswood,	3½	5	7
Beech,	3	3½	7
Butternut,	4	6	6½
Cherry,	2½	4½	6½
Chestnut,	6	6½	7½
Cottonwood,	6	8½	10
Cypress,	8	10	10
Elm,	5	7	9
Gum (Sweet),	4	7½	9½
Hickory,	2⅔	4	5½
Maple,	4	7½	8
White Oak (plain),	3½	5	6½
Red Oak (plain),	4	6	8
White Oak (quartered)	2½	5	7
Red Oak (quartered),	3½	6	7½
Poplar (Tulip),	4	6½	8½
Sycamore,	3	5	6
Tupelo,	4	4	6½
Walnut,	3	5½	6

Canada Lumberman.

Tight Cooperage Weights. The following weights are submitted by the "Barrel and Box," as being of value although not exact:

	Beer and Ale Staves. Full Dressed.	*Equalized and Listed.*
Half-barrel,	4½ lbs.	5¼ lbs.
Barrel,	6 "	6½—7 lbs.
Hogshead,	15 "	
Eighth-barrel,	2 "	2½ "
Quarter-barrel,	3¼ "	4 "

Beer and Ale Headings.

Half-barrel,	25 lbs. per set
Barrel,	40 " " "
Quarter-barrel,	18 " " "

Whiskey and Oil Stock, etc.

Pipe staves,	30 to 35 lbs. each
Clarets 36 inch (French),	8 to 10 " "
Clarets 42 inch (French),	10 to 15 " "
Tank staves,	60 to 125 " "
Hewn staves, 5½ feet,	35 lbs.
Hewn staves, 10 feet,	105 lbs.

	Per 1000 staves.
Air dried and listed White Oak Oils, 34 x ¾ x 4½,	3500
Kiln dried and jointed,	2700
Air dried oil barrel staves,	3300
Air dried tierce staves,	3000
Air dried pork barrel staves,	2250
Air dried pork half-barrel staves,	1700

Cost of Veneer. From a paper read at the annual meeting of the Veneer Association, the cost of $\frac{1}{8}$ inch Birch Veneer was figured from a 2 months run as follows:

First Cost.

1000 board feet in logs,		$20.00
Direct labor for all processes including crating,		11.00
		$31.00
Burden.		
Indirect labor,	$3.00	
Taxes,	.32	
Insurance,	.85	
Interest,	.88	
Upkeep,	.95	
Depreciation,	1.25	
Office (includes selling cost),	2.25	9.50
Total cost—1000 board feet logs,		$40.50

1000 feet of logs cuts 5000 feet of merchantable $\frac{1}{8}$ inch veneer. Total cost per 1000 feet $\frac{1}{8}$ inch veneer $8.10. This factory cuts 20,000 feet of veneering per day. For 1-20 inch veneer a cost of $3.40 per 1000 feet of merchantable veneer is given.—Barrel and Box.

Cost of Staves.

In the South in a mill running about 40,000 staves per day, the cost is as follows:

Labor (to produce and pile in yard),	$1.20 per M.
Office, supervision, repairs, etc.,	.57 " "
Packing, hauling, loading,	.78 " "
Timber (1 cd. per 1000 staves) at $2.50,	2.50 " "
Total,	$5.05 " "

On account of "moulding" during the very humid atmosphere in summer only 40 per cent of the staves can be classed as No. 1, while 50 per cent is given as an average for the 6 months of summer. In the winter 75 per cent may be classed as No. 1.—Barrel and Box.

Cooperage of Salt barrels.

The manufacture of cooperage for salt is especially interesting to saw mill men because pine staves may be used and because they may be made from scrap material around the mill. Almost any kind of stave can be used, the narrow one is the favorite because it will not "buckle in" when swollen on the inside from the moisture drawn by the salt. This gives the opportunity to use stock 2 inches wide. Another interesting relation between the salt industry and its cooperage is in the geographical distribution of the sources of supply. The six leading states in production of salt are Michigan, New York, Ohio, Kansas, Louisiana, and California. Each is in or near the center of a lumber region. The fact that the salt industry is a regular and stable industry that fluctuates very little is again a point of interest.—St. Louis Lumberman.

Utilization Notes.

The British Admiralty has placed an order for 200,000 feet of Canadian white spruce to be manufactured into oars for the rowboats of warships. The white spruce grown on Queen Charlotte Islands off the coast of British Columbia, was long ago discovered by the naval officers to be of superior quality and ideally adapted for making oars. This wood is now exclusively used for that purpose on British war vessels.—Canada Lumberman & Woodworker, Nov., 1911.

Dogwood for shuttle blocks is contracted for by the cord in 4, 6, and 8-foot lengths—5 inches at small end; weight about 4,000 pounds per cord. Shuttle blocks are cut into sizes from $12\frac{1}{2}$ x $1\frac{1}{4}$ x $1\frac{5}{8}$ up to 23 x $2\frac{3}{4}$ x $3\frac{1}{4}$. Thirty-five thousand blocks from $12\frac{1}{2}$ to 16 inches long in these sizes weight about 50,000 pounds. Timber is wanted free from knots and other defects.—Southern Lumberman.

Matches manufactured from Alder worth perhaps $7.00 per thousand instead of from high priced pine is an innovation in Washington. The logs are sawed to 16 inch lengths and cut on a veneer machine instead of being stamped out with delicate dies. which are considerably damaged when knots are encountered. The loss in waste is reduced by the lower cost of the material.—West Coast Lumberman, Nov., 1911.

A new paving block has been invented by A. D. Wilson of Beaumont, Texas. By treating sawdust with refuse of oil refineries, then pressing, a brick is formed which is claimed to be practically indestructible. It is being tested for paving value in that city.—Lumber Trade Journal.

In the Southern mountain country where Sassafras grows to merchantable size it has an independent market at a price above that of chestnut. It is used for wardrobes, closet linings, and refrigerators. The odor it is claimed keeps out moths.—Hardwood Record.

Charcoal Data.

The burning of charcoal in pits in Germany gives 500 to 550 pounds of charcoal per cord of beech wood or 215 to 250 pounds per cord of pine wood. The wood burned is small material 4 to 7 cm. ($1\frac{1}{2}''$ to $2\frac{3}{4}''$) diameter at the small end. In case larger material 7 to 14 cm. in diameter is burned the production rises to 650 to 680 pounds per cord for beech and to 280 to 325 pounds per cord for pine wood.

Einiges von der Köhlerei. Silva, April, 1911. IV Pp. 122.-3.

STATISTICS AND HISTORY.

Export Data.

The volume of wood exported from Sweden reached its climax in 1900. Since 1906 the decline has been especially rapid until 1910 showed an increase of 16% over the exports of the preceding year. Great Britain is the largest consumer of Sweden's exports and determines export prices. France, Germany, Denmark and Holland follow in order of the amount received.

The wood exported from Roumania goes largely to Germany and to the nearer Orient especially Bulgaria, Turkey and Greece. Germany imports mill run material and her lead among European countries is largely due to her readiness to accept mixed shipments. Roumanian wood competes in the German markets with that from the neighboring Austrian province of Bukowine and at a decided disadvantage, because it does not enjoy the special rates and through shipping facilities accorded the home product by the Austrian State railways. Cars are very scarce and much wood checks, stains and rots at the stations. Galatz is the principal market and shipping point for wood.

Russia's chief export consists of cereals, and wood follows in importance with 34% of the whole value. In 1902 the wood exported was valued at $42,700,000. By 1908 its value had doubled and by 1910 had further grown to $106,000,000, Germany took 42% of the amount exported, while 29% went to Great Britain, Holland, France and Belgium took most of the remainder. In 1909 7,620,000 tons were exported; this amount fell to 7,470,000 tons in 1910 but the price rose so that there was an increase in the value of 9% in spite of this drop in amount of 2%.

Silva, IV. April, May, 1911.

POLITICS, EDUCATION AND LEGISLATION.

Forestry Education in Bavaria.

In these days of standardizing teaching in the United States it may be of interest to state the newly announced curriculum at the University of Munich, which is suggested to students as fully satisfying the needs and following in proper sequence.

Semester 1. Introductory course, with excursions. Inorganic

Experimental Chemistry. Anatomy and Physiology of Plants. Forest Zoology (natural history of the more important forest animals). Botany, microscopical practicum.

Semester 2. Organic Experimental Chemistry. Botany (systematic and morphology of phanerograms), with excursions; also Dendrology. Mineralogy and Petrography (Laboratory). Forest Entomology.

Semester 3. Factors of Site. General Zoology. Elements of Higher Mathematics and Descriptive Geometry. General Meteorology and Climatology.

Semester 4. Agricultural Chemistry. Forestal Chemistry, especially chemical part of Forest Technology. Pathology of Plants and Protection, including demonstrations and excursions. Geodesy, with special reference to needs of foresters, field work. Geology, with excursions.

Semester 5. General National Economy. Law with special reference to Forestry. Silviculture, with excursions. Forest Mensuration, with practicum.

Semester 6. Finance. Utilization and Technology. Forest Protection. Forest Engineering (Building, Surveying, Drawing, etc.).

Semester 7. Special Economics. Forest Organization and Management. Forest Valuation and Statics. Forest Politics.

Semester 8. Bavarian Administrative Law. Statistics, theoretical and otherwise. Forest Administration. History of Forestry. Problems of Forest profit calculations.

Dr. Fürst, the former director at Aschaffenburg, where the first two years had been located, makes critical comparisons with the former curriculum, and finds that the number of lectures on fundamental and accessory subjects, as well as the extent to which they are to be heard, have been very essentially reduced.

Studienplan für die Studierenden der Forstwissenschaft an der Kgl. Ludwig-Maximilians-Universität München. Forstwissenschaftliches Centralblatt. November, 1911. Pp. 590-594.

Higher education in Finnland was reorganized in 1908 by transferring the same from Evois to the University at Helsingfors. The course is divided into two sections, namely preliminary studies given in the physico-mathematical section of the philosophical faculty, including botany, chemistry, mineralogy, geology, meteorology, mathematics, all in one year; and the main studies, located in the agricultural-economic section of the same faculty, lasting two to three years. Three professors and two assistants give the technical forestry courses.

OTHER PERIODICAL LITERATURE.

American Forestry, XVII, 1911,—

Fire Protection in the National Forests. Pp. 573-586; 652-657.

Describes conditions and methods.

Reforestation on the Pike National Forest. Pp. 646-651.

An account of the accomplishment during the past few years.

Coöperation in Forest Protection. Pp. 665-667.

Timberland Protective Associations. Pp. 667-670.

A summary of their work to date.

Forest Schools in the United States. Pp. 673, 679, 719, 735.

Scientific Management and the Lumber Industry. Pp. 724-730.

Forest Leaves, XIII, 1911,—

The Present Situation in Forestry. Pp. 91-94.

A review of the year's progress in the United States.

The Letchworth Park Arboretum. Pp. 109-110.

Canadian Forestry Journal, VII, 1911,—

Reforestation in Manitoba. Pp. 143-145.

An outline of the proposed work on the Spruce Woods Forest Reserve.

Ontario Should Reforest. Pp. 146-151.

The Future of British Columbia Lumbering. Pp. 157-159. The writer predicts a greater production than Washington within ten years.

Quarterly Journal of Forestry, VI, 1912,—

The Monterey Pine in Britain. Pp. 13-20.

Prussian Experiments with Exotic Trees. Pp. 58-64.

Transactions of the Royal Scottish Arboricultural Society, XXVI, 1912,—

Early Tree Planting in Scotland. Pp. 12-31.
Historical.

The Best Method of Planting at High Altitudes. Pp. 37-45.

Continental Notes—France. Pp. 48-58.

The Indian Forester, XXXVII, 1911,—

Forest Research in India. Pp. 595-605; 641-646.
An outline of the main duties of the officers of the Forest Research Institute at Dehra Dun, a consideration of the work done since the constitution of the institute in 1906, and a discussion of the share which officers throughout the service should take in research work.

[XXXVIII, 1912,—]

Expenditures on Forests in India and its Relation to the Revenue. Pp. 1-17.

The Pulp and Paper Magazine of Canada, IX, 1911,—

Pulp and Paper Notes in West Central Canada. Pp. 391-392.
Discusses the possibilities for mills in the central west to utilize spruce, jack pine and aspen.

The Wood Supply of Europe. Pp. 349-397.

Alberta's Pulpwood Resources. Pp. 435-436.

The Journal of the Board of Agriculture, XVIII, 1911,—

Theories of Plant Nutrition. Pp. 653-655.

The Botanical Gazette, LII, 1911,—

Reproduction by Laying among Conifers. Pp. 369-379. Describes method of layering in *Abies balsamea* as observed on Isle Royale, Lake Superior.

Light Intensity and Transpiration. Pp. 417-438. A comparison of results furnished by different instruments for estimating solar intensity.

[LIII, 1912,—]

Some Features in the Anatomy of the Sapindales. Pp. 50-58.

Annals of Botany, XXV, 1911,—

On the Origin of the Multiseriate Ray of the Dicotyledons. Pp. 1005-1014.

Evolution of the Annual Ring and Medullary Rays of Quercus.

Science, XXXV, 1912,—

Tier-Like Arrangement of the Elements of Certain Woods. Pp. 75-77.

Pomona College Journal of Economic Botany, I, 1911—

New and Little Known Trees Suitable for Southern California Avenues. Pp. 201-208.

NEWS AND NOTES.

The Province of British Columbia has passed important legislation relating to the preservation and conservation of standing timber and the regulation of commerce in timber and other forest products. The Act is divided into fourteen parts, the first of which deals with the establishment of a Forest Branch of the Department of Lands and a Provincial Forest Board which are to have jurisdiction over and control and administer all matters relating to and in any way connected with forestry.

Part II deals with the prevention of trespass upon crown timber lands and the protection of crown timber, whilst Part III sets forth the methods of holding and disposing of crown timber. Part IV deals with timber leases; Part V with timber licenses; and Part VI with rights of way.

Timber leases as they exist at present will be recognized and continued in future, but as certain leaseholders come up for renewal new terms will be imposed by the Forestry Department in view of the terms and conditions imposed on other holders of timber so as to maintain them all on an equality. The old method of staking timber is abandoned. The land is to be first cruised as to the quantity of the timber and surveyed, after which licenses are offered for the same by tender. The bonus on these licenses is fixed in several ways according to conditions, but principally at so much per thousand feet in addition to the royalty imposed under the Land Act.

In the case of pulp limits the licenses will be sold on rather more favorable terms, the present pulp concessions remaining at present until renewed. Although the conditions are much altered the Government retains the licensing system for the purpose of uniformity.

Provisions are made for the creation of Forest Reserves, on the basis of and mainly for the purposes of reforestation.

The present provisions regarding the scaling and measurement of timber are not interfered with and the present law relating to the marking and manufacturing within the Province of timber products remains practically unchanged.

Part VII deals with the royalties, taxes and charges. In future, royalties will be charged according to the grade of the lumber cut—there being three grades—and will show a material increase over the old rates.

Part XI deals with the important subject of fire prevention, and is entirely new. The main feature is the creation of a Forest Protection Fund for the protection of the forests and woodlands against fire. Every owner of timber lands, whether in the nature of crown grant, lease or license, will be required to contribute a cent an acre per year, and shall in addition pay two-and-a-half cents per thousand feet of timber cut, as a contribution to the cost of fitting out fire crews and looking after fires. Crown granted lands which do not pay royalty on the cut are required to pay two cents an acre. Against the amounts so contributed the Government puts dollar for dollar. At first this fund will amount to about a quarter of a million dollars and increase as time goes on. This fund will be expended for the specific purposes of establishing patrols, building trails, erecting telephone lines, etc., according to the most up to date and approved methods of fighting fire.

It is understood that Mr. Overton Price will organize the provincial service.

The following statement is summarized from the Fire Reports from the National Forests in District 1, which includes Montana, northeastern Washington, northern Idaho, northwestern South Dakota, northern Michigan, northern Minnesota, and southwestern North Dakota:

"During 1910 there was no rain from May to September—this year frequent rains occurred throughout the season. Last year there were 5,000 fire fighters and ten companies of soldiers in the field at one time,—this year the fire fighters for the entire season totaled only 600. Last year over $750,000 was spent fighting fire, while this year's bill totaled only about $15,000. The area burned over last year totaled 2,600,000 acres, and the timber burned amounted to 6,000,000,000 feet B. M. The corresponding figures this season are 35,000 acres burned and 2,500,000 feet B. M. killed. Only 5,000 acres were burned in Montana and Idaho this year and 30,000 acres in Michigan and Minnesota. The total number of fires reported last year was 1,736, and this year 500 fires. Extra help was required on only 50.

"In actual practice this season fires have been located from lookout points at distances of 30, 40, 50, and even 90 miles. From every Forest where permanent lookouts have been established come enthusiastic reports of the lookout plan.

"On the Minnesota Forest 64 fires occurred, 36 of which were caused by railroad locomotives. The fire report shows very strikingly the value of the cleared and plowed fire line along the railroad. The Soo line which traverses the Forest for 23 miles has fire lines along the entire route and as a consequence not a single fire was reported as caused by a Soo engine. Along the Great Northern Railroad fire lines have been established in the most dangerous places. All of the 36 railroad fires occurred along the Great Northern and of these 32 were held inside of the line, 3 started where no fire line had been constructed and one jumped the fire line at a grassy spot with a very high wind back of it."

The reforestation policy which is being developed by the State of New York already exceeds in extent that done by any other State, and promises to grow into an even greater undertaking in the near future. The planting on State lands, which in itself is very extensive, is to be continued, and, in addition, forest seedlings by the million are to be furnished from the State nurseries at low cost for planting on private land, the total estimated number available for distribution in the spring of 1912 being eleven million. In connection with the reforestation policy, a public hearing was held on Feb. 20 and 21 by the Forest, Fish and Game Committees of the Senate and Assembly on the bill to amend the conservation laws relating to lands and forests. Some eight per cent. of the State's total area now has no profitable growth, and its reforestation is required by the industrial, commercial, sanitary, and recreation needs of a rapidly increasing population. The Conservation Commission is seeking not only to enlarge the State's authority with reference to the reforestation of public lands, but also aims to further encourage tree planting by private land owners.

Several important changes have been proposed in the forestry laws of New York State during the recent session of the legislature, the two most progressive features being those relating to the regulation of timber cutting on certain private lands, and to afford taxation relief to the owner who reforests denuded or idle land. On the theory that the State may regulate the cutting of trees on wild forest lands which constitute watersheds of navigable streams, a statute was drafted to prohibit the cutting of softwood timber less than 8 inches, and hardwood timber less than 12 inches in diameter, in what is known as the fire towns, except under the rules and regulations adopted by the Conservation Commission.

The Conservation Commission of New York, in connection with its publicity work, has issued a news letter in regard to the migration of birds. The sentimental aspect of the question appeals to nearly everyone, but there is little doubt that the value of birds in their direct or indirect relation to agriculture and forestry has not been given sufficient consideration. It is clearly recognized that the control of injurious insect life depends largely on the birds, and if they are not protected and their numbers are reduced to any appreciable extent, increased damage from insect depredations will follow.

The Forest Service issues the following outline of a new organization of investigative work:

The Central Investigative Committee, provided for in the Manual, was designed by the Forester on January 2. It consists of Raphael Zon, chairman, representing Silviculture, James T. Jardine, representing Grazing, and Howard Weiss, representing Products. District investigative committees will be appointed as soon as practicable. They will consist ordinarily of four men, three of whom are engaged in the major lines of investigation, silviculture, grazing, and products. The fourth will be a supervisor.

The creation of these committees marks a progressive step in the development of the investigative work of the Service. It is a recognition of the old principle that several heads are better than one, in perfecting plans which call for the best the Service has in scientific attainments and experience in research.

The investigative work of the Service has greatly broadened within the last three years. A large and well-equipped laboratory in forest products is now conducted at Madison, Wis., with supplemental studies in the East and in three of the western districts.

Four experiment stations for the intensive study of silviculture have been established on National Forests. Aside from these stations an enormous amount of investigative work has been inaugurated, in reforestation, yield, results of various methods of cutting, and other fundamental aspects of silviculture. An office of grazing studies has been established. Its work, already begun in several districts, will be rapidly extended.

To get the best results all of these activities must be unified. Duplication must be avoided. Each investigative project must be undertaken by the unit, or the station, or the men best qualified to handle it. Where several men in different districts or branches of the Service should co-operate in a study, the part assigned to each must be carefully mapped out. Plans must be fully matured and checked, to make sure that the most important problems are attacked in the right way and that all of the available information and facilities of the Service are utilized.

The investigative committees are designed to assist in these ways. They are not to hamper or check the individual member of the Service, but to aid him by correlating his plan and efforts with those of all the other members.

The publication of the "Review of Forest Investigations" from time to time will be an important factor to the same end. It will aim to keep all of the men engaged upon investigative work in touch with each other. It will give them the fresh results of each study as it developes. It will be primarily for the interest and benefit of all the investigators in the Service, in all lines of its work, as a cumulative medium for interchange of scientific data and ideas.

At a conference in Spokane, in December, between officers of the University of Idaho and timber owners belonging to the North Idaho Forestry Association, it was unanimously decided to pro-rate the timber holdings of the members, in order to raise funds for the erection of a Forestry Building for the University, to cost $58,000. Prof. C. H. Shattuck of the University gave an address on Utilization of By-Products.

The following extract with regard to damage by porcupines is quoted from a statement by O. E. Lorenz, Assistant Forest

Ranger on the Pike National Forest, Colorado, in the "Pike News" of November 1, 1911:

" * * * The porcupine lives outdoors the entire year. During the winter months, he climbs into all conifers, usually Yellow Pine or Douglas Fir, and lives on the bark of the tree.

"Porcupines are usually found in bunches of from three to four in a tree. In the fall, the best way to locate them is not by looking up into the crown of trees but rather by looking on the ground for tracks, dung, or gnawed bark. At the best, these animals are hard to locate, as they usually pick out a tree with dense foliage, and sit in either the crotch of a limb or in a squirrels' nest.

"In the months of March and April, the porcupines usually come down from their high perch, and may then be found on trees from 20 to 30 feet in height, remaining in one tree until it is practically ruined and then moving to another one. Although these animals do most of their travelling in the night, they may, however, be easily tracked, especially if one has a good dog.

"During the summer and early fall, porcupines are usually found cruising around on the ground and feeding on young seedlings, the bark of which they can reach without climbing.

"On this district, there are, in many places, patches of yellow pine timber in which over fifty per cent. of the trees have been ruined by these animals. The principal cause of this destruction is the girdling of the main stem a short distance from the top, and the stripping of the bark downward for several feet, thus causing the death of the leader. Minor injuries also often result from the gnawing of the bark of limbs and of the main trunk near the foot of the tree.

"Stock grazing on the range and in the timber during the summer is occasionally injured by porcupines. Inquisitive cattle and horses will often smell around and nose a porcupine, with the result that they receive a nose full of quills. If the quills are not in very deep, the chances are that they will work out eventually. If, however, the quills are firmly embedded, it may be necessary to rope the animal and remove them with pinchers, in order to save its life.

"Although a large number of porcupines are killed each year by ranchers, lumbermen, and Forest officers, they do not seem to decrease very rapidly. Practically the only way to exterminate these animals would be for the Government or State to place a bounty on them, and even then it would probably be a long time before the injury done to the forest would be materially decreased."

According to the Census report for 1910 the industries connected with lumber manufacture and timber products, including logging camps, saw, shingle and planing mills, the manufacture of lath, cooperage stock, sash, doors and blinds, interior finish, other millwork and wooden packing boxes, employs the largest number of wage earners of any industry in the United States. The largest number employed (in November) was 739,160, the smallest number in January was 87.8 per cent. of the largest, namely 649,239.

This shows an unusually even labor employment, while in foundry and machine work, the next largest employers, the lowest employment is only 80.7 per cent. of the maximum mark.

The lumber industry shows a considerable increase in all respects from 1904 to 1909, namely 62 per cent. in number of establishments, 60 per cent. in capital, 41 per cent. in cost of materials, 32 per cent. in wages and salaries, 21 per cent. in miscellaneous expenses, and 31 per cent. in value of products (to $648,000,000).

According to a report of the Census Bureau the wood distilling industry has been on the increase in 1909 and 1910, 147 plants being in operation in the latter years as against 131 in the years 1907 and 1908. The 117 establishments distilling hardwoods consumed 1,257,997 cords; Michigan, Pennsylvania and New York representing 83.2 per cent. of the total, 60 per cent. of the wood being bodywood, and only 10 per cent. mill waste. The 30 establishments distilling soft woods, mainly in the Southern States, consumed 192,442 cords or 13.3 per cent. of the total. The total consumption was, therefore, 1,450,439 cords as against 977,844 in 1908.

Germany is a great basket-willow producing country. Who has not heard of the arrival in New York and Philadelphia of entire shiploads of basket ware and willow rods for the basket makers' use? The bulk of this material comes from Germany. Go where you will in Germany and you can find hardly a village which has not its basket makers who furnish the local requirements with baskets, hampers, crates, etc., all made from willow rods grown in Germany. The greatest difficulty of these basket makers seems to be to buy the rods from which to make their ware, for there is a scarcity of rods for the local markets.

Growers generally can get more for their rods from exporters than local basket makers can afford to pay for them.

Germany is unable to consume all the basket-willow rods she produces, and is therefore in dire need of more lucrative foreign markets. The recent increase on import duty in the United States discourages in a small measure the importation of willow-ware into this country. Enormous quantities of basket-ware and unmanufactured material are exported annually to England, France, Austria, and the United States.

The German willow plantations have an entirely different appearance from those in the United States. Here there is very little cultivation or care taken to prevent the growth of weeds in and between the rows of willows, nor is there proper drainage provided. Every winter or spring the rods are cut back to the stools, close to the ground, so that nothing remains except the thick, knotty stumps hardly more than an inch of two above the ground. Early in the spring when the frost is out of the ground laborers go over the field, loosen up the soil, so that it may become thoroughly porous and retain a sufficient amount of moisture. The stools put forth new shoots in the spring, sometimes to the number of 20 or even 40 or more, which often grow to the height of 6 or 10 feet in a single season, depending upon the variety planted, age of stumps, and upon the soil and soil moisture.

In the province of Pommern, in western Germany, the laborers who are employed in the willow fields are, according to the Oriental custom which still survives, hired by the day. They live in the small villages (Doerfer), and when the proper time comes to harvest the crop and prepare rods for the market, the proprietor or foreman of the farm goes to the neighboring towns and hires men, women, and children for from 25 cents to 50 cents a day. When the willow rods are all cut, they are placed with their butt ends in a shallow pool of running water from four to six inches deep, where they remain until the sap comes up and leaves begin to sprout. Peelers are hired to remove the bark, which is work generally done by old men, women, and children. Only a single rod can be peeled at a time, and it is, therefore, a very slow process. The apparatus for peeling consists of a round, steel rod, from one-fourth to five-eighths of an inch in diameter and about four feet long, which is doubled over so that the two ends are brought together, making a double rod about two feet long. This apparatus is known as a brake, which is firmly set perpendicularly into a log. The upper ends of the prongs are slightly curved out one inch from the top so that the rods may easily be inserted and drawn through between the prongs, which at once loosens and removes the bark from the rod. Before the rods are peeled, however, they are carefully sorted into as many grades or height and quality classes as the proprietor wishes to make, which are usually four. After the rods are peeled, they are spread out upon racks for drying and bleaching in the sun. When they have been exposed to the sun for a day, they are ready for bundling, which is done by means of a press especially designed for that purpose. The bundles weigh from 35 pounds to 75 pounds, depending upon the grade of rods in the bundle. Many hundred tons of willow rods in this way are shipped to America, where they bring from 5 cents to 10 cents per pound.

C. D. Mell.

The following prices were obtained in December 1911 in the state forests of Baden per cubic foot, cut, in the woods: Spruce logs, 14 to 16 cents per cubic foot; Fir logs, 12 to 15 cents, and log timbers of the latter up to 16¼ cents; White Ash brought up to 43 cents, and Beech only 10 to 16½ cents. For pulpwood 4 to 7 cents per cubic foot is paid.

Mr. Theodore S. Woolsey, Jr., has secured leave of absence from the Forest Service to enable him to make a very thorough study of forest administration in France, with the definite object of publishing, in one or more volumes, a record of his observations. He writes that he will appreciate it very much in case members of the profession can suggest special problems deserving investigation. Mr. Woolsey states that he will be very glad to look these up during his trip.* According to present plans he expects to cover quite fully, under the title "Forest Administration in France," the following points: history, organization, personnel (salaries, duties, etc.), administrative methods, financial results, forest laws (French code), experiment station work, description of forest regions, silvical characteristics of species,

*Letters should be addressed: 250 Church St., New Haven, Conn.

natural reproduction, artificial reforestation, including nursery practice, seed collection and extraction, as well as field planting, sale of timber, including marking, cutting, utilization and marketing, National Forest improvements, working plans, and such miscellaneous problems as grazing, trespass, fire protection, lands policy, the Dunes, etc., etc., in addition, some specific examples of well managed private forests.

A most representative and successful forestry convention was held at Ottawa, under the auspices of the Canadian Forestry Association, in Ottawa on February 7 and 8, in which lumbermen were fully represented. A banquet tendered by the Forestry Association to the Lumbermen's association formed an important feature; the new Prime Minister and Sir Wilfred Laurier, with Mr. Pinchot being the principal speakers. During the session most time was given up to discussion, especially of forest fire legislation. Mr. Pinchot presented an excellent resume of the principles which lie at the basis of a good forest administration.

A Forester's Convention was held in Harrisburg, Pa., in March, under the auspices of the State Department of Forestry, with a topical program covering a wide range of subjects.

At Portland, Oregon, on December 4 and 5, 1911, the Fifth Semi-Annual meeting of the Western Forestry and Conservation Association brought together a goodly attendance of those interested in its objects and resulted in the reading of papers of a practical character, which were followed by illuminating discussions.

These papers covered experiences with forest fires during the past year, reviews of work done towards prevention and protection, suggestions as to methods of presenting railroad and logging fires, methods of fire fighting, and the educational and legislative work necessary to further the objects of the association.

The resolutions adopted call for continued co-operation between the nation, the state, and individual owners by means of liberal appropriations from each; the clearing of rights-of-way of railroads of all combustible material on the ground; the establishment of an efficient track patrol during dry seasons, both night and day; the changing to oil burners of all engines operated through timber districts; the application of steam to all ashes dumped from engines and the prohibition of ash dumping while trains are in motion; the including in the curriculum of public schools of western states a course of instruction in forest protection; the use of troops as auxiliary fire fighters; and the appropriation by the forested counties of the Pacific Coast States of the necessary moneys to enable them to carry their share of the expenditure and effort required in maintaining fire patrols and fire fighting forces.

The Bureau of Entomology co-operating with the Forest Service and with organization of private owners is attempting to control the depredations of insects on the forests in the Northwest Four parties in charge of experts have been in the field during the past season working out methods and giving instruction and demonstrations.

The Governor of Pennsylvania has invited the chestnut-growing-states to participate in a convention at the Capitol at Harrisburg, on February 20 and 21, for the purpose of considering the dangers presented by the prevalence and spread of the "Chestnut Blight", and the methods for controlling it. It will be remembered that the State had appropriated $275,000 for the Commission which is to study and combat this dreaded disease.

Cornell University has decided to expand the instruction in forestry which it began last fall by reopening the school which it closed about a decade ago. Prof. Roth will leave Michigan to head the Cornell School this fall. Prof. Mulford will continue there as one of his assistants, and Mr. John Bentley, Jr., Yale, '07, as assistant professor. Some 55 students are taking this year's course in silviculture.

This year the department is not receiving technical students; but the enlarged department plans to offer a thorough professional forestry course, to open next fall.

Mr. Roth has been the director of the forest school at the University of Michigan since 1903.

The University of Syracuse has procured Dr. H. P. Baker to head the Forest Department which it will open this fall. Dr. Baker's successor at Pennsylvania State College has not yet been announced.

W. B. Dunham has resigned from the Pennsylvania Railroad Company to accept a position with Peters, Byrne & Co., landscape entomologists at Ardmore, Pa., after a few months' leave of absence, during which he worked for the J. L. Roper Lumber Co., in North Carolina.

Mr. Ernest A. Sterling announces that he has resigned as forester of the Pennsylvania Railroad, to open an office as consulting forester and timber engineer, 1331-32 Real Estate Trust Building, Philadelphia. Mr. John Foley steps into Mr. Sterling's place.

The centenary of the founding of the Tharandt Academy of Forestry by Cotta occurred May 24, 1911.

A new and revised edition, the third, of Dr. Martin's "Die Forsteinrichtung" has been issued by Julius Springer. Dr. Weber has reviewed the book in Silva and on the whole recommends it.

The same publisher has also just brought out the third edition of the well-known "Forstästhetik" of von Salisch.

On November 11, 1911, Professor Dr. Hermann Stoetzer for many years Director of the Forest Academy at Eisenach died. His various text books excelling in conciseness and clearness of statement will keep his memory green for many years.

A worthy effort is being made by the Sierra Club, to secure from Congress an appropriation to put the Yosemite Valley in proper condition as regards roads and other improvements for the year 1915 when in connection with the Panama-Pacific Exposition a large number of visitors may be expected. Letters to Congressmen asking for support of these measures are in order from every good citizen.

In the American Lumberman of November 11, 1911, appears an article of 100 pages profusely illustrated on the methods carried on by one lumber company in Coos County, Oregon. The pictures show the progressive steps of logging and milling the mammoth timber of that country by means of up-to-date machinery, e. g., a five gang band-saw. The illustrations alone are well worth while even if no reading matter accompanied them.

COMMENT.

It is incumbent on the Editor to refer once more to the subject of the White Pine blister rust on imported seedlings. The strictures made on the stock introduced from the nurseries of Heins Sons were submitted to that firm for their explanation. They reiterate that their *present* stock is free from disease, but declare that they "have decided to ship no further White Pine to the United States until we have a certificate from a German official pathological bureau about our stock."

At the same time wisdom forbids any slacking of the effort to keep a watchful eye upon importation, and to keep the disease out.

If the old saying is true that a cause which has no antagonists or fault finders is dead, we have lately had occasion to congratulate ourselves on the F. Q. being still alive. Fortunately the fault was found mainly in extraneous matters, poor proofreading, lack of form, and lack in discrimination as regards advertisements. When we explained that the shortcomings are due to the fact that the enterprise, although now in its tenth volume, is still a mere labor of love entailing an annual deficit of one to two hundred dollars, and that all the work must be done by volunteer labor in spare moments of a few busy men, we received the very satisfactory reply from one of our correspondents which we quote because it rings with the proper spirit, and may do the work that the writer has intended us to undertake.

"I had no idea that the Quarterly was not on a self-sustaining, even a profitable basis. I don't see, myself, how anybody who wants to keep up with the procession can afford to be without it. To have it die for lack of adequate support would be a portentous professional calamity, and to fail to give it that support is sheer professional ingratitude. It seems to me that if you could plan a personal subscription campaign, lay it frankly before your present subscribers, they would rally to your support and bring in a sufficient number of new subscribers to do the trick. There must be a large number all told, coming from our professional schools in, say the last five years, who are ambitious enough to want the Quarterly, if it were only presented to them by their Forest Service Supervisor, or any of the older men near them. I shall take a try at starting aright in that particular direction as many as possible of our graduates of this year. I think, many, like myself, have not bestirred themselves only because they have not realized that any assistance was needed. Put it up to us."

We must congratulate Mr. Higgs at the success of his methods of making stem analysis, especially in the fly-season, or in winter weather so easy and satisfactory. Nobody who has done such work will underrate the value of this simple process. A large number of such nature prints have been submitted to the Editor by the inventor, and every one may be pronounced perfect, even those of such ill-defined growths as Alder and Cherry.

The subject of nomenclature, which was lately raised in these pages is one pressing for closer attention as the development of professional writing goes on. We are struck in this number by a case of singular misuse of conceptions when the writer of one of the articles declares the Shelterwood system to be really a "clear cutting system." It is certainly not clear to us what "clear" means! The reason given, that the resulting crop is nearly even-aged seems to us to have nothing to do with the term "clear." We are afraid that Prof. Graves is responsible for this mixing up of terms, when in his valuable book on silviculture he calls the "seed tree" method a clear cutting method. A re-opening of the subject of nomenclature would, it appears, be timely.

A curious result of interference with the natural channels of trade has come to our ears which is worth recording. A few years ago men of the Forest Service proclaimed the proper price for Jack Pine seed to be $3.00 per pound, which was much below the market price. This discrepancy led many people into the business of supplying this seed cheaply. The price dropped to $2.00 per pound and most of the Cheap Johns dropped out too. The price is now again $6.00.

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FORESTRY QUARTERLY

A PROFESSIONAL JOURNAL

Subscription Two Dollars per Annum

CAMBRIDGE (BOSTON), MASS.
1912
Entered as second-class matter September 28, 1909, at the post office at Boston, Mass., under the Act of March 3, 1897.

FORESTRY QUARTERLY

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

To offer an organ for the publication of technical papers of interest to professional foresters of America.

To keep the profession in touch with the current technical literature, and with the forestry movement in the United States and Canada.

Manuscripts may be sent to the Editor-in-Chief at the University of Toronto, Toronto, Canada, or to any of the board of editors.

Subscriptions and other business matters should be addressed to Forestry Quarterly, 396 Harvard Street, Cambridge, Mass.

Press of
Watchman Printing House
Bellefonte, Pa.
1912

FORESTRY QUARTERLY

VOL. X] JUNE, 1912. [NO. 2.

NATIONAL FOREST TIMBER SALE CONTRACT CLAUSES.**

By THEODORE S. WOOLSEY, JR.

When the Forest Service took over the administration of "Forest Reserves"* on February 1, 1905, one of the most important problems of detail was the standardization of timber sale contracts. There were no fixed precedents to go by. Moreover, it was necessary to have a very clear idea of what was practicable from the lumberman's viewpoint, and how the silvical needs of the Forest could best be met by conservative restrictions on the ordinary rough and tumble slash methods that were followed by private loggers. These contract restrictions had to be so clearly stated that no misinterpretation was possible; and practicable, so they could be enforced. Therefore the first step was to become very familiar with local conditions. This took time and study; consequently it is not surprising that early contracts were crude, judged by present standards. Many operators in the west signed the early timber sale contracts blindly because they did not believe all the regulations and rules would be rigidly enforced. This misunderstanding caused a great deal of needless friction until it was understood that Forest Service contracts meant what they stated; if impracticable in any respect the proper redress was a formal modification instead of expecting local officers to wink at open violation. A study of recent contracts gives an illuminating idea of the present timber sale policy and practice of the Forest Service; moreover, many of the restrictions could be applied directly in state or private operations and consequently are of interest to the profession. But it must be remembered that the Forest Ser-

**Written February 10, 1912.

*Now called National Forests.

vice is still perfecting many of the details of timber sales management so that changes in existing contract restrictions and policy may be expected. As regards established custom the administrative policy is very progressive—because there is no established custom that may be considered final—if any officer can suggest a logical and practical improvement in existing methods it is pretty certain to be followed. Since the issuance of "The National Forest Manual," however, fewer changes will be made than in the past.

The Timber Sales Section of "The National Forest Manual" was issued to take effect December 1, 1911. The timber sale regulations are quoted verbatim, merely to give a general idea of the requirements in connection with a sale of timber.

Reg. S-1. *Appraisal of timber* No timber shall be designated for cutting, by stamping or otherwise, until the officer approving the sale is satisfied that the cutting will preserve the living and growing timber, promote the younger growth, and be compatible with the utilization of the Forest. Upon application for the purchase of any timber or in any cases where timber is to be advertised in advance of application, such timber shall be examined and appraised, and the area from which the timber is to be cut shall be described by legal subdivisions or otherwise. The officer making the field examination shall report the quantity and value of the various kinds of timber involved, and *shall base his appraisal* upon the character of the timber, the cost of logging, transportation, and manufacture, and the sale value of the manufactured products at practicable markets.

Reg. S-2. *Limitation of annual cut.* The Secretary of Agriculture will prescribe each year, upon data and information furnished by the Forester, *the maximum amount of dead, matured and large growth* timber that may be cut on each National Forest.

Maximum and minimum prices. The Secretary of Agriculture will prescribe each year, upon data and information furnished by the Forester, the maximum and minimum stumpage prices at which the timber on each National Forest or designated portion thereof shall be appraised. Appraisals higher than the established maximum and lower than the established minimum shall be made by Forest officers, in so far as the local conditions in each specific sale warrant. No appraisals at less than the established minimum or more than the established maximum shall be approved by any Forest officer authorized to sell timber until the approval of such appraisals by the Secretary of Agriculture has been secured.

Reg. S-3. *Authority to make sales.* The *Forester* is authorized to make timber sales for *any amount* on any National Forest, provided the limit fixed by the Secretary for any Forest is not exceeded by the year's cut, under sales and free use on such Forest; and to delegate this authority for any specified amounts to the *district foresters*, but *in no instance to exceed 20,000,000 feet* board measure. The district forester may in turn delegate authority to *supervisors* to make sales for specified amounts, which in no instance shall exceed *2,000,000 feet board measure.* All supervisors may, without special authorization, make sales of timber and cordwood in amounts not exceeding $100 in value in any one sale. The supervisor may authorize *subordinate Forest officers* to make sales of timber and cordwood in amounts not exceeding *$50 in value* in any one sale.

Reg. S-4. *Deposits.* The supervisor may, in his discretion, require that a deposit be made with the proper United States depository before any timber applied for is examined. In every case where a supervisor decides to recommend a sale of timber for which advertisement is required by law, he will notify the applicant to forward to the proper United States depository such part of the purchase price as will be sufficient to cover the cost of advertising; such deposit to be applied to the purchase price in case the sale is made to the depositor; to be refunded in case the sale is made to some one other than the depositor; to be retained in the discretion of the officer approving the sale, if through fault of the depositor, no sale of the timber is made.

Reg. S-5. *Payments and refunds.* No timber shall be cut under any timber sale contract until it has been paid for. Refunds may, in the discretion of the Forester or District Forester, be made to depositors of such sums deposited by them to secure the purchase price of forest products as may be found to be in excess of the amounts actually due the United States. Refunds or payments may also be made to the rightful claimants of such sums as may be found to have been erroneously collected for timber or other forest products sold from lands within, but not a part of, a National Forest.

Reg. S-6. *Instalment payments.* In any sale the timber may be paid for in one or more payments, as agreed. In sales of $100 or less the partial payments must not exceed three.

Reg. S-7. *Modification of contracts.* Modifications of contracts for the sale of timber will not be allowed except in those cases where the full performance of the contract by the purchaser is rendered inequitable and unjust by some act of the United States, or except where the modification is sought in respect to the unexecuted portion of the contract and such modification would not be prejudicial to the interests of the United States. Modifications, where proper, within the meaning of this regulation, may be made by the officer approving the sale, or by his superior officer.

Reg. S-8. *Advance cutting* No timber will be sold, other than in amounts not exceeding $100 stumpage value, in advance of advertisement, except in cases of unusual emergency. All applications for emergency sales of timber will be submitted to the Secretary of Agriculture for approval, with a statement setting forth the reasons for the emergency. When application is made for timber to meet an unusual emergency the Forest officer authorized to make the sale will, when practicable and proper, include in the advertisement of such timber a sufficient quantity of other timber in the same locality and of the same class to satisfy such other bids as may be reasonably anticipated. After approval by the Secretary, the Forest officer may, in sales not exceeding the amount which such officer is authorized to approve, permit the cutting and removal of timber in advance of the award, when the applicant has made a deposit covering the value of the timber to be cut, and removed, and has agreed to pay for all timber actually cut under the privilege of advance cutting at the rate of the highest price bid for the whole amount of timber advertised, or, if no bids are received, at the rate named in the advertisement. When necessary to protect the Government against loss a bond will be required.

Reg. S-9. *Private sale.* After any timber has been advertised and no satisfactory bid has been received, or if the bidder fails to complete the purchase, Forest officers may, within their authorization, dispose of it at private sale, in quantities to suit purchasers, without further advertisement, at prices not lower than those named in the advertisement.

Timber may also be disposed of at private sale without advertisement where the stumpage value of the timber does not exceed $100.

Reg. S-10. *Prevention of monopoly. Award of sales to trespassers.* In awarding advertised timber of a value exceeding $5,000, allotments at the highest price offered may be made to several bidders to prevent monopoly. Bids submitted by parties who have trespassed upon any National Forest will not be considered unless full settlement has been previously made for such trespass.

Reg. S-11. *Exportation of timber.* Timber cut from any National Forest may be exported from the State or Territory in which the National Forest is situated, except that from the Black Hills National Forest in South Dakota only dead and insect-infested timber may be exported from the State, and this only until the date upon which the Forester shall certify that the ravages of the destructive insects in said Forest are practically checked, but in no case after such date or dates as Congress has specified or shall hereafter specify. Timber cut from any National Forest in Alaska may be exported therefrom and sold anywhere, upon certification by the supervisor that the timber has been purchased and cut from a National Forest in Alaska.

Reg. S-12. *Conditions of sale.* No trees on National Forest lands, or from any unpatented claim within National Forests, shall be cut, or otherwise killed, injured, or destroyed, except under permit or where allowed by law in the development of claim.

No trees on any unpatented claim within National Forests shall be filed with the Forest Supervisor, except in emergencies arising from insect infestation.

No live trees shall be cut under any contract until marked or otherwise designated by a Forest Officer.

No timber cut under any contract shall be removed from the place selected for scaling, measuring, or counting until it has been scaled, measured, or counted, and stamped by a Forest Officer.

No person except a Forest Officer shall stamp any timber belonging to the United States upon a National Forest with the regulation marking axe or with any instrument having a similar design.

All saw timber will be scaled by Scribner Decimal C log rule, as used by the Forest Service.

Reg. S-13. *Time limits.* The period allowed for the removal of timber, which *in no instance shall exceed five years,* except in special cases upon specific approval by the Secretary, will be fixed in the agreement, and in sales in which a period of two or more years is allowed for the removal of the timber, the minimum amount to be removed each year must be specified, except in unusual cases. The Secretary may, in his discretion, when circumstances warrant, extend the time beyond a period of five years; but such extension will be granted only to prevent hardship in cases where the failure to remove the timber within the five-year period is due to circumstances over which the purchaser had no control.

Reg. S-14. *Bonds.* The officer approving any timber-sale contract may require the purchaser to furnish a bond for the satisfactory completion of the contract.

Reg. S-15. *Appeals.* The disapproval of an application for the purchase of timber or for the modification of an existing contract by the officer authorized to approve such application shall be considered final unless written notice of appeal to the next superior officer, District Forester, Forester, or Secretary, as the case may be, is filed with the officer disapproving such application within 30 days from the receipt of his decision. All appeals arising from the enforcement or execution of the provisions of a timber-sale contract shall be made in the first instance to the Forest supervisor. His decision thereon shall be considered final unless written notice of appeal to the district forester is filed with the supervisor within 15 days from the receipt of his decision. Appeals from the decisions of the District Forester to the Forester or from the decisions of the Forester to the Secretary may be made by filing written notice from the officer from whose decision appeal is taken within 15 days from the receipt of such decision.

Reg. S-16. *Use of steam engines or locomotives* The use of steam engines or steam locomotives in operation on National Forest lands under any timber-sale contract or under any permit is prohibited unless they are equipped with such spark arresters as shall be approved by the Forest Supervisor, or unless oil is used exclusively for fuel.

Sales are classified into four classes: namely A., Ranger's under $50.00; B., Supervisor's under $100.00; C., Supervisor's advertised under 2,000,000 as authorized; D., District Forester's above A., B., or C. In unadvertised sales (under $100) officers use the special short form of contract given below; the clauses in this form are seldom varied. The procedure in making a sale of timber is fully explained in the timber section of the Manual.

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE.

TIMBER SALE.

.................................., ...
(Date)
National Forest.

The timber designated herein is hereby sold to ....
of ...., who agrees to take before ....
(Give date of closure,
.... all the merchantable dead timber standing
always last day of some month.)

or down, and .... live timber to be marked
("Sufficient," if sale is by amount.)
for cutting by a Forest officer ....
("To produce a total value of $........," if sale
.... located on an area to be definitely designated by the
is by amount.)
Forest officer before cutting begins in ....
(If sale is by area, give approximate

....
location and describe by relation to some well-known landmarks, stream, etc.; legal sub-

....
division, if surveyed, and approximate legal subdivision, if unsurveyed.)
estimated to be ....
(If sale is by area, give quantity, species, material.)
.... more or less,
subject to the following conditions:

1. The purchaser shall pay in advance of cutting to the .... National Bank of .... (U. S. Depository), to be placed to the credit of the United States, the sum of .... Dollars, payment in full for this timber at the rate of ....
(Per M feet B. M., cord, or

....
lineal foot, etc.)

2. The purchaser shall comply with all the laws and regulations governing National Forests. No timber shall be removed until it has been scaled, measured, or counted, and stamped by a Forest officer. Scaling will be done as often as is practicable in the judgment of the Forest officer while cutting is in progress. The purchaser and his employees shall do all in their power, both independently and upon request of Forest officers, to prevent and suppress forest fires; shall dispose of brush and other refuse as required by Forest officers; and shall pay the United States for any unnecessary damage resulting from this sale. Unmarked green trees injured through carelessness, and all trees cut in violation of the terms of sale, shall be paid for at twice the price herein specified. All timber shall be cut and removed within the time specified above. All merchantable dead timber and all marked live trees shall be cut; if left uncut or if cut and not removed from the National Forest before the expiration of the time fixed for removal, they shall be paid for at twice the price herein specified. The purchaser agrees to repair all damages done to roads and trails in execution of this agreement. This sale is subject to all valid claims and contracts.

3. Stumps shall not be cut higher than .... inches, lower when possible, and shall be so cut as to cause the least possible waste.

4. All trees cut shall be utilized to a diameter of .... inches in the tops—lower when possible—and the log lengths so varied as to make this possible.

....
(Insert special conditions, if any, such as maximum scaling length, felling of trees

....
constituting a fire menace, etc.)

....
....
....
....
....
....
....
....
....
....

The title to the timber included in this sale shall remain in the United States until it has been paid for and scaled, measured, or counted, as herein provided.

Work may be suspended by the Forest officer in charge if the conditions and requirements of this sale are disregarded, and the failure to comply with any one of said conditions and requirements, if persisted in, shall be sufficient cause for the District Forester to rescind this agreement and to cancel all permits for other privileges.

No Member of or Delegate to Congress, or Resident Commissioner, after his election or appointment, and either before or after he has qualified, and during his continuance in office, shall be admitted to any share or part of this contract or agreement, or to any benefit to arise thereupon. Nothing, however, herein contained shall be construed to extend to any incorporated company, where such contract or agreement is made for the general benefit of such incorporation or company. (Section 3741, Revised Statutes, and Sections 114 to 116, Act of March 4, 1909.)

Refunds of deposits under this sale will be made only at the discretion of the District Forester.

This agreement is non-assignable.

None of the terms of this agreement can be varied or modified, except with the written consent of the approving officer. The decision of the District Forester shall be final in the interpretation of the terms of sale.

All moneys paid under this agreement shall, upon failure on the part of the purchaser to fulfill, all and singular, the conditions and requirements herein set forth, be retained by the United States, to be applied as far as may be to the satisfaction of the purchaser's obligations hereunder.

Signed in duplicate this .... day of ...., 191 .

(Corporate seal, if corporation.)

Witness:

....

(Signature of purchaser.)

Approved at ...., under the above conditions, ..., 191

....

(Signature of approving officer.)

....

(Title.)

It is in the contract for advertised timber that one finds rules and regulations governing every conceivable point in the conduct of the sale. According to the Manual instructions: deposits must be made before the contract is executed; promptness of execution is desirable; Form 202 will be used in the preparation of contracts with the insertion of the necessary special clauses; proper evidence of authority to sign contracts on behalf of a corporation is required. In order to avoid unpleasant misunderstandings it is the practice to explain requirements fully to purchasers before applications are made. These applications which contain essentially the same rules and regulations as the contract, are signed before the timber is advertised. If modified by superior officers changes are also fully explained to the applicant. It has often been found advisable to actually demonstrate contract requirements in the woods where the applicant is unfamiliar with federal usages. For example, sample logs may be scaled; brush piled or scattered; or areas marked to demonstrate how the timber must be cut. The most convenient method of demonstration is to take the prospective purchaser over an area which has been cut over under similar regulations. (See clause 30 d.) It is of course vital that it be clearly understood that minor changes in methods may be necessary during the term of the contract; consequently many of the rules are "blind," putting immense authority and discretion in the hands of the approving officer. Yet this authority is rarely, if ever abused. The Forest Service has maintained such a high standard of personnel that a case of "hold up" in enforcing contracts too rigidly has never come to my attention.

The policy, requirements, and forms for advance cutting, payments, deposits, refunds, transfers, modifications, cancellations, etc., are given in the Manual and will not be treated in this article which deals chiefly with the contract itself. As already explained, Form 202 is now standard except when the short form contract is used. Form 202 follows:

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

TIMBER SALE

.... National Forest
(Date of application)

....
(I or we) (If copartnership, "We, and
....
partners, doing business under the firm name and style of ")
....
(If corporation, "A corporation organized and existing under the laws of the State (or
....
Territory) of , having an office and principal place
....
of business at ")
of ...., State of ...., hereby
.... to purchase ....
(In applica-
....
tion "apply," in final agreement "agree") (In final agreement only, "In accord-
....
ance with my (or our) bid submitted in pursuance of the notice of sale of certain
....
timber in the National Forest, duly given by publication as required
....
by law," if sale has been advertised and bid accepted. If private sale, when timber
....
has been advertised and no satisfactory bid has been received, "at private sale, cer-
....
tain timber within the National Forest ,
......................., ...
duly advertised for sale in the , a newspaper of general

circulation in the State (or Territory) in which said Forest exists, by notice published for not less than thirty days before , 191 . Said timber is")
all the merchantable dead timber standing or down and all the live timber .... for cutting by a Forest
("Marked" or "designated")
officer located on an area of about .... acres to be definitely designated by a Forest officer before cutting begins in ....
(Give approximate
....
location and describe by relation to some well-known landmark, stream, etc. Give also
....
legal subdivisions if surveyed, and approximate legal subdivisions if unsurveyed. If
....
advertised, description of location should follow that given in notice of sale.)
....
.... within the .... National Forest estimated to be ....
(Give by species the quantity in proper unit of measure, state
....
whether live or dead, and kind of material, and add the words "more or less.")
....
.... do hereby,
("If this sale is awarded to me (or us)" in application only.) (I or we)
in consideration of the sale of this timber to ...., promise to
(Me or us)
pay to the .... National Bank of ....
.... (United States depository) or such other depository or officer as shall hereafter be designated, to be placed to the credit of the United States, ...
(In final agreement, "the sum of
....
dollars ($), more or less, as may be determined by the actual scale,
....
measure or count.")
....
for the timber at the rate of ....
(In application, "not less than")
....
(Per thousand feet b. m., cord, lineal feet, etc.)
....
....
in advance payments of at least .... dollars ($.................) each when called for by the Forest officer in charge
....
(If application for advertised sale, "50 being forwarded to the said United States
....
depository at this time to cover cost of advertising, this amount to be placed to my
....
(or our) credit if I am (or we are) the successful bidder, or refunded if my (or our) bid is rejected.")
credit being given for the sums, if any, heretofore deposited with the said United States depository or officer in connection with this sale.

And .... further promise and agree to cut and remove said
(I or we)
timber in strict accordance with the following conditions and all regulations governing timber sales prescribed by the Secretary of Agriculture:

1. Timber upon valid claims and all timber to which there exists valid claim under contract with the Forest Service is exempted from this sale.

2. No timber will be cut or removed until it has been paid for.

3. No timber will be removed until it has been scaled, measured, or counted by a Forest officer.

4. No timber will be cut except from the area specified by a Forest officer. No live timber will be cut except that marked or otherwise designated by a Forest officer.

5. All merchantable timber used in buildings, skidways, bridges, construction of roads, or other improvements will be paid for at the price herein specified.

6. All cutting will be done with a saw when possible.

7. No unnecessary damage will be done to young growth or to trees left standing, and no trees shall be left lodged in the process of felling. ...... (Un-
..................trees that are badly damaged during the process of log-
marked or undesignated)
ging will be cut if required by the Forest officers, and when such damage is due to carelessness, the trees so injured will be paid for at twice the price herein specified.

8. The approximate minimum diameter limit at a point $4\frac{1}{2}$ feet from the ground to which living trees are to be cut is ....
(Limits in inches for all species involved. When individual trees are marked for cutting, "Trees above these diameters
....
may be reserved for seed or protection, and mrchantable trees below these diameters may be marked at the discretion of the Forst officer." When other methods of cutting
....
are advisable, insert suitable provision so that the system of cutting and method of designation will be clear)

9. Stumps will be cut so as to cause the least possible waste, and will not be cut higher than .... inches on the side adjacent to the highest ground—lower when possible—except in unusual cases when, in the discretion of the Forest officer, this height is not considered practicable.

10. All trees will be utilized to as low a diameter in the tops as possible so as to cause the least waste, and to a minimum diameter of .... inches when merchantable in the judgment of the Forest officer; the log lengths will be varied so as to make this possible.

11. Tops will be lopped and all brush piled compactly at a safe distance from living trees, or otherwise disposed of, as directed by the Forest officer.

12. All timber will be cut and removed on or before and none later than .... and at least .... will
(Feet b. m. cords, etc.)
be paid for, cut, and removed on or before ...., 191 , and at least .... of the remainder of the estimated amount during each year of the remaining period.

13. Timber will be scaled by Scribner Decimal C log rule, or counted or measured as prescribed by the Forester, or specifically provided in this agreement, and, if required by the Forest officer, will be piled or skidded for scaling ....
("Measurement" or "count" if cordwood or other material is involved)
as directed by the Forest officer.

14. All marked or designated trees and all dead timber sound enough for lumber of any merchantable grade or timbers ....
(Insert cordwood or other
.... shall be cut. Unmarked or undesignated living
material to be included in the sale)
trees which are cut; marked or designated trees or merchantable dead timber left uncut; timber wasted in tops, stumps, and partially sound logs; trees left lodged in the process of felling; and any timber merchantable according to the terms of this agreement which is cut and not removed from any portion of the cutting area after logging on that portion of the cutting area is completed, or is not removed from the National Forest after the expiration of this agreement, shall be scaled, measured, or counted, and paid for at double the price herein specified.

15. During the time that this agreement remains in force ....
(I or we)

will, independently, do all in .... power to prevent and sup-
(My or our)
press forest fires on the sale area and in its vicinity, and will require .... employees and contractors to do likewise. ....
(My or our) (I or we)
hereby agree, unless prevented by circumstances over which ....
(I or we)
have no control, to place .... and .... em-
(Myself or ourselves) (My or our)
ployees at the disposal of any authorized Forest officer for the purpose of fighting forest fires, with the understanding that if the fire does not threaten .... property or the area embraced in this agree-
(My or our)
ment .... shall be paid for services so rendered at the rate
(I or we)
or rates to be determined by the Forest officer in charge, which rate or rates shall correspond to the rate or rates of pay prevailing in the .... National Forest for services of a similar character at the time the services are rendered, provided, however, that if ...., ... employees, subcontractors, or employees of
(I or we) (My or our)
subcontractors are directly or indirectly responsible for the origin of the fire, ... shall not be paid for services so rendered.
(I or we)

16. So far as is reasonable all branches of the logging shall keep pace with one another, and in no instance shall the brush disposal be allowed to fall behind the cutting, except when the depth of the snow or other adequate reason makes proper disposal impossible, when the disposal of brush may, with the written consent of the Forest officer in charge, be postponed until conditions are more favorable.

17. Necessary logging roads, chutes, camps, buildings or other structures shall be located as agreed upon with the Forest officer in charge. All such improvements not removed within .... months after the expiration of this agreement shall become the property of the United States.

....
(Insert special conditions, if any)
....
....
....
(Insert pages when additional space is needed)

The title to the timber included in this agreement shall remain in the United States until it has been paid for and scaled, measured, or counted, as herein provided.

The decision of the Secretary of Agriculture shall be final in the interpretation of the regulations and provisions governing the sale, cutting, and removal of the timber covered by this agreement.

Work may be suspended by the Forest officer in charge if the conditions and requirements contained in this agreement are disregarded, and the failure to comply with any one of said conditions and requirements, if persisted in, will be sufficient cause for the Forester to revoke this agreement and to cancel all permits for other uses of the National Forest.

No Member of or Delegate to Congress, or Resident Commissioner, after his election or appointment, and either before or after he has qualified, and during his continuance in office, shall be admitted to any share or part of this contract or agreement, or to any benefit to arise thereupon. Nothing, however herein contained shall be construed to extend to any incorporated company, where such contract or agreement is made for the general benefit of such incorporation or company. (Section 3741 Revised Statutes, and Sections 114 to 116, Act of March 4, 1909.)

Refund of deposits under this agreement will be made only at the discretion of the Forester or District Forester.

This agreement will not be assigned in whole or in part.

The conditions of the sale are completely set forth in this agreement, and none of its terms can be varied or modified except with the written consent of the Forester ....
(Or, "the District Forester's sales, or, "the Supervisor,"
.... No other Forest officer has been or will
in Supervisor's sales)
be given authority for this purpose.

And as a further guarantee of a faithful performance of the conditions of this agreement ....
(I or we) (deliver herewith a bond in the sum of $.)
....
and do further agree that all moneys paid under this agreement shall, upon failure on ....
(My or our)
part to fulfill all and singular the conditions and requirements herein set forth, or made a part hereof, be retained by the United States to be applied as far as may be to the satisfaction of .... obligations
(My or our)
assumed hereunder.

Signed in duplicate this .... day of ...., 191
(Same date as bond)

*Witnesses: (Corporate seal, if corporation.)

....
(Signature of purchaser) **(See note)**

....
(Signature of purchaser)

Approved at ...., under the above conditions, ..., 191

....
(Signature of approving officer)

....
(Title)

*Signature of two witnesses required if sale is over $100.

Note.—

If contracting party is a copartnership, form of signature should be

X Y Z Company,
By John Doe,
A Member of Firm.

If contracting party is a corporation, form of signature should be

X Y Z Company,
By John Doe,
President (*or other officer or agent*).

What special clauses to insert, takes, of course, judgment which can only be gained by experience. It is felt, however, that if each clause in its variable forms is taken up systematically and explained, the preparation of formal and intricate contracts will be simplified. In selecting typical special clauses the writer has used the National Forest Manual pp. 43-44, a specimen contract for each important type in each of the six western districts of the National Forests, courteously furnished by the respective District Foresters. This material was used in lectures on "National Forests" at the Yale Forest School in February, 1912. The notes that follow are of course purely personal and have no official significance whatever.

STANDARD CLAUSES. (Form 202.)

The feature of Form 202, (revised October 15, 1911) is the very complete interlinear directions for filling in the spaces left blank; these directions should, of course, be carefully followed and it is essential that the latest revised draft of the form be used. Frequently contracts have to be returned because local officers have used obsolete forms. In district III, at least the formal application, signed by the prospective purchaser, follows exactly the wording to be used in the final contract. This is a matter of convenience and accomplishes the desired result of informing the purchaser as soon as possible just what requirements will govern the cutting. It is the rule to describe the location of the timber *approximately* in the advertisement, and the contract follows this wording. If an irregular area, the exact boundaries can best be designated on the ground. Some purchasers have been dissatisfied because the estimates have occasionally run short; the Forest Service does not guarantee estimates because they are often based on ocular cruising and hence are very approximate. The language used in filling in after the words "Estimated to be" (Form 202, page 1) is therefore directed to end with the words "more or less." It is seldom advisable to specify an exact amount for lagging, stulls, ties, lumber, etc.; it is preferable to give lump figures except where local conditions require specific estimates. Of course stumpage rates in contracts cover the full appraised value of the species; yet it is often a matter of convenience to advertise timber at a flat rate rather than specify a separate price for each species or for dead and green material. It may often be advisable to closely estimate the average amount of dead and green cordwood, and on a mathematical basis figure an equitable rate. This cheapens measurement and is usually easier for the purchaser. In other words the price as specified in all contracts should be as simple as possible. Payments are made in installments as directed in the "Timber Sales" Manual. We may now explain the regular clauses used in form 202:

1. Timber upon valid claims and all timber to which there exists valid claim under contract with the Forest Service is exempted from this sale.

This automatically exempts from the sale valid claims and yet it is the policy to examine all claims within any sale area, the status of which are at all doubtful, since they would if continued actually interfere with the National Forest interests. During the advertisement of timber, it has occasionally happened that mining claims have been located in order to hold up the purchaser. Therefore, it has been the custom to cut the timber on these clearly invalid claims without special examination, provided they have been located after the initiation of the sale. Insect-infested timber, or fire-killed timber on unsurveyed "claims" can, under certain circumstances be cut and paid for pending the determination of ownership.

2. No timber will be cut or removed until it has been paid for.

Payment must not only be made in advance of removal, but also in advance of felling or cutting. Hence the officer in charge must keep close tab on the amount cut in advance of scaling, to check when payments should be periodically called for. During the business depression of 1907 cutting was allowed in advance of payment as a relief measure, but this concession will probably not be allowed again. The word "removal" in sales contracts has been interpreted to mean removal from the forest so far as cost, danger, or damage to federal interests is concerned, but not necessarily physical removal if the operation of removal could be completed without the attention of local officers.

3. No timber will be removed until it has been scaled, measured, or counted by a Forest officer.

There is some chance of misunderstanding this clause since scaling or measurement might be in the woods, at the skidways or landing or at the mill yard. Where entirely practicable and where it costs but little more scaling in the woods has the advantage of enabling at the time of scaling, a careful and systematic woods inspection. Scaling at the skidways is the usual practice in most sales. Where logs are scaled at the mill, especially in small sales there is danger of sawing in advance of scaling where the purchaser is dishonest. Such thefts have occasionally been detected. After scaling of course all logs are serially numbered with soft black crayon, and are stamped "U. S." Culls are so designated with crayon.

4. No timber will be cut except from the area specified by a Forest officer. No live timber will be cut except that marked or otherwise designated by a Forest officer.

It is essential that all sales boundaries be clearly marked, particularly when the cutting is up one side of a watershed so as to remove the good timber with that which is less accessible. Usually all trees to be cut are blazed on the lower part of the bole or on a projecting root and the blaze stamped "U. S." Where there is thick bark it may be better and cheaper to merely blaze and stamp the bark; provided this stamp will show when the final inspection is made. Where blazing the wood and stamping occurs, a year or so before cutting (rarely advisable to mark this long in advance) the mark is often covered by pitch and it is difficult to determine whether it is an official blaze. The U. S. print should show evenly and clearly at the time of stamping.

Where a few seed trees per acre are retained, it is usually cheaper to blaze and stamp the trees which are to be left; in the case of clear cutting it is sufficient to designate the boundaries of the area to be clear cut.

5. All merchantable timber used in buildings, skidways, bridges, construction of roads, or other improvements will be paid for at the price herein specified.

The use of unmerchantable timber, such as aspen, should be encouraged as a general conservation measure. Ordinarily a species too inferior for lumber is suitable for temporary construction. It is customary to allow camps, donkey engines and locomotives (oil is usually insisted upon as fuel in case there is danger from fire), to burn dead fuel wood free. The writer knows of at least one case where a charge was made for unmerchantable dead "sawtimber" used for fuel in a mill, notwithstanding the fact that the dead logs were a fire menace in the woods. It was considered dangerous and a poor policy to give a large quantity of mill fuel to a corporation.

6. All cutting will be done with a saw when possible.

In the northwest where the timber is large, this clause may sound ridiculous, but in smaller timber there is often a desire to chop down trees; this if course wastes valuable lumber and should be forbidden. When trees stand close together it is sometimes physically impossible to fell with a saw.

7. No unnecessary damage will be done to young growth or to trees left standing, and no trees shall be left lodged in the process of felling. .... trees that are badly damaged
(Unmarked or undesignated)
during the process of logging will be cut if required by the Forest officers, and when such damage is due to carelessness, the trees so injured will be paid for at twice the price herein specified.

In enforcing this rule we must remember that some damage *is* necessary. Logging roads, skidding and felling all mean more or less damage to advance reproduction and occasionally to standing timber. It is well to bear in mind that it is often better to fell into a thick clump of young growth rather than into a patch of sparse reproduction, simply because the seedlings can best be spared where they are too dense. Officers in charge of sales must take steps to stop careless felling; often inexperienced choppers will do a great deal of unnecessary damage during a high wind. They should use judgment to determine which trees had best be cut when the wind abates. Ignorant choppers also break brittle trunks by felling trees across ravines or across other stems.

When steam skidders are allowed it is quite often only prudent to leave additional seed trees to allow for some damage in skidding particularly on hilly ground.

8. The approximate minimum diameter limit at a point 4½ feet from the ground to which living trees are to be cut is ....
(Limits in inches for all
....
species involved. When individual trees are marked for cutting. "Trees above these
....
diameters may be reserved for seed or protection, and merchantable trees below these
....
diameters may be marked at the discretion of the Forest officer." When other methods
....
of cutting are advisable, insert suitable provision so that the system of cutting and
....
method of designation will be clear.)
....
....

Reference is made to the special clauses 20 (a) to (i) which illustrate the principle of getting away from a rigid diameter limit. Yet often an approximate diameter limit is available in order to give the purchaser a general idea of what will be cut and what will be left standing since this affects very vitally the cost of logging. It is often possible to demonstrate to the purchaser by a sample marking how the timber will be cut, but it must be remembered that minor or major improvements in methods are often made during the life of a contract.

9. Stumps will be cut so as to cause the least possible waste, and will not be cut higher than .... inches on the side adjacent to the highest ground—lower when possible—except in unusual cases when, in the discretion of the Forest officer, this height is not considered practicable.

Eighteen inches is the usual stump height specified. Some districts find it practicable to impose a 16″ height for western yellow pine; one contract examined had separate maximum stump height limits for western yellow pine trees of different size (2′ trees=18″; 2′—3′=24″; over 3′=30″). Lodgepole pine, Engelmann spruce and small-sized white fir stumps can be cut 15″ very easily. The large Douglas fir and associated veterans can always be felled so that the stump height will not exceed the diameter outside bark where cut, but ordinarily it is preferable to impose a definite maximum stump height in inches. See special clauses 22 (a), (b), (c).

It is interesting to note the low stumps in conservative white pine cuttings in New England—namely 4 to 6 inches.

10. All trees will be utilized to as low a diameter in the tops as possible so as to cause the least waste, and to a minimum diameter of .... inches, when merchantable in the judgment of the Forest officer; the log lengths will be varied so as to make this possible.

Most species of average size can be utilized to 8 inches D. I. B. Western yellow pine in Arizona and New Mexico has been utilized to 6 inches but 8″ is the usual top limit. The exact limit of course, depends on the local utilization and marketable product. It is often true that the Forest Service gets exactly the same scale whether western yellow pine is cut to 6, 8, or 10 inches, simply because a 16 foot log 6″ in D. I. B. has the same scale by the Scribner Rule Decimal C as a log 12 feet long and 10″ D. I. B. If cutting to a very small diameter is a hardship on the purchaser, it is certainly logical to be lenient if the scale is not seriously affected. Lodgepole pine is sometimes cut to 2½″ if it can be utilized for converter poles; if cut for stulls the top limit may have to be increased to 8″ D. I. B., but ordinarily lodgepole pine, Engelmann spruce, white fir and the Rocky Mt. form of Douglas fir can all be cut to 6″ D. I. B. Douglas fir and associated species of the Pacific Coast can often be cut to 10" D. I. B. One contract in District 6 specified 7" for Douglas fir, western yellow pine, larch or fir east of the Coast Range.

11. Tops will be lopped and all brush piled compactly at a safe distance from living trees, or otherwise disposed of, as directed by the Forest officer.

Theoretically this clause allows all sorts of variations in brush disposal, but the exact kind of disposal decided upon is often specified. (See clauses 23, (a) to (g). What constitutes "a safe distance" depends on the local conditions, and especially on the amount of reproduction; sometimes 20 feet has been specified. At present, brush is (a) piled, (b) lopped and scattered, (c) lopped and left as it falls (rarely), (d) lopped and burned, or (e) in a seed tree exchange the tops in two transactions were merely pulled away from living growth. The present tendency is to lop and scatter the brush, where this can be safely done, and where it will assist reproduction; in Minnesota the brush is piled and burned during safe seasons, and in other parts of the west piling is the rule.

12. All timber will be cut and removed on or before and none later than .... and at least .... will be paid for, cut, and removed on or before .... 191 , and at least .... of the remainder of the estimated amount during each year of the remaining period.

Take the case of a three-year contract for 10 million feet; probably two million would be removed the first year, and four million feet each year of the remaining period. It is recognized that during the first year's operations the purchaser will have set-backs, and that consequently the cut may be limited. The clause prevents speculation. When it cannot be lived up to the contract must be amended. See special clauses 28 (a), (b) and (c).

13. Timber will be scaled by Scribner Decimal C log rule, or counted or measured as prescribed by the Forester, or specifically provided in this agreement, and, if required by the Forest officer, will be placed or skidded for scaling ....
("Measurement" or "count" if cordwood or other material is involved.)
.... as directed by the Forest officer.

It is ordinarily well worth while to specify the exact method of scaling, (see special clauses on scaling) where the methods vary from the instructions given in the Manual or where past dealings with a purchaser signify that there are chances for misunderstandings along any particular line.

14. All marked or designated trees and all dead timber sound enough for lumber of any merchantable grade of timbers .... (Insert cordwood or other materials to be included in the sale.) .... shall be cut. Unmarked or undesignated living trees which are cut; marked or designated trees or merchantable dead timber left uncut; timber wasted in tops, stumps, and partially sound logs; trees left lodged in the process of felling; and any timber merchantable according to the terms of this agreement which is cut and not removed from any portion of the cutting area after logging on that portion of the cutting area is completed, or is not removed from the National Forest after the expiration of this agreement, shall be scaled, measured or counted, and paid for at double the price herein specified.

If in doubt whether a tree is merchantable or not, it is marked for cutting and the purchaser is supposed to fell it so the government scaler can see how it opens up. Ordinarily anything that will scale one-third the full scale of No. 3 common or better, is considered merchantable, but of course this rule cannot be applied uniformly. Any penalty scale that must be imposed, should be assessed as soon as possible, since to allow a continued waste in utilization to pile up against a company, would be hardship. The Forest Service is at least morally responsible for the acts of its employees, and consequently if the officer in charge of a sale makes no criticism of woods utilization, it is embarassing to have an "inspector" later insist on penalties for logging that has passed muster with the local force. The writer has tried various schemes for systematically checking the woods work as for example high stumps stamped U. S. once if all right, and twice is too high.

It occasionally happens that a company would prefer to deliberately leave certain logs in the woods and pay double stumpage; this cannot be countenanced since it is contrary to a proper conservative use of the product if merchantable; if unmerchantable there is no obligation on the part of the company to take out the logs and pay for them.

15. During the time that this agreement remains in force .... (I or we) will, independently, do all in .... (my or our) power to prevent and

suppress forest fires on the sale area and in its vicinity, and will require
.... employees and contractors to do likewise. ....
(My or our) (I or we)
hereby agree, unless prevented by circumstances over which ....
(I or we)
have no control, to place .... and ....
(myself or ourselves) (my or our)
employees at the disposal of any authorized Forest officer for the purpose of fighting forest fires, with the understanding that if the fire does not threaten .... property or the area embraced in this
(my or our)
agreement .... shall be paid for services so rendered at
(I or we)
the rate or rates to be determined by the Forest officer in charge, which rate or rates shall correspond to the rate or rates of pay prevailing in the .... National Forest for services of a similar character at the time the services are rendered, provided, however, that if .... employees, subcon-
(I or we) (My or our)
tractors, or employees of subcontractors are directly or indirectly responsible for the origin of the fire, ... shall not be paid for
(I or we)
services so rendered.

It was necessary to make the clause very explicit because of past misunderstandings; for example, should a camp foreman or saw filer be paid for fighting fire at his current rate of pay, or at the usual "fire" rate of 25c an hour? This is settled by clause 15.

16. So far as is reasonable all branches of the logging shall keep pace with one another, and in no instance shall the brush disposal be allowed to fall behind the cutting, except when the depth of the snow or other adequate reason makes proper disposal impossible, when the disposal of brush may, with the written consent of the Forest officer in charge, be postponed until conditions are more favorable.

When logging is piecemeal there is more damage to reproduction and moreover, the sale is more difficult to administer. When brush disposal falls behind, the needles often become loose and drop off when the brush is moved later on; yet during severe weather, it is impossible to keep brush disposal up-to-date.

17. Necessary logging roads, chutes, camps, buildings, or other structures shall be located as agreed upon with the Forest officer in charge. All such improvements not removed within .... months after the expiration of this agreement shall become the property of the United States.

This is designed not only to prevent damage to local interests, but to enable forest officers to locate improvements, (especially roads) so they will benefit the forest when this can be done without an undue increase in the cost of logging. Roads may be made to serve as fire lines is properly located; camp buildings as future ranger stations, and there was one instance where a lumber company pipe line enabled material water development.

18. (a) The title to the timber included in this agreement shall remain in the United States until it has been paid for and scaled, measured, or counted, as herein provided.

(b) The decision of the Secretary of Agriculture shall be final in the interpretation of the regulations and provisions governing the sale, cutting, and removal of the timber covered by this agreement.

(c) Work may be suspended by the Forest officer in charge if the conditions and requirements contained in this agreement are disregarded, and the failure to comply with any one of said conditions and requirements, if persisted in, will be sufficient cause for the Forester to revoke this agreement and to cancel all permits for other uses of the National Forest.

(d) No Member of or Delegate to Congress, or Resident Commissioner, after his election or appointment, and either before or after he has qualified, and during his continuance in office, shall be admitted to any share or part of this contract or agreement, or to any benefit to arise thereupon. Nothing, however, herein contained shall be so construed to extend to any incorporated company, where such contract or agreement is made for the general benefit of such incorporation or company. (Section 3741 Revised Statutes, and Sections 114 to 116, Act of March 4, 1909.)

(e) Refund of deposits under this agreement will be made only at the discretion of the Forester or District Forester.

(f) This agreement will not be assigned in whole or in part.

(g) The conditions of the sale are completely set forth in this agreement, and none of its terms can be varied or modified except with the written consent of the Forester (or "the District Forester" in District Foresters' sales, or, "the Supervisor," in Supervisors' sales.) No other Forest officer has been or will be given authority for this purpose.

(h) And as a further guarantee of a faithful performance of the conditions of this agreement ....
(I or we deliver herewith a bond in the
.... and do further agree that all moneys paid upon this
sum of)
agreement shall, upon failure on .... part to fulfill all and
(my or our)
singular the conditions and requirements herein set forth, or made a part hereof, be retained by the United States to be applied as far as may be to the satisfaction of .... obligations assumed here-
(my or our)
under.

Paragraph (a) is an added security; (b) puts the decision of disputes and the interpretation of the contract in the hands of the government; it is rarely that work is (d) suspended, in fact, during the writer's experience only one case has arisen; clause (d) is required by law; refunds are ordinarily on a liberal basis if the company has made an honest effort to comply with the contract. If a sale were made and a company, through no fault of the government, cut no timber, the cost of examining the timber and marking the cutting might be first deducted from deposits before a refund was allowed. No assignments (f) are allowed since this would introduce a speculative feature; in the past purchasers have often claimed they had verbal assurances from officers and (g) naturally this caused embarassment, because contracts should certainly not be subject to verbal modifications; a reasonable (h) bond is required. The exact amount varies with the needs in each sale, but it is usually small as compared with the bonds ordinarily required in public contracts. For example, in a sale of 90 million feet at $3.50 a thousand, the bond was only $10,000. The Manual gives the usual size of bonds for sales of varying amounts, but these are not rigidly followed.

Special Clauses.

The contracts drawn up in each district vary considerably, even for the same type, and where the conditions are similar. Therefore an officer accepting a transfer or starting on his career in the Forest Service should not only study local contracts, but also try to improve the standard by introducing features from other districts. The clauses enumerated are chosen from some twenty selected contracts. After each special clause, is given the main species in order of importance, name of Forest, number of district, year contract was approved or when it will be approved.

The following abbreviations have been used:

Species: w. y. p.=western yellow pine; D. f.=Douglas fir; l. p.=lodgepole pine; w. r. c.=western red cedar; c.=cedar; w. h.=western hemlock; E. s.=Englemann spruce; b. f.=balsam fir; w. f.=white fir; s. p.=sugar pine; w. w. p.=western white pine; w. l.=western larch.

District: D=district and number. Manual=M; this applies to general clauses applicable to all districts and presumably to all types where clauses are practicable. District 3, "brain book" containing sample clauses, compiled by Mr. A. B. Recknagel in 1909= B. B.

19. (a) Cutting will begin at a point designated by the Forest officer, and will be confined to the least possible area which will yield the amount specified in this agreement. (n)

(b) The Company shall employ a competent surveyor to survey the lines between the private timber lands owned by them and that of the Government. (w. y. p., San Juan, D2, 1911).

(c) Boundaries of cutting area shall be plainly marked by the forest officers before cutting begins; all timber market by the forest officers within such boundaries shall be cut, no timber outside such boundaries shall be cut, and no tops, brush or debris shall be left on adjoining lands. (w. y. p., D. f. Bitterroot D. 2, 1908.)

Clause (a) is self explanatory and is evidently designed to prevent indiscriminating cutting "in all sales made for a definite amount;" where a company has been reckless in overcutting on to lands not included in the sale; (b) may be sometimes necessary; (c) frequently inspections have shown debris thrown onto land not included in the cutting area and therefore special precaution is advisable.

20. (a) Not to exceed .... per cent of the merchantable timber (separate percentages to be designated for each species if advisable) will be reserved in marking. (M)

(b) No living healthy trees within 100 feet of the Verde or Tonto Basin wagon roads shall be cut under this contract. (w. y. p., Coconino, D 3, 1910.)

(c) No "blackjack" unless defective shall be marked except in thinnings. (w. y. p., Coconino, D3, 1910.)

(d) Cutting and marking similar to that done on the D. M. Wilt sale of September 14, 1910, will be satisfactory. (l. p., E. s., b. f., Medicine Bow, D2, 1911.)

(e) We have examined the marking done by the Forest officer upon the area for which we have applied, and we agree to purchase the timber as marked. (s. p., w. y. p., w. f., Sierra, D5, 1911.)

(f) White pine trees not to exceed 200 M. feet B. M. in total amount, in plots not exceeding 10 in number, may be designated by the Forest officer, and will be left uncut by the company. About these such cleaning will be done as may be deemed necessary by the Forest officer for their protection from fire at the time of brush burning. (w. w. p., c. Kaniksu, D1, 1911.)

(g) The marking will be such as to meet the silvicultural requirements of the stand. Ordinarily, "black jack" will be left; Merchantable "yellow pine" trees if necessary for seed and protection in the judgment of the Forest officer will not be marked. Not more than approximately one-third of the stand of merchantable timber will be left; this does not include the estimated amount of 600,000,000 ft. B. M. (w. y.p., Sitgreaves, —Apache, D3, 1912.)

(h) All green timber on the strips to be cut clean that will make a log 16 feet long 8 inches top diameter, regardless of whether it is merchantable or unmerchantable, shall be cut. (w. w. p., D. fir., w. h., w. l. Coeur d'Alene, D1, 1910.)

(i) We have examined a sample of the marking showing the system which will be followed in designating this timber for cutting and we understand that this sale includes all of the merchantable dead timber standing or down upon the area designated, and approximately 66 2-3 per cent. of the merchantable live timber to be designated and marked for cutting by the Forest officer in charge. (w. y. p., w. f., s. p., c. Tahoe, D5, 1912.)

(a) According to the Manual this clause is "desirable in the larger sales to indicate definitely to the purchaser the proportion of the stand which he will be permitted to log."

In western yellow pine stands in District 3 this is usually 33 per cent.; in the same species in District 6 the per cent. would be 20 to 25— less rather than more on account of the ease of reproduction. (b) is used when marking scenic reserves; all dead trees and unhealthy living trees within such a reserved strip should be felled. One hundred feet on each side of a road is perhaps too narrow a reservation for an open stand like western yellow pine; 200 to 300 feet would be better if such a width could be amicably agreed upon with the purchaser. (c) was designed to correct a common error in marking; in the case in point the local officers had marked too large a proportion of "black jack" in previous sales. (d) Here the method of marking and cutting was evidently demonstrated to the purchaser to prevent any misunderstanding.

In the early days there were no written marking rules; the second step in the development of marking was to draw up elaborate marking rules; then came the establishment of a marking board (started in D 3) to mark representative stands in large and important sales; finally the plan is on foot to mark sample areas on each type or variation of type in each forest. Such an area was marked on the Apache Forest (D 3) 1910. (e) illustrates the demonstration of marking methods to a prospective purchaser. (f) to (i) illustrate the development of marking methods.

UTILIZATION OF TOPS.

21 (a) Green timber which will cut a log not less than .... inches in diameter at the top and not less than .... feet long, and for diameters over .... inches containing not less than .... per cent. of merchantable lumber of any grade, and for smaller diameters not less than .... per cent. of merchantable lumber of any grade will be considered merchantable. Dead timber which will cut a log not less than .... inches in diameter at the top and not less than ...., per cent. of merchantable. (The diameters and per cents depending upon character of material and local market conditions. (m)

(b) Tops will be used for mining timbers, cross-ties, posts and cordwood whenever possible. (m)

(c) Dead timber, whether in tops or small trees, less than five inches in diameter at the big end, suitable for ties, shall be so utilized. Green aspen, whether in tops of trees cut for props or in standing trees six inches or less in diameter will be taken for ties when designated for cutting by the Forest officers. (aspen, a. f., Manti, D4, 1909).

(d) All trees will, if possible, be utilized to the diameter of six inches in the tops. Trees between 11 inches and 15 inches in diameter, breast high, when cut for hewn ties shall be so utilized to a ten inch diameter at the top. Nothing in this contract shall be construed to prohibit the purchaser from cutting more mine props than those resulting from the logging operations incidental to hewing and sawing ties, provided that such additional prop trees, when green, are properly marked for cutting by the Forest officer. In case the purchaser finds it possible to utilize fence posts of less than six inches in diameter at the small end, and seven feet in length the same may be cut and will be charged for at the rate of two cents per post. (l. p., Uinta, D4, 1911.)

(e) All trees cut will be utilized to a diameter of 2½ inches in the tops for any of the classes of material herein specified. Merchantable dead timber will be utilized to a minimum diameter of 8 inches in the top for stulls and the remaining portion will be put to such other uses as will permit of the maximum utilization to the minimum diameter limit of 2½ inches. Unless utilized for telephone poles, green timber will be cut to such a diameter in the tops that after the shrinkage due to seasoning has occurred, stulls with a minimum top diameter of 6 inches inside of bark will be obtained and the remaining portion will be put to such other uses as will permit of the maximum utilization to the minimum diameter limit of 2¼ inches. (l. p., Deerlodge, D1, 1911.)

(f) All trees cut will be utilized to the smallest diameter possible in the tops in making poles and piling of the classes named in this contract and to a minimum of 6 inches in the tops when utilized for posts. (c., Pend. Oreille, D1, 1911.)

(g) Any material cut and removed for sale below the minimum size specified for saw logs in Clause .... shall be scaled, measured or counted, as the Forester shall prescribe; converted into board measure, log scale, in accordance with a ratio determined by the Forester which shall conform with the current practice of the Forest Service; and paid for in accordance with the established rate for such species, unless or until a special rate upon such material is established by the Forester upon application of the purchaser.

Where there is chance for a misunderstanding, it is well to clearly define the top utilization by clauses (a) to (f). (g) is a recent clause for long term contracts.

STUMP HEIGHTS.

22. (a) If necessary, in the judgment of the Forest officer, exceptions in the height to which stumps are to be cut may be made in the case of swell butted, fire scarred or otherwise defective trees; the stumps, however, will be cut low enough to include their whole merchantable contents. (m.)

(b) Stumps will be cut not higher than the diameter of the tree at the point of cutting, and in no case higher than 18 inches. (l. p., Deerlodge, D1, 1911.)

(c) Stumps will be cut as low as possible; for trees up to two feet in diameter at the stump not higher than 18 inches; for trees from two to three feet, not higher than 24 inches; for trees more than three feet in diameter, not higher than 30 inches; the height to be measured on the uphill side of the stump. In case of defective logs, they will be scaled and deductions made for defects. (w. y. p., D. fir, Bitter Root, 1908.)

Clause (a) is seldom necessary since in the ordinary interpretation of a contract practical exceptions would be made by the officer in charge of the sale; as a matter of fact if stumps are "cut low enough to include their whole merchantable contents" few exceptions would actually be made—practically none in D 3. (b) may be used where there are very small poles to be cut as well as large trees. The last sentence in (c) is really superfluous.

SPECIAL FORMS OF BRUSH AND DEBRIS DISPOSAL.

23. (a) The purchaser will burn the slash at such times and under such conditions as the Forest officer in charge may prescribe. (To be inserted in sales where it is safe and practicable for the purchaser to burn slashings, particularly where the season permits burning slash as it is cut.) (M.)

(a1) We will furnish a sufficient number of men yearly free of charge for a sufficient period, as determined by the Forest officer in charge, to burn all brush and debris resulting from this sale; such brush and debris to be burned at such times and in such manner as the Forest officer in charge shall prescribe.

(b) Tops will be lopped and all brush and other debris made in the logging operation shall be piled in high compact piles, occupying the least possible space within a strip of at least 100 yards wide adjacent to the exterior boundaries of any body of green timber within sale area, provided that the width of this strip may be varied but in no case shall exceed 100 yards wide, if in the judgment of the Forest officer a narrower strip will be sufficient safeguard to prevent damage or destruction of green timber in disposing of the brush from the cut over area, and shall be burned if piling and burning is considered advisable by the Forest officer in charge. All tops will be lopped clear of brush on the area included in this sale other than the 100 yard strip above described. (w. w. p., Coeur d'Alene, D1, 1911.)

(c) If required by the Forest officers, we agree in lieu of piling brush, to lop the limbs and scatter all the brush as designated by the Forest officers in charge. (w. y. p., Coconino, D3, 1910.)

(d) All brush and other debris made in the logging operations shall be piled in compact piles or in windrows and occupy the least possible space. The piles shall be placed at least 25 feet from the edge of the alternate strips left and shall be burned by me at such times as directed by the Forest officer in charge. (w. w. p., D. f., w. h., w. l., Coeur d'Alene, D1, D1, 1910.)

(e) Tops will be lopped and all brush piled compactly at a safe distance from the living trees, or otherwise disposed of, as directed by the Forest officers. On an area of 100 acres, to be prescribed by the Forest officer, the brush is to be burned in compact piles as logging proceeds, or if this, in the judgment of the Forest officer, proves impracticable or likely to cost more than a sum equal to a levy of 10c per M. on all the saw logs cut under this contract, there is to be piled in compact piles, as directed by the Forest officer, so much of the brush as may be so handled at a cost of exceeding that sum. The company agrees to burn the brush on areas outside of the 100 acres referred to above, at such times and in such manner as directed by the Forest officer in charge. (w. w. p., Kaniksu, D1, 1911.)

(f) So far as is reasonable, all parts of the logging operations shall keep pace with one another, and in no instance shall the brush disposal be allowed to fall behind the cutting, except with the written consent of the Forest Supervisor which may be given when the depth of snow or other adequate reasons make brush disposal impossible. When the operation on any particular portion of the sale area is completed, the area will be examined by the Forest officer, and if satisfactory to him, he will give the company a written statement, releasing it from further responsibility for the utilization of the timber on such area, and the clearing and burning of the brush; provided that this clause shall not be interpreted to relieve the company of responsibility for damage thereafter caused to areas for which such written release has been given in case the company later needs to construct roads, tramways or to conduct any other part of the operation on such area. (l. p., Deerlodge, D1, 1911.)

(g) Should the snow become so deep at any time during the winter that the tops and lops resulting from timber cutting, under this sale, can not be disposed of to the satisfaction of the Forest officer in charge, then the Forest officer may authorize the postponement of the disposal of said tops and lops until the weather conditions are more favorable, but in all cases the area in question must be cleaned up to the satisfaction of the Forest officer in charge, not later than the 30th day of June, following such postponement. (w. y. p., D. f., w. f., San Juan, D2, 1911.)

For example in Minnesota, it is usually possible to burn the brush when it is lopped; in such clauses (a) (a′=recent revision) would be used. Clause (c) was necessary owing to a change in policy from piling to scattering. The other special clauses illustrate (b) (d) (e) (f) (g) the details, necessary in contracts when departing from the usual methods.

BRUSH BURNING.

24. (a) We agree, when called upon by the Forest officer in charge, to furnish a number of men, sufficient in the judgment of the Forest supervisor, up to the number of our entire logging crew, to burn the brush and debris resulting from the cutting, under the supervision of the Forest officer. (m.)

Under a recent ruling of the Solicitor of the Department of Agriculture, it is entirely proper for the Forest Service to require (see (a)) the purchaser to burn slash; from the administrative viewpoint it is only fair to see to it that purchasers be put to the same relative indirect expense In D 3 no compulsory brush burning has as yet been required since the district was established; other districts have required burning in one form (fire lines) or other.

DETAILS OF WOODS MANAGEMENT.

25. (a) Logs shall be decked or piled for scaling at places agreed upon with the Forest officer, with ends even on one side of the skidway or pile, and the length shall be marked on the small or scaling end of each log by the purchaser. Logs of different species or value shall, if required by the Forest officer, be decked or piled in separate piles. (M.)

(b) The location of the tie makers strips will be subject to the approval of the Forest officer in charge and will not be blazed. Not more than one strip road shall be cut in every 140 feet and all strip roads shall be cut out in such a way as to require as little felling of standing unmarked trees as is possible. (l. p., E. s., b. f., Medicine Bow, D2, 1911.)

(c) We agree to cut all trees marked upon the cutting area, whether merchantable or apparently unmerchantable. (s. p., w. y. p., w. f., Sierra, D. 5, 1911.)

(d) Logs will not be allowed to accumulate at the foot of the chute in such a manner as to injure the reproduction of the remaining live stand. (b. b. 1909.)

(e) It is agreed that as much of the timber at the time of cutting as is merchantable according to this contract and reasonably accessible in the judgment of the Forest officer in charge, will be cut from the area designated. (w. w. p., Coeur d'Alene, D 1, 1911.)

(f) Wherever possible, aspen will be used in road construction and for bridges. If aspen is not accessible, dead or defective pine or spruce will be used. (b. b., 1909.)

(g) After decision by the Forest officer in charge, that the purchaser has compiled satisfactorily with the cutting regulations as to specific areas, the purchaser shall not be required to move back upon or do additional work upon such areas. (w. y. p., w. f., s. p., c; Tahoe, D 5, 1912.)

(g1) The plan of logging operations on the respective portions of the sale area shall be approved by the Forest officer in charge when operations are begun on any natural logging area, the cutting on that area shall be fully completed to the satisfaction of the Forest officer in charge before cutting may begin on other areas, unless written permission is given by the Forest officer in charge to begin cutting on a different area, with the understanding that as soon as conditions warrant it cutting will be resumed on the area left incomplete. After decision in writing by the Forest officer in charge that the purchaser has complied satisfactorily with the cutting regulations as to specified areas, the purchaser shall not be required to move back upon or do additional work on such areas

(h) In order to check the spread of forest tree diseases and to eliminate from the forest old snags, which are a menace in the time of fire, we agree to cut all trees or snags marked upon the cutting area, whether merchantable or apparently unmerchantable. (w. y. p., w. f., s. p., c. Tahoe, D 5, 1912.)

(h1) In order to check the spread of forest tree diseases and to eliminate snags which constitute a fire menace, we agree to cut all trees or snags marked upon the sale area, whether merchantable or apparently unmerchantable. Such trees or snags after felling shall be opened up sufficiently to satisfy the Forest officer in charge of their condition, and any portions thereof which are merchantable in the judgment of the Forest officer in charge shal be removed, scaled and paid for.

(i) The removal of all species included in this sale shall take place simultaneously. (w. r. c., w. h., Snoqualmie, D 6, 1910.)

(j) As soon as logging on the whole of any such portion of the area under this agreement as may be tributary to a single landing is completed, and before the logging equipment is removed from such area, final decision as to the compliance with the terms of this contract so far as they apply to such portion of the area, shall immediately be given the purchaser by the officer in charge of the sale. Such decision having been rendered, no further utilization of timber on such portion of the area shall be required or further penalties imposed. (w. r. c., w. h., Snoqualmie, D 6, 1910.)

Clause (a) is to facilitate scaling when logs must be decked; (b) (d) (e) (f) (g) (g′=recent revision) (i) (j) are self explanatory; (c) is merely to insure very close utilization. It is well recognized that (h) (h'=recent revision) snags are a fire menace and undoubtedly if half alive are a menace in spreading forest tree diseases.

RESTRICTIONS IN LOGGING BY DONKEY ENGINES.

26. (a) All donkey or other steam-power engines not burning oil for fuel shall be equipped with a spark arrester satisfactory to the Forest officer, a steam pump, 200 feet of serviceable 1 inch hose, 6 buckets, and a constant supply of the equivalent of 6 barrels of water; all such equipment to be suitable and available for fire-fighting purposes. (m.)

(b) If donkey engines are used, the rigging shall be slung, as far as practicable upon stumps, or marked trees, and when possible the grab hook shall be used in all cases rather than the wire choker. (m)

(c) This contract is intended to provide for logging in the woods by means of ....
(Indicate whether by horses, donkey engines, etc.)
.... Any other method of logging may be employed only with the consent of the Forest officer approving this contract and under such conditions and restrictions as may be agreed upon with him. (To be inserted especially where there is a probability of substituting steam logging for other methods. (m).

(c) This agreement contemplates the use of the ordinary methods of logging followed in the territory in which the sale area is located, known as steam donkey logging. Should the purchaser elect to use an overhead cable system or other methods different from those ordinarily employed in the territory at the time of execution of this agreement, the use of any such system or methods shall be subject to such modifications as are deemed necessary by the Forester for the adequate protection of reproduction and unmarked trees.

(d) Donkey engines or steam skidders will be used only with the written approval of the Forest Supervisor and will be allowed only under restrictions which will prevent fires, and only in areas in which the damage done to the remaining timber and reproduction will be negligible. (w. y. p., Sitgreaves, Apache, D 3, 1912).

(e) The use of donkey engines or steam skidders may be forbidden by the Forest officer in charge upon any portion of the cutting area in this sale. If allowed, the points at which they shall be set up shall be subject to the approval of the Forest officer in charge; the ground around each shall be cleared of all brush and inflammable material; and each donkey leader or skidder shall use coal for fuel and shall be equipped with efficient spark arrester, subject to the approval of the Forest officer in charge. (w. y. p., Coconino, D 3 1910).

(f) If steam logging appliances are used in this operation they must be operated so as not to injure the timber left standing on the sale area. (w. w. p., D. F., w. h., w. l., Coeur d'Alene, D 1, 1910).

(g) Efficient spark arresters shall be maintained on all donkey engines and other wood-burning boilers operating on and near National Forest land. (s. p., w. y., w. f., Sierra, D 5, 1911.)

(h) At each setting of a donkey engine or other steam logging contrivance the ground shall be cleared of all inflammable material for a distance of 50 feet in all directions. A watchman will be provided by the company during the noon hour for each donkey. (s. p., w. y. p., w. f., Sierra, D. s, 1911).

(i) At each setting of each donkey engine or other steam logging contrivance, the ground shall be cleared of all inflammable material for a distance of 50 feet in all directions. During the period of June 1st to October 1st of each year, no donkey engine or other steam logging contrivance in actual use shall be left during the noon hour without a watchman, and during the same period of each year the purchaser may be required at the discretion of the Forest officer to employ a night watchman to guard against the escape of fire from the logging engines. (w. y. p., w. f., s. p., C. Tahoe, D 5, 1912).

The most satisfactory fire protection measure (a) is to use oil for fuel; any wood or coal-burning steam engine is dangerous. Even oil if forced unproperly in feeding by a green fireman may, with some machines, set fires. There is always some damage from rigging (b); consequently if steam logging can be avoided it is preferable from the lessee's standpoint to (c) (c'=recent revision) prohibit the use of donkey engines or steam skidders (d) (e) (f) (h) (i) (j) are clear. The officers in D 6 have, it is understood, hit upon a satisfactory spark arrester although it must be admitted that without repeated and careful inspection, spark arresters are dangerous (g).

PROGRESS OF CUTTING.

27. (a) No timber will be cut, except from the areas specified by the Forest officer. Cutting and other phases of the operation will only be allowed, and shall be completed successively, on such portions of the sale area as may be designated by the Forest officer. No live timber will be cut except that marked or otherwise designated by the Forest officer. If for any reason the Forest officer orders the cutting to cease on the whole or any portion of the sale area, no further cutting will be done until the Forest officer gives him permission.

(b) Cutting shall progress in such a manner as in the opinion of the Forest officer in charge, will not cause depreciation of the stumpage value of the uncut timber remaining on the sale area. (l. p., E. s., b. f., Medicine Bow, D 2, 1911). See also 25.

ANNUAL AMOUNT TO BE CUT AND REMOVED.

28. (a) Second, unless extension of time is granted, all the timber except the 15,000,000 feet of white pine timber will be paid for, cut and removed on or before January 1st, 1914, and 20,000,000 feet of the white pine timber will be paid for, cut and removed on or before January 1st, 1915, and the remaining merchantable portion of the timber on the area first described in this instrument will be paid for, cut and removed on or before and not later than January 1st, 1916, provided that if the actual scale of the timber overruns the estimate of the entire area by 15 per cent., the Company at its option upon application to the District Foresters, will be granted an extension of time to cut and remove the remainder of the timber uncut on January 1st, 1916, from the area first described in this instrument, or be relieved from the obligation to cut and remove any timber in excess of the fifteen per cent. overrun of the estimated amount of 75,000,0000 ft. B. M. on the area herein first described (w. w. p., Coeur d'Alene, D 1, 1911.)

(b) A period of twenty (20) years will be allowed for the cutting of the timber involved in this sale exclusive of the cutting of railroad ties and other timbers required in the construction of the logging railroad and other preliminary improvements in connection with the operation; provided, that all such improvements shall be constructed prior to January 1st, 1915. The contract period will extend for a term of twenty years beginning January 1st, 1915, unless such construction is completed or the cutting of timber for sale begins prior to that date. In that event, the date of commencement of the 20-year period shall be the date on which cutting for sale is initiated but in no case to be later than January 1, 1915.

Unless such amounts are reduced by the Forester, at least one hundred million (100,000.000) feet board measure will be cut prior to January 1, 1920; two hundred and fifty million (250,000,000) feet board measure prior to January 1, 1925; and four hundred and fifty million (450,000,000) feet board measure prior to January 1, 1930. (w. y. p., c. d., d. f., w. f., Sierra, D 5, 1911).

(c) Unless extension of time is granted, all timber will be cut and removed on or before and none late than September 1, 1915. The purchaser agrees to cut in each year ending September 1 at least 55,000 stulls 8" and over in diameter at the small end, and not more than 90,000 stulls 8" and over in diameter at the small end, together with such other material as has been specified as may occur in the logging operations with such stulls. The District Forester, however, may at his discretion extend the total number of stulls to be cut in any one year, said extension to be in writing. (l. p., Deerlodge, D 1, 1911).

It is sometimes wise to specify in great detail the amount (by classes of material) to be cut and removed each year, especially where overrun in the estimates is anticipated. (a) (b) (c).

TRIMMING ALLOWANCES.

29. (a) The maximum scaling length of all logs will be 16 feet; greater lengths will be scaled as two or more logs. Upon all logs 3 inches additional length will be allowed for trimming; logs overrunning the specified length will be scaled as 2 feet longer. (Insert in all scales including saw timber, except where other specific terms are agreed upon.) A greater overrun may be allowed when necessary in sales of large timber (m).

(b) On all poles and piling, for every 5 feet of merchantable length 1 inch additional length will be allowed for cutting and trimming. (c, Pend oreille, D 1, 1911.)

(c) The maximum scaling lengths of all logs shall be 32 feet; greater lengths shall be scaled as two or more logs, and upon logs 24 inches or less in diameter 3 inches additional length, and upon logs over 24 inches in diameter 5 inches additional length shall be allowed for trimming. Logs overrunning more than the specific allowance for trimming shall be scaled as if 2 feet longer. (D. f., w. r. c., w. h., Snoqualmie, D G, 1911).

Ordinarily logs over 16 feet in length are scaled as two logs, as fully explained under "scaling" in the Manual. (a) (b) and (c) give examples of allowance for trimming; this is a point which merits a frequent check by all scalers. There are few sales where there is not a tendency to overrun trimming lengths; this is due often to the natural mistakes in measuring logs by the sawyers since they use measuring poles instead of accurate tapes.

ALLOWANCE FOR DEFECTS IN SCALING,

30. (a) Where logs are sap-stained scaling shall be inside of the sap. (w. w. p., Kanikan, D 1, 1911).

Specific directions (a) governing the allowance for defects are rarely necessary.

"MERCHANTABLE" DEFINED.

31. (a) All marked or dead trees which contain one or more merchantable logs shall be cut. All logs that will saw out .... .per cent. of merchantable lumber shall be considered merchantable under the terms of this contract. (The per cent. depending upon character of material and local market conditions). (m).

(b) Any log or long butt containing 30 per cent. or more merchantable timber will scaled. (w. w. p., D. f., w. h. w. c., Coeur d'Alene, D 1, 1911.)

(c) In scaling, logs of all lengths down to and including 10 feet shall be considered merchantable. This clause simply defines merchantable logs as based upon length and does not take into account defects or crooks, which, of course, may exclude a log of any length from the merchantable class. (s. p., w. y. p., w. f., Sierra, D 5, 1911).

(d) The smallest stick of dead timber which shall be considered as merchantabe under the terms of this contract shall be 8½ inches top diameter and 10 feet long. (Special clause, not applicable to sales in general.) (l. p., E. s., b. f., Medicine Bow, D 2, 1911).

(e) Trees felled shall be opened up sufficiently to satisfy the Forest officer in charge of their conditions, and any logs in such trees which, in the judgment of the Forest officer, are merchantable, shall be removed from the woods scaled and paid for. (s. p., w. y. p., w. f., Sierra, D 5, 1911).

(f) Cedar trees that will furnish poles at least 30 feet long and 7 inches in diameter at small end will be cut and paid for as provided in the contract. (w. w. p., c., Kaniksu, D 1, 1911).

(g) Timber used for skid-roads and other improvements shall be obtained free of charge when the timber so used is designated by the Forest officer, and such timber will be unmerchantable under the terms of this agreement. (w. w. p., c., Kaniksu D 1, 1911).

(h) Wood taken from the tops from unmerchantable saw timber necessary for fuel in connection with the logging operations only shall be allowed free of charge. (w. r. c., w. h., Snoqualmie, D. 6, 1910).

These definitions (a) to (h) as to "merchantable" material are instructive.

FREQUENCY OF SCALING.

32. (a) Scaling will be done as often as practicable in the judgment of the Forest officer while cutting is in progress, and copies or abstracts of the scale reports will be furnished to the purchaser after they have been approved by the supervisor. (m).

(b) Scaling will, if practicable in the judgment of the Forest officer, be done twice each week or oftener provided there be not less than 20,000 feet B. M. on the skidway at the time of scaling. (D. f., l. p., Targhee, D 4, 1911.)

One of the chief sources of avoidable expense in small sales is too frequent scaling. The average hand-to-mouth operator often expects the ranger to ride ten or fifteen miles to scale a few thousand feet. If this class of sale is to be handled at a profit, scaling should be distinctly periodic, and only when there is an accumulation of unscaled logs. This is sometimes complicated by the danger of logs bluing if left in the woods, and by the danger of theft by illegal sawing before scaling, if held skidded at the mill.

SCALING OR COUNTING TIES.

33. (a) All hewn ties whose widest diameter inside the bark at the small end exceeds..............inches and all with visible defect will be scaled as saw logs. The scaling diameter will be the widest measurement at the small end of the tie. Small hewn ties which are sound will be counted as...........to the M. feet b. m. (m).

(b) The length of all timbers shall be plainly marked on the top end by the purchaser, except standard railroad ties, which will be piled with the tops flush one way. (l. p., E. s., b. f., Medicine Bow D 2, 1911.)

(c) Hewn cross ties used in the logging operation not over 6 1-3 feet in length with not less than a 7 inch top, shall be paid for at the rate of two cents (2) each. Ties cut from material with less than a 7 inch top and used in the logging operations, shall not be paid for. Yellow pine merchantable for saw timber which is used for ties shall be scaled and paid for at the price herein specified for saw timber. (w. y. p., w. l., D. f., w. f., Whitman, D 6, 1911.)

(d) All hewn ties not exceeding 8 feet in length and those hewn from logs less than 14 inches in diameter will be counted and paid for at the rate of 10 cents each. All logs or ties exceeding 8 feet in length or 14 inches in diameter at the small end will be scaled by the Scribner rule, Decimal C, and paid for at the rate of $3.00 per thousand feet B. M. Mining props will be measured by the linear foot and paid for at the rate of ¾c per linear foot. Fence posts if taken, will be counted and paid for at the rate of 2 cents per post. (l. p. Uinta, D 4, 1911.)

(e) If ties are hewn, so much of the stem of each tree as will make a log 16 feet long and 16 inches or more in diameter outside the bark at the small end shall be cut into saw logs to be scaled. (w. y. p., Coconino, D 3, 1910).

(f) Standard railroad ties shall be counted as 35 to the thousand feet b. m. or individually scaled by the specified rule, or measured in both ways, according to the judgment of the Forest officer in charge (l. p., E. s., b. f., Medicine Bow, D 2, 1911.)

(g) All 7-inch by 9-inch 8-foot hewn ties will be counted as 25 to the thousand feet, B. M.; all 8-inch by 6-inch 8-foot hewn ties, 30 to the thousand feet, B. M.; all 8-inch by 6-inch 3-foot hewn ties, 40 to the thousand feet, B. M.; all 6-inch by 6-inch 8-foot hewn ties, 50 to the thousand feet, B. M. Ties with seen defect will be scaled as saw logs. A proper allowance will be made for defect by the scaler; the scaling diameter will be the widest measurement at the small end of the tie. (w. y. p., Coconino, D 3, 1910).

The dividing point between tie timber and saw timber can always be figured out; occasional losses have occurred because saw logs (worth more per M if scaled by the foot b. m.) have been hewn into ties; clauses (a) (e) would prevent this. The second sentence in clause (c) might cause criticism; in an early sale the operator was allowed to take out culls free, since without paying stumpage prices he could just come out even, yet although the culls were a fire menace in the woods there were charges of graft against forest officers when these culls were given away. The tie converting factors (g) (f) are interesting.

SPECIAL UTILIZATION OF GREEN AND DEAD TIMBER.

34. (a) Both marked and dead trees which are considered a fire menace by the Forest officer in charge will be felled, but only such portions of them as are merchantable under the terms of this contract will be logged and paid for; this does not include trees or stubs too short or small to be merchantable under the contract. (m).

(b) The Company shall not be required to pay for, make, or take any cedar poles more than 40 feet in length, and trees that will make longer poles may be converted into logs after the maximum length pole required by this contract is made. (w. w. p., c., Kaniksu, D 1, 1911).

Clause (a) has been in every contract in D 3 for the past three years and is not seriously objected to; it is mainly a fire protective measure in having the dangerous dead stubs felled, but also insures very close utilization of dead timber.

MISCELLANEOUS SCALING INSTRUCTIONS.

35. (a) Shingle bolt material will be counted a certain number of pieces to the cord, as may be determined by the Forest officer after the piling, measuring and counting of a certain number of cords; thereafter shingle bolt material will be stacked on end or piled at the option of the purchaser for counting or measuring by the Forest officer. (c., Peud Oreille, D 1,1911).

(b) All material between 8½ and 6 inches in top diameter cut under this contract shall be piled and scaled in the woods, and may remain where piled and scaled, for a period not exceeding two years after the expiration of this contract, if the purchaser, after all reasonable attempts, is unable to find a market for it sooner. At the end of two years after the expiration of this contract, if the purchaser has been unable to find a market for this material, and consequently has not moved it from the woods, the material shall become the sole property of the Forest Service without further process of law and the purchaser shall then be relieved of all responsibility for the material under the terms of this contract. (Special clause, not applicable to sales in general). (1. p., E. s., b. f., Medicine Bow, D 2, 1911).

(c) A sufficient number of fence posts, having a perimeter or more than 15 inches at the small end and more than 7 feet long, and telephone poles will be scaled by the Scribner Rule, Decimal C. to determine the average contents thereof, after which they will be counted using the average so obtained to determine their board measure volume. In the case of material less than 6 inches in diameter at the small end, the board measured volume will be determined as agreed with the Forest officer. (l. p., Deerlodge, D 1, 1911.)

(d) The class of products which shall be manufactured from the timber involved in this contract shall be optional in the judgment of the purchaser. (c., Pend oreille, D 1, 1911).

(e) The standard sizes for cedar posts will be considered as a length of 8 feet and a maximum perimeter or circumference of 24 inches at the small end. Posts of greater size may be made, but shall be paid for at following prices: Split posts, 9 to 12 feet long and up to 24 inches in circumference, ½c each. Poles below six inches in diameter at the small end and 26 feet in length or shorter may be made at the option of the purchaser, but will be scaled as round posts and paid for at the rate of 1c for every 8 linear feet. (c., Pend oreille, D 1, 1911).

(f) When desired, western red cedar may be cut into shingle bolts and when it cannot be otherwise utilized, must be so removed. Timber so cut shall be paid for at the contract price for western red cedar logs, and in so doing, one cord of standard shingle bolts 52 inches long shall be counted as equivalent to 600 board feet. Bolts cut longer than 52 inches shall be rated at an increase in the number of board feet per cord proportionate to the increase in length. (d. f., w. r. c., w. h., Snoqualmie, 1911).

(g) Shingle bolts shall be counted as many to the cord as the judgment of the Forest officer in charge may determine upon as a fair count. In case of a disagreement as to what constitutes a fair count, the purchaser may be required to pile shingle bolts for measurement. (w. r. c., w. h., Snoqualmie, D 6, 1910).

(h) The scaling of logs and the counting of shingle bolts shall be done at the landing or wherever the Forest officers find most practicable without interfering unnecessarily with logging operations. (w. r. c., w. h., Snoqualmie, D 6, 1910).

(i) The timber will be scaled by the Scribner rule, Decimal C., by competent scalers employed by the Forest Service, and the sale will be so handled by us as to make scaling economical. The maximum scaling lengths of all logs will be 16 feet; greater lengths will be scaled as two or more logs. Upon all logs 36 inches in diameter and under 4 inches, and upon all logs above 36 inches in diameter, 6 inches additional length will be allowed for trimming. Logs overrunning more than the specified length shall be scaled as if 2 feet longer. (w. y. p., w. f., s. p., c., Tahoe, D 5, 1912).

(j) Cordwood will be compactly piled in the woods for scaling and will not be scaled until a sufficient amount (not less than .... cords) has been cut and piled. (b. b., 1919).

(k) The length of all logs shall be marked on the small end with crayon and all logs shall be skidded and piled in skidways with the small ends easily accessible for scaling. (a. f., E. s., Battlement, D 2, 1911).

(l) Four inch and five inch stulls, sixteen feet long, will be counted as 10 feet B. M., and larger dimensions will be scaled by the Decimal C log rule. (b. b., 1909).

(m) Consisting of one hundred million feet, board measure, of scale timber, or its equivalent in volume in other material counted as follows per thousand feet board measure; *converter poles, 40*; *logging poles, 125*; *telephone poles, 25*; *posts, 100 and cords 2.* (l. c., Deerlodge, D 1, 1911).

(n) All protests as to the accuracy of the scale or conduct of the sale, will be made in writing to the Supervisor, within 30 days after the alleged unsatisfactory work, and protest after the said 30 days shall not lie. (l. p. E. s., b. f., Medicine Bow, D 2, 1911).

Clauses (a) to (n) are self explanatory.

QUADRUPLE PENALTIES.

36. (a) In case of a breach of clauses and of this contract, the company shall pay four times the stumpage price fixed by this agreement for the timber involved. (l. p., Deerlodge, D, 1, 1911).

This clause is seldom necessary.

CORDWOOD RESTRICTIONS.

37. (a) All cordwood material will be piled in compact even stacks for measurement, as directed by the Forest officer. (m).

(b) If the material suitable for saw timber in the judgment of the Forest officer is cut into cordwood, it shall be scaled and paid for at the same rate as if used for saw timber. (To be inserted in sales which includes both cordwood and saw timber). (m).

(c) No timber fit for sawing, mining, or tie timber or posts, in the judgment of the Forest officer, will be cut into cordwood. (m).

At mining camps saw timber used for (b) (c) cordwood, unless it is expected the trees would be decayed or lost before they could reasonably be expected to be sold for saw timber, must be charged for at saw timber rates. Careful inspection is necessary in order to prevent the occasional use of post timber for cordwood.

USE OF TIMBER FOR CONSTRUCTION AND OTHER PURPOSES.

38. (a) Unmerchantable timber may be used free of charge for construction purposes in connection with the sale. (m).

(b) Timber unmerchantable under the terms of this contract may be used in the camp for fuel without charge. (w. w. p., D. f., w. h., l., Coeur d'Alene, D 1, 1910).

These clauses (a) (b) are seldom required.
See clause 5.

SPECIAL USES.

39. (a) Camps, flumes, roads, dams, bridges, chutes, and other improvements required in logging will be located as agreed with the Forest officer, and in accordance with such conditions as he may prescribe. (m.)

(b) Camps, chutes, and other improvements will be removed from the sale area within six months from the termination of the contract, and if not so removed will become the property of the United States. (m.)

(c) Sawmills, flumes or other special privileges not provided for in this agreement will be constructed and operated only under special use permit issued by the proper Forest officer. (w. p. p., Coconino, D 3, 1910.)

(a) (b). See also clause 17. (c) is rarely used.

TELEPHONE LINES.

40. (a) All telephone lines shall be constructed under free special use permit issued by the Forest Supervisor which will provide that free use of such lines shall be allowed to Forest officers for official business; that no stumpage will be charged for poles on lines which in the judgment of the Forest Supervisor are of sufficient value to the Forest Service. All other telephone lines, trails, and main traveled roads traversing the cutting area shall be kept open and free at all times from obstruction by logs, brush, and debris caused by logging operations; and all telephone lines, trails and roads damaged or destroyed by logging operations shall be repaired or rebuilt as required by the Forest officer in charge. (w. y. p., Sitgreaves, Apache, D 3 1912.)

Detailed directions (a) such as this may obviate the ordinary special use permit.

FIRE LINES.

41. (a) A fire line having a width of not less than ...... feet shall be cleared by the purchaser of all inflammable material, except stumps, whenever required by the Forest officer, along the boundaries of the cutting area and around groups of seed trees; such fire lines shall be constructed in a manner that will be satisfactory to the Forest officer, (m.)

(b) On the borders of the cutting area, except next to Section 29, a strip 60 feet wide is to be cleared of brush and all inflammable material before burning. (w. w. p., c., Kaniksu, D 1, 1911.)

(c) All stubs of unmerchantable dead Douglass fir trees over 15 feet high within 100 feet of the fire line shall be cut, and all dead Douglas fir stubs or dead trees over 30 feet in height, shall be cut whenever they occur on the cutting area except when in the judgment of the Forest officer any such cutting is not necessary. (D. f. w. r. c., w. h., Snoqualmie, D 6, 1911.)

(d) Not to exceed four miles of fire line of a maximum width of 35 feet, along the south and east boundaries of the cutting area, or whereever on the cutting area the Forest officer in charge may prescribe, shall be cleared by the purchaser. All brush, logs and debris, both that already on the ground and that resulting from the logging, shall be removed from this fire line. (D. f., w. r. c., w. h., Snoqualmie, D 6, 1911.)

(e) All snags, stubs, or unmerchantable dead trees over 15 feet high on the cut-over area shall be felled, and all tops and inflammable material piled for burning, unless, in the judgment of the Forest officer in charge, such cutting is not necessary. If any snags, stubs, or unmerchantable trees are felled so that they lie closer than four feet from unmarked trees, a section of at least six feet on either side of such unmarked trees shall be removed. (w. y. p., D. f. larch.; Whitman, D 6, 1911.)

In Washington where there is clear cutting and burning, fire lines take the place of the ordinary methods of brush disposal, but care is taken not to destroy seed trees.

LOCATION OF IMPROVEMENTS.

42. (a) All construction work, including railroad, mill, etc., necessary for initial logging operations shall be completed as soon as possible and not later than two years from date of final contract is prepared. (W. y. p. Sitgreaves—Apache, D 3, 1812.)

(b) The character and location of all roads, and the means, methods and facilities to be used in the transportation of all products, may be such as are best adapted to the purpose in the judgment of the purchaser, provided that no undue injury is done National Forests interests, in which case the Forest officer may require such modifications as he may deem necessary for the protection of the Forest. (C., Pend oreille, D 1, 1911.)

(c) Dead timber will be granted free for the construction of camps, bridges, cabins, roads and chutes, but such improvements will become the property of the United States at the completion of this sale. All green timber used for the above purposes will be charged for at the contract prices, and the improvements so constructed, or not removed from the Forest area within thirty days after completion of the sale will become the property of the United States. (L. p., E. s., Uinta, D 4, 1911.)

(a) prevents speculation; (b) and (c) are rarely required.

LOGGING RAILROAD RESTRICTIONS.

43. (a) All engines and locomotives not burning oil for fuel used in logging on the National Forest shall be equipped with spark arresters that are satisfactory to the Forest officer in charge.

(b) All locomotives operated on National Forest lands under this contract shall use oil for fuel. (w. y. p., Coconino, D 3, 1910.)

(c) This contract shall be void if the Railway Company fails to construct a satisfactory and usable spur or side track at or near the location of the abandoned "Monroe Spur" before June 30, 1911. In the event that this contract becomes void because of failure to construct the spur, all deposits made in this case will be refunded to the purchaser. (c. Pend oreille, D 1, 1911.)

(d) During the months of May, June, July, August and September, our logging locomotives shall burn oil or be equipped with spark arresters acceptable to the Forest officer in charge with a connected steam force pump and at least 100 feet of serviceable 1-inch hose, with five 12-quart pails, and with a constant supply of not less than the equivalent of 12 barrels of water kept exclusively for fire fighting purposes. (w. r. c., D. f w. h. Snoqualmie, D 6, 1911.)

(e) It is further agreed, as part of the consideration of this agreement, that all main railroad lines shall be made common carriers in accordance with the laws of the State of California; provided, that in any question as to what portions of the railroad lines constructed shall be made common carriers under this clause, the decision of the Forester shall be final. (w. y. p., c., D. f., w. f., D. 5, 1912.)

(f) Railroads for which easements are obtained shall be common carriers. Logging or other railroads for which easements are not obtained will be constructed under free special use permit to be issued by the Forest Supervisor. This permit will provide that when advisable in his judgment such roads shall be common carriers, and that wherever considered necessary by him, the rights of way of such roads shall be cleared and kept free from combustible material for a distance of 50 feet on each side of the center line of the track and when merchantable the timber cut in connection with such clearing shall be removed, scaled and paid for at the rates mentioned in the agreement that unless such roads are electrified, oil will be used exclusively for fuel; that Forest officers when traveling on official business, and fire fighters shall be transported free of charge on all trains of the main line south of Snowflake, Arizona, or any branch line of the railway constructed in connection with this sale and when necessary, in order to prevent great destruction, special train service will be rendered such Forest officers and fire fighters free of charge, except as provided for in clause 15. (w. y. p., Sitgreaves-Apache, D 3, 1912.)

(g) We do hereby agree as a part of the consideration of this agreement to grant to the Forest Service, may designate the privilege of using the main lines of railroad, both on and off National Forest land, which will be constructed, owned or controlled for the purpose of logging the timber of the area specified in this contract, for the purpose of or in connection with the logging of any National Forest timber naturally tributary to the said main lines of railroad, at such rates and under such regulations as may be specified by the District Forester; And further provided, that any such arrangement for the use of said roailroad lines may be terminated at the date of the expiration of this contract at the option of the undersigned; provided, however, that in the event the arrangement for the use of said railroad lines is terminated at the date of the expiration of this contract by the undersigned, the United States shall have the right as a part of the consideration of this agreement, to purchase the said railroad lines or to designate a person or persons who shall also have the right to purchase the said railroad lines, at such terms as may be mutually agreed upon between the United States or the person or persons it may designate and the owners of the said railroad lines; Provided, further, that in the event it is impossible for the parties aforesaid to agree upon a purchase price a board of appraisers consisting of three persons, one to be named by the undersigned, one to be named by the District Forester, and one to be named by the holder of any timber-sale agreement which would be affected by the use of the said railroad lines, and whose name shall be designated by the District Forester, shall fix the price at which the said railroad lines shall be purchased. This said option to purchase must be exercised within one (1) month from the date of the expiration of this agreement. The board of appraisers shall meet upon the call of the District Forester and the majority vote shall be binding on the board. It is hereby specifically understood and agreed that any purchaser of said railroad lines shall be an actual bona fide purchaser of timber which is tributary to such lines. (w. y. p., w. l., D. f., w. f., Whitman, D 6, 1911.)

(h) Whenever necessary in the judgment of the Forest officer, the purchaser shall clear, and keep clear, the railroad rights of way of all inflammable material including snags, and dead trees, for a distance of 100 feet on either side of the center of the main track and spur tracks, in such manner and at such times as may be designated by the Forest officer in charge. No refuse shall be burned during the months of June, July, August and September of each year without the written consent of the Supervisor; also during these months the purchaser may be required in the discretion of the Forest Supervisor, to patrol all railroad tracks after the passage of each locomotive. (w. y. p., D. f., larch, Whitman, D 6, 1911.)

As already explained, the use of oil (b) (d) is preferable to any spark arrestor (a) yet devised; (c) merely protects the purchaser from his obligation; lumber companies often object (d) (e) (f) to their logging railroads being made common carriers because of their liabilities in case of accident. Even with oil burning engines, cleared rights of way are a necessary precaution and form admirable fire lines, (h).

USE OF RAILWAY SPEEDERS.

44. (a) The use of railway speeders by Forest officers for official duty shall be allowed upon all lines of railway south of Snowflake, Arizona,

constructed in connection with this sale with the understanding that no responsibility for accidents which may occur in connection with their use is assumed by the railroad and further that they shall not be entitled to right of way over any trains. (w. y. p., Sitgreaves,—Apache, D 3, 1912.)

"The use of railway speeders" is a covering for forest officers, and are often used to follow up trains during a danger season.

DAMAGE TO LOCAL INTERESTS.

45. (a) All damage sustained to telephone lines in connection with the logging operations shall be immediately repaired by the purchaser to the satisfaction of the Forest officer. (w. y. p., D. f., W. l., w. f., Whitman, D 6, 1911.)

(b) Any damage done to the irrigating ditch belonging to the East Fork Ditch Company during the process of logging shall be repaired by the operators, at the request of the Forest officer. (w. y. p., D. f., Weiser, D 4, 1911.)

(c) All roads and trails traversing the cutting area will be kept open and free at all times from obstruction by logs, brush and debris caused by logging operations; and all roads and trails destroyed by the logging operations will be rebuilt as required by the Forest officer in charge. (w. y. p., s. p., w. f., Sierra, D 5, 1911.)

(d) All wagon roads and trails shall be kept sufficiently open to allow reasonable usage at all times, and suitable crossings shall be maintained wherever railroads cross such roads or trails. (w. y. p., D. f., larch; Whitman, D 6, 1911).

(6) All roads and trails traversing the cutting area will be kept open and free at all times from obstruction by logs, brush and debris caused by logging operations; and all roads and trails destroyed by the logging operation will be rebuilt as required by the Forest officer in charge. (w. y. p., w. f., S. p., c. Tahoe, D 5, 1912).

Lumbering operations often damage local trails, roads, telephone lines, ditches; if this is anticipated one of the (a) to (e) above clauses should be used.

ADJUSTMENT OF THE STUMPAGE RATES IN LONG TERM CONTRACTS.

46. (a) We agree to pay for all timber cut prior to April 1st, 1919, at the rate of $3 per M feet board measure for sugar pine, $2.50 per M feet board measure for yellow pine, and $1 per M feet board measure for cedar, white fir, and red fir; for all timber cut subsequent to April 1, 1919, and prior to April 1, 1924, at such rates as shall be designated by the Forester on April 1, 1919; for all timber cut subsequent to April 1, 1924, and prior to April 1, 1929, at such rates as shall be designated by the Forester on April 1st, 1924; for all timber cut subsequent to April 1st, 1929 and prior to April 1, 1934, at such rates as shall be designated by the Forester on April 1st, 1929; and for all timber cut subsequent to April 1st, 1934, at such rates as shall be designated by the Forester on that date; provided, that the rates to be designated upon each of the respective dates shall be determined as follows:

(a') For the purpose of this contract it is agreed that the average mill run lumber prices per M feet board measure prevailing at the date of execution hereof, f. o. b. cars, at the mills operating on the west slope of the Sierra Nevada Mountains tributary to the San Joaquin Valley are

$19 for yellow pine, $20 for sugar pine, $15 for red and white fir, and $15 for incense cedar.

(b') The Forester shall ascertain the average mill run lumber prices prevailing for the various species above specified, f. o. b. cars, at the mills operating in the territory above defined during the years ending December 31st, 1918, 1923, 1928, and 1933, respectively.

(c') If the average price of any species, prevailing during any one of said years specified in (b) shows an increase over the price of the same species agreed upon as prevailing at the date of execution hereof, of $2 per M feet board measure, or less, no increase shall be made in the stumpage rate for such species as fixed on the following April 1st. If the increase in the average price of any species is greater than $2 per M feet board measure, not more than 75 per cent. of the amount of such increase in excess of $2 may, in the discretion of the Forester, be added to the stumpage rate for such species as fixed on the following April 1st.

(d') If in the territory above defined during the life of this agreement certain of the material cut from any of the species included in this sale is manufactured into or sold for other products than lumber, the market value of such products and the proportion of the total cut of the species so used; in the territory above defined during the calendar year preceding the next readjustment date, shall be considered by the Forester, upon an equitable basis comparable to the thousand board feet of manufactured lumber, in determining the average mill run price of the species as above specified; Provided, that the Forester may at any time, upon application from the purchaser establish a special rate for material other than saw timber which the purchaser elects to remove for sale, which rate shall be equitable in accordance with the current market value of such material.

It is further agreed that the Forester will, upon written application from the purchaser setting forth good and sufficient reasons therefor, and showing the existence of a serious emergency arising from changes in market conditions since the last re-adjustment of stumpage rates, either:

(1) Redetermine and establish the stumpage rates and designate a date when the rates as redetermined shall be effective, which date shall be within six months of the date of application, or (2) grant an extension of time within which the respective amounts of timber specified hereafter in clause shall be removed, at his option, when action of either character is necessary in his judgment to relieve the purchaser from hardship; provided, that in all cases the stumpage rates as readjusted upon application to the Forester shall be determined in accordance with the methods and under the terms above set forth; and provided further, that the stumpage rates so determined upon application of the purchaser shall apply only during the remainder of the five year period, terminating upon one of the respective dates above specified when the stumpage rates shall be regularly redetermined and established.

It is further agreed that in no event will the stumpage rates as established upon any of the respective dates above named or upon the application of the purchaser be less than those specified herein to be paid for timber cut prior to April 1st, 1919.

It is further agreed that in making any readjustment of stumpage prices the Forester may require such modification in the clauses numbered in this agreement as are necessary in his judgment to protect the interests of the United States; provided, that such modification shall be limited to requirements contained in current timber sale contracts executed by purchasers and approved by officers of the Forest Service prior to the date of such readjustment; and provided also, that any additional operating costs entailed by such modifications, as ascertained by the Forester, shall be deducted from the readjustment stumpage price.

Payments will be made in advance in installments of twenty-five thousand dollars ($25,000) each one called for by the Forest officer in charge, credit being given for the sums, if any, heretofore deposited with the said United States depository or officer in connection with this sale. (See (a), Sierra, D 5, 1912).

Long term contracts are now sometimes allowed by the Secretary of Agriculture in order to put on the market overmature timber a long distance from the market, and consequently requiring a large outlay. There are two more methods of stumpage price adjustment (1). To definitely fix the price for certain periods; (2) to adjust the price as given in (a). In this case it is likely that complications will arise, but it is an exceedingly interesting experiment. More exact methods of stumpage price appraisal are necessary, and one of the stumbling blocks is what percentage of th final sale price should go to the purchaser as profit. It is interesting to note in France it is roughly 10 per cent. of the sale price.

EXPORT RESTRICTIONS.

According to law, the export of certain timber from the "Black Hills" is not allowed unless "insect infested;" in one contract on the Datil Forest, D 3, the export outside of Socorro County, of only the higher grades was allowed, because the bulk of the low grade produce was required for local development.

RESERVATION OF TURPENTINE RIGHTS.

48. (a) This contract does not include the right to turpentine any of the timber included in this sale. Turpentine rights may be leased by the United States provided the turpentine operations will not interfere in any way with the logging operations and that any lease given by the United States will prohibit the boxing of timber. (w. y. p., Sitgreaves-Apache, D. 3, 1912).

Since recent experiments indicate that western yellow pine may be successfully tapped this (a) clause is being put in all important contracts.

LIMITED SALES.

49. (a) It is agreed that, except in the case of small sales for strictly local consumption by the purchaser for his own use, no further sales will be made from the portion of French Gulch south and east of the Anaconda—Big Hole Road before January 1, 1915, unless this contract is cancelled, or modified before that date. (l. p., Deerlodge, D 1, 1911).

(b) Provided the company desires on or before March 20, 1912, under the conditions and provisions herein set forth, to purchase, cut and remove the remaining portion of the timber from the area first described, estimated to be 60,000,000 feet of white pine timber, B. M., more or less, which area will be reserved from disposal to any other application or applicants up to, but not later than March 20th, 1912, the Company agrees to have the following conditions become effective upon the approval of the District Forester, for the remaining portion of the white pine timber on the area first described in this instrument. (W. w. p., Coeur d'Alene D 1, 1911).

Before the policy of marking large sales for periods beyond five years was approved, it was often necessary to assure companies of their future stumpage before they could afford to make large investments on only a five year cut. Clauses (a) and (b) insure operating companies a chance at future advertised stumpage.

INSPECTION OF RECORDS.

50. (a) All the scale books pertaining to our logging operations and mill business will be open to inspection at any time by a Forest officer authorized by the Forester to make such inspection. (w. y. p., Coconino, D 3, 1910).

(b) All the books pertaining to our logging operation and milling business will be open to inspection at any time by a Forest officer authorized by the District Forester to make such inspection, with the understanding that the information obtained shall be regarded as confidential. (w. y. p., w. f., S. p., Tahoe, D 5, 1912).

Clauses (a) and (b) are rarely used.

LIQUIDATED DAMAGES FOR FIRE LOSS.

51. (a) The purchaser agrees to pay to the United States Depository aforesaid ten dollars ($10.00) for every acre burned over by fires originating during the life of this contract within the area covered by this sale or within 200 yards of the exterior boundaries thereof, as liquidated damages, in full satisfaction for all merchantable timber, young growth and forest reproduction injured or destroyed, whenever such fires are started by the fault or neglect of the company, its agents, employees, sub-contractors or employees of sub-contractors. (L. p., Deerlodge, D 1, 1911).

Clause (a) is designed to insure unusual precaution against setting fire and fixes before hand a basis for the assessment of dangers in case of fire.

CONTRACT SAWING.

52. (a) If required, we agree at the time requested, to do logging and sawing for and to supply lumber to the Forest Service at the lowest price given to any customer. (w. y. p., Coconino, D 3, 1910).

In a few cases the government has been "held-up" by extortionate charges for contract sawing; hence clause (a).

CAMP RUBBISH OR DEBRIS.

53. (a) All camp buildings and structures on the National Forest shall be located in a manner satisfactory to the Forest officers at a sufficient distance from any stream to prevent pollution of any city water supply. (m.)

(b) The ground in the vicinity of all logging camps shall be kept neat and clean, and all rubbish shall be removed and buried or burned. When the camps are moved from one location to another, all debris shall be burned or otherwise disposed of as directed by the Forest officers. (w. y. p., Coconino, D 3, 1910).

(c) All camps used in connection with this sale will be kept in a sanitary condition to the satisfaction of the Forest officers in charge. (l. p., E. s., b. f., Medicine Bow, D 2, 1911).

(d) Camps, buildings, railroads, logging roads, skid roads, log chutes, flumes, and all other improvements and structures necessary for the successful carrying on of logging operations shall be located and operated as agreed upon with the Forest officer in charge. All improvements shall be removed from National Forest lands within six months after the termination of this agreement, unless permits or easements are secured from the officer of the United States having jurisdiction and in accordance with the Federal laws for their further occupancy and use. If not removed within such time or further occupancy and use under such permits or easements authorized, they shall become the property of the United States.

Logging camps should be kept from polluting (a) streams; modern (c) sanitation is therefore a necessary precaution. The mass of rubbish (b) is not only an eye sore, but a fire danger. A recent combination of (a) and (b) is given under (d).

INSECT DAMAGE.

54. (a) All trees which are or which become insect-infested during the period of this contract, if merchantable in the judgment of the Forest officer, shall be cut and removed in accordance with the terms of this contract and at the time required by the Forest officer, which shall not be later than...................., and if unmerchantable, will be disposed of in accordance with Clause....... (B. B.)

(b) All trees, regardless of size, which are or which become insect-infested during the period of this contract, and which are unmerchantable in accordance with the terms of this contract, will, if required by the Forest officer, be felled, lopped, piled compactly and burned, or otherwise disposed of, at the time required by the Forest officer in charge, which shall not be later than.................... (B. B.)

(c) If required by the Forest officer all brush and other debris resulting from logging, including large chips made in hewing ties, and slabs, shall be piled and burned, or otherwise disposed of, under the directions of the Forest officer, at the time required by the Forest officer, and not later than.................... (B. B.)

(d) If required by the Forest officer, the stumps of all insect-infested trees will be peeled at a time to be designated by the Forest officer, which shall not be later than.................... (B. B.)

(e) All logs cut from insect-infested trees under this contract which have not been sawed shall be peeled on or before.................... (B. B.)

(f) All insect-infested timber upon valid claims or patented lands marked or otherwise designated by the Forest officer will be cut and disposed of in accordance with Clauses 1, 2, 3, 4 and 5. No timber shall be removed from such valid claims or patented lands unless the purchaser shall, within 30 days notice that the timber has been scaled, file with the Forest officer in charge of the sale, a receipt signed by the claimant or owner showing that the full contract price has been paid to him or a National Bank certificate showing that the purchaser has deposited the full amount in a National Bank convenient to the claimant or owner, and in his name. All operations under this sale will be suspended by the Forest officer in charge if the purchaser neglects or refuses to file such receipt of certificate. (B. B.)

These clauses were used in early contracts for the sale of insect-infester timber in the "Black Hills;" they are based upon a knowledge of the life habit of the bark beetle "dendroctonus" which has damaged western yellow pine.

Many of the foregoing clauses will be modified and the wording changed as Forest Service contracts are improved; at present, however, this compilation may be of interest to officers on National Forests and also show other foresters and lumbermen exactly what the Forest Service requires in its conservative logging. They will be of considerable historical interest years hence; in the meantime they will undoubtedly be gradually standardized for all districts.

LIGHT BURNING VERSUS FOREST MANAGEMENT IN NORTHERN CALIFORNIA.

By Richard H. Boerker.

At the present time there is much being said and written in California about "light-burning" as a means of protecting forests from fire. This theory aims to use fire as a servant to prevent fire, and its advocates are criticizing timber holders severely for not putting this theory into practice. It is an interesting controversy between old methods under a new name and Forestry, between short-sighted sacrifice of the future to the present on the one hand and true conservation on the other. This paper will attempt to treat of the use of fire as a servant in Forestry and its results, good and bad, on Forest Management.

That fire as "master" has done enormous damage is almost axiomatic—it needs no proof. It has been estimated that one billion dollars would not cover the forest fire losses in the United States during the last 30 years. Canada claims that in her Eastern provinces seven times more timber has been destroyed by fire than has been cut. The State of Michigan, which has produced more lumber than any other area of the same size in the world, is said to have lost through forest fires three times as much as has been cut. Towns have been destroyed, millions of acres of land made non-productive, and many lives have been lost. In view of such history it has been claimed by some that forest fires cannot be stopped, that fire must be fought with fire, and that big timber holders should abandon their "theoretical whims" and attack the problem from the practical side and burn up systematically the refuse in the forests which forest fires feed on.

Of all the methods of using fire as a servant, the "light-burning" theory is the oldest, the most important, and at the same time the most undesirable and the most mischievous, from the standpoint of Forestry. The term "light-burning" has been used to denote many different kinds of burning. "Light-burning" must be distinguished from all other uses of fire, in that it aims, by means of a light, rapid burn to rid the forest of needles, small dry branches, brush, weeds, and reproduction, in order to improve the pasture; or sometimes to make travel through the woods easier, or to drive out the game. This is the so-called Indian method of "light-burning;" this object was not forest protection, it was far from that, it was forest devastation pure and simple. Like all pioneers, his object was to destroy the forests so that he could make the soil serve his purposes. There is ample evidence all over California that the Indian succeeded in accomplishing his purpose. These "light-burns" often developed into disastrous conflagrations, and 2,000,000 acres of useless brush in this State alone bear witness to this fact.

The fire was set for reasons mentioned above, and as a result traveling was much easier. Unfortunately this did not remain so, for the next spring the brush sprouted more vigorously than ever; it had not been killed, it had not only been killed back. In three or four years the Indians set another fire, which since it had the dry stems and dry leaves of the last fire to feed on, was hotter than the one before. So the process continued, each fire was hotter than the one before. Each fire killed the seedlings, and each fire caused the unsuppressable chaparral to come up more vigorously than before. Each fire found its way into one or two of the larger trees, through a lightning scar, a frost crack, or through the roots. This scar was not serious at first but each successive fire enlarged it, until the tree was undermined and fell. Even though only occasionally a tree fell, there was no young growth to take its place, so that the extinction of the forest was only a matter of years. All stages of this destruction can be seen in California, and the result told in figures is surprising to say the least. The direct economic loss to the state of California may be summed up briefly as follows:

1. 2,000,000 acres of brush, the larger part of which can be traced back to the old Indian fires. These areas instead of growing timber worth from \$50 to \$100 per acre, are occupied by useless brush, of very little value as browse.

2. The remaining forests are greatly thinned out as a result of these fires. It has been estimated that these fires have reduced the merchantable stand of timber by about 1-3. The 30,000 square miles of forest lands in California have an actual cash value of \$700,000,000. How much more these

forests would be worth to-day if it had not been for these fires, can only be conjectured. At any rate the loss runs up into the millions of dollars.

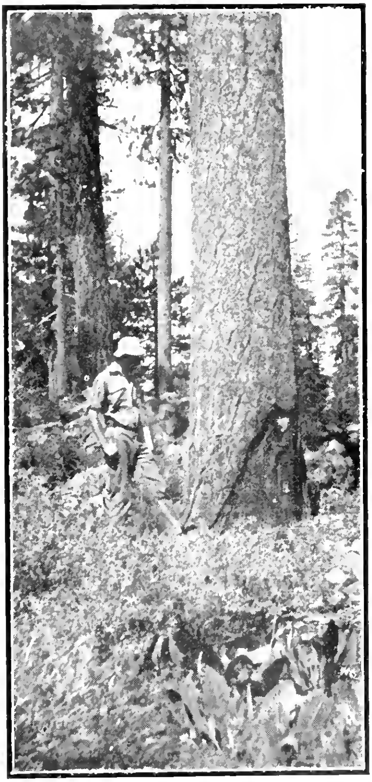
3. From 30% to 50% of the merchantable trees left standing in the forest have been injured by these fires at the butt. The work of fire is followed closely by that of insects and fungi. The great waste in lumbering can in many instances be traced back to the injuries received from these old Indian fires. High stumps, pitchy butts, and logs with a large percentage of heart rot are left in the woods.

The silvicultural losses due to loss in the fertility of the soil, followed by loss in the rate of growth; together with the loss that is occasioned by a change of the forest types from the valuable pines to the less valuable firs, have been enormous and are hard to over-estimate.

Although this paper deals more specifically with conditions in Northern California, the practice of light burning both past and present, is by no means a local one. This practice antedates the coming of the white man to America. The Indians have practiced it for centuries in all the Western and Southern States, and the stockmen have continued the practice where the Indian left off. In spite of the fact that forest conditions in California can hardly be compared to those of other regions where this practice has been going on, there can be no doubt that the economic and the silvicultural results of "light-burning" are the same whether it be California, Arizona, or Mississippi.

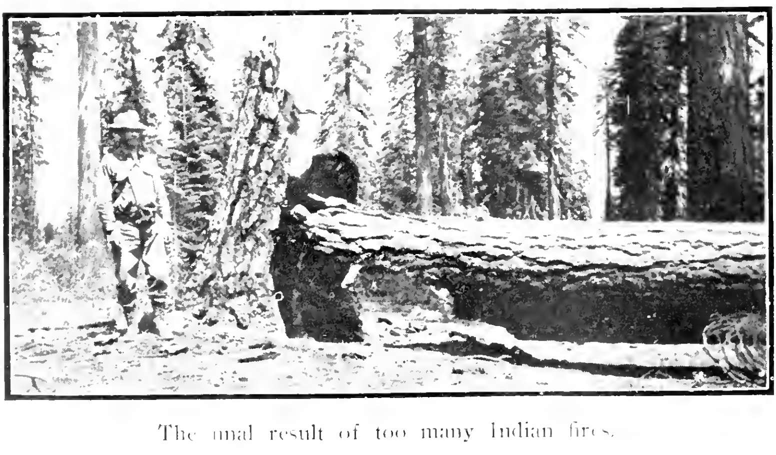
Like the Indian the stockman also "light-burned." His purpose was mainly to improve the range. During the last 50 years an enormous amount of this "light-burning" has been done by him. The creation of the National Forests put a stop to practically all of this, but to-day the private timber holder is continuing where the stockman left off.

Strange to say, to-day, many of the large timber holders in California are practicing this very method to protect their mature timber from the ravages of forest fires. This is not the worst part of it. They are criticizing other timber holders for not adopting these methods, and are influencing public sentiment in the wrong direction. It shows a woeful lack of knowledge of the



The result of a few Indian fires.

The fire scar gets larger with each fire. The result of many of the Indian "light-burns."



The final result of too many Indian fires.

WESTERN YELLOW PINE.

fundamental principles underlying Forestry. To quote one of the foremost timber holders in California: "If the old Indian custom of burning off the forests is adopted by the white man there will be no repetition of the appalling losses by forest fires as was the case in Idaho and Montana last fall." Then to quote this holder's foreman, who has charge of about 10,000 acres of "light-burning" every fall, "It is far better to destroy part of the young timber as we are doing and save some and all of mature timber, than to allow the brush and reproduction to grow and get so thick that, in a few years when a fire does start, it will consume everything in the forest, mature timber and all."

"Light-burning" methods vary a great deal. Sometimes the ground is prepared and more often it is not. In the case of the timber owner quoted above, the ground is usually prepared in the spring and summer by raking the leaf litter and other refuse away from the mature trees and piling dirt and rocks around their bases, in order to protect these from fire. Thickets of reproduction are cut down and cleared away so that the fire will not spread from the reproduction into the mature trees. Then after the first rains in the fall the fire is set out. Results show that wherever the litter burns at all well, practically all the young trees up to 15 years are killed absolutely, and of the trees from 15 to 40 years, one third to one-half are destroyed depending upon the nature of the distribution. Trees older than 40 years are not damaged very much. The old trees which will be harvested in the near future usually escape injury. This process is repeated every 2 to 4 years.

The whole operation it is thought, results in cleaning up the woods and affording the mature timber protection. This however lasts but a few years, for as has been said before, the brush sprouts up more vigorously than before. What has really been accomplished is that the light, fast burning litter has been consumed, but the larger and heavier refuse, which makes the hot, dangerous fires, is still on the ground. The young trees up to 15 years of age, have been killed and the charred stems and branches are still standing in the majority of cases. They were fresh and green before, now they are dead, charred and dry. Those young trees from 15 to 40 years that have been killed, in most cases were killed because the trees were girdled by fire.

Next year these trees will be dead and thoroughly dry, and many of the dead leaves will still be clinging to the branches, and the fire problem, will be, as before, unsolved. In other words it leaves everything in fine shape for the next fire, which will be hotter and fiercer than the one before; it makes the matter of fire protection worse, in the long run, not better. That this is fact and not theory, has been proven over and over again, in that fires burn on these areas, with greater damage than on the "unprotected ones." A lumber company in the Northern Sierras, every year resorts to a method of "light-burning" on its cut-over areas. This method is simply to start a fire in last year's slashings and not bother about it until it threatens valuable property. This is done to render the cut-over areas fire-proof, so to speak, and thus protect their logging camps, mills, and timberlands from fire. A good illustration as to how efficient this method is to protect valuable property is the following: this company moved its logging camp on the area that has been "light-burned" the year before, and proceeded to burn off the adjacent area, declaring that all danger had been removed by "light-burning" and that the camp was safe. Accordingly the adjacent area was fired and left to its own salvation, and before anyone knew about it the fire had reached the "safe" area where it fed on the dry and charred slashings of the last fire, became a conflagration and carried everything before it, camp, timber, and all.

From figures now available from actual experiments in "light-burning" it appear that this is a costly process. The cost of this method of protection varies from 50c and $1.00 per acre, depending entirely upon conditions, and how thoroughly the cleaning-up work is done. The preparation of the ground costs from 40c to 75c per acre, and the burning from 10c to 25c. As a matter of fact in this case, only the valuable pines and firs are treated in this way, and these constitute only about two-thirds of the merchantable stand.

For the big timber holders of the West to adopt this plan would mean an enormous expense. At a cost of from 50 cents to $1.50 per acre it would mean an expenditure of from $10,000,000 to $30,000,000 every three years in the case of the 20,000,000 acres of forest lands in the State of California alone. This would mean an annual expenditure of from $3,000,000 to $10,000,000, which, of course, is prohibitive. Moreover for but a very small part of this sum these big timber holders could form protective associations and protect their lands by employing fire-guards, so that forest fires could all be extinguished in their incipiency with the minimum amount of loss, and all this without the loss of millions of acres of fine reproduction.

Even if "light-burning" were feasible from the standpoints of results obtained and the cost, it would still be absolutely incompatible with Forest Management, or the growing of timber for profit. Here in the Northern Sierras it would limit the systems of reproduction we might use to either the "seed trees" method, or the "seeding from the side" method, the "clear cut and plant" method being excluded on account of lack of nursery stock and transportation facilities. The larger part of our forests are composed of uneven-aged, mixed stands of Yellow Pine, Sugar Pine, Douglas Fir, Incense Cedar, White Fir and Red Fir. In a stand with all these species represented, when "light-burning" has been practised, the lumberman would cut only the valuable pines and Douglas Fir, thus leaving the inferior species to take possession of the ground. This cut would not only eliminate the valuable species but it would also leave the forest extremely open, and give the unsuppressible brush a good chance to take possession. In the mature stands of pure Yellow Pine where this theory has been practised, the lumberman would make a clear cut, and take practically all trees. In this case lumbering on a large scale would exterminate the forest, or if seed did happen to come in from the neighboring stands the result would be large continuous stands of young growth, which are a worse fire-trap than before. At first the reproduction is burned off at a great cost to protect the forests from fire, and then these "light-burners" turn around and cause large reproduction areas to be formed which make the matter of fire protection infinitely worse than before.

In other words the "light-burning" theory is directly opposed to the selection system of management. Conditions in these mountains demand that the selection system be used, to assure the proper proportion of species and to eliminate *large young growth areas, which are undesirable* on account of heavy snowfall, and insects, but principally on account of fire. This region is in the dangerous zone on account of the long dry seasons and the many lightning storms without rain. Moreover the selection system is necessary to protect the soil from its three worst enemies, drouth, erosion, and brush.

While it is true that the conservative lumberman would employ a more conservative method of cutting than the lumberman mentioned above, in the case of cutting on "light-burned" lands, still we would face another flat contradiction. Even if the man that "light-burned" cut conservatively and left the proper proportion of seed trees of each species, he would leave just so much idle capital in the woods to insure reproduction which his light-burning would destroy.

Every time an acre of reproduction is burned over there is a financial loss which can be computed. On an average "light-burn" all the reproduction under 15 years is killed and from one-third to one-half of that between the ages of from 15 to 40 years. Very often much more damage is done. For the sake of computing an average case and to obtain round numbers, it is assumed that all the reproduction up to 25 years is killed. To get the value of such a stand it will be necessary to find the value that this stand would have at maturity, and discount it back to the age at which it was killed. In other words it involves the expectation value of the growing stock at the age of 25 years. Although there may be considerable difference of opinion as to whether the cost or the expectation value should be used, in this case it might be well to figure the problem both ways. The writer is of the opinion that damage to natural reproduction should be figured on the basis of expectation value, while that to artificial should be figured at cost value. The following case is therefore figured on the basis of expectation value. The case takes the conditions as those existing to-day on the private holdings of one of the largest timber holders in the Pacific Coast States, who, as has been said before, "light-burns" thousands of acres of timberland every fall. The final Yr is based on growth in virgin stands of pure Yellow Pine. Stumps have been counted, which show that under fair conditions Yellow Pine will attain an average diameter breast high of 26″ in 100 years. An acre usually contains about 20 such trees, with a contents of about 1,200 board feet per tree. At the prevailing stumpage rate of $2.50 per M., the final yield at the end of 100 years would be \$60 per acre. There would be no thinnings up to the age of 25 years. The value of the soil has been taken as the sum paid for cut-over lands in the vicinity. The protection expenses are figured at 2 cents per acre, being the figure at which the Western Forestry and Conservation Association protects timberlands, and a figure which could be duplicated if the timber holders of the Northern Sierras would organize themselves into a protective association. The taxes are based on the assessed value of timberlands in Tehama County, Cal., which is \$10 per acre, the tax rate being .0245. This makes a tax of 24 cents per acre per year. Since a well managed forest contains all age gradations from the cut-over stage to mature timber, it would not be right to assess all the land at the full assessed value of \$10 per acre, but to strike an average for cut-over lands and timbered lands at about \$5. Cut-over lands in this county are assessed at \$1 per acre. This allowance would make the taxes 12 cents per acre. The interest rate in this problem is assumed to be 3%, being that used by the Forest Service. In the following formula:

Yr is the yield at the end of r years.
Tq is the thinning at q years.
S is the value of the soil.
E is the capitalized value of the annual expenses.
m is the age of the stand when destroyed.
r is the rotation, 100 years.
.Op is the interest rate.

$$mGe = \frac{Yr + Tq\ (1.op)^{r-q} - (S+E)\ (1.\ op^{r-m} - 1)}{1\ .op^{r-m}}$$

$$= \frac{60 - 5.17\ (8.18)}{9.18} = \$1.93$$

In the case of the cost value the loss would be, assuming \$15 per acre as the cost of planting, as follows:

$$mGe = C\ (1\ .op)^{m} + (E+S)\ (1\ .op^{m} - 1 - Tq\ (1\ .op)^{m-q}$$
$$= 15\ (2.094) + 5.17\ (1.094)$$
$$= \$37.06$$

The writer is well aware that there are faults to be found in these figures. Probably the chief fault that will be found with them will be that they assume the loss for fully stocked stands of reproduction and that this is not the case in these forests. It must be remembered that the stands in the woods to-day would be fully stocked if it were not for the fires of the past. Parts of the woods which fires have reached but seldom have on them stands of young growth so dense, that they are well nigh impassible. In the case assumed the damage was done in probably half an hour, while actually the damage was distributed over scores of years.

There is no need of going into discussion of the accuracy of these figures here; one thing is certain, and that is that they are very conservative, and if these figures were based on what these forests could do under conservative management the loss would be nearer $50 per acre. These figures are offered principally as an argument against "light-burning" and not as indisputable computations in Forest Valuation. They show that reproduction has a value that is based on sound mathematical principles, and that its destruction means financial loss.

I conclude then, that "light-burning," from the standpoint of Forest Management is a failure. It cuts off absolutely all prospects of raising timber in the future, after the timber has been logged off. It is financial suicide. From the standpoint of present day lumbering, it has been said, "light-burning" has no serious drawbacks (except that it costs from 8 to 20 times as much as other more efficient means of forest protection). But lumbering will not be the reckless slashing that it has been, very many years longer. Private timber lands are beginning to be protected efficiently by means of protective associations, and tax reform will come, not by waiting for it, but by aggressive work on the part of those who own timberlands and are growing timber, and have concrete cases to bring before the Board of Supervisors and the county tax assessor. The "laissez faire" policy of the past which allowed cut-over lands to revert to the state for unpaid taxes, must give way sooner or later to a more constructive policy of applying forestry principles and trying out new forest taxation theories on concrete cases.

While in the long run timber holders will never sanction "light-burning" as a means of protecting forests from fire, they will heartily endorse and practice any inexpensive and efficient method that will clean up the debris in the forests and thus lessen the fire danger without the loss of valuable reproduction. To systematically clean up the woods as many propose, by piling and burning the debris, would mean an enormous expense, and would in most cases be out of the question. And why this expense, especially when there are other efficient means of protection? The Forest Service is protecting public timber lands for about one-half per cent. per acre, the Western Forestry and Conservation Association from one cent to three cents per acre, but the "light-burners" are paying at least ten cents and in some cases as high as twenty-five cents per acre.

Private timber holders have had very little use for fire as a servant, except the cases mentioned above. With the coming of Forest Management the "improper" uses of fire will very quickly give way to the more rational uses. The Forest Service, to-day, uses fire in several ways. Probably the most important is the burning of tops and branches after logging, in regions where there is great danger from fire. As a matter of fact the Service is the only holder of timber lands in California that does this. The cost of this piling and burning varies from $1.50 to $2.00 per acre. The Service uses fire to aid reproduction in the Douglas Fir types of the Northwest. Here by means of a systematic burning a mineral soil seed-bed is prepared for the Douglas Fir and the less valuable hemlock reproduction is gotten rid of. Fire is also used occasionally to fight fire, that is, in cases that demand it, back-firing is resorted to to save valuable property. In all the above uses of fire it is never allowed to run at random; it is systematically set out, and controlled absolutely.

The results of forest fires depend a great deal upon their intensity, but the following results are to be noted in the case of "light-burning":

1. Fire removes the nitrogen from the soil and makes it sterile.
2. Fire removes the protective soil cover and promotes evaporation.
3. Fire injuries are closely followed by those of insects and fungi.
4. Fire causes pitchy butts and hence inferior lumber.
5. Fire encourages weeds and brush.
6. It changes valuable into inferior forest types.

7. Fire kills valuable reproduction.

8. It greatly affects the physical condition of the soil since fire destroys the humus, which is a great factor in keeping the soil loose and flocculated.

In conclusion it may be said that fire should be used only after careful consideration of both the advantages and the disadvantages which its use carries with it. In short it should be used only where the fire danger is great; where there is no young growth; where the fire can be controlled; with fire-resistant species; and where the injury to the soil is justified by advantages of protection.

THE EFFECT OF FOREST FIRES ON TREES AND REPRODUCTION IN SOUTHERN NEW ENGLAND

By P. L. Buttrick.

Nearly all that has been written on forest fires in America has been of general nature, not applying to any particular forest region. This paper is an attempt to outline some of the effects for a single region. It discusses only the effect of fire on trees and reproduction not considering the effects on the forest floor, soil, etc.

The region chosen is the so-called Sprout Hardwoods Region of New England, located in Connecticut, Rhode Island and southern New York. The characteristic species are Chestnut, White, Red and Black Oaks, Hickories, Birches and the like. They all depend more or less upon sprouting for reproduction; some, notably Chestnut, rely almost entirely upon it. This gives the region many peculiarities.

Surface fires are the rule. There is never enough humus for severe ground fires, or coniferous growth for crown fires. Even the surface fires are light as compared with those further south, being seldom severe enough to destroy timber of any size, and so are not usually considered very harmful, so long as they do not endanger other property, are too often neglected. The profound effect of these light fires is not seen till long afterwards and then only by search. It is hoped that a larger appreciation of their damage will result in better protection of the woodlands of the region.

The discussion follows these headings:

1. Factors influencing the resistance of trees to fire.
2. The after-effects of a single fire.
3. The effect of recurring fires.
4. Fire in relation to sprouting.
5. The effect of fires on reproduction.
6. The effect of age on resistance.

1. FACTORS INFLUENCING RESISTANCE.

The effects of fire fall into two classes: (1) The direct effect of the fire on the trees. (2) The indirect effect produced by deterioration of the site. The indirect effect is long continued and difficult to estimate.

The several factors of varying importance influencing the resistance of sound trees of given age to fire are:

1. Thickness of bark.
2. Water content of tissues.
3. Season at which the fire takes place.
4. Character of the root system.
5. Origin, seedling or sprout.
6. Vigor.
7. Size,
8. Character of wood.

Thickness of Bark: This is the most important of all factors influencing resistance of a tree or species to fire. Trees with a thick, heavy or non-combustible bark have their living tissue protected, which enables them to withstand severe fires, while others having a thin bark, have their living tissue killed by the same fire. Thick bark protects a tree in two ways: it keeps the fire itself from the living tissue and being a poor heat conductor prevents dessication that follows high temperature, which is as likely to cause death as direct burning. Since bark thickness increases with age, fire resistance increases likewise. A hard, non-combustible bark acts as a thick one although not as efficiently.

Water Content of Tissues: Certain species normally have more water in their tissues than others and the amount varies with the seasons, being highest in the spring. The bark of a tree with much moisture in its living tissue is easily scalded and blistered by fire, but moist wood burns with difficulty. Thus in swamps where the moisture content of vegetation is high, fires are often fatal, but destroy little of the timber killed.

Season at Which the Fire Takes Place: Since the water content of trees varies with the seasons, fires of equal intensity are more harmful at some seasons than at others. In spring when the cambium is rapidly dividing. the newly formed tissue is tender and easily succumbs. Later when hardened it withstands much greater heat. A mid or late summer fire does not allow time for sprouts or healing tissue to become hard enough to resist frost. The season of a fire is more important to young trees where injury is to the living portions.

Character of Root System: The nearness of the roots to the surface is often important, especially with swamp trees whose roots are close to the surface enclosed in a moist humus. In late summer or early fall when this is dry enough to burn, a fire will scorch the roots, thus increasing its destructiveness. A fire in the hardwood region is seldom severe enough to consume living roots, but it may kill them, thus cutting off part of the source of the tree's food supply.

On ordinary uplands the roots of most species go deep enough to be out of danger of burning, but the depth of the root system is determined to some degree by the site, so we might class this factor of resistance partly a function of site.

Origin: Tree from seed and those from sprouts have not the same power of resistance at the same age. Seedlings are usually slower growers than sprouts of the same species, hence it takes them longer to develop thick bark. Also sprouts are generally thinner barked than seedlings and are attached to an old stump which may be dry enough to burn, forming, moreover, a convenient accumulating place for litter. When this burns it generates more heat than a fire running over unobstructed ground; consequently sprouts suffer more injury.

Small stumps cut level with the ground are soon grown over by sprouts which are almost as resistant as seedlings.

Vigor: The vigor and general health of a tree may determine whether or not it withstands a given fire. Of two trees of given size, age, bark thickness, etc., one dominant and fast growing, the other suppressed and dying, the first will be more resistant and may survive a fire that kills its weaker neighbor.

Size: The mere fact of large size irrespective of other considerations, is an advantage to a tree in its struggles with fire. The wood of living, uninjured hardwoods seldom burns of itself, but only when surrounded by burning litter. It takes more burning material to harm a large tree than a small one. Seldom is there enough litter under hardwood stands in southern New England to burn down trees more than three or four inches through at the base.

Character of the Wood: Some woods burn easier than others. A species with wood that burns readily suffers more than one with wood that does not. Chestnut seems to suffer more in this respect than most of the oaks. Character of the wood is one of the lesser considerations of initial resistance but of great importance in subsequent and continued resistance.

The sum of these factors of resistance for a species or individual comprise what we may call its *Initial Resistance;* that is, the resistance which a sound tree offers to the first fire which attacks it, at the time of the attack. No species surpasses all others in all resisting qualities, but some average more resistance than others. Thickness of bark, character of wood and of root system are more especially specific characters and vary more with the species, the others with individuals and seasons.

II. THE AFTER EFFECTS OF A SINGLE FIRE.

The effects of a fire do not cease as soon as the ashes cool, but are felt through many years. The damage may be increased by other agencies, or be wholly or partly repaired by growth.

In the after history there are two distinct factors to be considered: (1) The resistance of the tree to subsequent agencies, (2) Its recovery power exhibited by the healing of its wounds.

Resistance to Subsequent Agencies: It is known that nearly all decay of woody tissue is due to the action of fungi. Fungi to attack a tree must generally find some opening in its bark, and they seem to grow better on trees weakened in some way. Consequently fire by exposing the wood and reducing the vitality of the tree, sets up a condition favoring their growth.

Fungous attacks following injury by fire are of various kinds, dependant upon the character of the fungus. Infection may be by one attacking only dead wood as *Polystictus pergamenus* so frequently found on fire injured Red Oak and other deciduous trees. According to Von Schrenk,* this fungus can destroy only as much wood as has already been killed. Other fungi which follow fire can grow from the dead into the living wood or attack it directly. They are consequently more to be dreaded. Those fungi which attack only heartwood follow a fire only when it has been severe enough to expose this. Another group is the bark fungi which attack the bark and the cambium beneath. These may be more deadly than those operating in the wood although they do not destroy the wood of the trees they kill. *Diaporthe*

*"Diseases of Deciduous Trees," Bulletin 149, Bureau of Plant Industry.

parasitica, the Chestnut Bark Fungus, seems to be more numerous and severe on fire injured trees.

Perhaps the worst effect of fungi is the decay of heartwood. A fire scar may completely heal over, yet if decay has started it is likely to continue till the entire interior of the tree is riddled.

Woods resist decay to varying degrees. White Oak and Chestnut probably have the most decay resistant wood of any southern New England hardwood; aspen, the most perishable, fire injured specimens seldom lasting more than a decade or two, while White Oak will resist decay even though badly injured at the base for several times that long. The *subsequent resistance* of the aspen is low; of the oak high.

Next to fungi insects play the largest part in the after effects of fire. Weak or injured trees are generally more subject to insect attacks than sound ones. The exposing of the wood by the burning of the bark is not a consideration since insects enter in other ways. Like fungi they cause damage in two ways: (1) By attacking the living portions of the tree, reducing its vitality, perhaps killing it, (2) By boring in the wood, reducing its strength, thus inducing wind break and lowering its value. Insect channels in timber facilitate the entrance of certain fungi.

Under the first class of injuries come those by bark beetles. These mostly belong to the Family Scolytidae. The Hickory Bark Beetle *(Scolytus quadrispinosus)* is active in destroying the life of fire injured hickories and it is rarely that they escape its attacks.

Concerning wood boring insects Hopkins says, "The principal damages to dying and dead hardwood trees is caused by certain round-headed borers,—by timber worms,—and by Ambrosia beetles. All hardwoods suffer more or less, but the greatest damage is done to the wood of hickory, ash, oak, and chestnut, which is often reduced in value ten to fifteen per cent. or more during a period in which it would otherwise remain sound and available for commercial purposes." Elsewhere he mentions fire as an agent inducing insect attacks.

It is not uncommon for insect and fungus attack to both follow in the wake of a fire which has opened the way for the entrance of the fungus and weakened the tree for insect resistance.

Windbreak is another after effect of fire. Scarred trees are often unable to withstand the force of the wind and are overthrown while still living. A tree may stand for several years after a fire and then be wind thrown. The ease with which this takes place varies with the strength and resistance of the wood. A tree with strong, tough and elastic wood will stand long after one with weak and perishable wood has been blown down. Hickory saplings are often found burned to beyond the center, yet still standing because the wood is tough. Hickories are thin-barked and easily injured by light fires, yet their tough wood makes them rather resistant. Their *subsequent* is higher than than their *initial resistance.*

Gray birch has a rather hard, non-combustible bark. It often escapes fires that scar Chestnut and Red Maple, but its wood is very perishable and quickly rots after the bark has been pierced so that fungus spores may enter; hence it easily becomes a prey to windbreak, succumbing long before its neighbors which were more seriously injured in the first place. Its *initia* is higher than its *subsequent resistance.*

Swamp fires that have burned down to the roots are often followed by the overthrow of nearly all the dead trees, which may still be sound, but whose roots have decayed.

Recovery Power: While this destructive process, a combination of fungi, insects, and wind, is at work, the tree is not only passively resisting their attacks, but is striving to heal its injuries by covering them with new growth.

If a tree is young and vigorous the wound may soon be covered, but the damage is not thereby entirely repaired, since the energy the tree has put forth to repair it, has been subtracted from normal growth. The extent of the checking of growth depends upon the degree of injury. A stump analysis does not always show it, the rings being actually wider, since immediately after a fire the tree has to use most of its energy to heal its basal wound. Higher up the narrowing effect is observed.

The ability of a species to heal over its wounds has much to do with its holding its place in a burned stand. One which rapidly heals an injury, keeps out decay effectually, strengthens its base sooner, and is less liable to windthrow. White oak is especially active in this respect and soon heals an ordinary scar. It probably has a higher *recovery power* than any other species of the region.

The healing of a scar which takes four or five years, can rarely be accomplished before decay starts. During the period following a fire two opposing forces are acting; one, growth, trying to repair the damage and close the wound; the other, insects and fungi together, trying to destroy the remaining tissue. Healing must take place from the outside, each growth ring closing over more of the injured area, till at last the layers meet from the opposite sides. Sometimes they unite and the cambium ring again becomes complete. More often they merely remain in contact. Before the wound has closed the wood has usually commenced to decay at the surface. If this is not too rapid and healing is fast enough the growth rings meet across the opening and a closed cavity is formed. Otherwise the forward growing edges are rolled further and further inward in a vain attempt to coat the inside of the cavity which always remains open. If the decay be in the inside in the heartwood, the surface scar may heal, but in time a rotten butted tree results.

While decay at the point of attack is going on, it is also creeping up the heartwood and down into the larger roots. The tree has no means of repairing this damage. Its ability to resist decay is the sole consideration. A species with a decay-resistant wood remains sound above the point of injury for long periods. It is often a consideration what fungus attacks a tree. Some are more virulent than others.

III. EFFECT OF RECURRING FIRES.

If but one fire ever burned a stand, the effects of fire would not be nearly as great as they are. Many tracts are subject to recurring fires at frequent intervals, often annually. Although fires in a repeated burned stand are never as intense as in one previously unburned, the culminative effects are much greater. There are two causes for this: (1) Indirect effect of fires by changing the site conditions, (2) Direct effect of the fires on the trees. The resistance which trees put forth against recurring fires and the agencies associated with them we may call *continued resistance.*

Indirect Effects of Recurring Fires: The loss of the forest floor, destruction of reproduction, drying out of soil, perhaps followed by erosion, are among the indirect effects of recurring fires.

The loss of the forest floor, the drying out and loss of fertility of the site, have a marked effect on the growth of the remaining trees. The dry, semi-arid conditions prevailing in many constantly burned stands prevent the life of some species which might withstand the fires themselves. Pin Oak *(Q. palustris),* for a bottom land tree is rather fire resistant, yet it dies on sites repeatedly burned and consequently dry. Other species have their growth seriously curtailed. Often a stand stagnates and scarcely grows at all. "Stag-headedness" is a common result of recurring fires which destroy the soil leaving the trees without proper nourishment. Stands losing many of their members in early life, by the direct or indirect effects of fire, suffer later from incomplete stocking.

It is sometimes argued that fires by killing the smaller and weaker trees, do the forest a service by effecting what is practically a thinning. This may be true to a certain extent for some forest regions, but certainly not for southern New England. The injury to the remaining trees more than counter-balances the good effect of the thinning.

Direct Effect of Recurring Fires: There are two kinds of recurring fires—annual and periodic.

After annual fires have swept a tract a few times, there is nothing left to burn but the accumulation of a single season. Therefore fires are progressively less intense till they reach a point of uniform minimum intensity. One season's accumulation of litter is seldom sufficient to generate enough heat to injure the cambium of trees out of the sapling stage; hence if a mature stand begins to suffer annual burning without having been previously injured, little direct damage results. If it has been previously injured so that the wood at the base of the trees is exposed, fire becomes a fourth agent, with insects, fungi and wind, in the destruction of the injured trees. While the charring of the wood produces an unfavorable condition for the entrance of insects and fungi, it usually merely drives their attacks higher up where the wood is uncharred. Annual fires often at length reach the roots. In time they will destroy even a mature hardwood stand, killing the large trees one by one and preventing all reproduction.

The effect of periodic differs somewhat from that of annual fires. Time enough elapses for sufficient litter to form for a killing fire. Thus each successive fire may kill enough to counterbalance the growth since the last, or even more. Like annual fires they work in any existing cavities in the butts and enlarge them.

IV. FIRE IN RELATION TO SPROUTING.

No discussion of the fire problem in southern New England can fail to deal with it in relation to sprouting.

The relative sprouting ability of trees from stumps is fairly well known. Whether this same relation holds after fire, cannot at present be answered. Probably it does. All the well-known laws of sprouting hold as well for fire-killing boles as for cut stumps. When a fire burns down a tree it kills it, but sometimes only the bole is killed. Sprouting may then be possible. If the root system has been injured it will be feeble. The presence of a dead trunk may impede the growth of the sprouts and injure them when it falls. Ten to fifteen years usually effects the destruction of a trunk killed by surface fires, so that their subsequent development is not seriously interfered with. The presence of a destructive fungus in the rotting stub may be more serious. However not all fungi living on dead wood can infect living.

The season of a fire has much to do with the vigor of sprouting, which is better after one in spring than in late summer or fall. Late sprouts are apt to be frost killed.

A sprout from the base of a fire-killed trunk is to all intents and purposes a new tree, and the whole subject of sprouting might be considered under *Reproduction* were it not that injured trees also sprout. If they are tolerant and not of large size, some of their sprouts may come through and exist as equals with them. This is not uncommon with Ironwood *(Carpinus Caroliniana)*. More often the sprouts live for a few years only to die for lack of space or light. Sprouting is of value when a bole is killed, but not when it is injured. The sprout growth dissipates the energy of the parent, preventing it from putting forth all effort to repair its wounds and increase its growth.

The effect of periodic fires in young and middle-aged sprout stands is interesting to observe. A fire kills or injures the trunks so that they sprout from the base. The next fire kills or injures the survivors of the first crop. Another crop takes their place, is killed, and so on. Sometimes all are produced from the original tree; sometimes from older sprouts, or both. Each crop is less vigorous than the one before. How many crops can be produced is not certain. The writer has counted as many as four, produced at from three to eight year intervals, all surrounding a single still-standing Chestnut bole. Nearly twenty years had elapsed since the first fire. Such sprouts seldom amount to much even if fires are at length stopped.

The power of sprouting after fire gives a species an advantage in maintaining itself under conditions of annual, periodic or casual burning, but it does not help the resistance of a single trunk. Chestnut and Red Maple often maintain themselves in stands long after their original trunks have vanished. The sprouts keep company with the scarred trunks of oak and others which do not sprout as readily, but are otherwise more resistant.

Other than *Sprouting Power* it is difficult to isolate the factors of *Continued Resistance.* Resistance of wood to combustion and decay do not seem to be all. Some species have the power of hanging on to life under all sorts of unfavorable conditions. For lack of a better term, we call them *hardy.* If asked why they are so, we can only answer "the inherent quality of the protoplasm."

With few exceptions species characteristic of dry, barren, rocky, and exposed sites are also fire resistant. Species characteristic of moist, fertile sites are generally non-resistant. In the group of barren land and resistant species come; Black and Chestnut Oaks, Pitch Pine, and to a lesser degree, Hickory and Red Oak. On the other hand, not considering sprouting power, which seems to bear no relation to site, are such species as Beech, Black and Yellow Birch, Red, Silver and Hard Maple, Ash, Tulip, Basswood and Black Cherry, which are characteristic of good sites, and are non-resistant.

There are exceptions to this law. Trees with perishable wood are non-resistant even if characteristic of poor sites. Examples are Gray Birch and Scarlet Oak. Other species with very resistant wood or a high recovery power are classed as resistant even though characteristic of good soils. White Oak is an example. Chestnut which is non-resistant in youth, develops a thick bark at maturity and is then quite resistant.

V. EFFECT OF FOREST FIRES ON REPRODUCTION.

One of the worst things about fires is that they generally kill more than one tree generation. After a severe fire has killed everything, all reproduction must come from seed produced off the burned area. If this is very large it may take several tree generations to completely restock it. It is doubtful if this form of reforestation has ever been necessary in southern New England.

Effect of Seeding: For light surface fires the amount of injury varies with the season of the fire. One in spring kills all seedlings from seed of the previous fall as well as all ungerminated seed. Fires at the close of a good seed year for a species may prevent its reproduction till the next seed year. In Connecticut, the fall of 1910 produced a large crop of Red Oak acorns. The spring of 1911 was very dry and fires were frequent. On the many tracks burned there are no seedlings from this crop.

Fall fires coming before the seed falls, but after it is ripe, may have no effect on seeding; may help it, hinder it, or prevent it altogether, all depending upon how the fire leaves the forest floor.

Although no studies have been made on this point it is likely that continued fires, by causing deterioration of the site, affect seed production and fertility adversely, even though, as has been recently claimed for Western Yellow Pine, fire scars stimulate seed production.*

Resistance of Seedlings: It is doubtful if an oak seedling can survive a fire of the lightest kind unless it be at least three years old. Certainly other species are not more resistant. Above that size, till they reach a diameter of three inches, they are killed back by most fires, although two inch specimens sometimes survive light fall fires. Severe fires burning up hill may in spring kill oaks up to six, and chestnuts up to ten inches in diameter. A six-inch oak averages from fifteen to twenty-five years old.

There is then a period from germination to the age of three years during which oak seedlings are sure to be killed back; a period from three to ten years, liable to be killed back; one from ten to fifteen years when saplings run a good chance of being killed back; and a final period from fifteen to twenty-five years during which poles stand a possibility of being killed back.

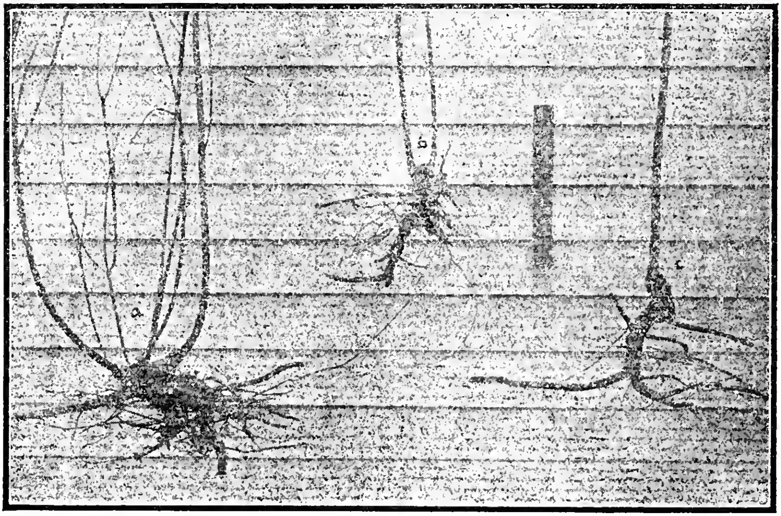
Seedling Sprouts: Seedlings killed back often sprout again.

*Circular 196, U. S. F. S. "Influence of Age and Condition of the Tree on Seed Production in Western Yellow Pine."

They are then called *seedling sprouts,* and it is often difficult to tell them from seedlings.

The extent to which fire delays the growth of hardwood seedlings is scarcely realized even by foresters. It is the writer's observation that fully half the seedling reproduction in parts of Connecticut is so delayed from three to ten years.

A crop of seedlings is killed back by fire. The roots send up sprouts, usually several weak rather than one strong one. A few



SEEDLING SPROUTS.

(a) Red Maple (Root 20 years old, top 3 years old).
(b) Black Cherry (Root 16 years old, top 3 years old).
(c) Black Oak (Root 12 years old, top 3 years old).

years later another fire necessitates the repeating of the process, and so on till even the most vigorous have succumbed. For seedling sprouts apparently follow the same laws as sprouts from older trees although we do not know that the relative sprouting abilities of seedlings and mature trees is the same for the same species. Seedlings sprouts do seem to differ from those produced by older trees in not forming an independent root system. Each generation of them appropriates that used by all before. Thus large roots may have almost no tops. We might suppose that these tops would grow sufficiently fast to offset the killing back. Field observations seem not to confirm this. The slightly accelerated growth is over in two or three years and thereafter development is that of a seedling rather than a sprout. Also among the many sprouts produced a few must attain supremacy before rapid development of any is possible.

VI. EFFECT OF AGE ON FIRE RESISTANCE.

As age increases so does size and thickness of bark. More heartwood is formed. The roots go deeper. All this gives the tree added powers of resistance; initial, subsequent, and to a degree, continued. It might be argued that the life energy of a tree past middle life is falling off, consequently its resisting powers would likewise decrease, but the increased size, thickness of bark, etc., far outweighs this.

It is true, however, that old trees do not recover from injury as rapidly as younger, more vigorous ones. We may say that while resistance increases with age, recovery power varies with life energy.

Old trees are more or less unable to withstand changes in the character of their site. They are thus more susceptible to the indirect effect of fires, more especially continued fires, and so lose some of the power of continued resistance.

SUMMARY.

The fire problem in southern New England has many phases peculiar to itself. It is here discussed only in reference to the effect of fire on the trees themselves and on reproduction.

Trees exhibit three kinds of resistance to fire; (1) *Initial Resistance,* the resistance which sound trees put forth at the time they are first burned. It depends upon several factors, chiefly thickness of bark, (2) *Subsequent Resistance,* that which trees once killed by fire, exhibit to insects, fungi and wind following the fire, (3) *Continued Resistance,* that which trees oppose to recurring fires. It depends upon the character of the wood, and the tree's ability to withstand adverse conditions. It is the final test of a resistant species.

Hardwoods frequently sprout after a fire. This is an advantage when they are killed to the ground, but not when they are merely injured.

Fire generally kills all reproduction and may delay it indefinitely; when not holding back its development by making seedling sprouts of the seedlings escaping.

Fire resistance in general increases with age, but *Recovery Power* varies with life energy. *Continued Resistance* declines after a tree passes its prime.

HOW THE INSECT CONTROL PROBLEM COMPARES WITH THE FIRE PROBLEM ON NATIONAL FORESTS IN DISTRICT 5.

By John M. Miller, *Forest Ranger.*

Upon the vigilance of the Forest Ranger depends the fire protective system of our National Forests. Great annual fire loss is prevented by the watchfulness of these men who ride the trails, by their resourcefulness and effectiveness on the fire lines. Every year the Forest Service is getting a better hold of the problem. By studying the local needs of each Forest, by better organization of the administrative force, by telephone improvements it is possible to meet fires sooner and check them with only a small burned over area. But under the best system of fire patrol there is another destructive agency, forest insects, that is constantly making inroads upon the timber supply. In protection against insects the part of the Forest Ranger will undoubtedly be an important one as it is now in fire protection, but as yet very little has been done by Forest officers on the whole to keep their territory free from insect attack.

The need of better fire patrol has been driven home by expensive and undesirable experience. Few men have fought forest fires who do fully appreciate the necessity of locating them promptly and getting them under control before large fires have time to develop. It is hardly necessary to emphasize the advantages of giving insect attacks the same prompt attention but quite often the presence of insect damage in a Ranger district is disregarded until it begins to reach the extent of a dangerous, destructive invasion.

Of course, if the loss caused by insects is unavoidable, or if it is not extensive enough to seriously interfere with the growing and marketing of a crop of timber, then there is very little reason for bringing this subject to the attention of the field men, the routine of whose daily work is already too well filled. They have already enough subjects on the list for systematic work and study. But if it is shown that the forest resources of California are being seriously impaired by insect damage, and that much of this can be prevented if greater interest is only manifested and the proper precautions taken by the men who are directly responsible for the administration of these forests, then the question of insect protection becomes vital.

Before any National Forest can be brought to its maximum producing capacity, we will have to know how to deal with those insects which attack and kill living trees. As yet there has been very little time to study or determine the damage caused by forest insects. To bring the organization of the Forest Service to a point where fire and trespass can be effectively handled has been an enormous undertaking, but as we gain control of these two essential features the need of protection against insects becomes more and more prominent.

There are a number of easily recognized differences between forest fires and attacks by forest insects. Fires are always conspicuous. The smoke of even an incipient fire is visible from a distance and is in itself a signal that help is needed. There is no such evidence to announce the beginning of an attack by insects. The red needles of the dead and dying trees are the first sign by which the Ranger knows that a destructive agent is at work in the timber. Forest fires start rapidly, burn fiercely and are extinguished in one season either by direct control or the advent of the rainy season. Insect invasions start slowly, increase from year to year, and, if allowed to continue unchecked, they are brought under control by natural agencies only after a period of years, usually not until a vast amount of timber has been killed.

Fire damage is easily mapped and estimated. The annual burned-over areas are computed with comparative exactness. However, as much of the insect infestation is broken in distribution and scattered over enormous areas, it cannot be easily mapped and the amount of loss cannot be estimated without even greater difficulty.

Insect infestations, especially those caused by the more destructive species of bark beetles, can be classified into various types or classes, just as fires are now grouped into different classes according to their seriousness and the amount of damage. A large local invasion of insects which kills thirty-five per cent. or more of the trees on the infested area in one or two seasons is more or less conspicuous and becomes apparent even to the laymen as soon as it is well under way. These large invasions represent one class of infestation. There is another source of direct insect loss which is caused by a different class of infestation. Annually throughout the forest, trees will die, either singly or in small groups. When these scattered dying trees are noticed, they are seldom considered an important item of damage. Quite often they are considered as only the necessary annual deadening of overmature trees. The total amount of loss in this type of infestation is much underestimated. The damage is very easily overlooked in the mixed stands which we find on many of our California forests. Where one species of tree alone is suffering from insect attack, the dead and dying individuals are sometimes hidden by the surrounding green foliage or resistant species.

A careful reconnaissance and estimate of insect loss is needed on all our National Forests. The results of such a reconnaissance will undoubtedly show that the greatest loss that our Western forests are now suffering does not arise from the few conspicuous local outbreaks, such as are now in progress in the lodgepole pine on the Lassen National Forest, but in the sustained annual loss of scattered merchantable trees. Although only a few trees may die in a season on the same section, still the dead timber which accumulates in a period of years amounts to a rather startling total. Much of this dead material however is burned up by periodical fires which destroy all evidence of insect attack.

The annual rate of dying timber may vary greatly in different situations and in some localities this scattered infestation becomes so serious as to approach the character of an invasion. A study to determine just how serious may be the loss from this type of infestation was recently made upon the Klamath National Forest by the Forest Service under the advice of Dr. Hopkins of the Bureau of Entomology. An area consisting of about four thousand acres was selected near the Klamath River in Township 46 North, Range 8 West, Mount Diablo Meridian, which contained representative sections. In places the dying of groups of trees has been so persistent that noticeable openings have appeared in the stand. The elevation of the area varies from 2,000 to 4,500 feet. Conditions seem to be worst in the lower yellow pine belt but the infestation extends well up into the sugar pine and white fir types.

One cannot give a better idea of the condition of the stand on this area than by quoting from Forest Assistant Hodgson's reconnaissance report of May 18, 1911.

"Upon going into the area one is immediately struck by the broken condition of the forest. Throughout the stand there are down and standing snags in various stages of decay, while standing trees that have been recently killed are numerous. Upon large areas practically all the mature trees have been killed and where was at one time a good stand of saw timber there is now only a thick stand of brush broken only by standing and down snags. There is very little evidence of fire and one of the oldest residents of the country who settled there in 1863 stated that so far as he knew there had been no fires on the north side of Little Humbug creek since that time, but that about 15 years ago a fire burned over the area on the south of Little Humbug."

The work of estimating this tract was conducted along the lines of a regular forest reconnaissance. Each forty was mapped and estimated by means of a ten per cent. strip. At the same time a careful study was made of the dead trees which furnished a pretty good history of the insect loss as it has progressed from year to year. All dead trees of merchantable diameter (18 inches or over) which still showed evidence of primary insect attack were tallied regardless of their present merchantable condition. The figures obtained give in board foot measure what this dead timber would be worth if it were still standing green. From records and data collected in the field it was estimated that this loss represents a period of about thirty years. By comparing these figures for the dead timber with those obtained for the green timber which was estimated at the same time on the same basis, the percentage of insect loss can be very fairly determined.

The final results of the reconnaissance show that the amount of loss varies from twenty to fifty per cent. of the total stand. This is on an area where the insect infestation was not at all conspicuous and where it has been only rarely noticed and reported by residents and Forest officers.

At the same time there is plenty of evidence to show that this area is capable of producing a good yellow pine forest. The surviving trees are of a merchantable type and the reproduction now springing up in the openings is thrifty and of rapid growth. The land is unfitted for agriculture and without the forest cover it produces only a worthless cover of brush. The present stand of pine is not disappearing from over-maturity, as very nearly all of the dead trees are not of mature ages or diameters. Neither can this condition be accounted for by fires. The loss can only be satisfactorily attributed to the direct agency of insects.

The result of this reconnaissance may be considered representative of conditions not only on similar sections of the Klamath National Forest but elsewhere in District 5. To make such land as this productive is one of the biggest problems of progressive forestry. But the saving of the merchantable timber now on the ground is a more immediate necessity. Were it not for the attack of insects the older trees, even though in an unthrifty condition, would probably have held their own until market conditions made them available. Under present conditions, they are a direct loss as the wood destroying fungi and secondary insects render them unmerchantable very soon after death. What is still worse these dead trees become veritable fire traps and are a constant menace as long as they stand.

There are many other sources of insect loss besides that caused by the girdling of living trees by barkbeetles. Insects mine the tree seeds and retard reproduction. They may strip the foliage from growing trees, and the finished lumber product is sometimes badly damaged. Much of the injury of this class is inconspicuous and is understood only by the specialist. But the feature which concerns most the field men on the National Forests is the loss of merchantable trees, and our first efforts should be directed toward checking the inroads of insects in the growing stands.

There is reason to believe that our forests will continue to suffer unless measures of relief are undertaken. To bring about better condition attacks will have to be met as they appear and checked before large invasions develop. These results can only be reached as they have been reached in fire protection—by the watchfulness of an organized force in the field. The duty of saving timber from insects will have to depend, as the fire problem now depends, upon Forest Rangers and field officers.

Destructive insects cannot be exterminated any more than we can hope to completely eradicate the cause of forest fires. It is shown, however, that heavy loss can be prevented by the methods of control demonstrated by the Bureau of Entomology. The scientific study of forest insects and the work of determining and demonstrating the best methods of controlling them is being rapidly advanced by the branch of Forest Insect Investigations, under Dr. Hopkins.

It would be a waste of funds for this Bureau to maintain a constant patrol for the location of insect infestation. The Forest Rangers are probably the only men who see most of the square miles of a National Forest during a season and upon them must depend the work of locating and reporting evidences of insect depredations, an essential part of good forest protection.

Of course we cannot expect the Ranger to become a trained entomologist any more than we expect him to be an expert land surveyor or an authority on the Federal land laws. If a knowledge of technical entomology is required the average forest officer will probably fail to qualify. It does not require a specialist to notice unhealthy or dying groups of trees, but it does require some observation with a knowledge of the characteristic work of the most important insect pests of forest trees. The scientific nomenclature of the forest insect group will have to be handled by the specialist. The timberman is attracted by the injury that appears on the tree. He is not much interested in insects and is not collecting them. If he is sufficiently interested to ascertain the cause of the damage, he will soon learn to identify its cause by the nature of the injury. The character of insect work is usually a pretty good clue to the species that is causing the damage.

There is also need of more educational work by representatives of the Bureau of Entomology on National Forests. A demonstration in the field is worth far more than a publication describing insects or insect work and is far more effective in arousing the interest of the layman.

As the use of National Forests develops, the problem of their protection against insects will become more important. At the same time the opportunity for practical control will improve. Through free use and ranger sales the small local infestations can be disposed of as they appear. There is reason to believe that eventually satisfactory insect control can be established, not at prohibitive expense but even at an actual profit to National Forests.

A NEW METHOD OF CONSTRUCTING VOLUME TABLES.

By Donald Bruce.

To the average forester of technical training a volume table is an essential to timber estimating. Upon its accuracy depends, to a large degree the accuracy of his work, and in its absence he is often nearly helpless. Fortunately, there are now published, chiefly by the U. S. Forest Service, quite usable tables of this sort for practically every species of tree of commercial importance.

It is well recognized, however, that even the most carefully compiled table is of assured accuracy only when applied to timber similar to that from which the measurements used in the construction of that table were taken. A slight variation in site, climate, or age or form of stand, may induce a considerable deviation from the tabulated figures. Yet in practical work it is exceptional to be able to find a table that does apply exactly to the stand which must be estimated. Furthermore, the construction of one to suit the occasion is almost of prohibitive expense on account of the large number of tree measurements necessary for really satisfactory results.

Under such conditions the would-be estimator of technical training has been forced to choose between two evils. He had either to use a table constructed carefully for other conditions, but of dubious accuracy in the case before him, or to roughly construct for himself a local table based on entirely inadequate data. In the former case he has, perhaps, checked his table by taking a few local measurements, but a completely satisfactory check would demand measurements almost sufficient in number for the compilation of a new table. Yet this has been probably the least objectionable method available.

A third method has recently occurred to the writer which has several advantages over either of the alternatives mentioned above. It involves the use of what may be termed, for lack of a better term, the frustrum form factor. This may be defined as the ratio between the merchantable stem of a tree and that of the frustrum of a cone having the same height, and the same upper and lower bases. For the present purposes the volumes may be figured in board feet, and the assumption may be made that the D. B. H. outside the bark and the D. I. B. at the stump are equal. This is of course fallacious, but when used as will be described in this article will be seen to introduce no error. The frustrum form factor expresses, to put it in other terms, the relation between a given tree and a tree whose taper between its top cut and a point four and a half feet from the ground is absolutely regular.

It is evident that the frustrum form factor will differ markedly from the usual form factor based upon the cylinder in two ways. While the values of a table of ordinary form factors will range in the neighborhood of .5, the frustrum form factors will be quite close to unity. Further, the range of variation of the latter will be considerably less. This is because one of the factors of variation of the ordinary merchantable form factor is eliminated. A full-boled tree, for example, has a larger volume in board feet and a consequently larger form factor than a more rapidly tapering tree of the same diameter and total height, due to the fact that there are more (or longer) logs composing its stem as well as that the top diameters of the logs are larger. This variation of merchantable length is obviously eliminated from the frustrum form factors.

But little use has been made of the form factor of any sort by the American forester. He has almost seemed to treat it as a sort of scientific curiosity, scarcely realizing, apparently, that every volume table is but a table of form factors in disguised form, and that the one can be readily converted into the other. A volume table based on diameter and total heights is equivalent to a table of ordinary form factors, while one based on diameters and merchantable heights can be converted directly into frustrum form factors.

The utility of the frustrum form factors can be most easily demonstrated by this conversion process. A volume table, to be available for this purpose, must satisfy the following conditions; it must be based on diameters and merchantable heights, and it should have the D. I. B. of the tops given by inch classes.

Two tables which serve admirably, and which offer an interesting contrast, are that for Western Larch in Flathead County, Montana, and that for Douglas Fir in Freemont County, Idaho, both published by the U. S. Forest Service (Form 874 d and 874 j). The former is based on measurements of 1,394 trees, and shows every evidence of careful workmanship, while the latter, though undoubtedly constructed with equal care, is based on but 486 trees.

The following tables of frustrum form factors have been derived from these. Every fifth inch class only was computed, as this was quite sufficient to show the trend of the values. The figures were obtained as follows: The volumes in board feet of the frustrum were computed by calculating the top diameters of each of their 16 foot sections, and applying the same log rule as that used in the volume table under consideration; (interpolations to the nearest tenth of an inch were, however, applied); these frustrum values were then divided into the corresponding values in the volume tables, the quotients being the values of the frustrum form factors.

Table of Frustrum Form Factors.

Western Larch, Flathead County, Montana.

	Number of 16 foot logs.						
D. B. H.	3	4	5	6	7	8	Average for all heights.
11	.85	.91					.88
15	.91	.84	.86				.87
20	.97	.87	.82	.82	.82.		.86
25		.89	.82	.82	.82	.85	.83
30			.81	.82	.82	.84	.82
35				.79	.80	.82	.81
40				.77	.78	.75	.77
Average for all diameters	.91	:88	.83	.80	.81	.81	.84

Douglas Fir, Freemont County, Idaho.

	Number of 16 foot logs.					
D. B. H.	2	3	4	5	6	Average for all heights.
12	.41	.66	.89			.65
15	.97	.94	.96			.96
20	1.54	1.04	.95	.91		1.17
25		1.15	.96	.91		.98
30		1.24	1.03	.95	.91	1.02
Average for all diameters,	.97	1.01	.96	.93	.91	.96

A number of points of interest are brought out by a study of these tables. First, the irregularity of the values, suggesting, since it is a reasonable assumption that the frustrum form factors follow some law, that even the 1,394 trees used in the construction of the larch table were an insufficient basis. Secondly, the far greater irregularity of the values in the second table, emphasizing the decided decrease in accuracy resulting from the employment of the less complete data. Thirdly, the comparatively small range of the values in the more accurate table, a point which would be much emphasized if one or two more doubtful figures at the extremes of the table were eliminated. Fourthly, that the variation throughout each diameter class and average of all diameter classes is far less in degree or regularity than through the height classes; in fact, if we take into consideration the uncertainty of the figures on the edges of the table, we have forcibly suggested to us that a single value for each diameter class might prove essentially accurate. This is in line with the opinion of many European authorities that stem form factors may be based on diameters only; and it must be born in mind in this connection that such a conclusion is much less radical when applied to the frustrum form factor than to the ordinary form factor with the cylinder as a basis.

Before proceeding to the practical utility of the frustrum form factor, let us consider for a moment the causes of error in the usual volume table. Assuming that the values from which such a table is computed are averaged by means of a set of harmonized curves, we see that errors may lie in:

a. minor irregularities of shape of the curves;
b. improper general shape or direction of the curves;
c. wrong position or location of the curves.

The first error is of minor importance, and can be made negligible by careful workmanship. Of the other two the first is by far the more dangerous. This is for two reasons. If the general shape and direction of any curve were known, all values along that curve would have their just influence in determining its location, while with the direction unfixed, an abnormally high value at one end of the curve and an abnormally low value at the other end, instead of properly averaging against each other, have a tendency to tilt the curve. The ends of the curves are, moreover, exceptionally susceptible to distortion, since the extreme values are not only unsteadied by other values except from one side, but are almost certainly the average of fewer measurements. Thirdly, the error in shape of the ends of one set of curves will often result in error of location of the second set drawn.

It is this danger of improper shape or direction of the curves that may be minimized by the use of the frustrum form factor. What it can do for us is to set a standard curve form with which we can compare our average tree measurements. It is a simple matter, for example, to draw a set of curves showing the volume in board feet of frustrums of cones having the same upper and lower bases as the average of the trees on which our table is to be based. Each of these curves and the corresponding curve of the volume table will be similar in shape and position. From our conclusion above that variation of frustrum form factors is least within the individual diameter classes, it is obvious that this similarity will be most marked in the corresponding set of curves, amounting, indeed, to an essential parallelism.

How best we may use the frustrum form factor constructively depends chiefly upon the number of tree measurements which we have at our disposal. In the case under consideration at the beginning of this article it is obvious that the field data required must be kept to a minimum. In such a case the following procedure is suggested.

a. Determine the top diameter (average) to which trees of different D. B. H. classes will be cut, if possible by actual measurements after a logging crew. Such measurements are very quickly taken, and sufficient to construct a good curve may be obtained in a short time.

b. As many full volume measurements of trees as is practicable should be taken.

c. For each tree thus measured the frustrum form factor should be calculated.

d. These figures should be grouped together by diameter classes, and the average frustrum form factor for each diameter class obtained.

e. These values should then be evened off by means of a curve.

f. A table should then be constructed showing the volumes in board feet of frustrums of cones having basal diameters and heights which correspond to the D. B. H. and merchantable height classes of the required volume table, using for the upper base the values obtained under a, and assuming the diameter of the lower base equal to the D. B. H. Since this last assumption is also used in calculating the factors for each tree measured, no error is introduced in the final results.

g. The values in this table for each diameter class may then be multiplied by the frustrum form factor obtained under c for that class in order to obtain the final values of the volume table.

This procedure involves the assumption mentioned above that a table of frustrum form factors can properly be based on diameters alone. This is an assumption which the writer confidently believes can be proved essentially correct by more extensive investigation. It is, at any rate, fully justified in a case such as has been discussed above. Until the point has been more thoroughly investigated, however, it may be wiser to abandon the assumption wherever there is sufficient data at hand to render it less essential. In such a case the following modifications of the procedure outlined above are advisable. Instead of calculating the frustrum form factor of each tree measured, considerable time can be saved by averaging together the volumes, upper bases, total merchantable lengths, and D. B. H's of all trees of a given diameter and height class, and then calculating the frustrum form factor for the whole class. Further, instead of finding the average factor for the whole diameter class a complete set of curves should be drawn for the factors just as would be done for the volumes in the usual procedure in constructing volume tables. The transformation of the form factors resulting from the harmonized curves to volume values is then simple.

Other methods of applying the frustrum form factor will readily suggest themselves. One in particular may be mentioned which should, however, be used in extreme cases. Suppose a situation in which even the first line of attack taken up above is considered too expensive, yet where absolutely no volume tables exist that seem of reasonable accuracy. In this case a very few measurements could be taken, the frustrum form factors calculated, and a general average factor for all diameters and heights obtained. This, applied to a table of frustrum volumes such as has been described under the other methods outlined, will give an approximate volume table on a minimum of field measurements.

In the latter case the assumption is involved that the curves represented by the table of frustrum volumes are exactly of the same shape, whether based on diameters or heights, as those of the volume table we are trying to obtain. While this assumption is rather extreme, yet it involves less serious errors even in individual figures than might be expected,—(examine the percentage variation in the table given above for larch of the individual figures composing it from the general average)—and these errors would be largely compensating in a stand estimate. It has the great advantage of allowing all the measurements obtained to be averaged together directly. In the second case discussed the advantage of the frustrum form factor method over that usually employed is less obvious. It is not, here, a labor-saving device, but it tends to make the resulting table slightly more accurate. We have seen that in the case of the larch table mentioned in the earlier part of this article its use brought to light irregularities in the values which were imperceptible by ordinary means. Any errors which it can detect it can, of course, prevent. In such a case, however, its greatest value will be in strengthening the extremes of the table. What seems, in a volume curve, to be a normal continuation of curvature may be shown by the frustrum form factor to be a rather sharp bend. But it is in the first case outlined that the method is at its maximum efficiency. The assumption involved therein is reasonable, has considerable evidence to support it, and at worst is a very close approximation to the truth, and its effect in aggregating the available measurements for purposes of averaging makes a very decided reduction in the number of measurements necessary for an accurate table.

In conclusion, then, the following advantages are claimed for the use of the frustrum form factor in the construction of volume tables;

a. A table of fair accuracy can be constructed on a very few measurements;

b. The number of measurements needed for a really satisfactory table is much reduced;

c. The table constructed from a given number of measurements is particularly strengthened at its weakest point, namely, its extreme values;

d. As a result of all these points, the cost of constructing a volume table of any given accuracy is materially lessened.

RAINFALL A FACTOR OF TREE INCREMENT.

CONDENSED FROM AN ARTICLE BY ~~FRANCIS~~ DAVIS, C. E.

The investigations of Böhmerle, Cieslar, and those of other European students of the subject, appear to show a correlation between tree increment and the amount of annual rainfall. (See Forestry Quarterly, Vol. V, 1907).

In order to determine whether similar responses obtained in the United States, specimens were obtained from Michigan, Vermont, New Hampshire, Massachusetts, New Jersey, New York and Long Island, N. Y. These were studied, the rings were measured and plotted, the monthly rainfall was tabulated. The results given in the following pages were found to exist between the meterological conditions and the wood increment.*

Samples were obtained from Shoreham, Long Island, located on the north shore of the Island about thirteen miles east of Port Jefferson and lies immediately on the Sound. The land at Shoreham is high and the underlying watertable is about 100 feet below the surface of the ground. The soil is the usual sandy soil to be found everywhere on Long Island, but in this case the top-soil and sub-soil is far from being rich.

The specimens are all taken from the land of the Suffolk County Land Company's property, and the trees were growing under natural forest conditions, about one-half mile from the Sound on the highland. They were good healthy trees, cut during the winter of 1908-1909.

X. S. White Oak. Y. S. Red Oak.

Year.	Rainfall ± Average. Inches.	X. S. Average. 12 radii.	Y. S. Diameter. Large.	Y. S. Diameter. Small.
1908	-9.27	3.21	3.25	2.0
1907	5.52	3.75	4.55	3.5
1906	0.41	5.00	6.00	3.5
1905	-6.89	4.75	6.75	3.5
1904	4.91	5.33	6.75	4.0
1903	8.43	5.46	8.00	5.0
1902	8.17	4.54	6.00	3.0
1901	6.21	3.73	5.50	2.0
1900	-1.24	5.00	7.00	4.0
1899	-0.12	4.08	7.00	3.0
1898	7.51	4.92	6.00	4.0

*The original article was accompanied by 15 diagrams showing graphically the relationships. We have space only for reproduction of one sample.

Both of these trees responded to the rainfall as indicated by the underlined figures which show low increments in the drought years.

A number of other specimens were obtained at Shoreham, they were taken from a natural forest growing under normal conditions, with the watertable 100 feet below the ground.

I. S.	Chestnut	7. S.	White Oak
A. S.	Wild Cherry	8. S.	Chestnut
4. S.	White Oak	9. S.	Hickory
5. S.	Hickory	10. S.	Chestnut
6. S.	Wild Cherry	Z. S.	Hickory

Year.	Rainfall ± Average Inches	I. S.	A. S.	4. S.	5. S.	6. S.	7. S.	Nine Averaged. 8. S.	9. S.	10 S.	Z. S.
1908	-9.27	1.0	1.0	2.0	1.0	1.0	1.5	2.73	1.0	2.0	1.0
1907	5.52	1.5	2.5	3.5	2.0	1.5	1.5	2.53	2.0	2.5	2.5
1906	0.41	1.5	3.0	3.5	1.5	2.0	1.5	3.17	2.0	2.5	3.0
1905	-6.89	1.5	2.5	2.0	2.0	1.5	1.5	3.47	2.5	3.0	2.5
1904	4.91	2.0	2.5	1.5	3.0	1.0	2.0	5.14	3.5	5.0	2.5
1903	8.43	3.0	2.5	4.5	3.0	2.5	2.0	5.50	4.0	5.5	2.5
1902	8.27	2.0	2.0	2.0	3.5	1.0	1.5	5.25	4.0	6.0	2.0
1901	6.21	2.0	2.0	2.5	2.5	2.5	1.5	5.11	4.0	5.0	2.0
1900	-1.24	2.0	1.25	3.0	3.0	4.0	1.5	6.08	3.0	5.0	1.25
1899	-0.12	2.0	1.0	2.5	3.5	1.0	2.5	5.08	3.0	4.5	1.0
1898	7.51	2.0	1.75	3.0	2.5	4.5	3.0	5.39	2.5	4.5	1.75

The Shoreham sections are unusually interesting and show various kinds of trees reacting to the meteorological changes.

The great drought year 1908 invariably shows a reaction with the exception of 8 S., which taking an average of nine diameter measurements shows a slight increase over the year 1907, the amount being less than 1/16 of an inch. The measurements taken for this tree for the years 1907 and 1908 are as follows:

1908,	3	3	3	3	2.25	3	3	3	1.5
1907,	3	3.5	3	3	1.75	2	2	2	2.5

showing that the tree practically held its own, probably due to its sheltered position in the woods, and the fact that it was protected from the north wind and open to receive the warmth of the sun's rays. Exceptions are naturally expected. On the whole, the samples prove that at least on Long Island rain exerts a certain influence over tree increment.

Samples were obtained from the N. Y. Botanical Gardens and here again it is noticeable how the rain influenced the formation of the annual rings, how the location of the tree, its exposure to the sun's heat, the light, its protection from cold winds, all affect the tree in its growth. These specimens are most interesting as they have received the best of care and all disease prevented by constant attention.

Samples taken in 1909.

B. G. 1. Tulip Tree.
B. G. 2. Carolina Poplar.
B. G. 3. Maple.
B. G. 4. Linden.
B. G. 5. Catalpa.
B. G. 6. Ailanthus.
B. G. 8. Elm.

Samples taken in 1910.

B. G. 3a. Maple.
B. G. 5a. Catalpa.
B. G. 6a. Ailanthus.

1 B. G. Tulip Tree standing free, drowned out by the construction of a dam and cut in June, 1909. Part of the summer wood was formed, it was located about eight feet above running water.

2 B. G. Carolina Poplar. It was transplanted in 1896 placed on the edge of a grove where it continued to grow under natural forest conditions. There were no trees situated within seventy feet of it on its free side and it was growing about twenty-five feet above the lake.

3 B. G. Maple. Taken from the center of the border screen along the Harlem tracks, where it was transplanted in 1896 about ten feet above the lake, and left to grow under natural forest conditions with nothing within ten feet of it.

4 B. G. Linden. Natural growth and growing under natural conditions fifteen feet above the Bronx River and surrounded on all sides by trees.

5 B. G. Catalpa. Transplanted tree growing in the center of a grove twenty-five feet above the Bronx River.

6 B. G. Ailanthus. Standing free in a very warm sunny position, natural growth, twenty-five feet above the Bronx River.

8 B. G. Elm. Natural growth, thirty feet above the Bronx River, growing on the upland, clear on one side but nothing growing very near it on the other.

Year.	Rainfall ± Average of 7 yrs. Inches.	1 B. G. Av. of 6 dia.	2 B. G. Av. of 3 dia.	3 B. G. Av. of 2 dia.	4 B. G. Av. of 1 dia.	5 B. G. Av. of 3 dia.	6 B. G. Av. of 3 dia.	8 B. G. Av. of 4 dia.
1908	-9.70	3.12	8.16	6.25	2.00	5.50	9.66	8.00
1907	-0.15	5.50	8.16	5.25	2.75	5.50	8.66	7.75
1906	-5.56	7.88	11.16	8.50	2.50	8.30	12.83	14.25
1905	-4.18	11.54	12.00	8.25	2.50	10.20	7.50	11.25
1904	-0.39	14.41	14.33	10.75	4.50	11.00	10.23	20.25
1903	8.90	14.00	20.33	13.00	5.00	15.58	12.33	22.00
1902	10.42	13.93	18.16	13.50	4.75	14.75	14.00	15.75

The above sections which were obtained through the courtesy of Dr. Britton, Director-in-Chief of the New York Botanical Gardens, show very clearly the retarding influence which the lack of water has on tree growth. Sections B. G. 1, 2, 4, 5 follow the decrease in rainfall and lack of water very closely and the thickness of the annual rings gradually gets less and less as the years go by, a deficiency of rain being recorded since 1904, using the seven complete records obtained since this station was established. The deficiency indicated is obtained by comparing with the average at adjacent stations.

Section B. G. 3, 6 and 8 which do not react to the deficiency of rain in 1908 do show a reaction during certain years of low rainfall; 3 B. G. reacts until the last year, while 8 B. G. does not react in 1906 and 1908. This tree, however, stood free in a very sunny spot more or less protected from the northerly and westerly winds. Measurements taken along one diameter show a decrease of 3/80 inch over 1907, while another shows an increase of only 1/40 inch, and the third diameter gave an increase of 7/80 over 1907 and the total average only shows an increase of 5/80.

As this tree stood free and clear on the southerly side, the heat of the sun was able to affect it and as the spring was fairly warm and there was a gradual increase in temperature as summer approached in those years, it is to be expected that this would have considerable effect upon the tree increment.

Although the above results prove without doubt that the annual growth of a tree is affected by the meteorological phenomena, further samples were obtained in New Hampshire and Vermont. The latter were four Norway Spruce growing on the Billing Farm at Woodstock, Vermont. They were splendid healthy specimens and were all cut in December, 1908.

1 Vt. a thirty-two year old Norway Spruce growing alone on a hill side (southerly exposure), exposed on all sides, fairly good soil.

2 Vt. a thirty-two year old Norway Spruce growing in a grove planted twelve feet apart in a sandy soil with a gravelly sub-soil located on a hill with a northerly exposure and taken from the center of the grove.

3 Vt. Norway Spruce growing under forest conditions in a sandy soil on a hill with northern exposure.

4 Vt. growing on a hill with a northern exposure in sandy soil, trees in grove planted eight feet apart.

Year.	Rainfall ± Average. Inches.	1 Vt.	2 Vt.	3 Vt.	4 Vt.
1908	-4.70	3.0	7.0	4.5	4.0
1907	1.19	5.0	7.0	5.0	6.0
1906	-0.06	3.0	14.0	5.0	6.0
1905	2.05	9.0	15.0	13.5	5.0
1904	-2.47	8.0	14.0	13.0	8.0
1903	0.60	11.0	14.0	7.5	10.5
1902	7.91	8.0	13.0	13.0	8.5
1901	-0.58	15.0	16.0	11.5	9.0
1900	0.80	9.0	18.0	16.5	9.5
1899	-5.25	23.0	16.5	17.0	11.5
1898	0.00	20.0	16.0	15.00	14.0

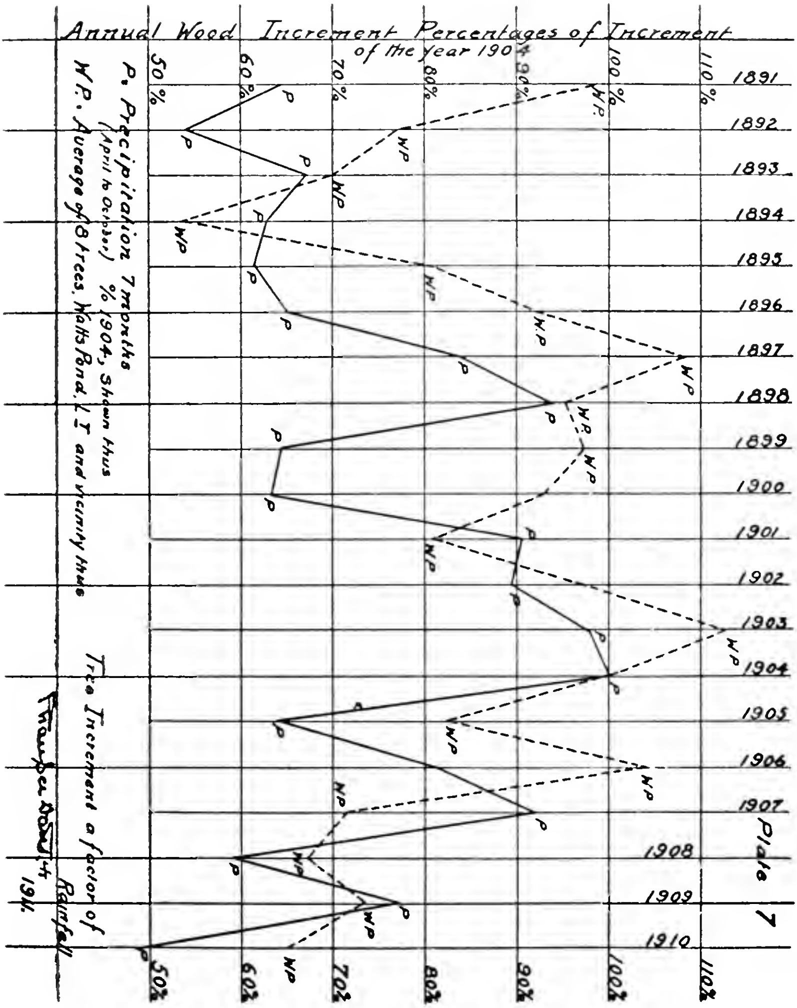
All of the above reacted to the drought of 1908, which year showed a precipitation 4.70 inches less than the mean rainfall.

The specimens obtained from New Hampshire were cut in May, 1909, and came from a farm which was abandoned in February, 1889. In the summer of 1888 the pasture was planted with buckwheat but has not been cultivated since and the trees came from self-sown seed.

The land is located fifty-six feet above the Sugar River and slopes abruptly towards it. There are two flowing springs on the land which form rills combining to make a fair sized brook which empties into the Sugar River. The sections were taken from trees growing from ten to four thousand feet from the springs and all were situated on higher land than the springs, which were located 1,768.3 feet from the river, so that all the trees were located on very high ground and none were very close to the river.

1 N. H. Maple.
2 N. H. Poplar.
3 N. H. Pine.
4 N. H. Locust.
5 N. H. Chestnut.
6 N. H. Birch.

All samples came from the neighborhood of Claremont, New Hampshire.



Annual Wood Increment Percentages of Increment of the year 1904
P. Precipitation 7 months (April to October) % 1904, shown thus
W.P. Average of 8 trees, Watts Pond, L.I. and vicinity thus
Tree Increment a factor of Rainfall
50% 60% 70% 80% 90% 100% 110%
1891 1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910
1914

Plate 7

Year.	Rainfall ± Average Inches.	1 N. H.	2 N. H.	Average 10 dia. 3 N. H.	4 N. H.	5 N. H.	6 N. H.
1908	-4.37	0.5	1.0	3.75	5.0	2.0	3.5
1907	4.33	1.25	2.0	3.75	7.0	3.5	4.0
1906	1.30	1.50	2.0	3.50	1.0	5.0	4.0
1905	-1.15	1.75	1.5	3.75	2.0	6.5	4.25
1904	-5.78	2.25	1.5	3.75	2.5	7.0	5.25
1903	-4.35	1.75	2.75	3.75	4.5	9.5	4.75
1902	4.89	0.75	2.5	4.00	4.5	7.0	2.75
1901	-2.02	1.50	4.0	3.50	4.0	7.0	6.50
1900	0.67	1.50	2.75	3.50	8.0	6.0	6.25
1899	-6.08	2.25	4.25	3.25	7.0	6.0	5.50
1898	3.12	2.25	3.00	3.75	9.0	8.0	3.25
1897	5.34	2.00	3.75	4.50	5.0	7.5	2.00

Here again we see the trees react to the deficiency in precipitation, and the drought year 1908 shows a decrease in the wood increment. Even the ten measurements taken on section 3 N. H. which show the same increment for both 1907 and 1908 when considered separately prove that the tree is affected by the drought.

1908,	3	5	5	6	3.25	2.5	4	3	2.5	3
1907,	2	2	3	5	4.00	4.0	4	4	4.0	4

A clearer and more graphic manner of showing the relation which exists between tree growth and the rainfall is to plot the growth curve as percentages of some one year taken as 100%, usually a year of maximum rainfall and comparing same with the rainfall curve, referred to the same year as 100%.

The deduction to be made from the above observations and tables is that rainfall is a great factor in tree increment, the location of the tree, however, must be taken into consideration as an exposed and isolated tree is more easily affected than one surrounded and protected by other trees, or shielded in some manner from the cold winds. An early warm spring and a continuous rise in the summer temperature with a fair and average amount of precipitation, will cause the tree to flourish and to form a broad annual ring. It is necessary, however, to have at least an average rainfall and this combined with the above meteorological conditions will produce healthy and sound wood. Generally the wood increment of the year following the drought year is small and readily observable in the cross section. This is frequently the case although the spring and summer conditions may be the most favorable for tree development.

THE EQUIPMENT AND OPERATION OF A PRUSSIAN SEED EXTRACTING ESTABLISHMENT.

By A. B. Recknagel.

The following additions to the article on page 26, Volume IX, Forestry Quarterly, the original of which appeared in the "Zeitschrift für Forst und Jagdwesen," June, 1910, and was briefed in "Forestry Quarterly, Volume VIII, page 515, are based on personal inspection.

The proposition of Wiebecke was conceived after seeing a large brick kiln in operation. In a brick kiln the baking must proceed gradually—*i. e.* the bricks must not be exposed to the maximum heat immediately, otherwise they are merely case-hardened and not baked through. No such necessity exists in handling seeds. Exhaustive researches* prove that the best results are obtained by subjecting the cones to a uniform temperature. This temperature must be gaged most carefully, for only a few degrees lie between a non-injurious and an injurious temperature. Furthermore, the danger of burning the seed is greatest *in the cone,* because of the well known fact that organic substances are much more sensitive to moist heat than to dry heat. The permissible limit is therefore 50° C. (122° F.) for cones that are still green, and up to 55° C. (131° F.) for cones that are dry.

Forstmeister Wiebecke's proposed system with its difficult range of temperatures and its requirement of much hand-labor has not met with commendation in Germany. In constructing the huge new Darre (Coning House) in Konitz, West Prussia, it was rejected by the Prussian government and the system in successful use for nine years in the Darre at Annaburg (Province of Saxony) adopted instead.

Through the courtesy of Forstmeister Hesse in charge at Annaburg, it was my good fortune to be able to visit the Darre* there.

*"Die Beschaffung des Kiefern-und Fichtensamens" by Oberföster Haack, 1909.

†The word "Darre" doubtless is derived from "durren" meaning "to dry."

Before describing the system used, a few general words as to the Prussian Seed Collecting policy may not be amiss.

Until recently, the Prussian foresters bought almost all their seed from wholesale seed houses. Especially at Darmstadt did this trade assume huge proportions. The universal system of clear cutting and artificial regeneration increased the demand for seed to such a point that dealers, in order not to lose their customers, resorted to the importation of foreign seed of the same species. Especially was this done in the case of the common pine (*Pinus sylvestric*) where during fail years in Germany, huge quantities were imported from France, Belgium and Hungary. While of the same species, there were seeds of distinct varieties (*Pinus sylvestris aquitana; P. s. batava* and *P. s. pannonica,* respectively) and, true to their ancestry, gave wretched results in Germany, being slower of growth, poorer of form, and more subject to the diseases common to their new environment. So unsatisfactory were the results and so uncertain the source from which the seed dealers derived their seed, that the Prussian government resolved to secure its own seed from home grown cones.

This experience in heredity is one from which we can well profit. Other things being equal, the native seed of native trees is by far the best for native environment. Were this not so, the law of natural selection would not be true.*

The earlier Prussian "Darren" were rather crude affairs—comparable to a chest of perforated drawers through which the hot air from a furnace below circulated. Of this type is the Eberswalde Darre mentioned in Forstmeister Wiebecke's article. It is not a satisfactory system because of the unequal temperature throughout the room and hence the more rapid drying of certain drawers as against others. All this necessitates sorting and changing—hand labor.

In the Darre at Annaburg an entirely different system is used. Here the cones are dried in two huge revolving cylinders, the liberated seeds fall down a chute into bags. The system is shown in the two accompanying sketches: Fig. 1. A complete cross sec-

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*The interested reader is referred to the masterly exposition of these facts in C. Wagner's, "Die Grundlagen der räumlichen Ordnung im Walde," 1910, Part I.

tion of the Darre, and Fig. 2, showing a cylinder in cross section.

The process in detail with reference to Fig. 1, is as follows: Side tracks (a, a′) lead to the buildings. At (a) the cars filled with cones are emptied and the cones immediately conveyed by a grain elevator (b) either to the storage house (c) or the filling

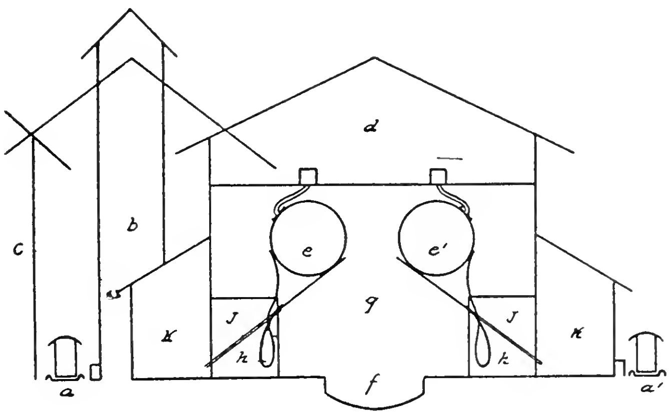

Figure 1.
Complete
Cross Section

a, a′ } Side Tracks
b - Elevator
c - Storage House
d - Filling Loft
e, e′ } Cylinders
f - Grate
g - Engine
h - Bag
J - Shute
K - Bin

loft (d). If to the former, they are spread out not over 18 inches thick on the floor and occasionally shoveled about to facilitate drying. If to the latter, they are shoveled into 6 wooden measures which hold just the proper quantity to fill the cylinders. They are then shot down (like oats from a feed loft) into the cylinders (e, e′) which after closing the 6 doors revolve slowly clock-wise in a masonry chamber heated to an average of 48° C. (118° F.). The construction of the cylinder is shown in detail in Fig. 2. It is made of cast iron, perforated so as to allow the seeds to drop out but forcing the cones to remain. Each is divided into 3 compartments, containing 5 hectoliters ($13\frac{3}{4}$ bushels) for the entire six compartments. The most important device is the conveyors (x, x′) which prevent the cones from clogging and keep the entire mass in perpetual motion.

The heat is furnished from the grate (f) where coal and cones are burned—chiefly the former because of the excellent price received for dry cones as fuel where a hot, quick fire is needed or as kindling for household purposes. In order that the heat in the cylinders may be absolutely uniform, a thermohydrograph*

*Manufactured by R. Fuess, Steglitz bei Berlin, Dünther Strasse 8.

automatically records the fluctuations in heat and moisture content, just as a barograph records barometric variations. These sheets are kept as a permanent record of each day's operations.

It requires from 20 to 24 hours to "dry" green cones, from 7 to 9 hours for ripe cones. The seed released from the cones, sifts through the perforations of the cylinder and falls down the chute (see Fig. 1) into the bag suspended at (h). When all the seeds

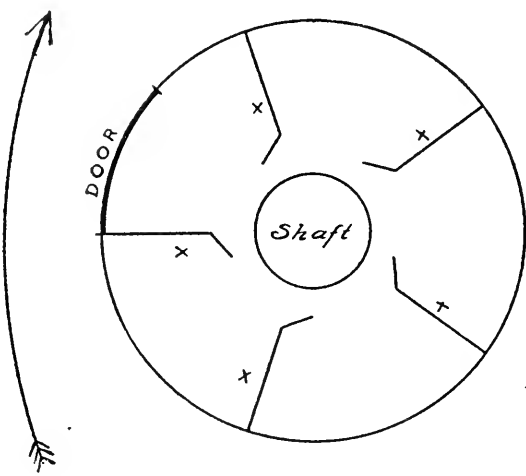

Fig 2
Cylinder in
Cross Section
x - Conveyor

are out, the engine (a 12 H. P. alcohol-gas engine (g) costing 7½ cents an hour to operate) is stopped and the door of each compartment opened. Then the engine is started again and the empty cones automatically drop down the adjustable chute (j) into the bins (k) whence they are loaded directly by elevators into cars on sidetracks (a) or (a').

Operations are usually suspended at night but during rush times the Darre can work all night. Kerosene lamps are used for illumination; of course electric light would be far preferable, but Annaburg is a small town.

The bags of seed from (h) are taken to the Winging Machine. This is a smaller fine wire mesh cylinder with revolving stiff brushes inside. These brushes remove the wings without harm to the seed. From the cylinder the good seeds drop to the final cleaning screens while the wings, dust, and lighter blind seeds are blown off by means of forced draught. The wings are beginning to find a market as packing for ice houses, etc.

After the wings are removed, the seed is screened twice and then placed in large glass carboys. No attempt is made to secure every last particle of foreign matter—such as broken cone scales and the like—but the seed is very clean. The glass carboys each containing from 30 to 35 kilograms (66 to 77 lbs. avoirdupois), have been adapted as more satisfactory than any metal device. They are packed in willow baskets with straw padding; each basket has two handles. Basket, carboy and all, cost about 50 cents apiece. They are preferably made of dark glass—so as to exclude light, that prerequisite of germination. When the carboy is filled it is corked, (with rubber cloth around the cork as a washer) and sealed with pitch. Then the carboys are stored on shelves in a dry dark cellar which (like an ice house) is kept as near 0° C. (32° F.) as possible. In the one at Annaburg the actual temperature was 7° C. (44½° F.) and after several years storage the germination per cent. was practically unchanged.

Sample from each carboy are germinated and the results, together with data as to source, date, condition, etc., entered on each consignment. The shipment to destination is made in regulation sacks and is timed so that the seed reaches its destination just before it is to be used—not sooner.

The Darre at Annaburg needs 5 men: 1 Forster (Ranger) as Darren-verwalter (Superintendent), 1 Machinist, 3 Workmen.

It was built 9 years ago (1902) by a Berlin firm* at a total cost of $23,300. Only one major repair has been necessary since that time.

This Darre turns out annually some 22,000 pounds† of pine seed at an average cost of 5½ cents per pound.‡ This seed has an average germination of 85%, whereas the usual seed from seed dealers has a germination of only 75%.

The saving in seed which this higher germination per cent. means is well set forth in Oberforster Haack's article referred to above. Haack proves that it is entirely wrong to figure that 70%

*Möller und Pfeiffer, Friedrich Wilhelm Strasse 19 Berlin W. 10.

†Usually requires 27,500 bushels of cones costing 35 to 70 cents per bushel.

‡Including cost of cones, the average total is 71 cents per lb.

seed results in seven-ninths as many plants as seed with a germination of 90%; but actually results in only about one half the number—it therefore is not worth seven-ninths as much but only one-half as much. According to exhaustive experiments by Oberforster Haack the plant per cent. (Pflanzenprozent) always lags behind the germination per cent. (Keimprozent). The real worth of a seed is determined by the plant per cent.—*i. e.* the actual number of plants resulting, under normal conditions, from a hundred average seeds.

Assuming 85% as the normal germination, the factors to be used in determining the amount of seed actually to be sown for the different germinations per cents. is as follows:

Germ per cent.,	65%	75%	85%	95%
Plant per cent.,	14%	22%	31%	44%
Factor,	2.2	1.4	1.0	.7

If therefore, the directions call for sowing 5 lbs. of 85% (normal) seed per acre, 11 lbs. should be used if the seed has 65% germination, 7 lbs. if 75% and only 3½ lbs. if the germination is 95%.

Prussia is now producing all the seed which its government forests need. It does not sell its seeds since this would interfere with the private seed industry. The various Darren are placed centrally and to them are sent the cones collected on the various forests. It is a rational, economical procedure based on natural laws which we in America would do well to bear in mind, as we approach the problem of supplying the seed for our increasing operations in artificial regeneration.

NORTH AMERICAN SPECIES IN HUNGARY.*

By Karl Petraschek.

In reference to the success of the American trees cultivated in Hungary last spring, reports have not yet come in. But in regard to a certain quantity of seed of the *Pinus ponderosa,* var. *scopulorum,* and *Pinus lambertiana,* which was planted in the nursery at Grehenz in the shifting sand desert of Doliblat in southeastern Hungary, I was able in the latter part of September to personally establish the success of this experiment. Although Europe, as is well known, has been subject the past year to extreme heat and drought, and damages were naturally more frequent in the Hungarian steppes, all the seed of the *Pinus ponderosa,* var. *scopulorum,* sprouted, and the greater part of the *Pinus lambertiana,* while the young plants, especially of the first-named species, showed, at the time I alluded to, a strong and healthy development.

It might be of interest to you to learn that in the afforestation of the desert of the shifting sands of Doliblat, and also in the sandy plains of Hungary, the principal part was accomplished not by the aboriginal species, but by a North American species, namely, the *Robinia pseudacacia.* But the *Robinia* only flourished on the sandy portions rich in nourishment. On very fine flour like sand and alkali soil the *Robinia* is a failure. On sandy tracts which constantly, or at least for a long time, have a high water table, the *Robinia* ceases to develop as soon as its roots reach the water. Besides *Robinia,* the Canadian and Silver Poplar have been naturalized on these sandy tracts of Hungary. The American Ash also flourishes better on damp soil than the native species. In Doliblat, experiments have been made with other North American broadleaf species and conifers, but of all the different species, only *Juniperus virginiana* can be noted as worthy of cultivation, for the reason that like *Pinus austriaca,* this juniper develops well on the firmer portions of these shifting sands (the hollows). The seed of *Juniperus virginiana* underwent the fol-

*Extract from letter to Mr. Zon, Chief of Silvics, U. S. Forest Service.

lowing treatment before sowing: The berries were rubbed apart and laid in wet ashes, so that three times as much ashes as berries were mixed with them, leaving them in the ashes three weeks. The ashes were then washed out, and the berries laid in boxes of wet sand, one layer of berries to four or five thicknesses of sand. These were then dampened and buried in the ground from the spring until the next autumn when the seed including the sand, was sown broadcast. They sprouted the following spring.

Vienna, December 31, 1911.

A later letter refers to the decline of the Slavonic oak forests.

GIRDLED TREES.

That girdled pines can live for years has been more than once demonstrated. (See U. S. Forestry Division, Bulletin 22, White Pine.)

Mr. W. B. Barrows furnishes an example of a Loblolly Pine found in Worcester county, Md., girdled in April, 1906, and photographed in June, 1910. Note increase in diameter above the cut: at the lower white dot the diameter is 10 inches, and at the upper it is 11 inches. This tree was still living in 1910 but had a thin crown bearing many cones, several hundred at least. The tree at the left had a much denser crown but bore only 4 cones. The soil is a loamy sand. The water table is about 6 or 8 feet below the surface.

TWO MINOR WOOD INDUSTRIES.

BY C. S. JUDD.

I. A Cut Shingle Mill in Washington.

Back of Boyd's, Washington, in the clearing of a dense forest of western red cedar, Douglas fir, and grand fir stands a unique mill where shingles are not sawn but are cut from western red cedar bolts. Here shingles are sliced from the softened blocks and fall away from the knife in a manner that reminds one of the days of the French Revolution when that cruel instrument of death, the guillotine, was in active use.

Standing on a raised platform in the center of his establishment the proprietor, for it is he alone that is able to manipulate successfully the machine of his own invention, presses the blocks against the swift-moving knife and slices off on an average almost 100 shingles to the minute. From his elevated station he can direct all of the various operations and see that none of his assistants falls behind in his work.

The inventor of this machine gathered his ideas for it from a stave cutter that he used to operate back in Arkansas. His first shingle slicer was operated by hand, then by horse power, and finally by a 10 H. P. engine with steam furnished by a 15 H. P. upright boiler. The whole establishment cost him in the neighborhood of $1,250 and eight men are required to operate it as follows: one engineer, one cross-cut sawyer and peeler, one bolt splitter, one vat man, one knife operator, two trimmers, and one packer.

In this mill the butts of cedar trees that are discarded in the process of pole and pile cutting, either on account of their size or on account of center rot are used and $4.00 per thousand board feet log scale is paid for them delivered on the main skidroads near the mill. It is found preferable to cut and split the bolts from the logs just before they are wanted at the mill because when split in the woods they check so badly in the process of seasoning that they can not be used in this unusual mill where only quarter-cut shingles are produced.

The logs are first peeled and then rolled on to a small saw carriage which takes them to a slow-moving drag-saw operated by belting from the engine. Here they are cut into bolts exactly 16 inches long.

The bolt splitter with the aid of a steel rule then carefully measures off on one end of a bolt two lines which cross each other at right angles exactly at the pith. The bolt is then split apart into quarters with a froe and mallet. This work is most carefully performed since the shingles have to be cut on the machine almost exactly along the radius of the bolt.

The bolts then go for the softening bath into two steam boxes each 8 feet long, 5 feet wide, and 5 feet deep and lined with tin sheeting. A heavy flat hinged top, similarly lined, closes on the boxes like the top of a tool box. Into these boxes the live steam from the boiler is conducted through pipes. The bolts are kept in this bath for about three hours when they become a greenish-gray color and so soft that one can press his thumb nail quite deep into the yielding wood. All knots are thus sufficiently softened so that the knife cuts through them as through cheese.

The steaming bolts are lifted from the vats by means of a spike-shodded stick and placed in a trough conveniently located to the hand of the knife operator.

The knife itself is made of fine thin steel 18 inches long and about 6 inches wide and is spanned in a sash frame which moves up and down severing one shingle from the block at each stroke. The frame is moved up and down in stationary hardwood grooves by a piston-like shaft the upper end of which is attached by a hinged joint to the lower end of the frame and the lower end to a point on the circumference of a wooden wheel which is revolved by a belt from the main flywheel of the engine.

Directly below the spanned knife on the frame itself is the gauge which consists of three round iron rods each ½ inch in diameter set vertically in the woodwork of the frame. The center rod, directly below the middle of the knife, is set in a plane 3/16 inch (the thickness of the middle of a shingle) back and away from the plane of the knife. The other two rods on either side are similarly placed but in planes 5/16 inch (the thickness of the butt end of a shingle) back from the plane of the knife. The sash frame in its vertical movements just clears a metal-faced shelf set about 3 feet above the floor of the platform.

A softened bolt is placed horizontally on this shelf and during the upward movement of the frame is pressed against it so that the middle of the bolt touches the middle gauge rod. The bevel of the shingle is secured by pressing one end of the bolt against one of the side gauge rods and then the other end against the other gauge rod alternately with each stroke of the frame, the center gauge rod always acting as the axis or turning point for this alternating horizontal movement.

The bolt, while being sliced, is so held that each stroke of the knife cuts off a shingle along its radius. The shingles are thus sliced off alternately from each of the flat sides of the bolt which is constantly turned so that the bolt becomes smaller and smaller and finally is too small for the operator to hold with safety. As a rule, the narrowest shingle cut in this machine is 4 inches wide.

The shingles fall from the knife down a chute to the trimmers. These stand before two small circular saws and trim off all knots and uneven edges. The finished shingles are then flung into a bin where the packer bundles them in a packing frame, about 250 shingles in a bundle. The shingles dry out in ten days after manufacture. They are all 16 inches long and from 4 to 10 inches wide. The first grade designated *A* comprises about 87 per cent. of the mill run of shingles and the second grade or "seconds" comprises the remaining 13 per cent. The average daily capacity of this shingle mill is 32,000 shingles but when in good running order it can produce 40,000 in a day. A sawn shingle mill of the same size could put out only about from 22,000 to 25,000 shingles a day .

The cut shingles are sold on board the cars at Boyd's, a four mile wagon haul from the mill, at $2.50 per M. for the first grade and at $1.75 per M. for "seconds." The proprietor and operator of this mill and his partner each earns a net profit of from $16 to $22 per day while the mill is running at its full capacity.

The main drawback to a cut shingle mill lies in the difficulty of keeping the knife in proper condition. The finely tempered steel is hard to sharpen and the proper setting of it in the sash is a still more difficult and delicate task. A great deal of knack is also required in manipulating the bolts so that they will be properly presented to the keen edge of the quick falling knife.

The advantages of this kind of mill are many. It can be readily moved from one part of the forest to another so that thereby a great deal of "junk" can be utilized which would otherwise be discarded and left to rot in the woods. This advantage is especially true in regard to the short butt ends of telephone poles and piling, affected with center rot, which at present can be used for no other purpose. This type of mill even makes possible the use of the shell of decayed butts down to 5 inches in thickness.

There is no waste in kerf or sawdust or in trimmed ends and, therefore, from the same amount of timber a greater number of shingles can be produced by this type of mill than by a sawn shingle mill. The shingle produced is of high grade, has a smooth surface, and is always a quarter-cut shingle.

2. *A Log Pipe Plant in Washington.*

At Curlew, Washington, not far from the Canadian boundary, there is a most interesting establishment turning out solid wooden pipes from ten foot logs.

While making the customary wait there recently for the down train, I strolled up the dusty main street of the village and was attracted by the chug chug of a gasoline engine to a spacious shed, not unlike a blacksmith shop in appearance. On closer approach, I found outside the shed a pile of small Douglas fir and western larch peeled logs, each 10 feet long and from 8 to 10 inches in diameter. From their very slight taper and the absence of knots they seemed to have been cut from trees which had been naturally well pruned in a close growing stand.

At the back of the shed two men were loading the logs, now converted into neat looking wooden pipes, onto a wagon.

Within the shed I found that a 5 H. P. gasoline engine furnished all the power for the simple plant, which at that time was being operated by only one man. First, a peeled log was placed in a trough-like receptacle where it was held firmly during the process of boring. This operation removed a core, 4 inches in diameter, from the center of the log and was performed by a special boring instrument slightly more than 5 feet long. The cutting end of this instrument resembled a half cylinder, the very end of which sloped up to a spoon-shaped point. First, one end of the log was bored for a distance of 5 feet. Then the log was reversed and the process repeated at the other end. So true is the alignment of this apparatus that the bore runs almost absolutely straight through the log.

The next and final step is to shape the ends of the log. This was performed on a different machine which bevelled one end and reamed the other while the log was held firmly in place as in a vise. This completed the simple manufacture of these solid, wood pipes.

The bevelled end of one log fits so perfectly into the reamed end of the next that no cement of any kind is needed to make the joining complete. Each finished log pipe weighs about 100 pounds so that it is easily handled by one man.

The green, peeled logs are bought at the plant for 15 cents apiece or 1½ cents per linear foot. After being manufactured into pipes, in the manner described above, they are sold for 9 cents per linear foot. The whole plant does not cost more than $500 and the daily capacity is from 700 to 800 linear feet. One four horse team can haul 450 linear feet of the manufactured pipes and 1,500 linear feet of them constitutes a carload.

The use of wooden pipes of this type is most economical near the source of the timber supply. They are a good substitute, under many conditions, for iron pipe especially where transportation costs are excessive and the suitable kind of timber is abundant. As compared with iron pipe in this particular region where I found them being manufactured, the wooden pipe described above costs only one-half as much as 2-inch iron pipe and less than one-third as much as 4-inch iron pipe.

This class of wooden pipe is, naturally, best suited for use where no great pressure is encountered, as in leading water down from a natural spring on a gently sloping hillside. The pipe must be laid in a straight line and it is usually buried completely under ground. Untreated pipe used in this way is said to last for at least ten years and when treated with creosote and kept full of water is reported to have lasted for thirty years.

CURRENT LITERATURE.

Statistik und Verbau der Lawinen in den Schweizeralpen. By Dr. J. Coaz. Bern, 1910. Pp. 126, pls. 28.

Our observations of avalanches in this country have so far been recorded only where one of fatal character has occurred, and little, or nothing is known of the many thousands which slide down every year, leaving their tracks for decades to be seen probably by a lone prospector or sheep herder, and nobody knows when, how, and under what conditions they occurred. The localities where avalanches occur are practically within National Forests and it will, therefore, be left almost exclusively to Forest officers to obtain data of future practical value.

The fatal catastrophe during the winter of 1910 along the Great Northern Railroad in the Cascade Mountains offered an opportunity for the Forset Service to make the first study of avalanches which will become more and more disastrous with the development of mountainous regions.

In order to spread information in regard to the character, origin and prevention of avalanches to forest officers and others interested on that subject we have to seek foreign literature. For this purpose there is no other land on the globe which furnishes more information and statistics than Switzerland. Switzerland, with one-fourth of the size of the State of Washington, and with twelve times denser population, has records which are singular in character. The federal Forest Service of that country has kept a record of about 10,000 avalanches which have occurred since 1872, and it has spent about 2,000,000 francs for their prevention. The book reviewed contains beautiful pictures, avalanche maps, and records, the author of which will remain an authority on the subject for many years yet to come.

The statistical observation of avalanches encounters very many difficulties. In the first place a sharp line between a snow slide and an avalanche does not exist. Besides the extent, we must consider the locality and the danger connected with it. An avalanche in higher altitude above the timber line may be called a snow slide, and what is merely a snow slide when occurring in a developed country may be called an avalanche. In order to illustrate the main points to be considered in recording statistical data in tabular form as used in Switzerland the following headings may serve.

The cause of the origin of the avalanche determines its character. There are four kinds distinguished: Dust, Top, Ground and Glacier avalanches.

(1) Dust Avalanches.

They originate usually during cold and stormy weather in high altitudes. The loose snow begins to roll like sand from steep barren slopes, constantly increasing in volume as its descends. The fine snow is carried by the wind, the heavier rolls on the ground, the whole mass becomes compressed and is preceded by a hurricane, the effect of which is usually stronger than that of the avalanche itself. Such avalanches often break loose during the time it snows, or are started afterwards by wind. The velocity of such snow slides is very great, and cases are known in which they travel four miles per minute and sprinkle snow-like powder over large areas.

(2) Slope or Ground Avalanches.

If a great amount of snow falls during warm weather it remains more compact and may start to slide at the same time over a wide area, somewhat like a mass of wet snow sliding in a body off the roof of a building during a sudden thaw. The speed is greatly reduced through friction by sliding over the ground. These avalanches are as a rule not accompanied by a hurricane. If such a slide becomes wedged into a canyon it may then also be a "canyon slide." Although dust and slope avalanches differ in character and origin, they vary in such a manner as to exhibit a number of intermediate stages between the typical forms. A dust avalanche may develop into a ground avalanche by taking with it hard snow, debris and rocks. On the other hand, a ground avalanche may end in a dust avalanche as a waterfall disperses into small particles by falling over rocks, or through the resistance of the air.

(3) *Top Avalanches.*

If snow commences to slide over a previously formed snow crust it is called a top avalanche. If such slides break through this crust they may develop into one of the first two mentioned forms. Such slides originate on south slopes where snow melts and freezes frequently.

(4) *Glacier Avalanches.*

They consist, as the name suggests, of bodies of ice that break loose from glaciers. They occur mostly during the month of September when warm weather lasting for a period has thawed the ground, and the pulling force becomes greater than the adhesion. At the terminal the accumulated ice remains frequently several seasons. These avalanches are always attended by a thunder-like noise. This noise may be the origin of many names given to rivers, as Thunder Creek, in the Cascade Mountains in the State of Washington. Hurricanes which precede these avalanches are of the worst kind and damage the forests by breaking and uprooting trees, splitting the bark on the upper hill sides, stripping the limbs and branches from the tree.

Small bodies of snow or avalanches with a short course are called simply snow slides.

Regarding the period of occurrence, whether occurring once or several times in a year, periodically, or rarely, depends on many factors, such as topography, prevailing winds, snow drifts, amount and quality of snow, the forms of snow fields, new burns, or wind breaks, etc. In some places in the Alps, avalanches occur only in many decades, so that only the oldest people can remember them, whereas in other places new ones occur frequently and in places where no one expected them, especially during stormy weather. To the subheading "Season" we may add that according to statistics of 1878-88, out of 1,200 avalanches, 45% occurred during the month of February, and 24% during the month of March. The breaking loose of avalanches depends mainly on the wind and temperature and may occur during any time of the day. Cold and stormy days cause dust avalanches especially during the winter, or on cold spring days after a heavy snowfall, whereas ground avalanches mostly occur in warmer weather, caused either by wind or sun. If caused by a chinook a ground avalanche may occur by night in any locality, because of the warm wind blowing. If caused by the sun it is likely to occur on a south slope during the early evening. The Italian language expresses this very correctly by calling a dust avalanche a "cold avalanche" (avalanga fredda) and a ground avalanche a warm avalanche (avalanga colda).

The statistics show that 60% of the avalanches start on rocky ground, and only 6% in timber or from brushy places. It appears, therefore, that the soil cover has a great influence on the origin of avalanches. The taller the trees and the less they are swayed by the wind near the ground, the closer does the snow hug the ground. In a closed stand of timber the formation of an avalanche is impossible. The higher the altitude, the closer do the shrubby species grow to the heat-reflecting soil. The alder is usually the first species which covers the slideways of avalanches. These alder brakes can be seen for a long distance on places where slides occur frequently. The geological formation of the rocks has also an influence on the origin of avalanches. Stratified rocks, like slate, increase the number, particularly if the strata are more or less parallel to surface of the slope; similarly smooth rocks without soil cover or brush protection, and especially if water from many small springs seeps through the soil. The safest are igneous rocks, as basalt or granite.

Other causes which start avalanches are: (1) Movements of loose snow, or steep slopes; (2) Game or men: (3) Earthquakes, blasting, trains, shots, or even the ringing of church bells, echoes; (4) Wind, breaking off of rocks, of over-hanging snow drifts, of icicles and limbs; (5)Heat from sun, reflection of heat from rock walls; (6)Extreme changes from warm and wet to cold weather, or vice versa. The range of latitude in the Swiss Alps, compared with that of our mountain regions, is very small, and the data under the sub-heading "Absolute Elevation of the Starting Point" relate only to that confined region.

During glacial times there seem to have been practically no avalanches, but they increased during the post-glacial period, and reached their climax before vegetation was established on these old glacial fields. It is interesting from the ecological point of view that in the Alps a Rhododendron and a Boxelder have

The figures entered show the result in percentage of observations from 1872—1910 on the basis of about 10,000 avalanches.

Water-shed		Kind of Avalanches					Period of Occurrence: Annual usually		Period of Occurrence: Periodical	Period of Occurrence: Rare	Season			Origin		Origin			Surface of Starting Point				Avalanche Extends Through				Avalanche endangered			Extent of Avalanche Track		Absolute Elevation of the Starting Point				
Name	Area	Ground	Dust	Glacier	Mixed	No. of A	Once	Several Times			Fall	Winter	Spring	Within Timbered	Above Area	Rocks	Grass	Timbered or Brushy	Rock Boulder	Grass	Brush	Meadows	Timber	Boulders, Rocks	Cultivated Land	Timber	Farms	Rock and Bridges	Building	Length in Miles	Area	Under 4500 ft.	4500—6000 "	6000—7500 "	7500—9000 "	9000 and more
		30	9.6	0.40	60		23	55	15	7	13	40	47	30	70				60	34	6	40	24	33	2	40	30	15	15	1/8-4		4	2	28	40	4

survived through the claimed four glacial periods and that other species returned again only in a different mixture from that in which they used to occupy the valleys, during other glacial periods.

It is also believed that valleys have changed considerably in the last period, after the pressure of the ice that caused falling of mountains had ceased, and that the lateral moraines have been carried down the hillsides, and the re-establishment of forests has crowded the avalanches into their present localities. As the population increased and men were depending on the cattle ranges in higher altitudes they soon commenced to get wise and learn to build their homes on other places, as below the forests, on hills, etc. But the forests can give protection only as they remain in closed stands which is best secured if interference by man is prevented. This led to the creation of "Ban Forests" or protection forests as early as in the year 1342. Since that time protection forests have been made wherever the necessity for them existed, and no less than 322 copies of proclamations of Ban Forests are in the possession of the Protective Service of Switzerland comprising the periods from 1535 to 1777. These forest reservations were created, but nothing was done for their future. Grazing of sheep and cattle continued, litter was taken, reproduction commenced to fail, old stands deteriorated and became too open to afford sufficient protection. After a hard fight with the cattle and sheep owners, ban forests were brought under a systematic forest management These forests are managed under the selection system in horizontal strips.

The construction works of early ages were merely of a defensive nature, restricted closely to the object to be protected, and consisted of walls erected in front of churches and houses with the object of dividing or breaking the avalanches. At the beginning of the ninteenth century more radical methods were employed against the attack of avalanches in their "*status nascendi.*" The construction works for the *prevention* of avalanches are divided into works which are confined to the starting point and those which are for the purpose of deflecting the slides from objects of special protection. To the first, the most important group, belong all those which increase the friction between snow and the ground, or prevent the breaking loose of snow. It is then extremely important to know the starting point. Local reports are not always reliable, neither can one make positive conclusion from the starting of one avalanche, as the conditions of the origin of the avalanches, such as other kinds of winds, different snow, new burns, etc., may vary the conditions. If the starting point should be difficult to locate it is always safe to build rather too high than too low so that in case the avalanches should re-occur the work would not be swept away. The starting point of an avalanche on slopes is very frequently found on the change of grade, and to such points attention should be specially directed, also on places where overhanging snowdrifts are amassed, and these cases should be carefully observed.

The constructions vary with the topography and local material at hand, and consist mostly of posts, wood or iron, high stone walls, terraces and banquettes, snow catchers and ditches. If these constructions are within the timber line (timber line is here understood not the present line but the line which can be reached by artificial planting), the main purpose is to establish a forest between these constructions in order to make the protection as permanent as possible. This has been the general practice in most of the constructions of the past to establish a forest.

The second group, which treats of constructions to deflect avalanches, consists mostly of high stone walls in order to direct the snow into places where less or no damage can be done.

Under the revised federal law of Switzerland expropriations for the creation of new ban forests can be made. The most extensive works of this kind are conducted by railroads.

Up to the present out of 268 larger constructions in Switzerland, 200 are completed at a total cost of two million francs, 54% of this being paid by the federal Swiss government.

What is done in the Alps is, however, with us entirely out of the question from practical points of view. The value of the property endangered would not warrant any great expense in protecting it, and the territory over which construction work would have to be done in order to protect even one valley is large.

It may be that sooner or later the rapid development of the West may require that at least statistics of avalanches be kept.

MAX ROTHKUGEL.

Forestry in New England. By Ralph C. Hawley and Austin F. Hawes, New York; John Wiley & Sons. 1912. Pp. 749. Illustrated.

It is fitting that the first general treatise on practical forestry to be published in this country should apply specifically to New England, for it was there that the art found its strongest supporters when it was new in this country as it is there that the opportunity for the practice of forestry is matched by that in no other section. With this important working field and a volume of information not available for any other region it is yet unfortunate that the authors have made so bulky a book. If it were half the size it would be proportionately more valuable, for in these days everybody wants his technical treatise, as well as his lighter reading, condensed to the last degree, and it is evident that this work could have been greatly abbreviated without loss of substance.

As the authors say in their preface, the book "aims to be for the woodland owner what many others are for the agriculturist." In this it clearly fulfills its purpose; technical foresters know, or should know, how to supply any deficiency from their point of view.

Part 1, General Forestry, gives an admirable review of accepted principles. Even a layman would have no difficulty in applying them to a much wider territory than New England. The work avoids the fault of so many German books in that, avowedly dealing with a section in which conditions are practically uniform, it makes no effort to deduce general laws or rules of practice from local observations. New England is distinctly a forest region, and one may safely prophesy that through forestry the land will ultimately be brought to its highest productiveness. And this expectation loses no force when other parts of the country with more favorable climate are named in comparison, for nearby markets and manifold resort interests will neutralize any disadvantage of that kind.

In the chapter on silvics the composition of a forest and the recognized forest types are discussed. Under silvicultural systems the various methods of forest utilization and reproduction are considered, not always as clearly as is desirable however, for both in the text and in the illustrations there is sometimes a doubt. For one thing the terms "system" and "method" are used indiscriminately or indefinitely. One need not be a stickler for form or for authority when one insists that in the development of a new profession every term and expression must have a definite meaning. All this is well shown on page 26 where figure 8 rather ineffectively illustrates the *"system"* of clear cutting in strips, because the succession of fellings, or cuttings, is not made plain. Diagrams of this sort when carefully prepared are a most valuable means of illustrating work of this character. Fortunately most of those employed are entirely satisfactory.

In chapter III the most important New England trees are considered specifically. The presentation is direct, and perhaps as brief as possible, though in view of the many times that matter of this kind has been printed one questions whether it was necessary to repeat it.

The detailed directions for planting and making improvement cuttings, form in many ways the most important part of the book, for here those who are attempting to handle woodlands will find most of their immediate problems considered. In discussing available species for planting the authors especially recommend red pine, although the work in general lays stress upon the availability and value of white pine. It may be questioned whether there is not danger in placing so much dependence upon a single species. The recommendation of red pine therefore needs emphasis. Another point of value made is that clear cutting followed by planting is a recognized practice worthy to be followed in many situations. Overemphasis has undoubtedly been placed upon the selection method, especially in spruce forests subject to wind-fall and in mixed forests from which most of the valuable species have been removed. Very wisely the list of insects and fungi is limited to the forms that are commonest or most to be feared.

The chapter on forest fires is rather general. Something more specific regarding preventive measures would be valuable while from the evidence submitted regarding the limited fire season in New England some more encouragement about the comparative ease of controlling fires might be presented. There is little doubt that except in the infrequent years when the normal rainfall is lacking the forest fire hazard is not so serious as it is in other parts of the Country. To the statement made on page 57 that "beech is a good fire resister" an emphatic dissent must be recorded.

The chapter on timber estimating and valuation is another of great practical utility, as is also that on the growth of trees and forests.

Readers of the Quarterly will find much in the first part of this book of value for occasional reference. It may be suggested that this value would have been heightened by more frequent paragraphs, headings, or marginal indexes. The good general index is not enough.

Part II deals specifically with New England forests and their management. Unfortunately this part even more than Part I is written in the narrative form rather than in a way to serve for readiest reference. It also frequently repeats the substance of what has already been presented.

Accepting these features as minor faults the section contains much definite information regarding the original condition of the forests, the extent to which they have degenerated, and a detailed discusssion of the various regions by forest types. Especially to be commended are the facts given relative to the present prices of stumpage, of milling, and of lumber, the cost of planting and the expected returns from plantations. This is the kind of information that is wanted. In this connection it may be observed that the cost of planting in New England is approximately the same as in European countries, and that recorded yields of New England forests when fairly managed compare favorably with those in Europe to which reference is so often made. On the other hand the authors appear to have accepted without question the oft repeated claims that solely as a result of intensive management the State forests of Europe have greatly increased their yield. (pp. 412, 413). No doubt a large part of the increase is due to management. It remains however that no small share represents simple maturity or greater age, for it is known that many such forests were planted within a century and are only beginning to yield timber. And let a protest be made against the use of such expressions as "work-wood per cent." Percentage is a legitimate term and if "timber" and "top-wood" are not fair equivalents for the German *Nutzholz* and *Reisholz* surely the language can afford something satisfactory.

The statistics of New England's lumber interests (p. 243-247) indicate the importance of the subject, especially in connection with the evidence that there is no need ever to suffer any material reduction in the output. It would have satisfied many people to know that whereas the pulp wood production of New England is 60 per cent. of the whole output, the pulp wood production of the whole country is less than 2 per cent. of the total lumber cut. The argument of the authors that the ability to use smaller wood for pulp than for saw logs is a positive advantage in practical forestry is of course sound.

By way of caution regarding some of the statements made may be noted that on page 316, "there seems to be no reason why red or scotch pine would not thrive on the pitch pine soils * * * and produce a much better grade of lumber and give a higher yield." It is doubtful if the two former species are ever satisfied with the poor soil on which pitch pine often makes a fairly good growth. And one wonders where is the necessity for piling the brush to be burned on a clear cut area as is indicated under Figure 123.

In the chapter "The Progress of Forestry in New England" very satisfactory references are made to the organizations that have been created in each State for the improvement of the forests. The one weakness in all is the lack of effective provision for controlling fires.

On the subject of forest taxation the authors are wisely conservative. It may be entirely true that the general property tax is inapplicable to growing forests; and it may be that the levying of a tax on that basis works hardship or injustice. Nevertheless we must admit that to modify anything so firmly established will require a better argument than can be made on behalf of a single class of property or a single interest.

The last chapter, and the appendix, deal with the possible yield of New England forests. The tables published furnish a means of answering the definite critical question, how much? that in the last analysis must always determine whether or not forestry is practical. The fact that a few of them do not clearly show the basis on which they are constructed, or how they are used, does not materially affect the value of the whole. For instance, it is not especially important to determine the relative values of Tables XXXV and XXXVI, both giving the yield of white pine in board feet.

It would have been possible to review this book and find only praise for the efforts of its authors, for apart from the fact that it is thus early in the field it possesses merits far outweighing the slight inaccuracies or deficiencies to which reference has been made. Its lack of condensation is a positive disadvantage, but with that let serious objection end. The assumption of the authors that forestry has come to New England to stay may be accepted. Surely there is no need of special pleadings in a work like this. And it is not needful that one agree with all the conclusions or recommendations. The authors themselves would be the last to insist that the facts they publish are the only facts, or their word the final word. If a suggestion may be made it is that the two parts be republished separately. There is room for a popular manual of forestry like Part I, and also for one giving the special information about the forests of New England contained in Part II.

A. G.

The Wilting Coefficient for Different Plants and Its Indirect Determination. By Lyman J. Briggs and H. S. Shantz. Bulletin 230, Bureau of Plant Industry, U. S. Department of Agriculture. Washington, D. C. February, 1912.

The wilting coefficient is defined by the authors as the moisture content of the soil (expressed as a percentage of the dry weight) at the time when the leaves of the plant growing in that soil first undergo a permanent reduction of their moisture content as a result of a deficiency in the soil-moisture supply. It is the point at which the forces opposing the further removal of soil moisture exceed the osmotic force exerted by the cell contents of the plant;

the point at which a part of the water transpired will be supplied from that stored in the leaf tissues and a loss of turgor will result. The wilted condition of the leaves is regarded as permanent when they cannot recover in an approximately saturated atmosphere without the addition of water to the soil. In case of plants having aerial water storage tissues or thick, heavy leaves this procedure cannot be followed, since they have no well defined wilting point. The investigators, however, were able to determine the wilting point by an ingenious device delicately balancing a potted plant in a horizontal position. As the plant loses water through transpiration, water will move from the soil to replace the water lost from the plant and the soil end of the balanced structure will become lighter and rise in consequence. When the soil is no longer able to supply the water to the plant at a rate sufficient to meet the transpiration requirements, the plant itself will begin to lose water from its storage tissues, will become lighter, and hence the plant and the balanced structure will begin to move upward. The moisture content of the soil at this point is the wilting coefficient. The oscillations of the apparatus may be recorded by a pointer and scale.

The usual view presented by text books on plant physiology and plant ecology is that some plants are capable of reducing the moisture content of a given soil to a lower point than others, in other words that the non-available moisture varies according to the kind of plant used as an indicator. As the result of over 400 experiments on this point the authors conclude that the differences exhibited on the wilting coefficient by different species of plants in the same kind of soil is very small, the maximum values being only about 10 per cent. greater than the minimum values. On the other hand when the same species is grown in different kinds of soil, the values of the wilting coefficients may vary by 3,000 per cent. in the case of extreme soil types. The results of the experiments indicate that to a very great extent the variations in the wilting coefficients for different plants are dependent upon the degree to which the roots of the plants penetrate every portion of the soil mass.

The wilting point according to the authors, does not mark the minimum limit of moisture that is available to the plant, for it is shown that water is steadily removed from the soil by dying and dead plants and that the limit is reached only when the soil moisture comes into approximate equilibrium with the moisture content of the air. While from a physical standpoint such water may be considered available to the plant, yet from the physiological standpoint it is non-available, since no vital process, no growth at least, takes place when the leaves are permanently wilted. The authors also found that the wilting coefficient is not materially influenced by the dryness of the air, by moderate changes in solar intensity or by differences in the amount of soil moisture available during the period of growth. The latter means that when plants constantly supplied with varying amounts of moisture during the growing period were allowed to dry out, the amount of moisture in the soil at the wilting point was practically the same in each case.

Certain points made by the authors do not seem clear to the reviewer. For example, on page 21 one reads that the soil moisture content at the wilting point is not dependent to any material degree on the age of the plant. Yet on page 56 the authors state that the differences observed in the wilting coefficient for different plants are largely due to the more perfect root distribution of one variety as compared with another. Certainly the root distribution of a plant varies from the seedling stage to maturity. If such variation in mature plants of different species brings about a variation in the wilting coefficient, it would seem that a variation in the root distribution of a single plant at various stages of its development would produce similar results.

Under the discussion of indirect methods of determining the wilting coefficient, the authors give formulae to determine such coefficient when such things as the moisture equivalent, the hygroscopic coefficient, the saturation coefficient and the soil texture are known.

The experiments described in the bulletin were made with a great variety of cultivated plants. Similar experiments with tree seedlings are very much to be desired.

C. D. H.

The Forest Conditions of the Ozark Region of Missouri. By Samuel J. Record. Bulletin 89, Missouri Agricultural Experiment Station. Columbia, Mo. 1911.

The bulletin is a result of the coöperation of the State and the U. S. Forest Service. The forest conditions are described by counties and then in general by forest types. The White Oak-Black Oak type makes up the bulk of the timberlands of the region. In an average stand the leading species occur about as follows: White Oak 60%, Black Oak 23%, Hickory 10%. The Black Oak, however, predominates on the drier, more stony situations, especially in the less deeply dissected portions of the Ozarks. The scrub oak type, consisting chiefly of Black Jack Oak and Post Oak prevails over the barren plateaus and ridges. The shortleaf pine—hardwood type occurs in a large block in the southeastern corner of the region. Black Jack and Post Oak become dominant after the cutting of the pine, and on about 80% of the area most of the pine has been removed. Only the defective trees are left from the lumbering operations, and as their progeny is very generally killed by periodic fires or crowded out by the more aggressive hardwoods the regeneration of commercial pine, with a few exceptions, is at a standstill.

The silvical characters of the principal species are given in detail and the author makes the usual recommendations in regard to forest protection and management.

As a whole 60% of Missouri is covered by woodland, but only a small per cent. of it consists of merchantable saw logs. The character of the forest, however, is particularly adapted for the products of the cooperage industry and the value of such products in 1905 amounted to 11.6 million dollars, somewhat greater than the value of the saw timber.

C. D. H.

Eighth Annual Report of the State Forester of Massachusetts. By F. W. Rane. Boston, Mass. Pp. 154.

This report is similar in character to those of the last few years. One advantage of this similarity is that the reader readily recognizes the great and steady growth that is taking place in the work of this office. The list of employees given on pages 10 to 21 inclusive, indicates the extent to which the organization has been developed and the lines along which it is working.

"General Forestry" and "Moth Work" still form the two main divisions and each is reported on separately. An improved forest fire policy is considered the most important forward step in general forestry. Under this newly established system the state is divided into five forest fire districts each in charge of a district forest warden, all reporting to the state fire warden. For discovery of fires fifteen main lookout stations strategically distributed to cover the entire state, have been located. Through telephone connections with over 1,500 town forest wardens notice of fires can be quickly given. Very few states, even those using the same general method of protection, have such a well equipped organization and as the different individuals become trained in their duties, mastery of the forest fire problem is to be expected—and this in spite of the fact that the forest fire hazard is unusually great in Massachusetts.

Under "Moth Work" the most interesting portion is that dealing with "The Future of the Moth Work." While the conclusions under this heading are not as definite nor as favorable as could be wished, the impression is given that in Massachusetts the moths can finally be brought under control, although their spread westward, while being retarded, has not been stopped.

It is shown that the situation in New Hampshire and Maine is already serious, and the advance of the moths into other states is hinted at. As the problem is evidently becoming of national or at least of sectional rather than of state importance, great financial support by the Federal Government is advocated. New methods of fighting the moths, especially spraying with the aid of more powerful apparatus, have been advised, greatly reducing the cost.

R. C. H.

The Wood-Using Industries of Illinois. By Roger E. Simmons. U. S. Forest Service in Coöperation with Department of Agriculture, University of Illinois, Urbana. 1912. Pp. 164.

There are 1,216 wood-using industries in Illinois, consuming annually more than one and three-quarter billion feet, board measure, of wood costing over 51 million dollars. Over 84 per cent. of the wood used was grown outside of the state while the source of the remainder was not specified. Black oak is the only species demanded by the wood-users which the forests of Illinois entirely supply. Chief among the native grown woods are, cucumber, 35 per cent.; tupelo, 15 per cent.; sycamore, 14 per cent.; cherry, 13 per cent.; black walnut, 11 per cent. Of the six leading species only 2 per cent. of the white oak, 5.5 per cent. of the red gum, and little more than 1 per cent. of the sugar maple were grown within the state.

Chicago is the greatest point of lumber distribution in the world. Compilations of the lumber shipment in 1909 show an aggregate of 2,600 million feet of which 43 per cent. was consumed locally. The latter figure does not take into account the rough lumber entering into buildings or other construction work.

The report calls attention to the importance of reforesting such parts of the state as will grow timber more profitably than farm crops. "One million acres of timber, cared for as woodland should be, may be expected to yield from 300 to 500 million feet of lumber a year for all time. A constant supply like that right at home would be of immense importance to the wood-consuming factories of the state, and it would likewise assure a large income to the growers of timber."

S. J. R.

Washington's Secondary Wood-Using Industries. By Howard B. Oakleaf. U. S. Forest Service. Published by Pacific Lumber Trade Journal, November, 1911. Pp. 22-30.

It is estimated that the present stand of timber in Washington is between 300 and 350 billion feet, or about one-eighth of the total amount in the entire United States. The area covered is approximately 25 million acres; the stumpage value is estimated at 400 million dollars. Since 1905 Washington has held first rank as a lumber-producing state. There are now within the state about 1,000 mills, the total cut of which in 1910 was 4,100 million feet worth 75 million dollars. About one-fourth of this material was shipped out of the state by water and one-half by rail. Of the remaining one-fourth which was consumed locally, about 40 per cent. was further manufactured into wooden products by 25 different industries.

In 1909 the wood-using industries consumed 337,555,125 board feet of raw material. Over two-thirds of this amount went to the plants in the form of lumber, the remainder as logs and billets. The cost of this material was approximately $6,500,000. Ninety-nine per cent. of the material used was locally grown and three-fourths of that brought in was domestic wood. The percentage of material other states import to supply their wood-using industries are: Oregon, less than 1; Mississippi, 1; Louisiana, less than 2; North Carolina, 4; Kentucky, 47; Wisconsin, 50; Missouri, 64; Massachusetts, 70; Maryland, 80; Illinois, 84.

The box manufacturers of Washington consume more material than any other industry in the state and over one-fourth of the total amount annually used by all of the industries. The species used for this purpose are in order of importance, Sitka Spruce, Western Hemlock, Western Yellow Pine, Black Cottonwood, Douglas Fir, Western White Pine, Western Larch and a small amount of Red Gum. The waste in box manufacture amounts to 15 or 20 per cent. and occasionally more. The boxes are nearly all used in Washington and the Northwest, with the exception of those sent to California, and a few to Alaska, Hawaii, and the Orient.

The manufacture of sash and doors mostly of the so-called "low grade," is second in importance, consuming 55,482,000 feet of material, of which Douglas Fir comprises nearly 93 per cent. Waste frequently amounts to 15 to 20 per cent., but by the use of all small pieces for sash stock has, in some instances, been reduced to 5 per cent. While the market for this product is mostly local it is believed that the opening of the Panama Canal will eventually develop a large eastern demand.

The cooperage industry uses 40,498,000 feet of timber, mostly Douglas Fir and Sitka Spruce. In this industry are included not only tanks, barrels and woodenware, but also wood stave pipes which are coming into wide use in the west in the development of water power, irrigation, and municipal water supply. Douglas Fir cannot be used for the manufacture of barrels or tubs to contain articles of food or alcoholic liquors, unless first lined with paraffine, since the large amount of resin in the wood imparts a taste to the encased materials. In making cases for food stuffs Sitka Spruce, Black Cottonwood, and Western Hemlock are preferably used.

The manufacture of crossarms has developed very rapidly in

Washington during the last few years. A large percentage of the crossarms are manufactured at sawmills and the only material used is Douglas Fir. Because of the particular size and grade required, the stock is usually bought under special specifications, but is about equal in character to the commercial grade "select common." The amount used annually is 35 million feet.

There are two pulp mills in the state consuming annually nearly 20,000 cords of wood. The principal species used for this purpose is black cottonwood followed by Douglas Fir and Sitka Spruce, and small amount of Western Hemlock and White Fir. The spruce and Douglas Fir are mixed with the Cottonwood in small amounts even in the better grades of paper. The hemlock and White Fir are used entirely for the production of "news."

Another use for Black Cottonwood is in the manufacture of excelsior. About 8,000 cords or 6,400,000 feet are required for this purpose. One advantage of this industry is that it can employ the cores of veneer logs, which otherwise would probably be wasted. Most of the veneer cut is used in the manufacture of baskets, principally fruit and berry baskets.

Of the various woods used, Douglas Fir, the most abundant and diversely adapted wood in the state, furnishes more than one-half of the material. Sitka Spruce ranks next because of its wide use in box manufacture. Black Cottonwood is highly esteemed for boxes and pulp but its limited occurrence prevents a larger consumption. Western Hemlock is still lagging behind because its real value is not yet fully recognized. White Fir and Western Larch are not now widely employed, but it is believed that eventually they will form a larger proportion of the state's consumption as the cost of the more desirable woods become greater.

Of the broadleaf species, Oregon Maple, Western Birch, Oregon Oak, Oregon Ash, Vine Maple, and Western Willow, have excellent qualities fitting them for use in the manufacture of many of the products for which eastern woods are brought in, and their use is restricted entirely by their limited occurrence.

S. J. R.

The Wood-Using Industries of Mississippi. By C. Gould and Hu Maxwell, U. S. Forest Service. Published by The Lumber Trade Journal, New Orleans, La. March 15, 1912. Pp. 19-29.

In production of lumber, Mississippi ranks third, being surpassed by Washington and Louisiana. The total stand of timber in the state has been estimated by the Commissioner of the Bureau of Corporations to be more than 95 billion board feet. At the present rate of cutting this will last about thirty years. The total area under forest is about 32,000 square miles, or 70 per cent. of the whole state.

Upwards of ninety commercial woods grow in the forests of Mississippi, though only about half that number are now used to any considerable extent, while the principal production is limited to comparatively few species. Of the coniferous woods, Longleaf, Shortleaf, Loblolly, and Cuban Pine, and Cypress in the order named are the important species. In fact, Longleaf and Shortleaf Pine furnish over 85 per cent. of the material for the state's wood-using industries. The principal species of broadleaf woods are: Cottonwood, Red Gum, Hickory, White Oak, Yellow Poplar, Red Oak, White Ash, Tupelo, Water Oak, Evergreen Magnolia, Pin Oak, Sycamore, Black Gum, Post Oak, Yellow Oak and Black Walnut, in the order named. The last eight species, however, contribute less than a quarter-million feet to the wood-using industries of the state.

For the most part the Shortleaf Pine is in the north, the Longleaf and Cuban Pine in the south, and Loblolly in nearly all parts of the state, except in the swamps, and the minor species of pines in a few restricted localities. The broadleaf species are scattered in nearly all regions. Red Gum and Cypress are most abundant in the delta region. In the southern part, particularly in the vicinity of the Gulf coast much of the pine has been cut. From that region, however, considerable amounts of cordwood and charcoal are shipped to New Orleans.

Manufacturers in Mississippi consume yearly about 618 million feet of wood, which is less than 30 per cent. of the total cut. Twenty-five different species are reported as being used, having an average value of $12.22. Less than one per cent. of the wood is brought in from other states while no foreign woods whatever are reported.

Outside of planing mill products, the manufacture of boxes and crates is the largest industry. The principal wood used for this purpose is cottonwood which supplies about 16 million feet or over 40 per cent. of the total. Red Gum follows as a rather poor second with slightly over 10 million feet. One-fourth of all the Yellow Poplar reported in the state went into boxes and crates. It was used for the best grade of boxes, on which stenciling, painting and printing were to be done.

The manufacture of furniture ranks next, requiring 10,278,000 feet of material of which red gum furnished 41.45 per cent. The average cost of Red Gum was $12.80 per M feet. By means of special finishes Red Gum can be made up into furniture which passes on the market for Circassian Walnut, Mahogany, Cherry, Birch, Maple and Oak. Some of these imitations are produced almost wholly by the application of stains to give proper color; others grow more slowly, like Red Gum, Tupelo and Cypress. So the usual method of imitating oak.

The other important wood-using industries in the state are: vehicle and vehicle parts, for which White Oak, Hickory and Yellow Poplar supply most of material; sash, doors, blinds and general millwork, for which Longleaf and Shortleaf Pine, Tupelo and Cypress are mostly required; handles, mostly hickory but including White Oak, Red Gum, Yellow Poplar and White Ash; agricultural implements, for which Longleaf Pine supplies nearly 72 per cent. of the wood used; fixtures; and miscellaneous, including pumps, patterns, coffins, excelsior, woodenware, etc.

In speaking of the future supply of material the report says: "There are many kinds of trees which grow rapidly in wet ground, such as Cottonwood, Carolina Poplar and Black Willow; and others grow more slowly, like Red Gum, Tupelo and Cypress. So much swamp land is found in Mississippi that tree culture on such land may be expected to assume large proportions in future years. Enormous cuttings of cottonwood and willow will be made at intervals of thirty to fifty years, while Cypress, Tupelo and Red Gum will take longer to reach desirable size; but many tracts will doubtless be kept growing such species long after forests planted and cared for in nature's way cease to be looked upon as a profitable resource in that region."

S. J. R.

The Wood-Using Industries of Louisiana. By Hu Maxwell, U. S. Forest Service. Published in The Lumber Trade Journal, New Orleans, La. January 1, 1912. Pp. 19-34.

"Louisiana has 18,000,000 acres of forest land, the hardwoods being principally in the northern half, the softwoods in all parts. More than 100 kinds of trees make up the forest, about one-half of the species possessing commercial value, the others being too small or too scarce to count for much. Six or seven softwoods—the pines and cypresses—supply fourteen-fifteenths of the annual lumber output of the state. At this time the softwood forests are given much more attention than those of hardwoods; but it may be expected that a change will come in time, diversified manufacturing will increase, and the large sawmills will lessen in number as the primeval stands of pine and cypress are cut out. Plants which manufacture lumber into other commodities will take the place of mills which now sell their output in the rough, or sell it planed or surfaced. Diversified manufacture of wood products has not progressed nearly as far in Louisiana as in the northern and eastern states. Many southern industries of that kind are still in their infancy, and there is room for many others which have not yet had a beginning. Development will come in time, for the raw material is abundant. The least encouraging phase in the outlook for Louisiana is found in the fact that it is selling immense quantities of its logs and lumber in the rough, to feed factories in other regions, and when the development of home wood-working industries shall be undertaken in the future, it may be found that the forests will be much depleted. It may thus happen that its forest resources will never reach their best development."

"One of the constant purposes of the field work was to note any new or little-used woods which were beginning to make their appearances in the mills and shops, and to observe any properties in them which seemed to command them for wider use. One of the earliest discoveries made was that a number of woods were going into the sawmills as one species and coming out as another. This was not due to any purpose to palm off an inferior wood for a better, but was owing to the fact that Louisiana has more than a hundred species of forest trees, while the lumber yards recognize scarcely a score of species of lumber. For instance, three maples are cut as sawlogs, but all appear in the lumber yard as 'soft maple.' Two species of ash are cut in the woods, and Sugarberry and Hackberry are loaded on the truck with them; but in the lumber yard the whole four are often simply 'ash.' Turkey Oak, Post Oak, Overcup Oak, Cow Oak, and White Oak all come from the mill as 'white oak.' Texan Oak, Yellow Oak, Willow Oak, and Water Oak blend in the yard as 'red oak', and not one of them is the true Red Oak *(Quercus rubra)* which is a more northern tree. Three elms go to the saw mill; one comes out. The same method holds to some extent in the softwoods. The two cypresses are never distinguished apart, and in many lumber yards where three or four pines are stacked side by side, one or two may be recognized. Black Gum and Tupelo are never mistaken for each other in the woods; but Black Gum almost invariably becomes Tupelo if sawed into lumber."

"The cut of lumber in Louisiana in 1909 was 3,551,918,000 feet board measure. About 2,196,000,000 feet was disposed of in the rough, and the rest was further manufactured. The extent of further manufacture was not the same in all cases. Some of the lumber was simply planed or surfaced, and in that form was sent to market; other was made into boxes, furniture, finish, vehicles, boats, and other commodities, and thus went, ready for use, to the consumer of those commodities. The total quantity thus manufactured was 1,354,954,101 feet, according to the statistics collected during this investigation, costing when it reached the factories $15,765,458, or $11.64 per thousand feet.

"This total is made up of a large number of species; yet of the total quantity of wood manufactured three species contributed 94 per cent. and 69 species only 6 per cent. Longleaf Pine supplies 50 per cent. of it, Shortleaf 28 per cent. and Cypress 16 per cent. The manufacturers of Louisiana brought in very little wood from other states and countries, only 15,014,102 feet, or a little over one per cent., and it cost $270,304, or less than two per cent. of the total cost."

Several little-used woods were reported on. Holly is cut occasionally and goes to the brush makers, or is converted into small articles, such as surveying instruments, or small boxes for handkerchiefs and collars. Black Jack Oak serves as repair material for heavy wagons, and sometimes goes into new vehicles. Some of it is made into chairs and other furniture. Chittim-wood and Southern Buckthorn are used for crosscut saw handles, small cabinet work, sometimes for box lumber and fence posts. Honey

Locust and Water Locust are poorly thought of but are used for crating and for floors which are to be covered with better wood. Live Oak is used to a very limited extent for furniture and vehicles, and somewhat more commonly for fuel. Sassafras is used for flooring, wardrobes, clothes chests, and dugout canoes. Sweet Magnolia is used to some extent for boxes and excelsior.

S. J. R.

Paper Pulps from Various Forest Woods. By H. E. Surface. Forest Products Laboratory Series, U. S. Forest Service. Washington, D. C. 1912. Pp. 29.

This bulletin embodies the data of experiments in chemical pulp production from twenty-two species, seven of them broad-leaved trees. The list includes a few which have already been used commercially to a slight extent. For each species are given the cooking conditions used, together with the resultant yields, and qualities and general characters of the pulps.

A unique feature of the bulletin is the inclusion of fifty-five specimens of the pulps obtained, both natural color and bleached.

J. H. W.

Increasing the Durability of Fence Posts. By F. W. Besley. Maryland State Board of Forestry, Baltimore, Md. 1912. Pp. 22.

This bulletin deals with a number of experiments begun at the Maryland Experiment Station to determine the efficiency of various methods of preserving posts from decay. The first experiments were made in 1888 and while the results are not conclusive they indicate (1) that applying a preservative with brush is not very effective; (2) that creosote oil is more efficient as a preservative than either coal tar or crude petroleum; (3) that charring the portion of a post set in the ground affords little protection against decay; and (4) that filling in around a post with stones or brickbats does not increase the durability of the post.

A new series of experiments in coöperation with the U. S. Forest Service was begun in the spring of 1909. Nearly 1,000 native grown posts of various sizes and species were used. Part of these were treated with creosote, the others set untreated as a control. The treating apparatus, costing about $50, consisted of two tanks, which are described as follows:

"The heating tank was cylindrical, three feet in diameter and four feet high. The bottom of the tank was covered with a coil of one-inch galvanized iron pipe. This coil was connected with a steam boiler to produce the proper degree of heat (about 220° F). A framework of boards on top of the coil, protected the pipe from injury, when the posts were dropped in. The posts were submerged in the liquid for a depth of two and one-half feet. In a tank of this size about twenty-five posts can be treated at one time. The tank should be sunk in the ground about eighteen inches for ease in placing and removing the posts.

"The cold bath tank was rectangular, eight feet long, three feet wide and three feet deep, reinforced by a framework of two by four inch material. The posts are transferred from the hot bath and laid horizontally. They are held under the liquid by means of a frame cover held down with a lever."

Tables are included, showing for the several species treated the duration in the bath, the penetration secured, the amount of oil absorbed, and the cost of oil per post. The last item varied from two to fifteen cents. The average cost of treatment was a little over eight cents per post. Notes concerning the treatability of the various species are given.

The writer emphasizes the important role seasoning plays in increasing durability, stating that "it is a well established fact that well-seasoned posts of any kind of wood will last longer than those only partially seasoned." The observations of J. J. Crumley of the Ohio Agricultural Experiment Station (Bul. 219) do not confirm this statement. He says (p. 639) "From data collected so far, seasoning does not seem to have any marked effect on durability. The best catalpa fence examined was set green. In the best oak fence examined, the posts were cut and put into the ground the same day. Likewise some of the best fences are those in which the posts were well seasoned."

S. J. R.

First Annual Report of the State Forester of Oregon. Salem. Oregon. 1911. Pp. 24.

"Prior to 1907 the statutes made it the duty of the State Game and Forest Warden 'to enforce the laws of the State of Oregon for the protection of forests.' However, the State Game and Forest Wardens were appointed solely because of their knowledge and interest in fish and game matters, and naturally they devoted little, if any, of their time in enforcing the forest laws then on the statutes. In 1907, the legislature passed a law providing for a State Board of Forestry, thus for the first time giving the State an organization charged exclusively with the administration of the forestry laws. The two biennial reports of the Board, covering the years 1907-1910, show that notwithstanding the meager appropriation of $250 per annum, a great amount of good was accomplished. The activities of the Board resulted in the appointment of hundreds of fire wardens annually, in acquainting citizens with the provisions of the forestry laws, and in advocating in every way possible the protection of forests from fire.

"The importance of the forest resources in connection with the industrial development of the State was recognized, when early in 1911 the present forestry law was enacted by the Twenty-sixth Legislative Assembly. It provides for the appointment of a State Forester, and carries an appropriation of $60,000 for fire protection and investigative work for the present biennial period."

This quotation taken from the opening page explains the present situation in State forestry. A statement that proposed changes to the present law will be considered in the 1912 report indicates that further advance may be expected.

The greater part of the report is devoted to fire protection. Statistics are presented by counties, for both private and national forests, showing the number and causes of forest fires, number of burning permits issued, the area of merchantable timber, second growth and cutover lands burned over, and the amount and value of the timber destroyed. The expenditures for patrol fire fighting and the number and names of the fire wardens are given. A total of $202,607.98 was spent by all parties, including the United States Forest Service, the State, counties, timber owners and the federal government under the Weeks' Law. This expenditure was divided as follows: $88,669.61 for patrol and $113,938.37 for fire fighting.

In connection with this expenditure it is interesting to note the amount and value of the timber destroyed in 1911, 545,000,000 board feet, valued at $680,000,000; and namely 84,622,000 board feet, valued at $79,684.

Attention to other problems besides fire protection is urged, especially taxation and methods of securing reproduction.

The report closes with a brief statement of facts regarding Oregon's forests.

R. C. H.

Report of the Maryland State Board of Forestry for 1910 and 1911. Baltimore, Md. 1912. Pp. 42. Illustrated.

The activities of the Maryland State Board of Forestry are shown by this report to cover a number of different lines. They are carrying on educational work, making forest investigations, examining private woodlands, protecting the forests from fire, and managing small forest reserves.

Three courses of lectures on forestry are given at the State Agricultural College, information is furnished at Farmers' Institutes, and many addresses are delivered before various organizations. Publications and public exhibits assist in the educational work.

Forest surveys have now been completed for 22 out of the 23 counties in the State. Planting experiments with Loblolly Pine indicate that wild stock of this species can be successfully and cheaply used and that the pine can be introduced into certain sandy lands where not now indigenous.

An investigation to determine the extent of, and methods for controlling the Chestnut bark disease was made in 1911. The conclusion reached was that the northern and eastern sections were the worst affected and elsewhere either less seriously or not at all; and that by adopting vigorous quarantine measures outside of the area of general infection much could be done to check the spread of the disease. The value of the Chestnut in the area now infected is put at $500,000. In order that the Chestnut, if killed, may not be a total loss, efforts are being made to find uses for the dead wood.

Brush burning and railroad engines were the chief causes of fires in 1910 and 1911. The forest-warden system of fire protection is now strengthened by a number of Federal patrolmen working under the Weeks Law, and by several lookout stations.

Four forest reserves, consisting mainly of cutover lands, and aggregating 1,960 acres are now owned by the State.

During 1910 and 1911, there were 13,472 acres of private woodlands examined by the State Forester, and it is thought that hundreds of owners whose lands have not been examined are applying the principles of forestry.

In order to provide numerous object lessons and to interest a greater number of people, Demonstration Forests are being started. These forests are small areas privately owned on which the owner agrees to carry out detailed treatment advised by the State Forester. As yet, the plan has not been given a thorough trial.

Among the recommendations for the future are: Establishment of a State Forest Nursery, and of a quarantine zone against the Chestnut blight, purchase of cutover mountain lands, and larger appropriations for various branches of work.

Tables showing the wooded area by counties, amount and value of standing timber and the production of the forests are included.

R. C. H.

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PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Virgin Forest in Germany

In *F. Q.*, vol. II, p. 274, we briefed an account of a piece of a virgin forest, about 100 acres, maintained in its natural condition by Count Schwarzenberg in the mountain region of Bohemia. Another virgin woods of about 120 acres is described by Guse as found in the plains of Oldenburg, otherwise poorly wooded. This very accessible part of Oberförsterei Varel is mainly composed of hard-woods, oak, beech, bluebeech, basswood, elm, birch, aspen, with Ilex aquifolium, the most frequent underbrush. Here, without the interference of wind and snow, old oaks of 8 foot diameter, even when dead and entirely hollow remain standing, and when they do break down, the remnants are soon overgrown by shrubs and weeds. Ivy of 8 inch diameter twines around these old giants.

The author unfortunately leaves off further description of this interesting tract, devoting the rest of his article to experiences with larch plantations in the same revier.

Aus dem Grossherzogtum Oldenburg. Zeitschrift für Forst- und Jagdwesen. January, 1912. Pp. 10-15.

Forests of Siberia

An official report, from which Guse abstracts, gives insight into the development of forest management in the Pacific coast region of Russia, Kamtschatka, Sachalin and the Amur district. The first attempt at a management dates to 1898. In 1910, 21 districts had been organized. With 57 officials looking after about 200 million desjatinen (500 million acres), there is, of course, little administration or even protection; the natives use the woods as before.

Export is hardly developed. The income is, however, about $400,000. Only the forests of the Amur and coast region are of value, some 130 million desjatinen (325 million acres). The vegetation is most varied; on small areas far nothern and southern forms are found together. The ocean with its continuous mists and raw winds has a deteriorating effect, so that the nearer the ocean the poorer the development.

Walnut and Grapevine grow under 51.5° latitude, while the more southern shores of Possjet bay is covered with northern conifers. On the shores of the Amur, Black Birch and Oak often show a stunted growth, while 20 miles away they develop excellently. The great humidity of the climate is unfavorable; rainfall and snow masses cause devastating floods. "An intelligent destruction of the vegetation is undoubtedly required; forest fires are beneficial in settling the country." But the Russians go too far in their use; the Mongolians are more careful.

The most important timber trees are *Larix dahurica,* most widely distributed and most useful; *Abies sibirica, Picea obovata* and *Ajanensis; Pinus silvestris,* superior in quality to the Russian pine; *Pinus mandschurica,* of inferior quality. Of broadleafed species besides the walnut, an oak, a maple, a basswood, elm, poplar, birch. *Phellodendron Amurense,* the corktree, *Maakia amurensis,* a small acacia-like tree. Schudra in 1895, before the country was well-known, distinguishes seven regions: (1) the farthest northern district with poor beech and birch growth; (2) from Albasin to the mouth of the Seja, oak and birch, the growth improving southward; (3) to the Bureja mountains, marsh lands with poor underbrush; (4) from these mountains down stream, good broad leaf forest with pine interspersed; (5) from the mouth of the Amur along the coast to Imperatorski bay, close larch-spruce-fir forest, mostly stagheaded and rotten with fallen timber; better, where protected from sea winds; (6) the middle coast district, mixed forest of inferior value, larch, birch and aspen prevalent; (7) South to Chinese boundary characterized by luxuriant growth of fruit trees and grapes, Hard broadleaf trees, and conifers of northern type of large dimensions in mountains.

Uebersicht über das Forstwesen im Amurischen Generalgouvernement, 1910. Zeitschrift für Forst- und Jagdwesen. January, 1912. Pp. 51-53.

Conditions in Japan

From an extensive abstract of the report of the Imperial Finance Minister for 1911 on the economic conditions of Japan, we brief the references to forest conditions.

While only 18.5 million acres appear on the tax lists, the total area of forest is 51.9 million acres or

70% of the land area; just about half of this is State property, besides 5 million acres of crown forest. Although from the exhibits at Expositions one would be inclined to credit Japan with a high development of forestry, the report admits that the forest is as yet little esteemed as an object for management, because there is an excess of it and much of it, as yet, inaccessible. This is only lately being changed by the government, the yield from State forests in the first decade of the century having increased from a little over one million dollars to five million.

Under the law of 1907 the government has the right to prevent devastation and order reforestation, restrict and even prevent utilization.

The forest area of Korea is estimated at around 12 million acres, the most important State forests lying at the headwaters of streams, several species of pine, larch and oak being important.

The rich mountain forests of Formosa are still unopened. Abies Tsuga, Pinus and Chamaecyparis are found in the higher elevations, Quercus, Cinnamomum, Machilus and Bamboo species occupy middle and lower slopes.

Another untouched forest wealth is found on the island of Sachalin, some 8.5 million acres, mainly coniferous, *Abies sachalinensis* and *Picea ajanensis,* besides Larch.

These forests are easily exploited and a beginning is to be made presently.

The development of forest and wood industries is still in its infancy, paper and matches, with an annual output of 7 million dollars each seem to be most important, while among the exports, besides 5 million dollars worth of matches, 1.3 million dollars of railroad ties figure.

Die wirtschaftlichen Verhältnisse Japans. Centralblatt für das gesammte Forstwesen. January, 1912. Pp. 45-50.

History of Soil Changes

The original forest cover of Rhenish-Hesse was according to Walther largely removed in the early years of the Roman occupation. Since that time the forest history has been part of the industrial history of the country. While wars ravished, the land industry languished and the forest area increased.

Periods of peace have permitted industrial activity and forests have made way for farms.

The fear of a fuel famine led to the planting of waste land with rapid growers as early as 1716, but recurring wars had so impoverished the State that these early attempts accomplished little in the way of increasing the wood production. Willows, poplars, alders and black locust were favorites with these early planters. The rising price of fuel wood was artificially held in check by ordinances fixing a legal price for wood, prohibiting export and establishing public warehouses to control the market.

The practice of alternating farm crops with forests (Waldfeldbau) was initiated about the middle of the 18th century to stave off the wood famine without entirely withdrawing the land from food production. The famine years, 1816-17 led to the extension of this practice to lands formerly kept in forest. The practice has persisted to the present day in many places, although analysis frequently shows that it no longer pays.

About the same time grazing and litter gathering grew in importance to the detriment of the forests and the subdivision of forests, previously held in common, further reduced their productivity. Such treatment was given the accessible forests while the adjacent hill forests remained untouched due to lack of roads. Charcoal was the only product which could be brought to market.

The exchange of fertile forest land for the more sterile farm lands was inaugurated in 1820, and has continued ever since. At times it has made heavy inroads on the forest and still heavier inroads have been prevented only by the most vigorous protests of foresters. On the whole the cleared areas have been largely replanted and agricultural production has been increased by more intensive cultivation rather than by larger areas.

A number of early ordinances setting forth forest policy are reprinted in this paper.

Das Schicksal des Waldbodens in Hessen. Silva. Aug. 1911. 265-7; 276-8; 283-4.

BOTANY AND ZOOLOGY.

Forest Biology

In an exceedingly interesting short communication, the well-known Forstmeister Meister, who for 50 years has managed the celebrated Sihlwald near Zurich, points out that the biology of a species and the biology of the forest composed of that species are two different things. While for the species within its climatic range soil and situation are the prominent influential factors, for the forest the climatic factors are more important. Frost and snowfall and the changes in light, etc., incident to fellings change the composition and the development of the forest as a whole.

The author accentuates that the attempt to secure a normal forest condition is constantly interfered with by our inability to insure normal development without interference by snowbreakages, windfalls and frosts.

The Sihlwald furnishes excellent data for the study of such changes. This forest was under some kind of management as long as the 15th century when a definite budget was determined. This was increased in the 16th century until in 1851 a technical commission declared the forest overcut and ordered a rest. Meister tries to refer this condition to snowbreakages, as records show unusual snowfalls.

At present the Sihwald is pronounced beech forest, but it has not been always so, as the record of felling results from 1630 on show. It is worth while to reprint the whole series.

Period.	Broadleaf. %	Conifer %	Period.	Broadleaf. %	Conifer. %
1631-1640	45	55	1761-1770	72	28
1641-1650	39	61	1771-1780	75	25
1651-1660	40	60	1781-1790	84	16
1661-1670	43	57	1791-1800	86	14
1671-1680	46	54	1801-1810	91	9
1681-1690	49	51	1811-1820	93	7
1691-1700	51	49	1821-1830	88	12
1701-1710	58	42	1831-1840	88	12
1711-1720	57	43	1841-1850	82	18
1721-1730	56	44	1851-1869	83	17
1731-1740	60	40	1861-1870	84	16
1741-1750	68	32	1871-1800	86	14
1751-1760	70	30	1881-1900	71	29

In the last 30 to 50 years there has been a tendency to increase the conifers, spruce and fir, the latter forming a much larger part of the natural regeneration, besides being planted in fail places.

To make the forest resistent to the attacks of an organic nature must be the aim of the forester. This according to Meister, where snowbreakage is to be feared, can be done by the mixed forest which shows a greater variation in the form of the crown-cover, by longer regeneration periods, and especially by the selection forest which assures the existence of the single species as well as of the forest formation.

Aphorismen zur Biologie des Waldes. Schweizerische Zeitschrift für Forstwesen. March, 1912. Pp. 77-87.

Wood Structure of Populus and Salix

It is well-known that the wood of these two genera is difficult to distinguish. Prof. Burgerstein uses for diagnosis the structure of the pith rays, which in both woods consist of two kinds of cells, namely one set radially longest without pits, the other set vertically longest and on their radial wall towards adjoining vessels beset with large round pits.

In Populus the relation between the average height of the pitted pith ray cells (*H*) and the average height of the unpitted cells (*h*), i. e. *H*: h lies between 1.2 and 1.55, while in Salix this relation lies between 1.85 and 2.1, that is to say the height of the unpitted cells is relatively smaller than those in Populus. Moreover, the pits on the radial cell walls occur in Populus in 2 to 3 (in root-wood occasionally 4) rows, while in Salix in 2 to 10, mostly 4 to 6 rows.

Diagnostische Merkmale der Markstrahlen von Populus **und Salix.** Centralblatt f. d. g. Forstwesen. March, 1912. Pp. 150, 151.

Heat Splits

Fankhauser reports on a phenomenon, observed in a number of localities of Switzerland and Belgium during the unusually dry summer of 1910, which in its results resembles frost splits. So far as known spruce only has suffered. In a 15-25 year plantation of very rapidly growing trees longitudinal (not spiral) splits of considerable length and depth were observed, in the middle of the plantation where direct sunlight did not or only slightly reach them. Another plantation in Belgium, 30 years of age, luxuriously developed, had in the middle of August such splits developed from top to bottom and through and through, vertical and without loss of bark. Other cases are cited. The splits occur on any aspect and on northern aspects more frequently than on others.

As to the exact cause of this phenomenon, the drought alone cannot be accepted, otherwise it would be more general. In a plantation of 90,000 plants, 80,000 were killed by drought, but no heat splits occurred, and the affected trees exhibit a perfectly sound dark green foliage, so that physiologically they did not suffer any more than from frost splits. A relatively open stand and vigorous branch system seems to favor the trouble. This suggests that it is due to the formation of loose wood which with a decreased water supply shrinks excessively, individual differences and differences of soil explain the variation in behavior.

Hitzerisse. Schweizerische Zeitschrift für Forstwesen. January, 1912. Pp. 21-26.

Records of Drought Influences

The summer of 1911 was notable in Germany for uninterrupted hot, dry weather, lasting from the late June into mid-September. The fire danger was enormous and the whole personnel was kept on tenter-hooks for more than two months. Sundays and holidays only necessitated doubling the usual precautions. These drought conditions were excessive in the sand plains of lower Hesse. No serious losses from fire occurred there, but many small fires were extinguished. The flatness of the country made the location of fires difficult even after the smell of smoke was evident. Lookout towers were erected and watch kept from them with good results. Game suffered from thirst, and birds, too, whose work in checking insect pests is of great advantage, had to be supplied with water.

Trees from more southern regions throve remarkably well, but those more important commercial species which are native here or to the northward suffered correspondingly from the same cause. The Scotch Pine is the principal tree in the sand plain forest of lower Hesse and were there frequent seasons like the last it would soon be the only tree. The drought and heat killed very few trees except in the youngest plantations where the losses were unusually heavy.

The only plantations more than three or four years old, which suffered greatly, were those just recovering from blight. Grass appeared to protect young plantations for a while, but finally all succumbed alike.

Spruce is of course somewhat out of its element in the sand plain, but the need of replanting fail places laid bare by white grubs has led to the introduction of quite an admixture of spruce and white pine in the region. Both have suffered severely, trees 10 and 12 feet high turning red and dying. The rarity of such dry summers as 1911 cannot control silvicultural practice and these species will continue in use to fill fail spots and to minimize insect and fire dangers. *Picea pungens,* the Douglas Fir and Sitka Spruce have endured the drought better, the Colorado Douglas Fir especially.

The larch and the broadleaf trees shed their foliage, and the terminal shoots withered. The Red Oak held its leaves better than either of the native varieties, but all alike are dry now. Beech occurring as a second story was little injured except that the upper crowns had lost their leaves. Birch and Black Locust are bare, but apparently alive.

Nurseries were saved by screens and sprinkling though it is doubtful if the results will justify the expenditures.

One observer reports that spruce plantations of the year suffered less from the drought than those a few years older and attributed this to the looser condition of the soil, which had not become compacted since it was opened to set the plants. This observation is not general.

The northern edge of mature stands has revealed itself most favorable for the growth of seedlings during such a dry season —a point in favor of Wagner's new method of cutting narrow reproduction strips from the north side.

Dr. Walther gives detailed meteorological records and many interesting points on the behavior of various species.

von Schmitburg: *Die Hitze und ihre Wirkungen in dem Diluvialsandgebiet der Mainspitz.* Silva, 1911. 381-3.

Vogt, Emil: *Einwirkung der Hitzeperiode auf Fichtenkulturen.* Silva, 1911. 305.

Rau: *Die grosse Dürre und der Wagner'sche Blendersaumschlag.* Silva, 1911. 306.

Walther: *Die Hitze und Dürre im Sommer 1911.* Silva, 1911. 337-9.

Effects of Lightning.

Lightning frequently strikes in the most unexpected places and, according to Baltz, no precautions can be depended upon for immunity. Danger is greatest in the open fields because here a man is the most elevated object on the landscape. Trees standing alone in the open country are only correspondingly more liable to be struck and are to be avoided altogether. Lying flat on the ground is undoubtedly the safest thing to do when overtaken by a thunderstorm.

In the woods some kinds of trees are more frequently struck than others and popular notion that an oak is more liable to be struck than a beech tree seems to be justified, but even beech trees are struck at times. There is no evidence indicating that the danger is greater when carrying a gun.

Der Blitz und seine Wirkung. Silva, Sept., 1911. 306-7.

Cause of Staghead.

The dying back of the upper branches characteristic of stagheadedness has always been attributed to a change in the transpiration current. Light admitted to the bole and lower crown stimulates leaf activity there; this foliage evaporates water and so reduces the supply of water available at the top of the crown that whole branches die back for lack of it. Dr. Münch, Forstamtsassessor in Stiftswald, near Kaiserslautern in the Bavarian Palatinate has made the remarkable discovery that stagheadedness in the oak is caused by a parasitic ascomycete which attacks the bark, destroys a small area and then enters the outermost annual ring of the wood. Through this it extends up or down the tree and may pass back to the bark again. Apparently sound trees of all ages and in stands of all densities are alike subject to attack, but a season of drought appears to favor infection. Dr. Münch was formerly at Munich; he is best known for his work on the blue stain of pine wood.

Leitsätze zu den Mitteilungen über die Gipfeldürre der Eichen. Silva, Dec. 1911. 415-416.

Identity of the Oak-mildew.

The "oak-mildew" so abundant on the continent of Europe during the past few years is shown by Arnaud and Foëx to be the oïdial stages of the cosmopolitan fungus, *Microsphaera alni* (Wallr.) Salm., or, as the authors prefer to call it, *Microsphaera quercina* (Schw.) Burrill. The perithecia were found December 30, 1911 on diseased and undersized oak leaves on an unthrifty trunk of *Quercus sessiliflora* in southern France. Harlot and Mangin had earlier predicted this connection, but had no direct evidence. Several authors have attempted to show a difference in form between the conidia of the "oak-mildew" and those of *M. alni,* and Griffon and Maublanc finally ventured to describe the fungus as *Oïdium alphitoides.*

The present authors compared their material with specimens of *M. alni* on leaves of several North American oaks supplied by Professor Farlow of Harvard University, and were unable to establish specific differences which would warrant a separation. A description of the French collection is given. The conidia are shown to be quite variable, and this has, in the opinion of the authors, led several investigators to make distinctions which are not justifiable.

The authors believe that the fungus is indigenous, and not introduced from America, and express the view that, at first, it was localized, or rare, and has developed rapidly under the influence of slight modifications in the host which were favorable to its evolution. The present appearance of the perithecia is attributed to the dry summer of 1911, followed by a wet mild autumn which gave a long growing period.

Sur la forme de l'Oidium du chêne en France. Comptes Rendues Academie Science (Paris), January, 1912. 154:124-127, 15.

SOIL, WATER AND CLIMATE.

Site Classification.

Dr. Leininger of Tharandt points out that the description of sites and their classifications by estimate, as usually practised, especially for experimental work, is entirely inadequate, because the estimate is made without any measured basis. He quotes the best authorities, referring to the absolute ignorance mostly exhibited in this direction, and cites the work of Braza who examined the site description based on opinion in the yield tables of Weise for pine in detail of mineral constituents, humus contents, soil moisture and compactness, and found no proportional relations between those factors and the site classification.

Precise investigations, by which to learn to estimate site classes, are required. Such are conducted by Leininger in the soil laboratory of Tharandt. He gives examples of his investigations.

The first investigation concerned itself with the question whether the average height can be used as index of site classes. This index had already been pointed out by Oettelt in 1765. Again Baur in 1870 called attention to this relation, pointing out that in stands of approximately the same age the volumes were proportionate to the average heights. And ever since this factor has been utilized for site classification in yield tables.

The justification for relying on this factor is established by careful ascertainment of the heights after the Draudt-Urich method, and relating them to Kunz's yield tables.

The relation of the average height to certain soil qualities on the same rock formation is then investigated, namely the hygroscopicity at 15.6° *C* and 91% relative humidity of the soil and the ability for nitrogen, known as Knop's absorption coefficient. All investigations so far have shown that on same rock and at same elevation great parallelism between average height of stands, hygroscopicity of the fine earth and Knop's coefficient exists.

The author points out that one of the most difficult tasks of the soil investigations is the taking of samples and complains that so often no data are furnished by investigators how the sampling was done. The necessity of a large number of samples evenly distributed and taken to the same depth is accentuated and the method used described in detail. The necessity of investigating the soil in layers is explained; a table showing the variation of lime contents and exhibiting the great changes with depths. The different layers must be measured. For the shallow-rooted spruce a depth of 12 inches seems sufficient; for pine, a greater depth would appear necessary to investigate.

In determining the volume of pores, which is of great importance, if, as is done at Tharandt, the nutritive elements are related to the space and not to weight of the soil, great variety of procedure seems to exist.

Since the pore volume cannot be determined from the usual sample after it is taken, special samples for the purpose are secured by Schermbeek's sampler, specially fitted for the purpose. The contents are measured, not weighed to .1 mm.

As regards number of samples, for the upper layer of 4 inches, where the greatest variation is found, 12 samples are taken; for the next 4 inches only 8; and for the third 4 inches, 4 samples suffice. Special ways are used in coarse soil.

The contents of the sampler are divided into coarse and fine soil, dried at 105° *C* and weighed. The specific weight of the coarse soil is determined directly; but the fine soil has supposedly been changed by drying, hence an additional sample is taken, allowed to become air dry and used to determine the weight; then by drying to 105° *C* the hygroscopic water is determined, which permits determining by calculation the weight for the same degree of dryness. The calculations are given. Investigations to simplify the procedure for forest soils are under way.

SILVICULTURE, PROTECTION AND EXTENSION.

White Pine on Lowlands.

Hatt gives a description of White Pine plantations in the neighborhood of Epinal in Southern France, now 45 to 60 years old, which were made on marshy ground between coppice of oak, birch and alder and on brushland. Spruce planted with the pine has developed poorly or disappeared.

One area, about 8 acres, had been clear-cut in 1865. In 1873 it was a poor, open coppice, when the plantation was made. In 1911 it is a polewood of White Pine, ready for regeneration. The soil is covered with a thick mat of needles, only occasionally with mosses and herbs. The trees bear seed annually, but the seedlings cannot live under the shade of their mother trees. These are liable to fungus disease and windfall on account of shallow root system in the shallow soil. Hence they should be reproduced so early.

The volume and value calculation is particularly interesting. The volume of the 150 trees per acre, running from 8 to 20 inches diameter (and one tree of 24 inches, at 46 years) with an average below 12 inches, was 3,300 cubic feet or an increment of nearly 72 cubic feet per year per acre. The cubic foot on the stump is valued at 10 cents, hence the value per acre is $330. The original soil was worth hardly $16, the cost of planting including drainage about $20. Assuming the cost of administration to be covered from thinnings, etc., the investment has paid 5 per cent., leaving the soil in a condition four times as valuable.

Plantations de Pin Weymouth dans les terrains marècageux. Revue des Eaux et Forêts. No. 7, 1912. Pp. 193-195.

Planting on Raised Beds.

Stolz reports on the success of plantations carried on poor heath soil with bog iron ore by planting on raised beds of 12 feet width, throwing the soil from ditches, 4 to 5 feet wide and 2 feet deep, over the bed and heightening the ground thereby 7 inches. Although expensive, nearly $15 per acre, the astonishing success of the plantation seems to justify the expense. After 32 years, in comparison with other plantations, both in height and diameter, and in volume the plantation on raised beds is considerably favored.

A number of experiences from other localities support this method as effective on poor soils.

The same method of ditching was applied to a 20-year old pine and spruce stand on washed, poor, gravelly soil in exposed northwest aspect. The spruces hardly 3 feet high, the pines almost shrubs, maltreated by Tortrix, oak sprouts almost creepers. Ditches were thrown up every 12 feet, the soil carefully distributed not to bury the plants, then additional pine, spruce and larch planted. This proved an unnecessary expense for in two years an unexpected revival in the original growth took place, spruces making 18 inch shoots, and oaks astonishing by the richness of their foliage, while a small area left in original condition remained poor. Pine and larch, however, were crowded out by the spruce.

Similarly a 30-year pine stand of "umbrella" trees was revived, by cutting out all but the best stem, distributing the brush and covering it with the soil from the ditches, 1½ foot wide. After the soil was settled, it was planted with 4-year old spruce. After 20 years the stand had become a 6 to 10 foot spruce thicket, with 10 to 12 inch leaders, from which the last pine was being cut out.

Rabatten Kultur und deren Erfolge. Zeitschrift fur Forst-und Jagdwesen. January, 1912. Pp. 26-33.

Seed Supply. The expositions of Kienitz, briefed in *F. Q.*, vol. IX, p. 484, and in other volumes on racial variations and hence on the importance of seed supply for planting receive confirmation by Orlowsky in Livland, especially with regard to the Scotch Pine, and he recites the various regions which produce undesirable growth forms.

He refers to the resolution of the German Forestry Council in 1910, henceforth to use only warranted pure German pine seed, excluding all foreign importations, so that the crooked growing French, the poorly lignifying Hungarian, the northern slow growing races be excluded. He points out that some of the German sections do not produce desirable races, and that on the contrary the optimum of development is found in Russian Poland, hence the exclusion of this seed is undesirable.

Einige Bemerkungen zur Provenienz-frage. Zeitschrift für Forst-und Jagdwesen. January, 1912. Pp. 20-26.

Exotics in Sweden. A fully illustrated article by Kempe gives the results of the planting of exotic conifers under forest conditions in Angermanland, Sweden, for (in some cases) the last 30 to 35 years. Among the species used are naturally found many Americans.

Illustrations and account are given of *Tsuga pattoniana, Pseudotsuga douglasii, Abies concolor, nobilis, engelmanni, pungens, sitchensis, Pinus strobus* and *ponderosa;* all of which seem to thrive.

Försök med utländska barsträd. Skogsvardsföreningens Tidskrift. February-March, 1912. Pp. 57-80.

Practical Forest Fire Control. At the last conference of the Western Forestry and Conservation Association held in Portland, Oregon, many points of interest in forest fire prevention and fighting were brought out. The value of the information may be judged from the fact that the men who made the statements have been directly interested in the fires for the past five or six years, and these men represented various organizations patrolling from 800,000 to several million acres each.

The number of acres allotted to each patrolman and the average cost per acre for protection during the season were shown as follows:

State.		Acres per man.	Cost per acre for Season.
Washington,		40,000	$0.0125
Oregon,		14,000	.013
"		.....	.04
"		.....	.011
No. Idaho,		40,000	.011
"		11,000	......
"		.....	.011
"	(Dry season,	20,000	......

Causes of Fires.

Origin.		Oregon.		Idaho.	
Lightning,	6.6%	4th	6%		10%
Campers, hunters, incendiary, etc.,	25.6	3rd	22	60	
Slashings,	21.0	2nd	14		90%
Unknown,	38.0	1st	20		
Engines, Mills, etc.,	8.8	5th	38	40	

Each column is a report of one association.

Consensus of opinions show that slashings should be burned, but time of burning varies with region and varies with conditions in the same region so there was general opposition to laws which compel burning during certain months.

Suggestions were made to hold woods foremen responsible for carelessness of men by charging up all damaged timber against cost of logging. Also to burn strip 50 to 100 feet wide between standing live timber and tract being cut.

In California in the Redwoods the down trees are barked and the debris burned with the tops before the cross-cutting is done. This is a feature of economy in logging rather than a measure for protection against fire. The slashings which accompany tie-making are a fire menace but the remaining Redwoods are so resistant to fire that a carelessness has grown up which is endangering the tanbark oaks on the highlands, for even a light fire will kill them.

Concerning patrol and fire fighting the following suggestions were made:

Examinations for wardens, as to tactfulness, executive ability, woodsmanship, knowledge of fire laws, and so on. Chief warden should be centrally located while assistants have charge of outlying districts. System is absolutely necessary, no time to organize after a fire is started. Tools kept in locked boxes distributed to points of vantage and several keys left with people nearest to boxes.

On railroad "speeder" patrol is very efficient. Where oil is used for fuel no fires were recorded and cost of oil is about the same as for coal operation. A satisfactory spark arrester was not reported.

Reported as high as 25 to 30 fires started from one electric storm within a few hours.

The hunter is considered a more serious menace than either settler or camper, because he is hard to find; suggested that he ought not be allowed in woods during dry season.

Where pack animals are brought into use the cayuse is better than any other horse and the mule is better than the cayuse. The mule is a longer lived animal, requires less feed, does not eat poisonous weeds, is not bothered by flies, is built for pack saddle so does not get sore back, can carry 100% more than cayuse, is more careful and is tougher.

Concerning means of communication, No. 9 wire is recommended for telephone and wires to be attached to poles not trees. Cost of telephone ranges from $28 to $50 per mile. The Heliograph has proven unsatisfactory.

West Coast Lumberman, Dec. 1911.

Fire Patrol.

Conclusions drawn by F. J. Davis, chairman of fire committee of Coeur d'Alene Timber Protective Association, after six years experience in that office, are interesting. Patrolmen are assigned districts varying from 20,000 acres to 60,000 according to topography, fire danger and ease of travel. Equipment of each,—light, ax, short-handled shovel with round point, and small sized water bag. In settled country patrolmen work singly; in unsettled, two camp together and work in opposite directions. Telephones are best for getting early information. Class of labor employed should be best woodsmen and rivermen for they are familiar with fire fighting tools and are less liable to become excited or nervous. It is impossible to get too many men on a fire line. Care of a fire after putting it under control is constant vigilance, burying smouldering roots, falling old stubs, and searching and falling defective trees in heavy timber. The best methods of working men is by the hour rather than by the day; no night work except watchmen, and not more than 10 hours a day. Night work is unsatisfactory and ineffective; the ideal time to fight fire is from daylight to the middle of forenoon, beginning again at about 4 o'clock and working until dark. Wages should be a little higher than local wages but not high enough to suggest setting fire in order to prolong the job. In Idaho the legal rate per day for fire fighters is $2.50 and subsistence. Paying men at once in money is conducive of better help.

Canadian Lumberman and Woodworker, January, 1912.

Tree Diseases in National Forests.

Dr. Hedgcock of the Bureau of Plant Industry, U. S. Department of Agriculture, has given us a second paper on this subject, in which he briefly discusses the prevalence in the western forests of a number of trunk and root fungi, largely belonging to the *Polyporaceae*. None of the species are new to science, but the complete records of the hosts of both hardwood and coniferous trees which the various fungi are known to inhabit throw much further light on the distribution of the wood-rotting forms. The work is based on data and specimens available in the Laboratory of Forest Pathology, Washington, D. C., and on the writer's personal experience for several years past in the western forests.

The following fungi are reported as causing diseases of deciduous trees: *Polyporus dryophilus* Berk., causing a piped heart rot of oaks, and particularly abundant and destructive in the southwest; *Fomes everhartii* (Ell. & Gall.) Schr. & Spauld., producing a brown to white heart rot of both red and white oaks, walnut and mesquite; *Fomes igniarius* (L.) Gill. on many species of trees in fifteen genera, causing the well-known white heart rot with black or brown margin; *Polyporus texanus* (Murr) on mesquite, where it is often associated with *Fomes everhartii; Fomes nigricans* Fr. which as it occurs on Betula in Minnesota, is apparently only an abortive form of *F. everhartii; Fomes applanatus* (Pers) Wallr., rarely found on living trees, but readily decaying dead portions of trunks and roots of at least forty species, including several conifers; *Fomes fasciatus* (Sw.) on mature pecan trees and a few other species in the southern states; *Polyporus sulphureus* Fr., causing a reddish-brown rot in twenty-eight host species, about one-third of which are conifers; *Fomes fraxinophilus* Pk. on various species of ash; and *Fomes robiniae* Murr. on two of the three American black locusts.

Coniferous species comprise the greater part of the natural forests of the western United States and it is estimated that two to ten per cent. of the mature trees are attacked by fungi and rendered worthless. In some localities such species as *Pinus monticola, Tsuga heterophylla, Abies grandis, A. lasiocarpa,* and *Pseudotsuga taxifolia* suffer to the extent of fifty to seventy-five per cent.

The most destructive decay of the heartwood of conifers is the common "pocket rot" due to *Trametes pini* (Brot.) Fr. This fungus probably occurs on nearly all species of conifers, except junipers. The disease is said to communicate from tree to tree through the roots. *Polyporus schweinitzii* Fr. stands next in importance, producing in many conifers a root and basal trunk rot which is of a red-brown color and breaks up into coarse cubes. *Fomes laricis* (Jacq.) Murr. is a common heart rot in several conifers, but particularly on the larch in the northwest and pines in the southwest. *Polyporus amarus* Hedgc., which causes the "peckiness" of Incense Cedar in Oregon and California, is found affecting fifty to ninety per cent. of the old trees.

Of the *Hydnaceae* two species are mentioned, *Echinodontium tinctorium* E. & E. being abundant in the west on firs, spruce, Douglas fir, and western hemlock, causing a separation of the annual rings. Among the *Agaricaceae* a form identical with, or closely related to, *Lentinus lepideus* Fr. occurs on living and dead conifers.

The heart rotting fungi of conifers enter largely through wounds, and in the arid southwest the production of sporophores seems very limited.

Notes on Some Diseases of Trees in our National Forests. II. Phytopathology, April 1912. 2:73-80.

Chestnut Bark Disease.

In a paper before the Chestnut Tree Bark Disease Conference at Harrisburg, Pa., on February 20, 1912, attention is called by C. L. Spear to promising methods of treating ornamental and orchard chestnut trees suffering from this much-discussed epidemic. It is unfortunate that State and Federal workers have had to devote so much time to locating and destroying infected trees and so little to research on the life history of the fungus concerned.

When it was learned during the past year that the mycelium invaded the outer zone of the sapwood the difficulty of treatment was increased, but Collins shows by experiments that completely cutting out the diseased areas of bark and wood with a sharp gouge and treating the wound with tar or lead paint results in rapid healing over the excised area. If shellac or creosote is used as a first dressing it should soon be followed by the thicker compounds. The wounds largely heal from the sides, the newly-formed fibers sometimes bending 80° from their normal longitudinal direction. For this reason the incisions should be pointed above and below. The destruction of the infected chips is a very necessary sanitary measure, as the fungus will persist in them even through hot summer droughts.

The possibility of developing immune varieties of the American chestnut is doubtful. Importations from northern Asia and Japan have given good results, but the trees are small and the fruit inferior in quality. Perhaps, in time, a satisfactory hybrid can be secured.

The systematic position of the fungus, named by Murrill *Diaporthe parasitica,* has been discussed by various authors. A few years ago Rehm placed it in the genus *Valsonectria,* but American mycologists, such as Farlow, Clinton and Shear, think it more closely related to *Endothia,* although distinct from *E. Gyrosa* (Schw.). The exact relation of the European *Endothia radicalis* (Schw.) to *Diaporthe parasitica* Murr. is still in doubt, although some American writers consider these two species of *Endothia* as synonymous. Further studies are being conducted along this line in order to clear up the nomenclatorial difficulties, and as Dr.

Shear is at present in Europe it is hoped that he will be able to throw more light on the question on his return.

Collins, J. F. *Treatment of Orchard and Ornamental Trees.* Am. Lumberman 1912. 34-.2 Mr. 1912.
The Chestnut Bark Fungus, Diaporthea parasitica. Phytopathology. April, 1912. II:88-89.

"Dry Rot" in Buildings.

Smith and Hoxie, Special Inspectors for the Associated Mutual Fire Insurance Companies of Boston bring vividly to the attention of engineers and builders in this day of increasingly inferior lumber products the need of more careful selection and preparation of structural timbers for factories. They call to mind the report of Prof. Woolson regarding the sudden failure, during a fire in 1909, of the heavy white oak posts supporting the floors of the Gledhill Wall Paper Factory of New York City. This was due to decay at the upper ends of the timbers where encased by the metal caps which joined the posts and girders.

Even more striking is the recent experience of the Canadian Spool Cotton Co. in their factory at Maisonneuve, Quebec, in which decay had so far progressed in the southern pine frame timbers that these had to be replaced with steel after four years service. The first defect was noticed two years after the mill was begun, when the floors began to settle, due to the crushing in of the three-inch block fillers between the posts of each story. The history of the structure and the method of construction and operation explain the cause of failure, and these obvious defects should be remedied by future builders. The timbers consisted to a large extent of inferior wide-ringed southern-pine, instead of the heavier close-ringed longleaf which the specifications called for, and the material was piled out all winter exposed to the snows and outside infection. The floor beams were placed in pairs with a seven-eighths inch space between, and on top of these was laid a heavy floor. To further improve the conditions for decay, the space between the floor beams was battened and the floor above was kept moist by the fine spray developed in the operation of the machinery. Hardly more favorable conditions for the development of fungi could be imagined!

The writers suggest that the decay was produced by *Merulius* *lachrymans,* but the evidence is very doubtful. After a discussion of the need for close-grained, properly seasoned, resinous pine, or, in case of inferior timbers, of a suitable preservative treatment, in important structures, the writers conclude with the statement that the increasing prevalence of "dry rot" in England, Germany and America is probably due to the increasing use of poorer lumber.

Rapid Destruction of Timber Beams from Dry Rot. Eng. News, 1911. 66:727-729, figs. 1-4. 21 D.
Dry Rot the Cause of Collapse of a Factory Building during a Fire. Eng. News, 1909. 62:620-621, figs. 1-3. 2 D.

New Preservative.

Under the name 'Kulba' a new patented preservative material is being introduced in Germany. It is a solution of sodium zincate. Hitherto alkaline solutions were tabooed as destroying the wood fiber, but this material contains besides the zinc, an excess of free alkali. It reacts neutral and does not attack the wood fiber.

Apparently the albuminoids of the wood cells act as protective colloid which prevents the sedimentation of the zinc-oxide, while the alkaline zinc solution kills the living cells of the fungus.

The material is colorless, non-poisonous and non-odorous, and, moreover, is very much cheaper than any of the other preservatives and claimed to be more effective, the cost of Kulba comparing with zinc chlorate as 1.14:18. It may also be used as an insecticide, and reduces inflammability of wood.

It is manufactured by Hartman and Schwerdtner at Grossschönau, Saxony.

Ein neues Holzschutzmittel. Holzkäufer. April, 1911.

MENSURATION, FINANCE AND MANAGEMENT.

New Line Measure.

Dr. Dock points out that in accurate surveys the use of short measures like chain and steel tape gives rise to various errors on account of the necessity of applying them frequently on long lines, on account of kinking, changes of length due to temperature difficulty of straightening and other accidents due to topography. To overcome this a wire rope appears serviceable of a diameter of 2.5 mm. (.0984 inch) consisting of 42 fine wires, 6 strands, 7 wires to the strand, with a hemp core, 300 feet long weighing about 4½ lbs. The subdivisions are noted by a small brass bullet soldered on, on which the reading is impressed on a flattened part of the bullet. The ends are treated like those of a steel tape with stout ring through which a stretcher stick can be passed. The ring is connected with the rope by a swivel. To the other end is attached a dynamometer (apparently constructed on the principle of a spring balance) provided also with a ring through which the stretcher stick is passed. This dynamometer permits a constant stretch for every measurement, the most satisfactory having been found to be 20 *Kg.*

The author has subjected this measure to careful tests and with considerable mathematical apparatus determined its errors, and has found that in regard to accuracy it lies between steel tape and lath measurements. Due to its length the errors of laying the measure on out of line and of frequency of laying on are reduced; due to its lightness and the considerable and uniform stretch to which it can be subjected (20 *Kg*) no kinking is experienced; temperature influences are no more unfavorable than on other measures; topographic inequalities do not influence it, especially when used with a clinometer. A long series of trial measurements is given to show its accuracy.

Die Längenmessung mit dem Drahtseil. Centralblatt f. d. g. Forstwesen. March, 1912. Pp. 116-128.

Forest Maps in Germany.

A map to be used in the management of a forest property should according to Dr. Glaser possess the following qualifications: 1. Delineation of the topography; 2. The stand and type relations: 3. Clearness and comprehensiveness; 6. Ease of reproduction and durability.

The contour interval in German forest maps varies from five to twenty meters. Contours are considered necessary on account of their value in delineating the forest types and in planning road systems and cutting operations. The scale most commonly employed is 1:10,000. The kinds of roads and trails, the character of ownership, and the location of villages, cultivated fields, and points of aesthetic interest are shown in great detail.

As a basis for management the logging units, the species, the age of the stands, the site quality, and the density are all set forth on the best forest maps. Three methods of representing this data may be employed namely: Color for species and tones for age; color for species and hatching for age; symbols for species and colors for age.

The latter method is considered best by the author. An elaborate set of symbols are given for differentiating the different species. Non-productive soil is indicated by an absence of coloring. Age is shown by varying the tones of the basic color. Site quality is indicated by roman numerals and density by arabic numerals. The cutting areas are shown by hatching and the working sections are bounded by a special form of border.

In order to make sure that maps will last for ten or twenty years they should be mounted on linen or prepared on a special form of paper into which linen threads are compressed. For ease of reproduction the base map of which an indefinite number of copies can be readily made should contain all permanent features such as topography, roads, and ownership lines. Then it is only necessary to add by hand work the coloring and symbols which indicate the more ephemeral characters.

Die Herstellung forstlicher Bestandsübersichts-und Wirtschaftskarten. Forstwissenschaftliches Centralblatt. January, 1912, pp. 10-27.

Approximating Compound Interest.

Oberförster Fischer develops in a very neat and easy manner the possibility of solving compound interest calculations without interest tables or logarithms, quickly and sufficiently approximately for the purpose of gaining an insight into financial relations.

He starts by showing that capital doubles, i. e. $1.0p^n=2$. if np (or 100 log 2)=70 approximately. E. g.

with 2 per cent. capital doubles in 70 : 2=35 years
with 2.5 per cent capital doubles in 70 : 2.5=28 years
with 3 per cent. capital doubles in 70 : 3=23.5 years
Again to treble, quadruple, etc., the capital, i. e.

$1.0p^n = 3$. the constant np (or 100 log 3)	=110 appr.	Diff.
$1.0p^n = 4$, the constant np	=140	30
$1.0p^n = 5$, the constant np	=160	20
$1.0p^n = 6$, the constant np	=180	20
$1.0p^n = 7$, the constant np	=195	15
$1.0p^n = 8$, the constant np	=210	15
$1.0p^n = 9$, the constant np	=220	10
$1.0p^n = 10$, the constant np	=230	10

This is an easily memorized logarithmic table. If np does not coincide with any of these values, a simple interpolation between two values is possible: e. g. $1.02580 = 7.3$. since $np = 200$, and

$$200 > 195 = 100 \log 7$$
$$< 210 = 100 \log 8$$

Various logarithmic relations can then be used to secure solutions lying outside of these given numbers. E. g. when in the fundamental equation $1.0p^n = C$. C is the unknown, say $1.04^{10} = x$ since $np = 40 = 110 - 70 = 100 \log \left(\frac{3}{2}\right)$, hence $x = 1.5$ app. (1.48 exactly).

Similarly. $1.03^{100} = x$.: since $np = 300 = 230 + 70 = 100 \log (10 \times 2)$, hence $x = 20$ (19.2). If in the equation n is unknown e. g. $1.035^x = 15.68$.:. since C nearly $16 = 2^4$, $x = \frac{70 \times 4}{3.5}$ 80 (precisely); or again $1.03^x = 1.8$.: since $C = \frac{2 \times 9}{10}$, hence $x = \frac{70 + 220 - 230}{3}$ $= 20$ (precisely).

The shortcuts for the various rent formulae are worked out and examples in application given. We give one of the latter: The celebrated Spessart oak brought for I class logs in 1836, 23 Mk; in 1907, 185 Mk; what is the price increment rate in the 71 years

$$1.0p^{71} = \frac{185}{23} = 8.0435$$

$$p = \frac{100 \log 8.0435}{71} = \frac{210}{71} \text{ appr.} = 2.96 \text{ (2.98 actually)}$$

The author believes that for a clearer understanding of forest-valuation and statics at least this short cut procedure may be helpful.

Zur Zinseszinsrechnung. Allgemeine Forst-u. Jagdzeitung. January, 1912. Pp. 11-19.

Forest Taxation.

The question of proper forest taxation has lately agitated the forestry world of Germany and Austria, as that of the United States, although from different points of view.

Some fundamental principles have lately been decided by the Austrian courts which may eventually become objects of adjudication with us. Hence we brief a long article by Dr. v. Bauer on the subject.

The main question is what constitutes the taxable property. Where income tax is levied as in Austria and most German States, the income of the preceding year or the average for the last three years serves as basis. The next question arises, what is the taxable forestal income. Should it be the actual or that which under proper management may be secured, or the net annual value increment? The first position is that taken by the Austrian law. This raises the question whether or not the sale of stock capital beyond the annual increment or proper budget is not merely a sale of property, hence the amount received not taxable because not income.

Originally the courts recognized that "the soil with the stock of timber necessary for an orderly management is the source of the income, the property." But in 1906 court decisions have entirely reversed the attitude and declared that the *soil alone* is the productive source and that the so-called wood capital can in no way be counted as anything but product, which, to be sure, the owner can harvest earlier or later: the soil rent is the basis or object of forestry. For purposes of taxation, therefore, the fact that in civil law grass, trees, fruit and other useful products of the earth, as long as they are not separated from the soil, are considered immoveable property, has no bearing upon the question whether these are, when separated, sources of income, or form income themselves. Any income resulting from fellings, whether economically sound or not is subject to tax; the question of ripeness has nothing to do in the case. "The distinction between mature and not mature stands, since it only expresses what portion of the forest may be exploited with due regard to annual increment and to maintenance of a given wood volume, has significance only as regards equality or inequality of the annual yield, but is no criterion for the question whether the harvested wood is an income or a consumption of capital." It is only an anticipation of a harvest according to the preference of the owner. But as long as the increment is either voluntarily or through force of circumstances left to accumulate, and is not turned into an income it is also not taxable.

A number of cited cases give opportunity for discussing arguments pro and con. The theory of the stock capital is in every case demolished, a surprising fact from the standpoint of forest management. (And this in the country where the normal forest idea had its birth in the tax collector's office. Ed.)

The author then cites authorities, legal and forestal, who recognize that soil alone is not the producer of forest crops, the wood stock being a necessary concomitant; he also cites decisions of Prussian courts, which recognize the wood stock as productive capital, but admits that nothing but a definite declaration in the law can alter the adjudication.

Das forstliche Jahreseinkommen. etc. Centralblatt f. d. g. Forstwesen. January, 1912. Pp. 3-23.

Forest Taxation. The Timberman offers a suggestion for the creation of a system of timber taxation which might be an improvement over the present inequitable methods.

Briefly the plan contemplates simply an addition to the present method of taxation. The election of the system would be optional with the timber owner.

Its salient features are:

1. Creation of non-operative timber zones which could include timber lands not required for immediate operation.

2. Assess the timber and the land in the non-operative zones separately.

3. The land tax to be imposed and collected by the county annually.

4. The timber tax to be imposed annually and deferred timber tax certificates bearing six per cent. interest, issued against the timber.

5. Interest on deferred timber tax certificates to be collected

annually in the same manner and at the same time that the land taxes are collected.

6. The deferred timber tax certificates would be a lien against the property.

7. In case of fire destroying the timber upon which deferred timber tax certificates were issued the county would have the right to lien on any other property, to insure payment of principal and interest.

8. When the owner desires to cut the timber he must first notify the county tax collector, 60 days prior thereto, and pay all accrued principal and interest due on said lands before commencing operations. The county shall release such units as desired.

9. The timber shall be re-assessed every five years.

10. The present provisions in the law regarding delinquent taxes would apply under this system.

11. When the timber is cut the state may elect to purchase the land by the payment of the assessed valuation plus the taxes and the interest.

The apparent advantages of this system are:

The county receives the annual tax on the land, and through the sale of the deferred timber tax certificates, also the principal of the tax on the timber.

The timber owner is not compelled to cut his timber regardless of physical or market conditions to prevent practical confiscation.

The state is assured the acquisition of the land for reforestation or agricultural purposes, at a fair price and pre-determined price. The lands best adapted for cultivation could be sold for homes and the rough, broken, mountainous land utilized for reforestation purposes.

Mineral rights should be reserved to the state.

The method of timber taxation in British Columbia embodies the above ideas and has produced excellent results.

Taxation of timber should be as nearly uniform as possible throughout the state, taking location, yield and quality into consideration.

The Timberman, January, 1912.

Forest Fire Insurance.

The first Mutual Forest Fire Insurance Company, as far as we know, has been organized last year or is organizing in Sweden under the title Svenska Omsesidiga Försäkringsbolaget Skogseld. Its charter is so drawn, that if by May, 5, 1912, it has not secured at least 500 members and 50,000 Kr ($13,500) insurance, its charter is forfeited.

By making the company a mutual association, many difficulties are overcome which have prevented regular insurance companies from taking such risks readily. The premium can be low until experience has shown its proper amount. The valuation of properties can be secured without much expense; coöperation and mutual watchfulness is secured.

The premium for the first year has been made one per mille of insurance value. If a railway pass within 50 yards the premium is increased by 40 %; if a charcoal meiler or kiln within that distance the premium is increased 10%. On the other hand, the neighborhood of field, meadow or pasture secures a reduction by 20%. The minimum premium is 2 Kr. (54 cents). The highest risk taken is ¾ of the forest value.

The valuation is based upon the owner's own estimate or under some circumstances on that of an expert employed by the association at the expense of the insurer. The damage is appraised by a committee of two, chosen, one by the insured, one by the association, who, if they cannot agree, choose a third member from outside of the locality, who, however, may not award a higher nor a lower damage than the two original appraisers. Finally, there may be an appeal to the courts.

Skogsbrandförsakningsfragan. Skogsvardsföreningens Tidskrift. December, 1911. Pp. 462-464.

UTILIZATION, MARKET AND TECHNOLOGY.

Five-mile Log Flume in Idaho.

At St. Joe, Idaho, a flume was constructed for floating down saw-logs, piling 80 feet long, and boom sticks 40 feet long. The flume is about 5 miles long built through a rough rocky canyon, with an average grade of 11% and with curves so great as 20 degrees. The grade line varies from 2% at the lower end to 15% at the upper. A wagon road was first built up the gulch to transport a small saw-mill which was to cut the lumber for construction of the flume. All the lumber used was cut by this mill and floated down in the new flume to the lower end as the construction work progressed.

The flume is built V-shaped with bents of 4 x 8 timber every 16 feet carrying 5 x 10 stringers, on which brackets having 4 x 6 sills and arms, and 3 x 6 braces are placed. These brackets form the frame work of the V-shape box which is made of 2 inch plank and battoned on the outside with 1½ x 4 inch stuff. The upper 1½ miles has sides 48 inches high and brackets placed mostly 2 feet apart because logs were to be loaded into the flume from both sides all along this distance. For this reason too the grade line was kept close to the ground. For the rest of the distance, 3½ miles, the sides were 54 inches high. Considerable grading, rock-work, bridging, and cribbing was required on account of crookedness of the gulch and the danger from high water. Round pole supports were placed between each 16-foot bent on all low bents, while on high bents the distance was shortened up to 12 feet. The latter were built with three and four posts to the bent, and 2 x 6 lateral bracing was used. The same size sway bracing was used on all bents. On the curves brackets were placed 2 feet apart, and the boxes shortened to ease the curve; on 10 degree curves the boxes were jointed every 12 feet; between 10 and 15 degree curves, jointed every 8 feet; and where over 15 degrees, every 6 feet.

Feeders, flat-bottomed, were taken from the creek and its branches every half to three-fourths miles where grades were steep.

Total cost of the flume including feeders and necessary dams averaged about $7,500 per mile. This includes cost of engineering, right of way, clearing, bridging,. cribbing, rock-work, grading and lumber. About 300,000 feet, all low grade, timber was used in construction.

The Timberman, January, 1912.

Wood Prices in Switzerland.

The Schweizerische Zeitschrift für Forstwesen brings from time to time reports of the actual sales of standing timber, with prices that have been obtained. These sales are made in the small communal forests and refer to standing trees, differentiated by species and size class, the buyer to fell and work up, the measurements being made after felling; remarks as to cost or at least chances of transportation, etc., are added. Also prices for logs and worked up wood are given.

For spruce and fir the prices for standing trees move between 14 and 28 cents per cubic foot; for felled trees only about 2 cents more; for logs (measured within bark) between 18 and 31.5 cents. The cost of transportation to nearest station seems to lie between 2 and 5 cents per cubic foot.

Hardwoods are very much higher in price. Ash trees bring over 40 cents; oak logs up to over 60 cents. Fuelwood ranges from \$7-\$9 per cord.

Im December, 1911, January, 1912 erzielte Preise. Schweizerische Zeitschrift für Forstwesen. Pp. 32-36.

Market in South Germany.

A report on the movement of the wood trade records that in spite of war scare, crises in stock markets, dear money, and high prices, increases in industrial development are noticeable in 1911.

The volume of trade on the whole showed by end of October an increase of 6%, and in wood alone of 3 per cent. In the labor market after May the demand continued to exceed the supply. Wood prices for logs, long timber, and pulp wood rose; drouth, with its consequent low water conditions aiding in depression of the latter article. But lumber prices are ruled by the world market and did not show the same advance.

Zur Lage des Holzmarktes in Süddeutschland. Schweizerische Zeitschrift für Forstwesen. January, 1912. Pp. 30-32.

German Wood Industries and Trade.

Whoever wants to become acquainted with the remarkable development not only of the wood industries but the means of transportation of the wood trade in Germany, should read the report of the journey of Austrian foresters as part of a commercial course instituted for the government foresters. This course lasts three months, of which two to three weeks are devoted to a longer trip under competent guidance.

The German waterways are developed to the highest efficiency facilitating cheap transportation for bulky wood goods. Electric machinery everywhere for rapid loading and unloading; specially organized operators; canals connecting all the rivers; shipbuilding establishments for river traffic of astonishing capacity; large river harbors and boom rooms (the small river Brahe, an affluent of the Vistula carries $10,000,000 worth of goods annually, in which are 35 million cubic feet of wood); coöperation of municipal and State governments; fixation of sand dunes; factories in which machine work displaces almost entirely hand labor, etc., all the complex commerce of the northeastern part of the Prussian monarchy was the object of the study trip.

Der Kommerzielle Kurs für Staatsforstbeamten, 1911. Centralblatt f. d. g. Forstwesen. February, 1912. Pp. 82-92.

Paving Blocks.

At the risk of repetition the following brief summary of the paving-block is submitted.

The wooden block pavement is laid with the end grain up, otherwise exactly like brick upon concrete foundation costing $1 to $1.10 per square yard. The blocks are 3, 3½ and 4 inches thick, cut from 4 x 6, 4 x 8 or 4 x 10 sound timber; are treated at creosoting plants with either the 16-pound or 20-pound treatment. In hot weather blocks with 20-pound treatment are likely to "bleed." When they average 17½ lbs. the following prices per sq. yard are quoted:

16-Pound Treatment.

3 inch blocks,	$1.51 per sq. yard
3½ inch blocks,	$1.74 per sq. yard

20-Pound Treatment.

3 inch blocks,	$1.62 per sq. yard
3½ inch blocks,	$1.87 per sq. yard

Block pavements costs about 12 cents more than brick. It is claimed they are smooth, wear smooth, never chip, do not store heat, never slippery, reduce noise of traffic, easy on hoofs and tires, no cost of maintenance.

Southern Industrial and Lumber Review, February, 1912.

Wooden Shoe in Europe.

Formerly willow was used almost exclusively for manufacturing wooden shoes but the scarcity of this wood brought Poplar into use. It requires about 1 cubic meter for 100 pairs of shoes of ordinary sizes. A cubic meter equals 35.32 cubic feet and costs about $6.00. The wholesale price of the shoes is 12 cents. One workman can make 12 to 15 pairs per day. Relatively few wooden shoes are made by machinery; it requires hand work to give them the satisfactory finish.

Woodcraft, February, 1912.

Quarter-Sawed Oak History.

The custom of quarter sawing oak is of only recent origin. In 1871 an Englishman named Thayer, in designing the city hall of Providence, R. I. suggested that oak sawed on the quarter be used for the interior finish. He had heard of a similar finish recently used in England. The contractors secured the material from Jacob L. Rumbarger, Monroe County, Indiana. The best white oak logs were used and great pains exercised in sawing the lumber accurately. It was years afterwards that quarter-sawed oak was used in furniture manufacture.

Hardwood Record, January, 1912.

STATISTICS AND HISTORY.

Baden Statistics.

The official statistics of the forest administration of Baden for 1909 have appeared and show an advance in all directions over those reported for 1904 (see F. Q. vol. VI, p. 199).

The total forest area of the State has increased to 1,445,600 acres, of which 248,000 are State property, but nearly 600,000 acres more of municipal and corporation forests are under direct State control, leaving only 674,000 acres, or 40%, in private hands.

The cut in the State forests has increased to 108.7 cubic feet per acre, with a work wood per cent. of 40.7%. The net money return for wood alone has increased per acre to $7.40 from $3 in 1881, although prices have in the last two years gone back. The best cuts of spruce and fir during the last 10 years averaged 17.5 cents per cubic foot, for pine, larch and beech 24 cents, for oak over 50 cents, the smallest logs selling at 5.6, 10.5, and for oak even 47 cents respectively less.

While in 1878 the forest capital figured at 2.5% was $21 million, in 1909 it was nearly $50 million, an increase in 32 years of 135 per cent.

Statistishe Nachweisungen aus der Forstverwaltung des Grossherzogtums Baden für 1909. Schweizerische Zeitschrift für Forstwesen. March, 1912. Pp. 99-101.

Swedish Statistics.

At an exposition by the mine districts at Orebro, Sweden, statistical tables of interest were exhibited, from which the following data are reproduced. Of the 101.5 million acres of total land area about 12 million is in farms, and nearly 16 million mountain waste, leaving 72.8 million acres in forest. Of this 78.2% is private, 21.8% State forest (in 1905). A table comparing forest areas of the European countries makes out Sweden, with 47.6% of land area and 9.76 acres per capita, by far the best wooded. The mine forests with around 7.2 million acres are, to the extent of 93.8%, privately owned, 570,000 acres of which only are under State supervision.

The increase in State forest area by purchase during the last 40 years is striking, the growth from quinquennium to quinquennium being given. It increased steadily from 425,794 hectar in 1870 to 4,588,588 hectar in 1910 (over 11,000,000 acres), the largest purchases having been made around the year 1900. The cost per acre varied from $3.33 to $11.55 per acre in the quinquennial averages.

A comparison of expenditures and annual cut reveals remarkable disproportions. In Saxony, with a cut of 284,000 cubic feet per revier the expense for personnel alone is $1.33 per acre; in Wurtemberg with a cut of 695,000, the personnel expense is 82 cents; in Prussia with a cut of 575,000 the expense is 76 cents per acre; while in Sweden with a cut of 1,775,000 cubic feet per district, the personnel expense is only 3.4 cents per acre. Even the mine forests incur a greater expense for service than the State with 11 cents on a cut of somewhat over one million feet per district.

Curves showing the incomes, expenditures and net results in five to five year periods show as steady growth of net income as the growth in area, the small income of 1870-74 with $115,000, had in 1905-9 grown to over $1,200,000.

A very interesting profit calculation for two characteristic single districts (Kronopark) shows the great difference when dealing with a district which at once furnishes a budget to be offset against the purchase money and interest (at 3.6%) as compared with a district of waste and young growth. The former had in 12 years almost paid for itself, while the latter, of course, had only accumulated expense and interest.

Bergslagsdistriktets Kolleklivutställning, etc. Skogsvardsföreningens Tidskrift. December, 1911. Pp. 441-459.

Waste Land in Prussia.

The extent of the waste lands in the hands of the government on October 1, 1908, was 69,585 acres, to which in 1909 were added 2,121 acres by purchase and exchange, and 16,030 acres were planted up, leaving still 55,676 acres to be reclaimed. In 1910, a further acquisition of 9,750 acres is recorded but the planting reduces the area by 18,342 acres, leaving a balance of 47,084 acres to reclaim.

Zeitschrift für Forst-und Jagdwesen. January, 1912. Pp. 63, 64.

MISCELLANEOUS.

Forestry Education in Germany.

At the annual meeting of the German Foresters Association at Königsberg the question of forestry education in continuation courses was discussed at length and led to the appointment of a special committee to which all propositions for extension of educational means are to be referred for report in 1913.

Wappes, the chairman of the committee which was to act as referees at the present meeting, had in a number of articles in the Allgemeine Forst und Jagdzeitung discussed the principles of a good educational system. The main question is the manner in which the education after the academic courses is to be continued, practically as well as theoretically. The lack of knowledge in many directions, which in spite of a good school education, remains is pointed out. "It is a mistake to call the forester's activity a *practical* profession—as in all other technical professions, basing every piece of work on scientific principles becomes more and more necessary." Extension work, as in other professions developed is needed. A high grade school education is useless, if the work is not continued in the same high grade spirit. The speaker also desires to develop the faculty of appearing in public —character and professional knowledge for best executive work. The continuation work should be merely an opportunity furnished by the government, not obligatory.

One of the co-referees points out the lack of interest of the practitioner in the literature, books as well as magazines, except for the government's subscribing for the latter; the book market is described as very bad, also the lack of interest of old officials in the improvement of their younger colleagues is censured. The overburdening with routine work is acknowledged.

Improvement in this direction, and libraries for every district are advocated. For Prussia an expenditure of $215,000 is advocated, against which a saving of twice that amount may be effected by reduction of unnecessary clerical work, etc. Increased activity of the Foresters Association is also advocated.

Traveling under guidance, or traveling scholarships are discussed.

Other matters discussed show that the "insurgent spirit" has taken possession of the German forestry world, and that not all things are as they ought to be in the fatherland of forestry.

Much is to be learned by us from these discussions.

Die XII Hauptversammlung des Deutschen Forstvereins. Forstwissenschaftliches Centralblatt. January, 1912. Pp. 27-47.

As a result of the above cited discussions the forest academy Eberswalde instituted a trial continuation course of six days duration, namely from the 10th to 15th July, 1911. It consisted of only five set three-quarter-hour lectures and the rest of the time was devoted to excursions under proper guidance, provocative of discussions. The gist of the lectures has been briefed and printed in separates. It was found that to be successful the maximum number of forty hearers must not be exceeded, and that those attending should be advised beforehand, at least a week before, and in detail of the questions that will be discussed, by means of a printed guide; also that too much was crowded into the six days. Otherwise, the undertaking was a great success, and attendance being non-compulsory, the interest did not flag. Theory and practice were bridged, as Dr. Moeller put it in his welcome, by having practitioners meet with the professors.

The lectures were, each by an expert: Rainfall distribution in North Germany and its causes; Wood import and its relation to general economic conditions; Old and new methods of securing mixed stands; New methods in soil investigation; Influence of time on plant growth. At the excursions the aim was to have definite problems brought to view and to discussion after a short statement of the surrounding conditions.

From the printed abstracts we may brief elsewhere only a few points of interest under their appropriate headings.

Der Fortbildungskursus der Forstakademie Eberswalde. Zeitschrift für Forst-u. Jagdwesen. February, March, 1912. Pp. 77-105; 161-170.

Forester a Merchant.

Experience in German forest administrations, according to Schilling, has shown that auctioning woodsales does not produce proper market prices on account of "rings" among bidders: the forester must make the price! Hence he must know general trade condtions—the market

—and he must be able to judge beforehand the trend of the market. In Germany the import trade is a good measure of the trend of the market. The causes for ups and downs in the market are discussed and the relation of various industrial phases to the wood trade shown in curves. There is a striking coincidence in the curves of rises and depressions, especially between wood import and wood prices.

The necessity for the managing forester to keep himself in touch with the changes in trade conditions is accentuated.

Unsere Holzeinfuhr und ihr Zusammenhang mit der allgemeinen wirtschaftlichen Lage. Zeitschrift für Forst-u. Jagdwesen. February, 1912. Pp. 85-95.

Distribution and Causes of Precipitation.

The detailed rain maps of Germany show, according to Schubert, that not only the mountains but even small elevations receive increased rainfall and that the eastern slopes are in the rainshadow (drier). Forest areas receive a slightly larger rainfall than open areas, the forest having an effect like an elevation of double the tree height.

In the North German plain summer rains prevail, frequently accompanied by thunder storms and hail storms, with a maximum in July. Nearer the coast of the North Sea both rain maximum and temperature is displaced towards the fall, August being the rainiest month.

Die Niederschlagsverbreitung in Norddeutschland und ihre Ursachen. Zeitschrift für Forst-u. Jagdwesen. February, 1912. Pp. 82-85.

Ancient Wood Contract.

Professor Bezold has deciphered a letter written probably about the year 650 in Assyrian cuneiform writing, which advises the King of Assyria of the shipment according to order of "living beams: 372 stout beams, 808 of two generations, 2,313 of three generations, 11,807 of four generations, total 15,200 (should be 15,300) sound, and in addition 13,157 old eaten ones."

Species and place of derivation are not mentioned, probably from the composition of the shipment a virgin stand. Living beams are probably those cut from green timber, while eaten ones probably from dead trees; generations probably refer to age classes or at least diameter classes.

Eine Holzlieferung im assyrischen Reich. Forstwissenschaftliches Centralblatt. January, 1912. Pp. 63, 64.

OTHER PERIODICAL LITERATURE.

Canadian Forestry Journal, VIII, 1912,—

Tree Planting in Southern Alberta. Pp. 42-47.

Canadian Pulp Woods. Pp. 48-50.

Quarterly Journal of Forestry, VI, 1912,—

Experiments on Trees at Colesborne. Pp. 83-111.

The Structure of the Timbers of Some Common Genera of Coniferous Trees. Pp. 112-134.

The Pulp and Paper Magazine of Canada, X, 1912,—

The Degradation of Mechanical Wood Pulp During Storage. Pp. 80-84.

Pulp and Paper Industry in British Columbia. Pp. 97-98.

The Need for a Canadian Experimental Pulp and Paper Plant. Pp. 115-119.

Rod and Gun in Canada, XIII, 1912,—

Final Report of the Ontario Game and Fisheries Commission, 1909-1911. Pp. 1413-1508.

The Ohio Naturalist, XII, 1912,—

Key to the Fruits of the Genera of Trees of the Northern United States. Pp. 506-512.

The Botanical Gazette, LIII, 1912,—

The Morphology of Leitneria Floridana. Pp. 189-203.

Ray Tracheids in Abies. Pp. 331-338.

Do the Abietineae Extend to the Carboniferous? Pp. 339-344.

The Journal of the Board of Agriculture, XVIII, 1912,—

Varieties of Willows. Pp. 906-915.
Descriptions of best varieties for basket-making purposes.

The Agricultural Gazette of New South Wales, XXIII, 1912,—

A Weevil Destructive to Pine Trees. Pp. 55-56.

White Ants Attacking Australian Sleepers. Pp. 237.

The Gardeners' Chronicle, LI, 1912,—

British Elms. Pp. 199; 216-217.

NEWS AND NOTES.

An "Act to Amend the Conservation Law and in Relation to Lands and Forests" has recently become a law in New York State, the Bill being prepared by the Conservation Commission. The more important provisions are:

Section 88, giving the Conservation Commission power to examine any private forest or woodland with the view to the application of forestry methods, "to the end that the water power of the State may be conserved, forests protected, and the public interests safeguarded;"

Section 89, providing for taxation relief when waste land is reforested by private owners;

Section 102 and 103, providing for a State-wide inspection of railroad locomotives and fire patrol in forest sections;

Section 105, permitting inspectors to remove from service engines without adequate fire protection devices;

Section 106, providing for suitable spark arresting devices on all portable and stationary engines used in forest sections.

Other distinct features of the new law cover provisions for the setting of fires at any time for the clearing of land after proper permits have been obtained, and changes in the title of Fire Superintendent to District Forest Ranger, and from Fire Patrolman to Forest Ranger, this being a step towards the standardization of terms suggested by Mr. Pinchot. A new feature is found in section 62, which authorizes the Commission to employ convict labor in the growing and field planting of forest trees, and provides for the transportation by common carriers of nursery stock for reforestation at less than the established rates. The provisions in the old law for top lopping in lumbering operations have been retained, but the application of this provision has been restricted to the so-called fire towns.

The position of State Forest Pathologist has been created in New York under the new forestry laws. This innovation is probably the result of the chestnut bark disease, which is very severe in southeastern New York, and has led to a realization of the danger to the State forests which may follow a serious forest tree disease of any species.

The Agricultural Appropriation Bill, in the form in which it passed the House, did not include the appropriation of $1,000,000 asked for by the Forest Service for emergency fire fighting. The Forest Service expended about $900,000 in fighting the big fires of 1910, this being in excess of their appropriation and was covered by Congressional Act. It is of course the hope that the fire season of 1910 will never be duplicated, but even under the improved conditions and with the effective aid rendered by the lumbermen's fire association, it is unsafe to anticipate that emergency funds will not be required. The roads, trails, and telephone lines which are being built by the Forest Service will help very materially in preventing or reducing fire damage; but in the same Bill the current appropriation of $500,000 for this purpose was reduced to $275,000, so that the preparations for preventing and controlling fires cannot go forward as rapidly as is desirable. In view of the loss of $12,000,000 worth of timber in 1910 and of 79 fire fighters and 25 settlers, the full appropriation asked for by the Service would be none too large; but it must be remembered that certain members of Congress are still not heartily in sympathy with National Forest work, and we should perhaps be grateful that Congress has granted an appropriation sufficient to maintain an efficient, although inadequate organization. If the half million dollars requested for preventive measures was granted, it would amount to only one-fourth of one per cent. of the value of the timber standing to-day on the National Forests, and certainly no one should begrudge such a nominal expenditure for the protection of resources whose money value approximates over half a billion dollars and whose indirect benefits are incalculable.

The Forest Service is preparing to issue a folio to contain separate maps of North America, upon each of which will be shown the geographic distribution of a single tree species. This will be the most accurate and exhaustive representation of this subject which has yet been attempted. Such a set, based upon all accessible printed data, is already in existence in the Facutly of Forestry of the University of Toronto, in constant use by the students.

The following item is from the New York Times of April 12, 1912:

Considerable interest is evinced in the New York paper market in the report from Pascagoula, Miss., that the Southern Paper Company has awarded contracts covering the erection of a large paper mill at that place. The plant is on the Escawtapa River, near Moss Point, and when completed will be the largest of its kind in the South. Waste from the mills of the J. L. Dantzler Lumber Company of Moss Point will be utilized as raw material.

The Southern Paper Company is capitalized at $750,000, a good part of which represents English investments.

The Office of Wood Utilization of the United States Forest Service is making an exhaustive study of the wood-using industries in all the states. The investigation has been concluded already in a number of states and the reports have been published. In others the work is going on, and it is planned to conclude it in every state in the Union as quickly as possible. As a result of all this fundamental work the Forest Service will issue two sets of publications, one dealing with the uses of the principal commercial woods, the other showing the kinds of wood used in the principal wood-consuming industries, such as furniture, agricultural implements, etc. The list so far published includes Washington, Oregon, Louisiana, Mississippi, Missouri, Wisconsin, Illinois, Maryland, Massachusetts, North Carolina and Kentucky.

From the Bulletin of the Bureau of Statistics, U. S. Department of Agriculture we learn that the export of forest products for 1910 amounted to $85,030,230, an increase of $12,587,776 over 1900, although not quite one-tenth of the very much lessened export of farm products. But this export is offset by an import of $178,871,797, an increase of nearly 55 million dollars over 1909 and 81 million dollars over 1908. This includes, to be sure, India rubber and many other articles which we do not produce.

Even though the wood preserving industry in the United States has developed at a remarkable rate, or from 11 plants in 1900 to 101 plants in 1911, conditions arise from time to time which threaten to curtail the work under way and the development of new plants. At the present time three conditions, two of them actual and one threatened, are confronting the wood preserving people. The two actual conditions are an increase in the price of British creosote, amounting to about one cent a gallon, and a very marked advance in ocean freight rates, the price on tank steamer charters to American ports having increased as much as six-fold in the last year. The inevitable result is that the American consumers, since their oil requirements cannot be met by the domestic producers, must pay materially more for creosote, which leads either to a curtailment in the amount of material treated, a lessening of the amount of oil injected, or, in a few cases, the shutting down of plants. On top of this comes a provision in the Chemical Bill before the Senate imposing a duty of five per cent. on creosote, which would still further increase the price. The question of duty was up some two years ago, when an attempt was made to impose the twenty per cent. called for in existing schedules on manufactured creosote. A muck-raking magazine came out with a scare article on how the Government was being defrauded by the corporations and urging the collection of 20% duty on all imported creosote. This was all very well, but the writer failed to distinguish between the manufactured creosote used for toothache and the by-product creosote imported for wood preserving purposes. The presence of a fraction of a per cent. of chlorine in a cargo or two of oil was made the basis for a claim that creosote is a manufactured product, since chlorine is not present in coal gas tar. The amount of chlorine revealed on analysis was so slight as to be insignificant, and its presence was easily explained by the washing down of the tanks by sea water and by chemical conditions arising in the by-products distillation. Since the domestic by-product ovens are able to produce less than 30%, or only about 18 million out of the 63 million gallons of creosote used annually in the United States, and as the domestic producers are able to market all of their products at remunerative prices, to impose a duty would not only hamper an important industry, but would curtail a work which perhaps more than any other tends to lessen our timber consumption and conserve our forest resources.

It is but natural that the lumbermen should turn to wood preservation as a means of marketing grades and species which are not in active demand untreated. A recent and one of the first applications of this policy is found in the case of the St. Paul & Tacoma Lumber Co., of Tacoma, Wash., which is erecting a new creosoting plant to be operated in connection with their mills at Tacoma. Another new cross-tie treating plant is under construction at St. Helens, Oregon.

White Pine as the king of lumber woods has been looked upon as a timber of fast declining prominence, and it is unquestionably true that the best and most accessible White Pine is gone. The advertising campaign which the lumbermen are now engaged in along various lines presents the present White Pine situation in a somewhat new light in the little leaflet called "The Pine Cone," published by a half dozen white pine manufacturers in Minnesota. It would hardly seem necessary to give much publicity to White Pine, because its value is known to all consumers and the buyer was educated to use it years ago. While the pamphlet tells many interesting things in regard to White Pine manufacture and indicates that considerable quantities are still available, there is apparently no effort being made to perpetuate any of the forests in which the loggers are now operating. In the manufacture of White Pine, this year's report of the Northern Pine Manufacturers' Association shows the production in 1911 of 1,223,132,000 feet, which is an increase of 227,000,000 feet, or nearly 17%, over 1910. This is probably the result of demand rather than of available supply.

While on the subject of White Pine, it is worth while to call attention to a note in the American Lumberman of April 20, in regard to the felling by the Potlatch Lumber Co. of the largest White Pine tree in the Idaho country. While this tree was not a *Pinus strobus,* the note regarding this particular Western White Pine is interesting in that it states that the tree was 207 feet high, 6 feet 9 inches in diameter, and 425 years old. The mill scale showed a volume of 29,800 board feet. While it seemed like a sacrilege to cut such a tree, it is stated that it was deteriorating, and having lost the protection of the surrounding forest, would probably have been blown down the coming season. Sugar Pine often exceeds these dimensions, a particularly fine specimen on the tract of the Diamond Match Co. in Butte County, Calif., being nearly nine feet in diameter breast high, and scaling 58,000 board feet on the stump.

The voluntary forest fire association work, which originated with the lumbermen of the Northwest only three years ago, is developing at a rate which promises greater results in the way of forest fire protection than any one or all agencies heretofore devised. Current trade journal notes indicate the organization of at least three additional fire protective associations this year, these being the St. Maurice Valley Protective Association, in Canada, the Fire Protective Department of the Michigan Hardwood Manufacturers' Association, covering over 200,000 acres, and the Linn County Fire Patrol Association, of Oregon.

At a meeting held in Montreal in March a number of limit holders formed the St. Maurice Valley Forest Protective Association to protect their timberlands from fire. The members have agreed to assess themselves one-fourth of a cent per acre for the coming year and the Department of Lands and Forest for Quebec will contribute three thousand dollars in consideration of the protection afforded provincial lands. In addition to this patrol expenditure lookout stations, telephone lines and trails will be built; the provincial government will also bear a share of this cost.

It is learned that the Court of Chancery of New Jersey has declared the Railroad Fire Line Law of the State unconstitutional upon the ground that it confiscates or destroys private property without compensation. A re-hearing before the Court of Errors and Appeals, the last judicial resort, will be made. Practically the decision means little, since the more important railroads at least have voluntarily been constructing such fire lines.

A new firm of Consulting Foresters has opened office in Boston, under the firm name of Miles and Hall, by Messrs. Herbert J. Miles, (Harvard), and Stanley B. Hall,(Biltmore).

Additional appointments to the forestry faculty of the New York State College of Forestry at Syracuse University have been announced by Dr. H. P. Baker, whose acceptance of the position of Director, appeared in the last issue of the Quarterly. John W. Stephen, who has been with the New York State Conservation Commission, for the past five years and who developed the State nursery at Salamanca, will have charge of the nursery work and demonstration planting, and will give courses in seeding and planting. Prof. Frank Moon, of the Massachusetts Agricultural College, will take charge of the work in Mensuration and Forest Engineering; while Mr. Nelson Brown, formerly Deputy Supervisor of the Deerlodge Forest, will take charge of the work in Lumbering and Utilization on July 1st and will spend the summer in the lumber camps of the State studying logging conditions and procuring material for the Museum. Prof. Frank Moon is to spend the summer in Europe studying forest conditions.

Professor William Darrow Clark, (Yale '09), hitherto Assistant Professor at State College, Pennsylvania, has been selected to fill the vacancy as head of the forest school.

The school has a 20,000 acre tract of virgin White Pine in the western part of the State, where two months are spent during the full-grade four-year course. A large mill in the vicinity offers opportunity for studies in mill scale and similar work. The entire second semester of the senior year is spent in the woods of the South. There are more than one hundred and fifty students reported as enrolled. thirty graduating this year.

By the new announcement of the Colorado School of Forestry at Colorado Springs, a one year ranger course is to be established. Also the proportion of field work in the School is considerably increased. In both the two year technical course and in the ranger course the students will be in the field from September 10 to December 1 and from April 1 to June 28. The intervening portion of the college year will be spent at Colorado Springs. The ranger course given by Colorado College last winter was very successful. There is, however, a great need of more thorough training of men for ranger service than can be given in a ten weeks course. Men are to be accepted in the one years course (1) who have completed a high school course, or (2) who have had employment in the Forest Service (3) or if not less than eighteen years of age at the discretion of the Director. The course is to be conducted along practical lines and is intended primarily to prepare for work on the National Forests in the Rocky Mountains. A large proportion of the instruction will be in surveying, engineering, mensuration, lumbering, silviculture, grazing and fire protection.

Mr. P. J. Anderson, Investigator in the Department of Pathology of the Graduate School of Cornell University, has accepted the position of Field Pathologist for the Pennsylvania Chestnut Tree Blight Commission. Mr. Anderson has previously investigated the cement dust injury to fruit trees in New York State and carried on other investigations concerning tree injuries and diseases. He will have charge of the field investigations conducted by the Commission.

There are now over seventy-five men in the field for the Pennsylvania Blight Commission, scouting for the blight in the western half of the State. The blight has been found in each of the southernmost range of counties in the western half of the State, although the infections are widely scattered and consist of only a few trees each. These isolated groups have been removed as fast as found.

Recent advices are to the effect that Prof. Filibert Roth will remain as head of the forestry department at the University of Michigan instead of taking charge in the new forestry department at Cornell. Prof. Walter Mulford will have charge of the Cornell School and is to appoint two additional Assistant Professors, making a total staff of four. The State has recently granted an appropriation of $100,000 for a forestry building, which will insure adequate facilities. It is expected that this will be ready for occupancy by September, 1913. Meanwhile the department is to occupy quarters in one of the new buildings of the College of Agriculture. At a recent meeting the trustees of the University approved the plan of giving a five year course in forestry, leading to the degree Bachelor of Science at the end of the fourth year and the degree Master in Forestry at the end of the fifth year. This course will be opened to students in September, 1912.

The department now has about 300 acres of land available for forestry purposes within easy walking distance of the Campus. This includes stands of pine, hemlock and hardwoods, and open land for planting.

On February 24, 1912, the Missoula Section of the Society of American Foresters was formed under the provision of its recently amended Constitution. District Forester F. A. Silcox was elected Chairman, Assistant District Forester R. Y. Stuart, Secretary, and Forest Supervisor Elers Koch was appointed by the Chairman as the third member of the Executive Committee. The meetings will be held on the third Monday of each month, the first being on March 18, at which F. I. Rockwell delivered a paper on "Forest Types in District 1."

The Pennsylvania Railroad forest planting this spring totalled 369,648 trees. They were distributed over ten tracks and cover fourteen species as follows: *Larix europea, 9,000; Pinus austriaca, 2,850; Pinus resinosa, 21,120; Pinus strobus, 20,375; Pinus sylvestris, 74,475; Pinus taeda, 3,161; Catalpa speciosa, 600; Fraxinus americana, 4,800; Gleditsia triacanthos, 448; Hicoria ovata, 100; Juglans nigra, 11,167; Liriodendron tulipifera, 602; Quercus rubra, 219,900; Tilia americana, 1,050.*

A proposal for a State forest in Scotland to show the growth and utilization of timber from the seed-bed to the saw-mill, is the main recommendation of the Departmental Committee appointed to consider the best means of promoting silviculture in that country. The area, says the Committee, should contain at least 4,000 acres, including if possible, 2,000 acres already under wood. The plantable land might with advantage for the purpose of demonstration amount to say, 10.000 acres, but such an extent combined with the necessary growing woods, might be difficult to secure.

The areas should be acquired by purchase; a lease, however long presented an eventual risk which the Committee thinks ought not to be run.

The demonstration forest, besides providing in itself a field for fresh study and research shoull be a centre where data from other parts of Scotland can be collected and compared, and thereby assist the application of scientific silviculture to Scottish conditions.

It is proposed that in addition to the director and other trained officials there should be twenty student-apprentices, who should be housed in a hostel in the forest. It would be impossible, says the committee, to estimate the probable capital expenditure, until an estate had been selected.

There are about 850,000 acres of private woods in Scotland. None of these privately owned woods are under the charge, or even the personal supervision, of a fully trained forest officer. Nine-tenths of them are lamentably understocked, and what might be a great source of wealth and employment is going to waste for want of the application of scientific silviculture. The committee is convinced that nothing short of ocular demonstration will overcome the obstacles to their proper development.

In "Country Life" (London, May 4, 1912, pp. 646-647), E. P. Stebbing briefly recounts some of the work of the students at Edinburgh University, where a full scientific course in forestry leading to the degree of B. Sc. was inaugurated some years ago. The theoretical courses in forestry proper are taken in two consecutive winter sessions, weekly excursions being made to neighboring woods. A large amount of practical work, in both Scotland and Germany, is given in the advanced courses.

The ten days' practice to which this illustrated article is devoted comes at the end of the first theoretical course, and is to personally acquaint the students with the manual labor of the woodsman. They are taught to correctly hold and use spades, billhooks, saws, axes, etc., the program covering nursery and field planting, deepening drains, burning brush, measuring tree diameters and heights, calculating yields, and making thinnings.

The University of Missouri forest school will run a camp on the lands of the Missouri Land & Mining Co. at West Eminence, from July 1 to August 15, for instructing woods workers in rough surveying, estimating, and marking. It is the idea to do no more than teach methods of doing better what woodmen have to do in their regular work. Tuition will be free. Applicants must be connected with some lumber concern or must be recommended by one.

The University of Toronto has graduated this year from the Faculty of Forestry the first larger class, namely 12, all of whom have found employment in the federal Forestry Branch; 8 of them in permanent, the others in temporary positions.

The Forestry Branch for the first time has tolerably adequate appropriations, $360,000, and every effort will be made by watch towers, trails, and telephone lines to develop an effective fire control. Mr. W. N. Millar, formerly supervisor of Kaniksu National Forest, has been specially imported to direct this development.

Another importation from the United States to Canada is that of Mr. Clyde Leavitt, who is to act in dual capacity, namely as advisor to the Commission of Conservation and, in administrative capacity, as Chief Fire Inspector to the federal Railway Commission. An elaborate set of regulations has been worked out, which should be effective under such inspector.

These regulations foreshadow the time when oil-burning will be obligatory. The Railway Commission has very extensive powers over all railroads operating under federal charter.

Still another importation is that of Mr. R. E. Benedict to take a position in the newly created Forest Service of the province of British Columbia. Here, too, the organization of an effective fire protection will be the first task of the new department.

The firm of Clark & Lyford, of Vancouver, B. C., and Lyford, Clark & Lyford, of Montreal, Forest Engineers, have recently opened a branch office in Philadelphia under the firm name of Clark, Lyford & Sterling. Mr. E. A. Sterling will have charge of this office in connection with his work as forest and timber engineer, while Dr. Judson F. Clark, C. A. Lyford, and P. L.

Lyford will remain in charge of the activities of the Canadian offices.

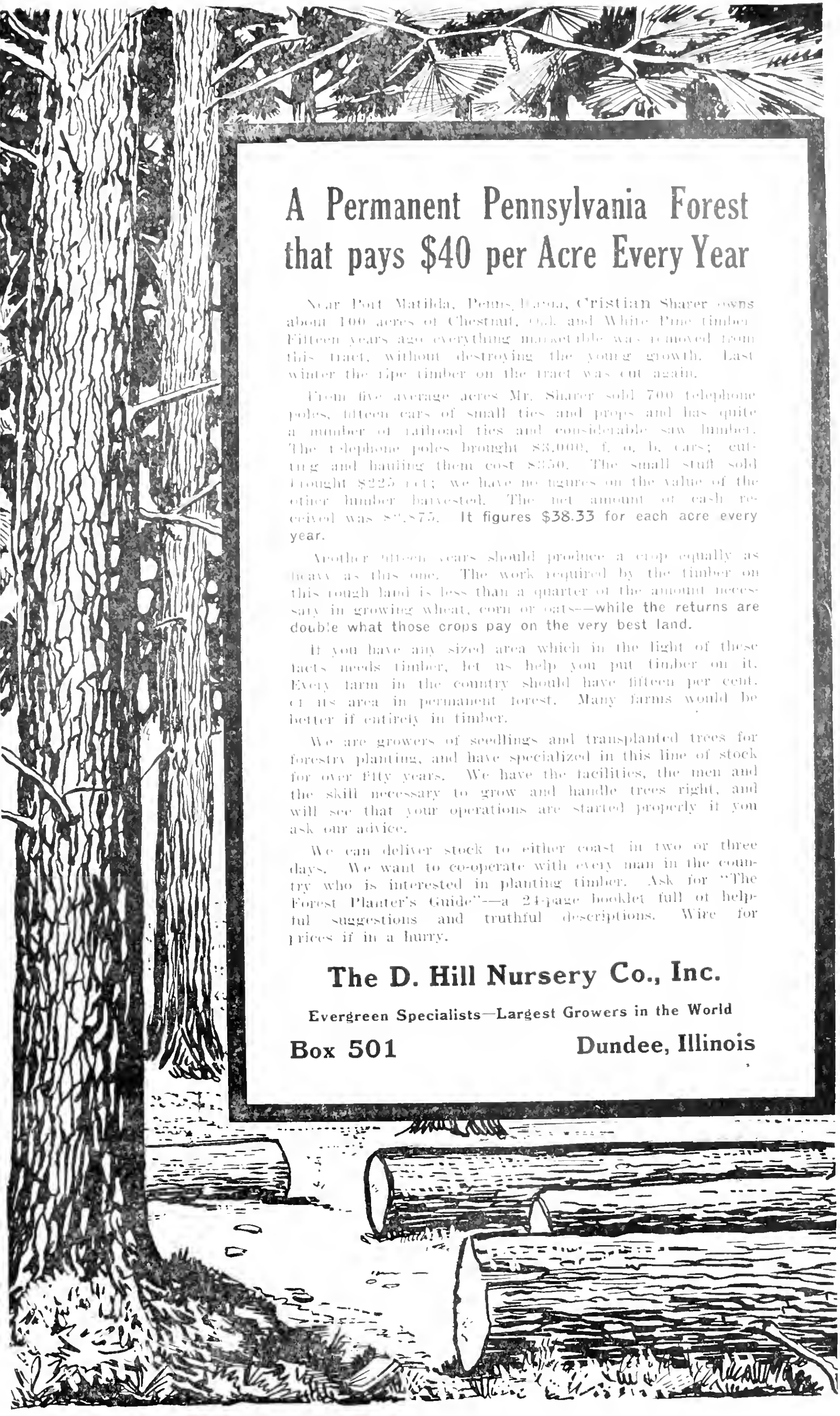
Plans are under way for a National Conservation Exposition to be held at Knoxville, Tenn., in September and October of next year. A company has been organized to back the project and citizens of Knoxville have contributed $100,000 as an initial fund, and a Bill has been introduced into Congress providing for the appropriation of $400,000 for a Government building and exhibits. A National Advisory Board has been appointed to plan the details, this board being headed by Gifford Pinchot as Chairman and by Don Carlos Ellis as Secretary. Several prominent lumbermen and others interested in the conservation movement are members of the Board. The Exposition as planned would encourage and foster the development of natural resources, particularly throughout the Southern States, and in a broad way indicate the methods by which the resources of the forests, lands, waters, and minerals, might be more effectively utilized and conserved.

The Board of Directors of the American Forestry Association, at their quarterly meeting in May, varied from the usual program of an official meeting in Washington or New York by making a trip to the New York State forest nurseries and plantations in the Adirondacks. The party, which comprised the Directors and their friends, numbered about twenty, and included in it were lumbermen, State Foresters, and professional business men who are interested in forest work. The party left New York on the evening of May 2 and spent the following day inspecting the nurseries at Saranac Inn station and the plantations at Lake Clear and Paul Smiths. The trip was very instructive, particularly to those who are not familiar with the larger phases of reforestation operations, as the nursery work, packing and shipping, and field planting were under way. Mr. C. R. Pettis, Superintendent of State Forests, acted as host, and in the comparatively short time available was able to show the party the more important features of the State nursery and planting work.

Dr. Joseph Roman Ritter Lorenz von Liburnan, for many years one of the leading and most learned foresters of Austria, responsible for the organization of the School of Soilculture and the Austrian Forest Experiment Station, died in his 86th year in November, 1911. His volume on "Wald, Klima, Wasser," (1878) is a classical discussion of forest influences and the forest-meterological stations and their work his most prominent contribution for American readers.

COMMENT.

The Cosmopolitan Magazine last fall announced a series of articles to appear in the early winter by Charles Edward Russell on the Lumber Trust. For some reason the Cosmopolitan did not publish this series, but it has appeared in the World To-day, now called Hearst's Magazine. To one at all familiar with the lumber industry, the attempt of the writer to develop something spectacular and conclusive as regards trust conditions is pathetic. The methods of some retail lumbermen and their associations are perhaps open to criticism, but when we go back to the manufacturing end, the one unanswerable question from the commercial standpoint is: What other methods could the lumbermen have possibly used with profit, in view of prevailing stumpage values and wholesale lumber prices?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BY

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Assistant Professor of Forestry, Yale University

AND

AUSTIN FOSTER HAWES, M. F.

State Forester of Vermont and Professor of Forestry, University of Vermont

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JOHN WILEY & SONS

43 and 45 East 19th Street NEW YORK CITY

London: CHAPMAN & HALL, Ltd. Montreal, Can.: RENOUF PUBLISHING CO.

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Volume X No. 3

FORESTRY QUARTERLY

A PROFESSIONAL JOURNAL

Subscription Two Dollars per Annum

ITHACA, N. Y.
1912
Application pending for entry as second-class matter.

FORESTRY QUARTERLY

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

To offer an organ for the publication of technical papers of interest to professional foresters of America.

To keep the profession in touch with the current technical literature, and with the forestry movement in the United States and Canada.

Manuscripts may be sent to the Editor-in-Chief at the University of Toronto, Toronto, Canada, or to any of the board of editors.

Subscriptions and other business matters should be addressed to Forestry Quarterly, Ithaca, N. Y.

Press of
WATCHMAN PRINTING HOUSE
Bellefonte, Pa.
1912

FORESTRY QUARTERLY

VOL. X] SEPTEMBER, 1912. [NO. 3.

STANDARDIZATION OF INSTRUCTION IN FORESTRY.

REPORT OF THE COMMITTEE OF THE CONFERENCE OF FOREST SCHOOLS.*

The first and most essential condition which determines the progress of any enterprise is the efficiency and the skill of the personnel behind it. This truth applies with particular force to the progress of forestry in this country. Its development and its service to the nation as a whole rests upon the knowledge and training which the American foresters are able to bring to their work. The leaders of forestry in this country have realized for a long time the important part which forest schools must play in the development of forestry. Within the last decade, the number of forest schools in the United States has increased with remarkable rapidity. To-day there are 24 institutions which give courses leading to a degree in forestry, and about 40 others which include forestry in their curriculum. Over 500 young men are preparing themselves in these schools for forestry as a profession. Within the last few years, it has been felt more and more that with the large number of forest schools, there is a danger of lowering standards and that it is desirable to attempt a standardization of forestry education. The first step towards such standardization was brought about in December, 1909, on the initiative of Gifford Pinchot, who called a conference of forest schools to consider the aim, scope, grade, and length of curriculum. At this conference a committee was appointed to draw up a plan for the standardization of the requirements for technical training in forestry. There were appointed on this committee Henry S.

*This report has been formulated by Mr. Graves, revised by Mr. Fernow and read by Mr. Fisher. Owing to their absence in Europe, the final report has not had the formal approval of Professors Toumey and Roth, and for other reasons, of Mr. Pinchot.

Graves, Chairman, B. E. Fernow, R. T. Fisher, Gifford Pinchot and Filibert Roth. The committee formulated provisionally a standard for forestry education, and called a second conference of forest schools in December, 1911, in Washington, to consider its report. The following institutions were represented at this conference: Yale University, Harvard University, University of Minnesota, Michigan Agricultural College, Massachusetts Agricultural College, New Hampshire College, University of Maine, University of Missouri, Iowa State University, University of Nebraska, University of Washington, Ohio State University, Syracuse University, Pennsylvania State College, Pennsylvania State Forest Academy, and University of Toronto, Canada.

The provisional plan of the committee was discussed in detail by the conference, and an expression of opinion by majority vote obtained as to the requirements for admission, the courses to be given in the curriculum, and the number of hours for each course. The committee was then authorized to prepare a final report embodying the conclusions reached at the conference, and to recommend the scope of each technical course.

The conference voted to continue the committee and to empower it to call meetings at its discretion. The chairman expressed his desire to withdraw from the committee as soon as the final report had been completed. It was voted that Professor J. W. Toumey, Director of the Yale Forest School, should then take his place. It was further voted that the committee be increased by two, and that the new members should be named by the committee itself. It was agreed further that the final report of the committee should be published in the Forestry Quarterly.

The committee herewith presents its final report on higher grade education:

Grades of Training.

It has been generally recognized both by the representatives of the different forest schools and by the committee that in aiming to standardize the educational work in forestry there should be recognized the need for at least four different grades of training:

1. Advanced professional training, to include not only a substantial general education but also a well rounded course in all branches of technical forestry.

2. Instruction for Forest Rangers, requiring merely a common school education, and conducted mainly along thoroughly practical lines.

3. General instruction in forestry supplementary to a course in agriculture, and designed to assist owners in the handling of their own woodlands.

4. General course in conservation and forestry designed for those who wish, as a part of their general education, to have some information on the economic problems involved.

The work of the educational conference held on December 28-29, 1911, was confined exclusively to formulating the requirements of the high grade professional course. The ranger schools and the courses of a general educational character were discussed to some extent, but no definite action was taken by the conference. This report, therefore, deals exclusively with the standardization of a course for advanced professional training.

Need for High Standard in Forestry Education. The standard of professional forestry training in this country, if it is to meet the country's needs, must be high. The profession of forestry is at present still in the process of formation and crystallization. In his pioneer work, the professional forester will be called upon not only to do a great variety of technical work, but also to develop the science of forestry itself. To do this efficiently he must be trained to develop methods of forest management suitable to our conditions, to apply these methods to actual management, and to educate the people to the need of forest management. The development of far reaching policies in constructive management of Government, State, and private forests will depend upon the wisdom and foresight of the professional forester. Upon the forest schools rests, therefore, the responsibility not only of training men in technical forestry, but of creating a body of professional men who can formulate the principles and do the constructive work required by our conditions. The rapidity with which the science and practice of forestry develops, and the quality of the work done, will depend on how the forest schools meet their responsibility.

Grade of the Institution. The educational requirements for training in professional forestry should be at least equal to those for the other learned professions, such as civil and mechanical engineering, law, medicine, etc. At the conference, the need of a thorough foundation in subjects of general educational character was clearly realized. The representatives of the conference advocated a collegiate training in history, economics, English, and foreign languages, as well as in botany, geology, and other auxiliary scientific subjects. Since it is impossible to give an adequate training in these subjects and in technical forestry in less than four years of collegiate work, the conference placed itself definitely on record that the technical schools should be of collegiate grade and of a rank equivalent to that established by the Carnegie Foundation. It was agreed that the course should comprise at least four years of undergraduate work. In the case of post-graduate schools, there should be at least one year of post-graduate work in technical forestry, making a five-year course altogether; and no post-graduate degree should be granted to a student who has not had at least two years' work in technical forestry either in the graduate course or the graduate and undergraduate courses combined.*

General Educational Requirements for a Degree in Forestry.

It was the decision of the representatives of the different schools that an adequate training in mathematics, general and national history, and modern languages should be required for admission to a forest school. In some cases the required work should be done in college, and in other cases it would be sufficient to accept an equivalent of college work done before entrance.

No attempt has been made to define the scope of the general educational requirements and those in the subsidiary technical subjects, since these courses are already well standardized in all high grade colleges.

Mathematics. The minimum requirement in mathematics should include trigonometry. The advanced work may be given in the forest school, or an equivalent of the college course re-

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*The University of Toronto offers besides its four-year undergraduate course, a six-year course combining a full arts course with the technical course.

quired for admission. The committee recommends that the higher mathematics, including, if the necessary time can be spared, elementary calculus, be given in the college.

General and National History. The requirement covers at least one year's work in general and national history, to be given in college, or the equivalent of a college course to be accepted for admission. There should be required further a course of one semester to be given in college covering such phases of American history as will specially meet the needs of foresters. During recent years, instructors in American history have given much greater consideration than formerly to a discussion of the development of the public land States. This should be emphasized in the course. The public side of forestry will always be of great importance. It is, therefore, recommended that the principles of government organization be emphasized. Such facts as are presented in Bryce's American Commonwealth are of great value to both public officials and citizens who have to do with public matters.

English. The minimum requirement in English should be at least one year of instruction given in college.

Foreign Languages. A working knowledge of at least one foreign language has been accepted as a minimum requirement. Instruction in the foreign languages may be given in college, or work outside accepted as its equivalent.

Quasi-Technical Subjects. The study of forestry requires a thorough foundation in certain natural sciences, and in surveying. Institutions have frequently been in doubt whether to align the forestry work with the department teaching natural sciences or with the engineering department. The growing of trees requires essentially biological knowledge. Yet, the forester must also be an engineer. Most institutions have tended rather to the natural sciences and in some cases have not sufficiently emphasized engineering. As a matter of fact, to meet the requirements of technical forestry the student must be prepared not only in the fundamentals of botany, zoology, and geology, but also in physics, chemistry, and surveying.

Physics. There should be required one year's work in physics, to be given in college, or work outside accepted as its equivalent.

Chemistry. An equivalent of one year's college work in inorganic chemistry, and one year's instruction in organic chemistry given in college have been adopted as the minimum requirements.

Botany. Two full years of collegiate work in botany, such as given in first class institutions, are considered essential for the forestry student. The course should comprise systematic botany, general morphology of plants, anatomy and histology of plants, and plant physiology. The course may comprise also the subject of plant ecology, where the colleges are equipped for it. It was the opinion of the conference that the two year's work should be done in college, since the courses in botany ordinarily given in preparatory schools are not adequate.

Geology. A half year in geology has been accepted as the required minimum.* The fundamental work in geology should comprise physical geography, the study of rocks, and the study of soils. Agricultural colleges will be able to specialize in soils in their relation to plant production better than the ordinary college or scientific school.

Zoology. The minimum requirement in zoology should be at least one-half year of college work. The understanding of the conference was that this work should be confined strictly to zoology, and would not be covered by a half year's work in general biology, which ordinarily includes the study of plant life. The purpose of the preparatory course in zoology is to lay the foundation for later work in forest entomology and in the study of fish, mammals, and birds.

Meteorology. While the conference considered meteorology a very important subject for the forester, it did not recommend that a separate course in this subject be given in college. It is believed that the essential ground work in meteorology may be covered incidentally with other subjects, for instance in physics, physiography, forest geography, or silvics.

Mechanical Drawing. A half year of mechanical drawing was accepted as the required minimum. This course is absolutely essential as a foundation for map work and surveying. The course is well standardized in all engineering institutions and needs no special comment with reference to its scope.

Surveying and Map Drawing. A full year's work each in plane

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*To this small requirement which received the majority vote at the conference objection is made by Dr. Fernow, the University of Toronto requiring not less than 100 hours for these subjects.

and topographic surveying as given in first class engineering schools was considered absolutely essential for a forestry student. The importance of a good foundation in surveying cannot be over-estimated. The student in forestry should have in the beginning the same work in plane and topographic surveying as a student in civil engineering. In addition, there should be ample instruction in the use of rough methods of topographic surveying. The course should provide not only for class work, office work, and map drawing, but also for adequate field work.

Technical Courses.

It should be recognized at the start that there is a constantly growing need for specialists in forest work of three distinct types, namely, besides general practitioners:

1. Foresters who have specialized chiefly along the lines of either forest management, or forest planting, or forest valuation, or similar technical problems, i. e. forestry proper.
2. Forest engineers, who have specialized in engineering lines and would be capable of organizing a logging job, laying out and constructing all the necessary roads, building of flumes, construction of sawmills, etc.
3. Forest technologists, who have specialized in one or more lines of manufacture of products derived from wood, which interest the general practitioner only incidentally, as for instance, wood distillation, pulp industries, etc.

To develop specialists along these three lines within four years of college work is an impossibility. Different schools, in order to meet the growing need for specialists, will eventually offer opportunities for advanced work along one or more of these lines. It is possible that some school may reach the ideal and be able to offer instruction in all of the three lines. At present, however, the time has not yet come for such specialization, and the forest schools must aim to give a well balanced general training in forestry proper, perhaps with a little more emphasis on either silvicultural work, or forest engineering, chiefly lumbering. Any tendency, however, to increase the training along any of these specialized lines within the four-year course must necessarily be done at the expense of the other subjects, or else the number of years required for this training must be increased. The scope of courses considered here has in view a well balanced professional school which does not aim at great specialization in any of these three lines of work, but attempts to give a general knowledge of the principles which underlie the entire field of the forester's activities, leaving the acquisition of specialized knowledge to be gained by the students in actual business life, or after graduation from the forest school, or by special study.

Some difficulty has been encountered in describing the requisite courses of technical character because of the different terminology and methods of arranging the work obtaining in the various forest schools. An attempt has been made to describe at some length the scope of each course, outlining, at least for the most important courses in forestry, topics which are to be covered in them. It is not the intention to force the adoption of these exact outlines by all forest schools, but rather to indicate the scope and contents of the courses. There is a full appreciation that on account of the personnel of the teaching staff and other practical considerations, there must be considerable latitude left to each school to arrange its course in such a way as to meet its special needs and use its particular facilities.

For the purposes of this report there must be some definite terminology. It should be understood, however, that there is no effort to require schools to adopt in their catalogues the names of courses or the exact classification of work used by the committee. The aim has been to make clear the scope of the work which should be covered by the curriculum.

Time Schedule.

The technical courses considered essential in a high grade school and the number of hours accepted by the Educational Conference as the minimum time to be devoted to each course are given in the following schedule:

Subject.	*Hours.* Class Work.	*Hours.* Field or Laboratory.	Total.
Dendrology, Forest Geography,	60	65	125
Silvics and Silviculture,	100	250	350
Tree Diseases,	20	30	50
Forest Entomology,	20	30	50
Forest Protection,	20	with management	20
Forest Mensuration,	40	100	140
Forest Management, Finance—Regulation—Working Plans,	70	150	220
Forest Utilization, Lumbering—Engineering,	90	190	280
Forest Products, Timber Physics—Wood technology,	50	100	150
Forestry History,	20		20
Forestry Economics, Forest Policy, Forest Administration,	95		95
	585	915	1500

In assigning the time to be devoted to each of the technical courses, the committee as well as the conference were well aware of the inadequacy of a time standard, since the contents of each hour must be of different value with each teacher. The above hour assignments, however, are the result of experience and the consensus of opinion of those who have had to deal with the different subjects as to the minimum required to encompass the subject. The same difficulty of hour assignment is experienced as to the division in class work and field work.

The committee, however, after hearing the opinions of the members of the conference has attempted to suggest an appropriate approximate division of time, the sum total of 1,500 hours in all being taken as the ultimate standard.

In the distribution, the biological branches receive 595 hours or 40%, the mathematical and business branches 790 hours or 52%, and the economic branches 115 hours or 8%.

Mathematically, taking field and laboratory work at an equivalent of 2½ hours for one lecture hour, this total represents 951 units, distributed through two years, or 15 hours per week for a 32 week session.

To overcome in part the inadequacy of a time standard the committee has outlined in more or less detail the contents of the various courses as understood by the committee.

Dendrology.

There is still considerable difference as to the conception of the scope of Dendrology, and in the methods of teaching it in our forest schools. In some schools, the course in Dendrology is devoted almost exclusively to teaching systematic forest botany, with particular emphasis on the external morphological characteristics distinguishing the different species of trees. On the other hand, some consider that Dendrology properly covers all distinctive characteristics of trees, including those of external form and development, as well as those of internal structure, and those of general and local occurrence or distribution and, indeed all biological facts of the species. In some schools, therefore, the course in Dendrology includes not only the botanical characteristics but also the geographic distribution and the various silvical characteristics of the different species.

It is somewhat of an academic question as to whether the descriptive and the biological or silvical characteristics of species are to be given in one and the same course under the name of Dendrology or be given in different courses. The essential problem is adequately to cover the ground in the schools and to properly co-ordinate the two subjects. In general, it is our belief that when the subjects of Dendrology and Silvics are carried along in the same semester the silvical characteristics of the individual species may best be taught under Dendrology, together with the botanical characteristics. In order to avoid any confusion, however, in this report, Dendrology will be considered to cover only the descriptive part, by which is meant the classification of different species and study of their external morphological characteristics as means of recognition. The characteristics which touch the life history of the species are classed under Silvics or Biological Dendrology (Forest Ecology).

Where the course in descriptive dendrology is taught a year or so ahead of Silvics or Biological Dendrology, it should perhaps include the general geographic distribution of the species so that the student will know not only what the trees look like, but where they occur.

The chief difficulty in giving instruction in descriptive dendrology is that so much material is ordinarily loaded on the student that he is unable to digest it, and when the course is finished he does not have an actual working knowledge for the recognition of species but an accumulation of facts which are to him largely a matter of memory. This has been proved repeatedly in the Civil Service examinations for government service where graduates of some of our best forest schools have shown by their answers to specific questions that they were drawing on their memory of text book and note book information, rather than possess actual knowledge. It is believed that the defect in the training in Dendrology in our forest schools has been due primarily to the effort on the part of the instructor to cover too much ground. It is a physical impossibility in the time usually devoted to this course, for the ordinary student to acquire a real working knowledge of *all* the species of the United States. It is therefore, believed that this course should cover only such ground as may be very thoroughly taught in the time at the disposal of the instructor.

The course should include, first, a very thorough and complete training in recognizing species which are found occurring locally, either naturally or by introduction. There is no reason why every student should not acquire a thorough knowledge of those species which he can actually see growing. Every forest school is so located that in the vicinity there may be found not only the species which occur naturally in the region, but a great many others planted for ornamental purposes. It is exceedingly desirable that schools should develop arboreta so that ultimately there may be found growing all the species which are climatically adapted to the locality.

The greatest difficulty is found in giving adequate training in the knowledge of trees which the student has not opportunity to see growing in the field. The schools in the North, for example, find difficulty in giving instruction in the characteristics of the species which occur in the far South or in the far West. The schools in the West naturally have difficulty in giving knowledge of the species which occur in the far East. Nevertheless it is absolutely necessary that every student should have a working knowledge by which to recognize the most important commercial trees of the whole United States. This means a certain number at each school which must be studied by the use of books, herbarium specimens, photographs, lantern slides, etc., rather than by actual observation in the field. These species can, however, be reduced to a relatively small number.

There should be at least a thorough knowledge on the part of the student of the distinguishing characteristics of the different genera, and of the different groups, if any, within the genus. Thus, it is important for the student to know the distinction between the white oaks and the black oaks. He should know thoroughly the characteristics of a few of the most important commercial oaks of the country, but there can be no great advantage in requiring him to master all of the different species of oak which occur.

There are about 40 genera to be studied, and at least one species in each of the genera should be mastered. In addition, the student should be taught all species which can be found growing in the locality of the school, and the most important species carried in the lumber market. As an illustration, a school in California should teach the local oaks. In addition, the students should be taught the white, red, and chestnut oaks of the East, but it is unnecessary to take the time to teach the long list of other eastern oaks. In the same way an eastern school should include in its course *Abies concolor, magnifica,* and *grandis,* but the distinctions between the minor *Abies* seem unnecessary. It should be kept in mind, that if the student knows the genera, knows of the existence of the species in the genus, and is practised in methods of analysis, he can quickly acquire the knowledge needed in a new field.

The time necessary for the work in descriptive dendrology is set at 100 hours, including class, laboratory and field work. This would be sufficient to cover not only the botanical study of the species as outlined above, but general forest geography of the country. If the course includes also the silvical characteristics probably the time should be increased by at least 10 hours.

Silviculture, Including Silvics.

Silviculture,—comprising the establishment, care, and development of forests,—must rest on a solid foundation of the natural sciences. The contents of a course on Silviculture may be conveniently divided into three parts: the study of the forest as a society of trees which is the unit with which silviculture deals—Silvics; the study of the general methods of natural reproduction and care of forests; artificial reproduction of forests.

Silvics, or the study of forest ecology,* concerns itself with such biological characteristics of species not only but of stands of trees, as are of basic importance in the application of silviculture. And as these characteristics are shown in reaction to the environment, the factors of site, including not only soil, but temperature, moisture, light and other atmospheric agencies, the relation of these to tree and forest development needs a broad treatment, for this knowledge forms the foundation of silviculture.

A clear differentiation and definition of dendrology, general ecology and silvics or forest ecology on the one hand, and of arboriculture and silviculture on the other hand is desirable at the outset; also a discussion of the relation of silviculture to other branches of forestry. It should be accentuated that not the single tree but the tree society, the stand, is the silvicultural unit, and the behavior in association the important direction of study.

The silvicultural characteristics of trees are their specific requirements for existence on soil and climate and hence their natural distribution; their natural form; their rate of growth and development, and their length of life; the peculiarities in their reproduction; their resistance to adverse factors, and their recuperative power. Each of these characteristics is subject to variation under different environment; and these variations should be discussed under each of the heads enumerated. There may also be discussed under each head the methods of measuring and expressing the silvical characteristics.

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*Which would be the better name!

Under silvical characteristics of stands there should be discussed (1) such silvical characteristics of forest trees as are exhibited by them only when they are growing in a stand; and (2) such influences on the factors of site or environment which are produced by the stand.

As soon as trees form a stand there arise new conditions which change more or less the physiographical environment. The unit of area occupied by a stand receives a different amount of precipitation than an area of the same size, but occupied only by a few individual trees. A part of the precipitation that falls over a dense stand is intercepted by the crowns of the trees. The snow has a different depth and density; it thaws differently within the forest than on a similar area outside of the forest. Under a dense forest cover the thermal and light conditions are altogether different from outside a forest. The humidity of the air and the wind velocity within the forest are also different from these conditions outside of it. These differences in the physical conditions inside and outside the forest are brought about by the trees forming a dense stand. As a product of the social life of forest trees there appears a leaf litter which has a great influence upon the physical character and structure of the forest soil. The foliage of trees in the forest, in addition to assimilation and respiration, acquires still a third function, namely of protecting and enriching the soil. The forest leaf litter is important to the forest not only by its beneficial influence, but often also by its harmful effect when a sour humus is formed.

In addition to the dead ground cover in stands of different ages and density, there appears also a living ground cover, the composition and ecological character of which is typical of the stands under which it springs up. Under different conditions of density and age of the stand the living ground cover varies greatly in character; one can find all gradations of vegetation characteristic of the densest forest to vegetation characteristic of open meadows. The living ground cover serves not only as a criterion of the conditions prevailing in given stands but, together with the dead ground cover, has an important influence upon the soil and reproduction of the stand. In connection with the general discussion of the influence of the living ground cover, it may be advisable to give specific description of certain typical and characteristic ground covers, such as sphagnum and other mosses, ferns, flowering plants, etc.

In addition to the changes in the external conditions of the life of forest trees which arise as soon as they form stands, or tree societies, there occur other processes in the life of the forest itself which are the result of the aggregate or social life of the forest trees. The most important processes are the struggle for existence between trees of the same stand and the process of differentiation of trees into dominant and suppressed. The rapidity of these differences is dependent upon the physical conditions of the site as well as upon the conditions of the stand itself (density, composition, etc.). What are the causes of this differentiation of trees into dominant and suppressed classes, and what is the silvical importance of these processes? In connection with the differentiation of trees into dominant and suppressed classes, it may be advisable to explain the general laws of growth of stands, the influence of soil and climatic conditions on the increment of stands, and the basis for classifying the conditions of growth into site classes or quality classes. Here also would be the proper place to explain that the natural thinning of stands does not mean only a change in the increment of the stand but brings about a change in the ecological or silvical conditions of the stand as well. The light conditions under forest cover, the soil protective capacity of the trees, the character of the living and dead ground covers all change in the natural process of thinning of the stand.

Aside from the direct struggle for existence among trees of the same stand, there may be observed also other relations which are more in the character of co-operation. Here belong the assistance which one species gives to the other by forcing it upward, by clearing its dead branches, etc. Another social function is the natural regeneration of the forest itself, the appearance of a new growth under the cover of the old one and also outside of the forest on ground not yet occupied by forest. The natural regeneration of a stand depends upon conditions created by the stand as a whole. These conditions should be considered now with special application to natural regeneration. In connection with the discussion of the spreading of a forest upon ground not yet occupied by it, it is necessary to discuss the influences of stands upon the land surrounding it. A comparison must naturally be drawn between the influence which strips of trees, such as windbreaks, and that of large bodies have upon the surrounding land. Here also should be described the conditions which exist for natural reproduction in natural parks, meadows, or other openings in the forest. The forest spreads and conquers new territories, first, by pushing its edge further into the open ground, and, second, by the assistance of some species which are endowed with peculiar silvical characteristics and thus justly make them forest pioneers (aspen). From such a discussion the transition is entirely natural to another phenomenon, the so-called rotation of species and later to forest types.

As a part of the silvical characteristics of stands may also be considered the composition and the form of stands, pure and mixed, even and uneven-aged, one-or many-storied stands.

The discussion, then, of the silvical characteristics of stands should cover more or less the following points:

Change in the physical environment of forest trees with the formation of a stand; the effects of the formation of stands upon the amount of precipitation which reaches the forest floor; effect of stand upon wind velocity; stands as means of conserving moisture in the upper strata of the soil; temperature, humidity of the air, and light conditions under forest cover; evaporation under forest cover; forest leaf litter, its importance and effects; living ground cover; struggle for existence among forest trees; laws of growth of stand; division of conditions of growth into site or quality classes; effect of some species in forcing the growth of others; silvical characteristics of one or many storied forests; silvical characteristics of pure and mixed stands; stands of seedling origin; stands of sprout origin; even-aged stands; uneven-aged stands; importance of shrubs in silviculture; natural reproduction of stands; silvical characteristics of natural parks, meadows, and other openings in the forest; formation of forest types.

In this discussion there will necessarily be used many illustrations of specific stands. It will be shown also how the characteristics of stands vary under different conditions of climate, soil, etc.

The study of forest types requires special consideration. The basis or criterion for determining forest types must be the physiographic conditions of growth. Another criterion for differentiating a stand into forest types is the method of regeneration which is dictated by given physiographic conditions of growth. The division of forest types into permanent or temporary must be fully explained as well as the importance of forest types for the preparation of yield tables, choice of method of reproduction, method of thinnings, and so on. In carrying on experiments it is essential to designate the type in which the experiment is located. In connection with the discussion of forest types there should also be brought out the types of locality which are capable of supporting definite forest types. The determination of such types of locality is essential in reforestation work.

The study of forest types should cover more or less the following points: Definition of forest types; factors determining forest types; permanent and temporary types; identification of forest types; naming of types; use of types in forestry.

After the student has mastered the silvical characteristics of stands, he should be taught how to describe a stand and a whole forest, although this subject may be deferred to another course. It is a difficult matter to make a brief description of a forest and present just those features which are of importance to the forester. The student should be given constant practice in this work throughout his course. The novice is apt merely to enumerate the species, or the types without bringing out those features of proportion of species, size of trees, and relations of density, quality of trees, growth, yield, and reproduction, needed to form a judgment of the needs and possibilities of the forest for silvicultural treatment. The foundation for forest description should be laid in silvics, or, if a special course in forest geography is given, in part at least in that connection and it should be followed by additional instruction and practice as further points are brought out in advance portions of silviculture and other courses.

After the discussion of the principles of silvics, the silvical characteristics of the individual species and of specific forest types may follow. If, as has been suggested, the characteristics of the species are considered in dendrology at the same time with the study of their identification, it is essential that this part be carefully co-ordinated with the course in silvics and those points emphasized which are needed by the forester. In short the forester's point of view must be held throughout, and the relation of the facts to practical silviculture never lost sight of.

The study of the individual forest types may be combined with a study of the forest regions of the whole country. The country may be subdivided into general regions; the northern, southern, hardwood, prairie, Rocky Mountain and Pacific. These are then sub-divided into silvicultural regions, such as those shown in Hawes and Hawley's "Forestry in New England". Each region has its peculiar forest types which may be handled with such detail as the conditions may require.

Forest Geography is a subject which at the conference did not receive separate attention, but receives a special assignment in some institutions. It may then in part include a broader discussion on the ecology of forest types besides a description of these, by so much relieving the course in silvics.

In this connection the same problem is encountered as in dendrology, namely, that it is impossible for students to learn all the types in the country. There should be a thorough mastery of at least all the silvicultural regions and their chief characteristics. The types of the general region where the school is located should be thoroughly covered. Beyond that the institution may be confined to the main features of the types in which the species covered in dendrology grow. Thus an eastern school would, under dendrology, consider Sugar Pine; but the type in which Sugar Pine is an important factor should be described in the course in silvics. In all this work it should be borne in mind that the object is to lay the foundation of silviculture. The botanical and silvical characteristics of Sugar Pine and of types in which it is a dominant factor are studied to aid the student in handling that tree in silvicultural practice. For this reason some schools defer the discussion of forest regions and specific forest types until the senior year and then include not only the description of the types but the problems of protection, silvicultural management, lumbering, reforestation, etc.

Field training in silvics is of the greatest importance and in many ways is the most difficult task in forestry education. The student may be taught without great difficulty how to observe and determine the characteristics of individual trees and how to express the results in terms of averages and extremes. It is more difficult to give a grasp of the forest as made up of stands, each with a character distinguishing it from others, and having a life, growth, and development, all of which may be measured and expressed in specific terms. This involves many individual field tasks by the student and the most intelligent personal supervision by the instructors. The student cannot merely be shown by excursions; he can master the principles of silvics only by familiarity with the forest through repeated practical problems which will enable him to recognize a stand as a unit of a given forest, diagnose its condition, place it in its right relation with reference to progressive development or retrogression and distinguish its needs.

Reproduction and Care of Forests (Natural Regeneration). This section of Silviculture concerns itself with the actual cutting of forests with a view to their reproduction, and with thinnings and improvement fellings in forest stands. There are certain underlying principles of cutting for reproduction. The application of these principles has developed certain methods and these have been developed into silvicultural systems. The teacher should at the beginning make clear that these methods any systems of fellings represent an expression of principle and are subject to great variation under different conditions. This is to avoid the tendency of undertaking to apply rules of felling in a more or less rigid manner. The mere enumeration and description of the silvicultural methods are the smallest part of the instruction. The student must rather see the fundamental principles underlying them, and understand their relation to the facts of silvics.

The forester has a definite aim in view relative to the reproduction of a given stand. His knowledge of silvics enables him to see how this can be done. The silvicultural methods as described enable him to systematize his work, but in applying a given method on the ground he has to exercise the greatest selective judgment in designating the individual trees or groups of trees to be taken and those to be left standing for seed or for subsequent growth. All too often a student feels that he understands the methods of reproduction but when he begins practical work he finds himself at sea because he tries to apply a method rather than a principle; because he knows only the books, and not the life and requirements of the forest.

A second fundamental necessity at the beginning of the instruction is that reproduction cuttings are in practice governed not only by considerations of forest production but by the cost of the work in relation to its final practical returns. One may cut a given stand in a way to secure the maximum of reproduction and final product in volume and quality, and yet the conditions may be such that the cost would be prohibitive. He must often operate at a less cost with a full realization that the results in production will be smaller. Applied silviculture must always go hand in hand with practical consideration of logging and disposal of the products.

With the fundamental principles mastered, the instructor takes up the various silvicultural methods as used in this country and abroad. Text books are now available which deal with these in their application to American conditions.

What has been said of the methods of reproduction applies equally to the work of improvement cuttings. Emphasis should be laid on the importance of extensive field practice. Every student should have practical training in marking for both reproduction and improvement cuttings, and to see cuttings carried on. He should also be given a chance to see stands where cuttings have been previously made, and to study the results obtained. In all this work the cost of the silvicultural work and the cost of marketing the timber selected for cutting should be made a feature of inquiry.

Forest Seeding and Planting (Artificial Reproduction). The scope and purpose of this section of Silviculture is already clearly indicated by its title. It should comprise the following points:

1. Forest Seed. Seed production of forest trees. Collection of seed and their storage; extraction of coniferous seed; seed drying houses; determination of the quality of seed; apparatus for germination of seed; stratification and other methods of accelerating seed germination.

2. Tools for Use in the Nursery and in Field Sowing and Planting. Various types of plows, harrows, spades, rakes, and mattocks; tools for planting; tools for stirring up the soil in the nursery.

3. Forest Nursery and Transplant Beds. Location of nurseries; establishment of seed and transplant beds; making of furrows; sowing of seed; care of seed beds; weeding; lifting and packing of plants; special methods of raising certain species.

4. Sowing and Planting in the Field. Direct seeding and planting; choice of methods; broadcast sowing; tools for broadcast sowing; sowing in strips and in spots; tools for strip and spot sowing; different methods of planting; selection of planting sites; subsequent care of plantation.

5. Sowing and Planting for Special Purposes. a. Fixation of shifting sands; water, wind, and man as causes of formation of shifting sands; importance of forest growing on sand; sand dunes; fixing of coast, continental, and river sand dunes; b. Checking erosion; fixation and forestation

of gullies; c. Forestation in the mountains; Karst; Alps; d. Hedges and windbreaks: Trees and shrubs especially suitable for hedges and windbreaks; care of the hedges; hedges along railroads; hedges for protection against fire; e. Willow culture. Species of willow suitable for different purposes; bark; baskets; f. Establishment of coppice forest; g. Planting on cultivated fields, drained swamps, moors, and heaths; h. Planting in the prairie region. Review of forestation in the prairie.

Field work in artificial establishment of forests should consist of: The laboratory study of seeds; cutting tests. Greenhouse study of the germination and early growth of several species of seedlings. Preparation of nursery beds (actual work). Transplanting in nursery (actual work). Seed spot sowing by various methods and in various sites (actual work). Field planting on various sites and with various kinds of stock (actual work). Preparation of plan for running a nursery of given capacity and character in great detail. Preparation of a detailed planting plan for the artificial reforestation of a specific tract.

Forest Protection.

In a number of schools no separate course in "Forest Protection" is given, but the different parts of the subject are handled partly in connection with Silviculture and partly as special courses like Forest Entomology, Diseases of Trees, etc. In whatever connection Forest Protection may be taught the following topics should be covered:

Protection from fire; from injuries by grazing; from insects; from injuries caused by herbaceous vegetation, fungi, and parasites; from injuries caused by mammals and birds; from injuries caused by atmospheric agencies; trespass.

1. Protection from Fire. The importance of this subject cannot be overstated. The discussions should include:

a. Nature and behavior of forest fires: crown, surface, and ground fires. b. Causes of forest fires. c. Damage by forest fires. d. The prevention of forest fires: 1. Educational work: 2. Development and equipment of forests for fire protection; 3. Organization of the forest force for fire protection; 4. Fire plans. Fighting forest fires.

The student should be taught first the principles underlying the nature of forest fires and their behavior under different conditions. Instruction should include the classification of fires, the form of the fire area, the rapidity of burning, and the intensity of the fire under different conditions. These conditions necessarily vary according to the character and quantity of inflammable material, the character of soil, and the conditions of the atmosphere.

The different principles may be illustrated by charts and photographs and by describing the behavior of specific fires concerning which the instructor may have adequate information. This instruction, however, should be supplemented by practical work in the woods. Often it is impossible for the student to study fires actually burning, but usually it is possible to make studies of areas which have burned, and it is exceedingly valuable for the student to work out in advance on a given area how a fire would behave under given conditions of season, drought, atmosphere, winds, and a fair start at a certain point.

The damage by fires is very closely related to problems in silviculture. The question of the resistance of different species to fire, the rapidity of deterioration of injured trees, the injury to the productiveness of the soil, the reduction of the rate of growth of the stand, and the effect on reproduction are all silvical questions. It must remain with the instructor whether to introduce these subjects under silvics or under protection. The instructor should, however, bring out the relation between the injury and the different classes of fires burning under different conditions. The student should be trained to appreciate the fire hazard, that is what the damage will be from fire on a given tract.

Under the head of educational work may be discussed the posting of the forest with fire notices, and the various means of educating the public using a forest to an appreciation of the danger of fire and the need of care in the use of fire in the forest. A great many ingenious methods of publicity have been devised by the Forest Service, State Foresters, and the fire protective associations.

Under the development of the forest for protection are included the following: 1. The reduction of inflammable material, as the disposal of slash after logging and the gradual disposal of dry tops and other material from old logging operations, windfall, and the felling of dry snags; 2. The construction of roads, bridges, trails, fire lines, ranger stations, lookout stations, tool boxes, etc. Under equipment of the forest are comprised the means of transportation, such as pack horses, teams, wagons for transporting men and supplies in case of need, tents and other equipment for the establishment of emergency camps, fire fighting equipment needed under different conditions, portable telephone sets, and miscellaneous other supplies.

The organization for fire prevention includes: 1. The posting of fire warnings, and other means of educating the people to an appreciation of the danger of fire and the need for care in the use of fire in the forest; 2. Organization of a regular fire patrol; 3. Organization of all co-operating agencies which may be drawn upon in case of fire; 4. Arrangements for securing supplies and for transporting them in case of fire, etc.

The preparation of practical fire plans is of great importance. The efficiency of the fire protection on the National Forests has, during the last two years, been enormously increased by such plans. Under the fire plan should be considered first the fire map showing roads, trails, lookout points, telephone lines, patrol routes, protection units, tool caches, ranger stations, supply stations, areas of special hazard, areas of valuable timber, young growth, brush, grass, barren, etc. This map should be correlated with the plan itself which describes the improvements and equipment for protection and the organization of the patrol force, transportation of supplies, reserve protective force, plan to secure additional men and supplies in emergency, and to transport them to a fire, co-ordination of protection with administration work, etc.

Instruction in fire fighting is difficult because a man can never become a good fire fighter without having had practical experience. A mere recounting of the methods of fighting fires under different conditions is good as far as it goes, but the principal work should be of a practical nature in the field. The students should, in the first place, learn how to handle all the various fire fighting tools. They should have practical training in cutting trenches, transporting water, economical use of water, use of sand, etc. They should also be given field problems in calculating on a given tract the probable nature of a fire starting at a given point and with specified atmospheric conditions and state of drought; the best point of attack, the location of trenches, the necessary force of men needed, etc.

Field work should also include the preparation of a fire plan for a tract of substantial size, say at least 5 to 10 thousand acres.

2. Protection from Injuries by Grazing. Problems concerned with the control of grazing on the National Forests will naturally fall under "Forest Administration" or under a separate head as

"National Forests". In a course on "Forest Protection", however, whether it is to be carried on as a separate course, or in connection with Silviculture, there should be indicated the damage done by different domestic animals to forest growth; the dependence of the extent of the damage upon the kind of animal, composition and age of the forest, time of the year, weather, and other conditions; the length of time for which different animals should be excluded from forest plantations; the number of stock which may be permitted; and regulations governing permitted grazing, etc.

3. Protection from Insects. It is impossible and undesirable in a general course in forestry to make the students trained forest entomologists. This is a specialty in itself. Every forest officer in charge of a forest will, however, have to fight injurious insects just as he has to fight forest fires. He must be in a position to recognize an insect attack when or before it occurs and to use known methods of combating it. A course in *Forest Entomology* in all schools should include the study of the main groups of insects injurious to trees. The previous training in zoology required as a foundation should enable the instructor to teach the students characteristics of the different groups; to show the nature of the damage done by them; and the methods of preventing infestations by silvicultural operations and combating large infestations so far as such methods are known.

The student should be taught to identify a restricted number of insect species. Thus he should be familiar with the Dendroctonus family, but it would be sufficient if he has learned the identification of only one or two species. It is better to have learned thoroughly a limited number of species representing the important groups than to undertake to learn the identification of a large number of species.

As stated, an important feature is to teach the student to recognize insect damage when it occurs and to collect specimens and report conditions so that he can secure the assistance of a specialist, who can identify the insect, and if this has already been studied, can determine the general method of attack. The training in the forest should then enable the forester to apply the known methods of attacking the insects. If the insect is a new one, the aid of a specialist on the ground would be required.

In short, the forest schools should not try to make investigations in forest entomology, but to train the men to apply in their work of forest management facts established by men who make investigation a specialty. Ultimately the executive force on a large forest should be able to meet in their regular silvicultural work all the ordinary problems of fighting insects.

4. Diseases of Trees. The problem of protection from diseases of trees and parasites is similar to that of forest insects. As yet the science of forest pathology is in its infancy. Yet the forester every day meets practical questions of protection from diseases which are injuring the trees. Such questions as whether certain defective trees may be left for seed, how long decadent stands may safely be left standing, how rapidly trees killed or injured by fire will deteriorate, whether certain unmerchantable diseased trees should be cut to prevent the spread of disease, are constantly puzzling the forester. Just as in Forest Entomology, the specialist must investigate these questions in the first place. When the diseases and methods of preventing them are known then the forester should be able to apply this knowledge in practice.

In school, the student should be taught the nature and life history of the principal classes of fungi and parasites and the methods of controlling their spread. He should know how to recognize injury by fungi and be prepared to put into effect control measures in the case of the most common. He should also be equipped to collect specimens and report on conditions, so that he may secure the aid of expert pathologists in the Government or State service.

5. Protection from Mammals and Birds. This is chiefly important in work of reforestation. The course should cover the protection from rodents and other animals and birds which destroy seed and kill or injure seedlings in the nursery and field. Special methods have been devised for protection against such injuries, and these should be covered either under the above head or under Silviculture. The damage to trees by deer, moose, porcupines, etc., may be touched upon but it plays at present a small part in our forest problems.

6. Protection from Injuries by Atmospheric Agencies. This includes injury by wind, frost, sun-scald, lightning, hail, snow, etc. Most of this ground would probably be covered in Silviculture. It is mentioned here for the sake of completeness.

Under this head might be considered also damage by smoke and sulphur fumes.

7. Trespass. This subject is mentioned here to prevent its being overlooked in preparing a curriculum. Most schools cover the ground under several different courses, as Forest Law, Forest Management, Lumbering, and Administration. The forester has occasion to seek damages for timber, fire, and grazing trespass, as well as trespass in occupying forest land without permission, or for breach of conditions of permits granted for special uses on a forest. Ordinarily, a forester secures legal aid in pushing a trespass case, but he has the task of determining the extent of damage to the forest. He must be prepared to do this work.

Forest Mensuration.

The course in Forest Mensuration covers besides scaling of cut wood the methods of determining volume and increment of trees and stands. It is the foundation for the course in forest management. Its scope has been well standardized in European institutions, and American schools have already pretty generally adopted this standard. Just as in the case of surveying, instruction in the use of methods should be largely by field work, the class room work being primarily in connection with the computation of data collected in the field, with quizzes and written tests.

The course deals first with the determination of the volume of logs and other parts of felled trees. The student is taught both commercial methods of measurement and also the methods of accurate determination of volume for use in scientific work. One of the subjects of early consideration is commercial log scaling. The theory of scaling is simple; its practice presents many difficulties especially in making discounts for defects. Just as far as possible the student should be given considerable practice in actually scaling saw logs during his course in mensuration, but he should be given further practice in his practical training in lumbering when he has the chance to see logs actually cut at the mill.

When the student has learned the different units of measurement and their application to felled trees, the determination of the contents of standing trees is considered.

The next subject in the course is the determination of the volume of stands. This subject also is taught both with reference to commercial timber estimating and the accurate determination of volume for special purposes, as the determination of growth and the construction of yield tables. Ordinarily, the subject is taught early in the forestry course when it is somewhat difficult to give successful training in commercial timber estimating. The students are then still becoming acquainted with the trees, and their ideas of the uses of woods, and of the specifications required for different classes of products are still unformed. A thorough foundation may, however, be laid in the use of methods of measurements, the use of averages, the application of volume tables, etc. In the practical field work of the senior year, extensive practice in commercial estimating should be given.

Finally, in developing the method of determining the rate of growth of trees and forests, it is not sufficient to teach the mechanics of making stem analyses, and preparing growth tables in diameter, volume, etc., but the student must secure a thorough grasp of the character of forest increment and to devise methods of procedure for determining for a given stand the rate of growth in volume, etc.

The details of the various points covered in Forest Mensuration are not here enumerated because they are now available in text books written from the point of view of American conditions. The results of forest mensuration furnish the basis for forest management.

Forest Management.

Forest Management in its broadest sense includes a group of subjects which deal with the quantitative and financial aspects of forestry, and with business considerations. Forestry as a business must conform to the principles which make for success in any other business. This means securing the highest returns on the investment, the most efficient organization and conduct of operations and the regulation of the forest output so as to secure a permanent and steady income.

While the attainment of these results is dependent on knowledge of practically all conditions which affect forests, from the academic point of view it is desirable to segregate two groups of subjects which deal, to be sure, with methods and conditions, on which management must be based, but may be treated separately, namely, the technical group, including silviculture, lumbering, protection—crop production and harvest; and the economic group, including studies of forest influences, statistics, forest laws, which determine guiding principles or objects to be attained by the management. Forest Management is to harmonize these abstract principles and technical methods with the financial condition of the owner, map out the exact nature and extent of the operations which can be most effectively carried out, organize the work, and secure the quantitative and financial results desired for the tract as a whole.

Five subjects may be grouped under Management, namely, Mensuration, Finance including Valuation and Statics, Regulation or Organization, Formulation of Working Plans, and Administration. Ordinarily, Mensuration is given as a separate course in forest schools, partly because it is a large subject in itself and may be clearly defined in scope, and partly because it is usually given in the junior year, while Management is given in the senior year. The usual custom is followed in this report of making Mensuration a study by itself. Administration may also be either included as a part of Management or else, as in this report, be made a separate subject. For similar reasons, some schools make Finance also a special subject, leaving to Management only the two subjects of regulating the yield and organizing the forest and formulation of working plans.

So essential in management is the knowledge of the result of mensuration that every instructor includes in his course in Management a review of increment to make certain that the students understand its significance and understand how to apply the knowledge for practical purposes. With a knowledge of increment the student is in a position to consider the problems involving the organization of a forest for future development; without that information he is as helpless in studying forest regulation and forest finance as he would be in studying silviculture without a knowledge of the life habits of trees and stands.

There has been considerable doubt as to a proper nomenclature for this subject. It would appear that the word Management is so all comprehensive that it does not satisfy the need of a name for a segregated portion of the field. As an academic subject it would appear that Forest Organization—organizing a forest for business or management—expresses most completely the contents of the course leaving regulation of budget, and formulating of working plans as sections of the larger subject.

Forest Organization (Forest Regulation and Formulating Working Plans). Forest Organization deals with the principles of organizing a forest for business. A part of such organization may require the regulation of the yield for sustained management. Finally a working plan is formulated. The working plan must be defined, not as a plan to secure sustained yield, but as a definite plan for the conduct of operations on a tract to secure most effectively the objects desired by the owner, who may or may not want to manage for sustained yield.

Working plans are the focus of all the knowledge of forestry. As a subject for instruction working plans do not take up the silvicultural methods themselves or the results, but should deal with the scope of the material which such plans must contain and the points they must cover.

The chief function of instruction in the subject of working plans should be to teach how to co-ordinate the information at hand into a practical plan which will work because it accomplishes at least cost and in an orderly manner the results most beneficial to the owner. In the collection of data, reconnaissance of area and preparation of the descriptive portion of the plan, it must be emphasized that the only justification for collecting data is the definite intention of using it to solve a practical problem or settle a definite point of policy in the proposed management of the tract.

It must also be shown that working plans and the actual management of the tract are correlated so closely that the personality and character of the management will largely determine what goes into the working plan. The function of written data and written directions which constitute a plan is to put in permanent form facts which cannot be intrusted to memory or to a personal knowledge, but which in a record becomes a permanent asset available for all concerned.

The emphasis needed is for conciseness in description, and the actual solution in the form of directions of the problems of management, especially that of sustained yield where possible, which calls for a definite plan of cutting whenever the transportation facilities permit the control of the location of cut.

The following syllabus used by Dr. Fernow will aid the instructor in shaping his course.

Forest Organization.

I. Introduction: Definition and Relationships. Literature.

Forest management divided into technological and business branch. Technological branch concerns itself with forest crop production; silviculture, protection, utilization. Business branch, or Forest Economy concerns itself with business problems. It may be sub-divided into Forest Organization, concerned in bringing about regular systematic use of forest property to obtain regular maximum continuous yield or revenue; based upon Forest Mensuration and Forest Finance; Forest Administration which includes the organization of a service.

Forest organization is to order in time and space the procedures needed to secure the most profitable use of the forest as such in the interest of the owner bent on continuous, either annual or intermittent, management. It involves forest survey and description, measuring in quantity and value of stock and yield, determining rotation and regulating felling budget, arranging time and place of utilization, and formulating working plans.—Synonyms.—Literature.

II. Fundamental Premises and Principles of Forest Organization.

a. *Premises:* 1 Extraneous; economic condition making forest management practicable; markets, price movements; freight; taxes, tariff; distance to market; all influence practicability. Relative intensity of management.

2. Internal; area large enough to make independent business practicable; financial ability and willingness on part of owner (lumbering is not forestry); silvicultural plan which will provide felling budget; eventually desire to secure sustained yield, cut annually or intermittently.

b. *Principles:* 1. Interests and objects of owner the pivot around which all business turns; various classes of owners. Relation between form of forest management and character of ownership. Consideration of indirect functions of forest by State.

2. Sustained yield, silvicultural and economic, a maxim or guide and final ideal.

3. Annual returns; objections to intermittent business; how does lumberman avoid it.

4. Profitableness; variously figured; difficulty of determining capital and interest. Sequence in process of development: rough exploitation; conservative lumbering; protection of young growth; silviculture; management in recognition of capital and interest.

III. The Normal Forest.

Definition: The business ideal of forest management. Conditions of normality. Possibilities of abnormality. Approach to normality the final aim; how secured. Normality under different silvicultural systems, (selection forest.) Relations of normal stock, normal increment, normal felling budget, normal age-classes in size, gradation and distribution. Determination of normal stock by means of average increment and by yield tables. Problems.

IV. Increment of Trees and Stands.

Differentiation in direction, height, diameter, basal area, form, volume; in time; current—periodic—average.

Stages of development: Infantile or seedling; juvenile or brushwood; adolescent or polewood; virile or young timber; senile or old timber. Brief quizz on methods of ascertainment and formulae, $\frac{400}{nd}$, $\frac{200}{a}$, $\frac{100}{a}$. Borggreve modification for stands. Quantitative—qualitative increment.

Laws of progress of increment, and relation of species and site to increment, illustrated by curves and yield tables. Discussion of construction and value of yield tables.

V. Determining the Rotation.

Definition of maturity: Natural—technical (size)—financial.

Definition of rotation: Normal or average felling age chosen as a guide vs. actual felling age.

Considerations influencing choice of felling age, silvicultural—technological—managerial. Rotation of maximum volume—of most profitable diameter limit—of maximum gross value—of maximum net money yield; forest rent and soilrent theories briefly explained. Formulas of financial rotations. Index per cent, its ascertainment and use. Rotations in use for different species and silvicultural systems; their justification.

VI. Determination of Felling Budget.

Felling Budget, the amount of material to be harvested, area, volume, number of trees of stated size, value.

Determined upon one of three premises:

a. Removal of merchantable part of growing stock at once—lumberman's method—exploitation—varying with market conditions and immediate financial considerations alone.

b. Removal of exploitable stock with increment distributed in harvests during given time—conservative lumbering—limited exploitation—involving more far reaching financial calculation and crude silvicultural practice.

c. Preparing at once for sustained yield management of crop production under normal forest idea (forest management proper).

Budget regulation for sustained yield management has two objects in view: secure a budget of proper size (interest of the present), and secure approach to normal conditions (interest of the future); this involves always compromises: budget regulation a guide, not a force.

Bases for budget regulation and their relation: Area, age classes, diameter classes, volume, value. Importance of thinnings in influencing all these factors. Various methods described as historically developed, with examples and problems.

1. Schematic Methods.
    - a. Simple Division.
        - Area Division—Stock Division—Tree size Division.
    - b. Periodic Allotment.
        - Area allotment—Stock allotment—Combined allotment.
2. Normal Stock (Formula) Methods.
    - Austrian—Hundeshagen—Heyer—Other modifications.
3. Individualizing (Age class) Methods.
    - Saxon—Judeich modification—other modifications.

Brief Review. Advantages and disadvantages of various methods compared and application to different silvicultural systems.

VII. WORKING PLANS.

A scheme for handling large areas in which principles of management are announced and prescribed fellings set forth in general terms, with a view eventually to secure continuity and sustained yield.

A. Ascertaining Data.

a. Reconnaissance—object and methods.
b. Views of owner—Discussion of policies; business, silvicultural, administrative policy.
c. Selection of principal crop species and silvicultural system.
d. Examination of market, prices, transportation, competition.
e. Forest Surveys—geometric—descriptive or qualitative—arithmetic or quantitative. Interdependence of these. Methods and degree of accuracy—mapwork—costs.

1. Geometric survey, boundary and topographic.
   Forest Districting, principles involved. Subdivision into compartments for purpose of orientation, formation of definite felling areas, units of management. Ranges. Working Blocks. Administrative Districts. Practice work on maps.
2. Qualitative survey—forest description.
   General. Detail.
   Schedule supplied and discussed in practical application.
   Preparation of table of age classes. Site classes.
3. Quantitative survey. Stock taking.
   Brief rehearsal of methods.
   Construction of Yield Tables and Stand Tables.
   Ascertaining Increment.
   Financial Calculations.

B. Formulating Working Plans.

1. General Plan—contents.
   Summary of actual conditions and proposition for improvements—general business policy, silvicultural policy, administrative policy, organization of area and service.
   Special recommendations for changes.
2. Special plans.
   Detail calculation of budget.
   Felling plan—location of felling areas.
   Improvement fellings and Thinnings. Location and quantities.
   Planting Plan.
   Utilization of by-products.
3. Bookkeeping and Accounts.
4. Periodic Revision of Working Plans.
   Need and object of revisions. Methods of Procedure.

VIII. CRITICAL DISCUSSION OF SPECIFIC WORKING PLANS.

Reports in seminary style.

Field Work. There should be extensive field work in forest organization. Some of this may be given in connection with the theoretical part of the work, but there should be at the end of the whole course, after all the difficult branches have been completed, a period during which practical work can be conducted which involves all the phases of work needed for the formulation of a working plan, for which a large tract should be selected having favorable conditions for study. If, in addition, practice in marking timber for cutting under a chosen system of silviculture, laying out of a logging operation and perhaps practical instruction in forests could be had, the ideal of conditions would be reached.

Forest Finance.

Forest Finance concerns itself with all financial matters pertaining to forests and forest management. The subject divides itself naturally into two branches, namely *forest valuation,* the ascertainment of values and *forest statics*, the comparison of values, with a view of satisfying the financial aims of forest management. The first is applied to determine values of forest properties for sale, exchange, damage suits, taxation, etc., the second is to determine the most profitable procedures in carrying on the forestry business.

Forest Finance bears the same relation to management as mensuration does—they are both handmaidens to management, and mensuration, the ascertainment of volumes, must furnish the data for finance, the ascertainment of values. Valuation as an academic subject requires the discussion of the factors which in general create values, of the economic laws which influence prices, markets, values, interest rates, etc. These problems of economic theory belong to the field of political economy and may have been sufficiently discussed in the courses of that department, and hence proper co-ordination is indicated. There still remains, however, for the teacher of forest finance the necessity of discussing the special features and peculiarities of forest values, besides the mathematical methods of determining values, which on account of the compound interest calculations often needed become somewhat complicated.

There is danger of making the mathematical method, the means to an end, appear as the end, failing to bring out the practical judgment which always is needed in making valuations. The best method of teaching the subject is by means of problems, which as far as possible should be taken from practical life, when the practical considerations entering into the problem can also be discussed while developing the method of calculation. The methods are fully developed in European text books, but the device of methods and their application under our conditions need judgment. Nowhere else so often may the theory be correct and yet not of practical value. Thus, American foresters may get lost in the maze of the soil rent and forest rent theories for which as yet there is little call in this country. Perhaps the most frequent call at present for forest valuation is in case of damage from fires. Hence an analysis of the problem of damages should occupy a large place in the discussions. A time allotment of 25 hours seems for the present sufficient to give to the subject.

The following outline, (in which in part a syllabus by Prof. H. H. Chapman has been used) will suggest the contents of the course:

I. *Definition and Scope.* Two Divisions: Forest Valuation, determining values; Forest Statics, comparison of different operations financially—balance of effects, based on valuations.

II. *Value definitions.* No commodity or property has one objective value; all values subjective, hence at least two values (seller—purchaser) to everything; and variations according to at least three points of view: cost—sale—rent. Hence in practice determine several values and choose according to circumstances.

Commodity vs. Capital value. Use value the controlling basis of valuation, but not expressed in money. Real value (value to all parties) a phrase.

Values never remain the same but are subject to change.

a. *Cost value* based on expenditure for production—the minimum price for disposal without loss. Actual vs. fictitious. May be excessive compared with other values or the reverse (present stumpage prices represent not even approximately cost value). Used generally only to figure loss or gain, or for young growths.

b. *Sale or Exchange Value,* based on current market conditions—what property may bring if exposed for sale. Minimum—Maximum value.

Factors influencing market prices.

Tendency of rising prices for natural resources.

Special sale values:

Wrecking value (minimum) secured by dismantling—immediately available by forced sale.

Stock value (fair, real economic value) secured by operating.

Former favors purchaser, latter favors seller.

Expectancy value (prospective sale value), an assumed future sale value, discounted to present time, as for immature stands.

c. *Rent value* (Yield value—Investment value) based on net income or profits possible or actually to be derived by management—requires continuous operation, and conception of capital and interest.

Forest Rent Value based on conceiving soil and stand as capital paying annual interest (like rented house and lot); applicable in established forest management with annual yield.

Soil Rent or Soil Expectancy Value based on soil alone as capital, producing rent intermittently, hence requiring compound interest calculations; applicable in intermittent management; also for statical calculations.

III. *Capital and Interest.*

a. In General.

Capital, the basis of interest, whatever produces values or income. Fixed (permanent) vs. Circulating, (used up in production) capital.

Non-productive (dead) capital, having prospective ability to produce revenue.

General economic laws and influences affecting capital values.

Interest, the result of use of capital, or price paid for its use for a given time, or net product estimated in money. Difference between income and interest.

Nature of relation between capital and interest.

Compound Interest justified, where applicable.

Interest rates (valuation of capital) how influenced.

Impersonal—personal moments; general credit—supply and demand—competition—character and safety of investment—sinking tendency; *contract rate vs. business rate*—borrower's, lender's, operator's attitude—security of investment—character of business—of lender—size of investment—amenity of investment—belief in appreciation of values—personal prejudices.

b. In Forest Production.

Difference between exchange value, operating for the present, and capital value under management for continuity; stumpage value vs. rent value or forest capital producing wood crops (commodity vs. capital value). As long as forest property is treated as commodity current prices and interest rates are applicable to its valuation; future prices and interest rates when forest used as crop and revenue producer, real capital.

Nature of Forest Capital.

Composition: soil and stock or wood capital. Difficulty of separating wood capital and wood income. Stock the result of abstemiousness, unrealizable for some time, hence unattractive investment.

Form: Coppice; high forest; selection forest; plantation.

Safety: Negotiability; other drawbacks influencing investment value.

Interest Rates on Forest Capital.

Business rate a matter of choice as in any other business and no more certain than in other business. Different rates for soil capital—wood capital—administration (money) capital, combined into one for easier figuring.

Arguments for low interest rate (make capital value larger!) in forest calculations: persistency, long time, size of investment; tendency of sinking rates, of rising wood prices and of increasing productiveness; safety of returns and (eventually) of investment; low value of soil for other use; appreciation of value due to development; all soil culture brings lower rates than manufactures. Examples to prove these arguments.

Determine maximum and minimum rates within which to choose. Influence of silvicultural system and rotation on rates. Proposed rates.

Uncertainty as to factors for future reduce value of finance calculations to a mere check on judgment.

IV. *Formulae of Simple and Compound Interest Calculations.*

Theory of continuity of management. Capital in terms of interest. Derivation of formulae. Practice work in reading readily the meaning of parts of formulae and solving problems to illustrate their application can best be carried on independently while lecture course goes on.

V. *Methods of Determining Soil, Stand, Forest Values.*

These are also best explained by discussion in connection with definite problems, cost values, sale values and rent values being calculated and explanations given how values will be influenced, and what considerations lead to choice of value.

VI. *Statistics.*

Under this head a collection of data and references should be early begun by the students themselves—costs—prices—volume and quality production being included.

VII. *Special Cases and Practical Hints.*

Under this head—if time permits and the problems hitherto used have not illustrated sufficiently the application of method and judgment—at greater length some of the more frequent and important cases of forest valuation may be discussed. E. g.

Appraising of damages (see Fernow, Considerations in appraising damage to forest property).

Nature of damages—fire, theft or illegal cutting.

Valuation of damages—basis.

When timber is sold or removed.—When damaged by fire.

Partial damages—Sometimes greater than total removal of crop.

Damages to future crops: Relation of future crops and rental value of land. Relative importance of first, second and subsequent crops.

Financial effect of damages.

Extra damage due to fire shown by damage to future crops. Damage to sale value from aesthetic standpoint.

Basis for valuation of damage always sale value unless expectation or cost value shown to be more reasonable.

Dependence on ability to prove growth of forest.

Legal aspect of damages.

Present status of timber and possibility of using. Expectation value. Purpose of owner considered. Reasonable proof of damages. Actual versus remote damages. Difference in value before and after the damage. Cost of restoration as a basis.

Presentation of damages.

Damage to sale value: to expectation value of present crop; to value of future crops. Simplified methods of presenting claims for damages.

Application of forest valuation.

To find costs. Dependence on determination of yields per acre, and on assumed future sale values.

Determination of rate of interest earned by a forest, based on its annual income. When sale value of forest is used instead of total cost.

Practical Hints may take the following form:

Practical requirements differing from theory, yet practical judgment based on theory, combining actual and anticipated conditions.

Avoid use of formulae in presenting a case, explain by words; formulae are to develop proper modes of thinking. Simplify calculations as much as possible and make them as far as possible for short terms. Leave out minor considerations. Figure all possible values and choose the most reasonable, if possible, the most profitable.

Forest Statics.

Definition and History of Statics.

Concerned in measuring financial effects or profitableness of different methods of management, relying upon forest valuation.

Three ways of measuring effects:

a. Bookkeeper's Balance, surplus comparing charges and incomes.
b. Entrepreneurs Profits, surplus, charging interest account.
c. True finance calculation, interest rate earned on capital.

Applicability of these methods.

Formulae in use.

Consideration of most frequent problems:

Choice of species;
Choice of method of regeneration, and silvicultural systems;
Choice of rotation;
Relative result of various thinning practices.

Forest Administration.

In discussing Forest Management, Lumbering, Forest Protection, and Forest Policy, questions of organization of administrative work may crop up, and these cannot be separated without distinct loss. On the other hand, there are certain broad principles of administration which should be thoroughly discussed at some point in the curriculum, and that in a separate course. There should be a careful co-ordination with the special problems that may have been taken up in the individual courses so as to avoid duplication. Such a course should present the principles underlying business conduct, methods employed in administration of forest properties, organization of service, varied according to character of owner, size of property, intensity of management.

1. Personnel and Organization, exemplified by various actual organizations, discussing principles involved;

a. Functions and Grades:—Directive—inspective—executive—protective service; special detail (survey, working plans, investigations); accounting; law business.

b. Relations and Co-ordination:—Responsibilities,—assignment of duties—promotion—pay; reports on existing organizations, critically discussed.

c. Character and Education of Personnel.—Needs in different grades—recruiting of personnel.

d. Numbers, in relation to area and intensity of management.

e. Organization of Forest Labor:—Requirements and principles of employment—methods of employment—contract work—standardizing of work—wages, various methods—benefits.

2. Business Practice. Projects—executive business; form of procedure, preparation of budgets, bookkeeping and accounts; cost keeping; disbursement of moneys; purchase of supplies; property accountability, etc.

Timber Physics and Wood Technology, Forest Products.

In some institutions, the subject matter of this course is included, together with lumbering, under the head of Forest Utilization. The importance of lumbering in this country and the distinct and unique problems involved in it justify making it a separate course, and treating the products and their use separately

Forest Utilization is then made equivalent to lumbering, treating of the harvest of the crop and its preparation for market, while the course on Forest Products discusses the character and properties of the products themselves and their application in the arts. The course then falls naturally into two sections, namely Timber Physics and Wood Technology; the former discussing the structural, physical, mechanical and chemical properties of wood; the latter describing the uses, depending on these properties, which are or could be made of them.

Structure of Wood. Under this head there should be covered the external features of wood, the structural elements of wood, the value of structural characteristics in identifying and classifying woods and their products, and the classification and identification of commercial woods. This subject is regarded by some as properly a part of dendrology. It is more often taught in schools in connection with the course in Forest Products. Without question the study of the structure of wood may be handled to very great advantage together with the study of the other characteristics of wood. It is believed also that the ordinary student gains more from the course when it is given in the latter part of the curriculum than when it is taken up at the beginning in connection with dendrology. In addition, it is important to correlate the structural characteristics of the wood with their physical, mechanical and chemical qualities.

Physical Properties of Wood. Under this head are considered those properties manifest to the unaided senses, like color, odor, taste, touch, and resonance; properties determined by measurements like density, weight, moisture content, shrinkage, warping, permeability and hygroscopicity. This section of the course considers the subject of drying of wood, including a discussion of methods of seasoning lumber, unless this problem has been taken care of in utilization.

Mechanical Properties of Wood. These are based on the behavior of wood when subjected to external stresses, as determined by various methods of timber testing. They include strength (compression, tension, shear, and torsion), stiffness, resilience, toughness, and cleavability. A discussion of the mechanical properties of wood should include the factors which affect these properties like defects, rate of growth, moisture, temperature, and preservatives. It is believed that enough instruction should be given in timber testing to thoroughly fix in the mind of the student the essential facts relative to the mechanical properties of wood. Some institutions have a well-equipped timber testing laboratory.

Such institutions are able to specialize in this subject and give advanced courses in it. No effort should, however, be made in a general course to give a thorough training in timber testing. That belongs to the specialist.

Chemical Properties of Wood. Under this head may be included the chemical composition of wood and of minor forest products; the carbo-hydrates, the hydro-carbons; tannin and dye stuffs; properties governing the fuel value of wood; charcoal; destructive distillation; and properties affecting durability.

In connection with the course in Forest Products may be considered chemical processes used in the manufacture of wood pulp, in the wood distillation industries and in the naval stores industries, unless this is given, as in some institutions, in a separate course of Applied Chemistry.

Wood Uses. Wood technology furnishes the basis of a knowledge of the adaptation of different species to different uses and the reasons why a given species is better adapted to a particular use than to another. During the course, or treated separately, there should be instruction touching the uses of the more important tree species. Necessarily this is closely related to the discussion of the minor industries.

There has been some discussion whether the minor forest industries should be treated under Products or Lumbering. Thus, for example, should the manufacture of ground wood pulp be given under Forest Products or under Lumbering? This is entirely a matter for consideration of individual instructors. In general, however, the discussion of the industries themselves and their relation to the forest may properly be handled under Lumbering, while technical processes in manufacture of by-products may be considered under Products.

Wood Preservation. This subject should be considered also under Forest Products or Applied Chemistry. There should be comprised under this head the mechanical importance of wood preservation; relation of wood preservation to forest management; chemicals used in preserving wood; seasoning timber for preservative treatment; methods used in applying preservatives; wood preservation plants; preservative treatment of cross-ties, posts, poles, mine timbers, and piling; preservation of lumber and the effect on strength; treatment of paving blocks; and fireproofing wood.

FOREST UTILIZATION. LUMBERING.

Of the various courses of instruction offered to the student of forestry that which deals with the lumber business stands in greatest need of standardization. Indeed, the success of most forest schools may be said to depend largely upon the development of practical and efficient instruction in this subject. The increasing number of graduates from many forest schools, coupled with the narrowing field for employment offered by the national and state forest services must result inevitably in a comparatively large number of foresters entering the employ of lumber companies and other private owners of forest property. Therefore, the preparation of students for effective service in privately owned as well as public forests is an essential part of the curriculum of forest schools.

With present prices of stumpage, methods of taxation, and fire danger, the application of silvicultural practice to large timber tracts of private owners must often be very primitive. However, the necessity for studying and modifying existing methods of logging and milling to secure greater economy in utilization is keenly appreciated by many timberland owners and progressive lumber companies. This applies not only to reduced cost of production by improvement in the efficiency of labor and equipment, and by the reduction of the waste of timber in the woods and mill, but also to the modification of existing methods, even at a slightly increased cost of production, in order to leave cut-over land in as favorable a condition as possible for succeeding crops.

Thus, in order to make his service valuable and to secure the opportunity of gradually introducing principles of silviculture, the forester should receive training in the forest school *to enable him, upon graduation, to learn readily* the details of the logging business and lumber manufacture. He should be able, through trained powers of observation and analysis, to study the comparative efficiency of different logging methods under varying natural and economic conditions, and modify existing methods to secure more economical utilization. During the next decade the development of forestry on private holdings will rest very largely in the hands of foresters of this type, who by successful management of logging operations secure the confidence of timberland owners and their consent to the gradual introduction of such principles of silviculture as are financially justifiable. Furthermore, increasing timber sales and exploitation of timber on the national forests make it desirable that foresters entering the national service be able to analyze accurately the efficiency and cost of logging and milling methods, and determine the financial effect of modifications of existing methods of operation, desirable from the silvicultural point of view.

The logging business is distinctly an engineering problem since it is concerned principally with the transportation of the raw product of the forest to the manufacturing center. Therefore, carefully selected instruction in engineering should form the foundation upon which subsequent instruction in lumbering is placed. It is obviously impossible for the student of forestry with the limited time at his disposal to attempt to digest the numerous difficult theoretical principles and methods essential to the expert engineer. Fortunately, an intensive engineering training is not indispensable in handling most problems in logging. Rough methods of transportation and construction adapted to conditions which exist in the woods do not require in most cases elaborate technical calculations of a fine degree of accuracy, but are dependent upon low cost secured by rapid and approximate methods. Occasional problems of unusual difficulty, requiring complicated types of construction and equipment, are solved by securing the advice of an expert engineer.

It is well to emphasize what it is possible to accomplish in a course in lumbering at a forest school. Many practical lumbermen are accustomed to look askance at forestry education because in their belief it is impossible to substitute a school training for practical experience. The pressure brought upon the schools to make the course in lumbering "practical" has some times created a tendency to emphasize particular methods rather than principles. Even foresters have fallen into the mistake of expecting from recent graduates of forest schools a knowledge of lumbering which it is absolutely impossible to acquire except by practical business experience. The principles of teaching lumbering are essentially not different from those in other branches of engineering. Theoretical and practical instruction is given in the school, but the graduate is expected to pass through an apprenticeship in which he works under direction until he has acquired that experience necessary to enable him to apply with judgment and self-confidence his knowledge to varying conditions. Lumbering is unique only in that the principles underlying it have not been systematized either in theory or practice.

The difficulty in teaching lumbering has not been so much a question of the ground to be covered as a question of method of instruction. Most of our schools are not located in the woods, but at a university. Under such circumstances it is difficult to synchronize the class and field work. Ordinarily there is a course of theoretical instruction by class work, assigned reading, and special theoretical problems to lay the foundation in the principles of lumbering; then later on, the students are taken into the lumber woods and given systematic practical work. The theoretical instruction can do but little more than acquaint the student with the different problems, the general methods of logging, and manufacture, the factors which influence the choice and use of logging methods, the principles underlying the determination of the cost of lumbering operations, problems of markets, a determination of stumpage values, the conduct of lumber sales, etc.

In the field of instruction, the aim should be to thoroughly fix these principles by special practical application. Frequently there is an effort to cover too much ground and to take into consideration too many widely diversified conditions in the course in lumbering. The student should in his field work master the problems in some one operation. It is a great deal more important that he have a thorough knowledge of some one logging operation than a superficial knowledge of how logging is carried on all over the country. With a thorough local knowledge the student has a basis upon which to build in the application of principles under other conditions.

It would be of great advantage if the course in lumbering could be preceded by a course in the construction, operation, comparative efficiency, cost, and maintenance of various types of steam, gas, and electric machinery; types of power transmission, their operation, strength, relative cost and efficiency; materials of construction, their strength, cost, and relative efficiency in various types of construction; and the design and construction of simple structures, trestles, foundations, flumes, etc. Such a course should not attempt to give the student of forestry the difficult theoretical principles and methods essential to the expert engineer, as the successful handling of most logging problems will not require such an intensive engineering training. The rough methods of transportation and construction adapted to conditions which exist in the woods will not require, in most cases, elaborate technical calculations of a fine degree of accuracy.

When such a course is not given the instructor must handle the material as far as he can in the consideration of railroad logging, flume construction, use of steam logging devices, etc.

The course falls naturally into the following topics: Logging methods and equipment—Manufacture of lumber—Sale of lumber—Sale of timber on the stump and sales of timber land—Problems of the industry—Minor industries.

Without giving a detailed syllabus, the topic of Logging Methods may cover the following ground:

1. Preliminary work in organizing a logging operation.
   Cruise of property to determine: topography, outlet for logs, improvements required; species, amount, and character of timber; best method of logging, etc.
2. Problems of organizing logging operations.
   Labor, location and construction of camps, equipment of camps.
3. Yarding.
   Felling and skidding, organization of work, tools, cost.
4. Method of transporting logs.
   Different methods are discussed under the heads of equipment, installation, operation, cost, conditions when used, and comparison to other methods. The methods include slides, flumes, river driving, railroads, carts, wagons, sleds, and steam devices of various types.
5. Special problems in different regions to show different methods used with the object of developing the principles underlying choice of methods. In this discussion emphasis may be laid on small as well as larger operations. The small operation is destined to play in the future, an increasingly important rôle.

Under the Manufacture of Lumber, consideration is given to the different types of mills together with the main features of their equipment. The details of the machinery may be largely left until the student is doing his field work at a sawmill.

There would then be discussed the principles underlying the choice of the type of mill and extent of equipment; location relative to the source of supply of logs and the market; problems of organization and operation; preparation of lumber for the market, including planing and seasoning.

The Sale of Lumber would cover: grades and grading, methods of sale, markets and requirements of each, prices, transportation of lumber.

The question of the Sale of Timber on the stump must be fully covered in a course in lumbering. Especially there are involved the questions of the determination of stumpage values; the conduct of a timber sale transaction from the time of first negotiation until the final contract; administration of timber sales. This subject is very close to the valuation and the purchase or sale of forest land, which should be included either in the course of lumbering or elsewhere in the curriculum.

The Problems of the Industry cover timber bonds, insurance, statistics of the industry, associations, price lists, etc.

Under Minor Industries (if not discussed under Wood Technology) may be considered the problems connected with the production of lath, shingles, cooperage, veneer, box boards, vehicle stock, spool stock, excelsior, dowel pins and similar stock, tan bark, wood pulp, turpentine, maple sugar, charcoal, etc. In general there should be discussed under each head the species used, manner of extraction and manufacture, specifications of forest material, sources of supply markets, relation to forestry, etc.

Field Work. The field work should include a complete analytical study of a logging operation. Every phase of the operation is considered on the ground and the student must be required to understand all steps in the organization and equipment of the enterprise, the improvements made, methods and cost of operating, etc., but there must be a clear grasp of the reasons for every step and the conditions requiring all actions taken. He must be in search not only of facts but of principles so that when he encounters other conditions he will know how the methods will have to vary. With such a foundation, the student may then be required to make a complete plan of logging for a given unit, or to do work which will be the full equivalent of such a task.

Field work in lumbering should include practice in commercial estimating of standing timber on a large scale; determination of stumpage values; and valuation of lands; projection and surveying of logging spurs (or corresponding work); and commercial scaling. Ordinarily most of this work may be combined with the final field work of silviculture, or mensuration, or management.

In practical work in lumber manufacture the student works in different parts of a mill until he knows its parts thoroughly. He should follow logs through the mill as a basis for his training in scaling. He should be given practice grading boards until he has mastered the principles of grading the lumber produced at that mill. The same class of analytical study is extended to the planing mill, to the yard, and dry kiln. He should be given problems touching the location, equipment, and establishment of mill plants. Somewhere in the course the student should have an opportunity to work at a small sawmill and to study the problems of logging connected with their operation.

Construction Engineering. Under Lumbering it was explained that a preliminary course in certain phases of engineering is very desirable. There is a further field of construction engineering which concerns the improvements on a forest for protection and administration. This comprises first the projection and construction of roads and trails. In some cases it may be desired to handle logging roads under lumbering. It is usually preferred to discuss the engineering features of road building in a separate course. It is the design to teach only such matter as is necessary for the forester to know. This means the construction of the ordinary gravel road, and the trail adapted to travel by pack train. In some part of the course practical field practice should be given in laying out roads and trails and estimating their cost. If possible they should have the opportunity to study trails under actual construction.

There are other classes of improvements required on a forest. These include construction of bridges, cabins, barns, fences, domestic water development, telephone lines, signal stations, etc. The method of giving instruction to prepare for such work has been a problem so far unsolved. Of course the best way is to show the student the work of construction actually under way. When this is not possible the instructor must confine himself to the principles which underly all such construction work.

It will have become apparent from this discussion of the contents and the methods of this instruction that very few schools will be able to give such a full course, especially the practical part of it. This suggests that the few in position to do so might admit students from other institutions to attend such a course as post-graduates, making it a specialty. The time allowance in the regular curriculum allowed for forest utilization may then be proportionately reduced.

Forest History.

Forestry in this country is in its infancy. The forester has as his objective such a development of forests as is exemplified in continental Europe. He is handicapped now by various obstacles of poor markets, lax public sentiment, insufficient funds, poor laws, etc. Foreign countries have had to meet similar obstacles, and we find in history a parallel to almost every progressive step we have taken in forestry in this country. The Committee, therefore, urges the importance of this course. A minimum of twenty-five and maximum of forty hours would be necessary to cover the ground. The scope of forest history is fully covered in Dr. Fernow's History of Forestry.

Forest Economics. Synopsis.

There are certain fundamental economic principles at the basis of forestry which should be taught early in the course. Forestry concerns not only the individual owner of forest property, but also the public. At the present time we are engaged in bringing about the establishment of better protection and management of the forests of this country. While the forestry movement has made substantial headway, we are still near the beginning of our task of bringing about such a management of the forests as will meet the needs of the country in the production of timber and in guaranteeing to the public the indirect benefits which come from the existence of forests. A large amount of educational work remains yet to be done. Opposition and indifference is to be overcome. Constructive legislation is required both by the Nation and by the individual States, and the principal constructive work by practical forest organization has been scarcely commenced, except on the National Forests and on a portion of the State forests. Every forester whether he goes into public or private service is likely to have more or less to do with the development of public policies and legislation. It is, therefore, essential that there be a thorough grounding both in the principles of forest policy and in the economic considerations underlying them.

Forest economics presents the forest problem from an economic standpoint and shows the need of forestry and the results which may be accomplished through its practice. In general this branch of forestry should comprise a discussion of the following:

1. The economic value and benefits of forests. 2. The results of abuse of forest resources. 3. The requirements of our Nation for forest products. 4. The relation of the forest problem to the different industries of the country. 5. The forest resources of the United States. 6. The results which must be accomplished to meet the needs of the country.

Under the head of the economic value of forests should be included their value to the owners as productive property, the value to the public in supplying the products essential in the arts, their function and importance in the prevention of erosion, the conservation and protection of water, their ameliorating influence on climate, their services to the public as recreation and health resorts, and their functions as game refuges.

The subject of the results of the abuse of forest resources includes a discussion of destructive methods of lumbering, the effect of forest fires from the standpoint of public injury, and the effect of forest destruction on the industrial life of the community.

Under the head of the requirements of the Nation for forest products there is necessarily involved a presentation of statistics regarding the amount of lumber and other material consumed in the country. In this connection there should be shown other sources of drain upon the forests.

The third section of the course is designed to bring out the importance of well-managed forests to different industries and classes of people. There should be shown the importance of the continuance of forests to railroads, the mining industry and the many other wood-using industries of the country. There should be shown the close relationship between forestry and agriculture, with particular reference to irrigation. The protection value of forests in its relation to manufacturing industries dependent upon water power should also be shown, and finally the relation of forests and forestry to the stock-growing industry.

The problem of the forest resources of the United States should be discussed with reference to the possibility of their supplying the needs of the Nation. There should be presented a discussion of the original condition of our forests, the progress of their destruction, and their present condition with reference to the total supply of available material, and their condition with reference to providing the protective benefits to the public. Under this same head may later be considered also the extent to which forestry is being practised to-day.

Taking into consideration the requirements of the Nation and our resources, there arises then the problem of what must be done to meet the future needs. In the main, Dr. Fernow's "Economics of Forestry" covers the subject.

In many schools the subject-matter just described is presented in a course entitled "Introduction to Forestry" or "Synoptical Course." In some undergraduate schools this introductory course is given in the freshman or sophomore year before any technical work in forestry is undertaken. The purpose of the course is to acquaint the students with the general purpose and scope of forestry. There is usually included not only the economic considerations underlying forestry, but also a general description of the technical courses, their scope and place in the curriculum.

It is desirable that the student thus early be made cognizant of the importance and the bearing of the subject to the commonwealth and have a general oversight of the field he is to study.

Forest Policy.

With a foundation in economics of forestry the student is in a position to consider specific problems of forest policy. There should be discussed first the responsibilities of the public relative to forestry, showing that it is a problem which cannot be met without direct participation by the public itself. There may then be discussed the functions of the Government, State, Counties, Municipalities, and Communities relative to forestry. Under Government forestry there would be considered first the problem of public lands. The instructor would doubtless present a historic sketch of the public land policy with a critical consideration of its defects and what is required by our present day conditions. There should be discussed in full the problems relative to different classes of public lands, as those best devoted to agriculture, the production of forests, mining, grazing, water power, and other special uses. Special consideration should be given to the establishment and development of the National Forests and the broader questions of policy in their administration. It should be the aim to present to the student the principles underlying governmental forest policies. He should become acquainted with the main features of certain of the more important public land laws. These should be taught from the standpoint of giving a grasp of governmental policies rather than from the standpoint of a student of law.

There should be a discussion of the functions of the federal government relative to educational work in forestry, the development of the science of forestry through investigative work, and the promotion of the practice of forestry through demonstration and through co-operation with the States and private owners.

The subject of State forest policy may be handled in much the same way as federal forest policy. After presentation of the functions of the State relative to public forests, education, co-operation with private owners, etc., there arises the question of specific policies in the different States. Scarcely two states in the Union have the same forest laws. There is a great difference in the way the different States are going about the solution of their forest problem. Some are headed in the right direction; some in the wrong direction. It would be exceedingly difficult in the time ordinarily at the disposal of an instructor to enable his students to master all the details of the forest laws in the different States. The aim should be to show what the different States are doing in connection with the discussion of underlying principles of policy. Thus, for example, when the problem of an organized fire protective system is discussed it would be shown that there are a number of different methods in practice in different States. The instructor could then show which States have adopted the specific principle of organized fire prevention, and discuss so far as may seem desirable local practice and the results accomplished. The aim should be to give the student such a foundation as will enable him in case later on he has anything to do with State forestry to work toward the application of correct principles of policy.

There should be discussed finally the question of public regulation of privately owned forests.

This subject may be dealt with together with the preceding one, and in a way it touches the subject of Forest Administration, but as discussed before, the latter at least requires separate treatment.

National Forest Administration.

Optional.

In many schools it will be desired to give a special course on National Forest Administration. This should of course be correlated with the general course on Forest Administration and unnecessary repetition avoided. To give an idea of the scope of such a course the following syllabus of a course at Yale in 1912 is presented.

1. Brief History National Forest Administration.
2. Organization of Forest Service;
    - Forester, Branches, Duties and Authority
    - District Forester, Branches, Duties and Authority
    - Supervisors, Duties and Authority
    - Forest Assistant
    - Deputy Supervisor
    - Rangers
    - Guards
    - Temporary Laborers
    - Inspection
    - Theory of Organization.
3. Work on a Forest;
    - Organization of a new Forest
    - Preliminary study of conditions and amount of work
    - Location headquarters
    - Determination number of rangers
        - Location of Districts
    - Selection of Rangers
        1. Civil Service List
        2. Guards
    - Location Rangers' Headquarters
        - Administrative Sites
    - Assignment of Rangers
        - Duties
    - Forest Assistant
        - Duties and Powers
    - Deputy Supervisor
4. Permanent Improvement;
    - Necessity and Object
    - Ranger Stations
    - Pastures
    - Telephone Lines, Bridges
    - Roads, trails
    - Canals, tanks, pipe lines, fences

5. Location, plans, estimates;
   - Approval
   - Construction
   - Co-operation
   - Supervision
   - Maintenance.
6. Claims
   - Claims on National Forest
     - Homestead
     - Timber and Stone
     - Desert
     - Coal
     - Mining—placer and lode
     - Railroad Lands
     - State—school lands and grants
   - Examination, report, recommendation
   - Action by Supervisor, District Forester, Forester
   - General Land Office, appeals, protests, hearings
   - Forest Homesteads
     - Statute
     - Factors governing classification of land
       - Soil, Climate, Crops raised, Acreage, Topography, Timber average.
   - Examination, survey, report, action, advertisement.
7. Timber Sales
   - General policy
     - Demand, local, foreign
     - Supply, local, foreign
     - Reproduction
     - Condition timber—Maturity, Insects, Fire injured, disease and decay
     - Stumpage price
     - Responsibility of purchaser
   - Application
   - Examination and preliminary report
   - Survey, estimate, report on conditions, recommendations in regard to marking, cutting, clearing.
   - Preparation Contract
   - Approval
   - Marking—supervision cutting
   - Scaling—check scaling
   - Cleaning up—supervision.
8. Forest Planting
   - General Policy
     - City watersheds
     - Denuded, non-reseeding areas
     - Commercial
   - Establishment nurseries
     - Selection species
   - Field planting
   - Extent and Description existing projects.
9. Grazing
   - Historical
   - Grazing regulations
   - Counting stock
   - Methods of handling
   - Restrictions in use of range
   - Cancellation of permits
   - Range controversies

Transfers of privileges
Amendments of applications
On and off permits
Payments and refunds
Trespass
Use of private lands
Crossing permits
Grazing uses
Pastures and improvements
Quarantine
Predatory animals
Extermination of prairie dogs
Investigations
Improvement of range.

10. Special Uses
    General Policy
        Complete Use National Forests
        Kinds
        Examination, report, recommendations
        Factors governing approval
        Preparation contract.
11. Hydro-Electric Power Plants
        Possible development, value, present and future
        Economic aspect
        Danger of monopoly
        State laws
        Preventative measures
        Policy and practice of Service.
12. Game Preserves
    National Monuments
    National Parks
    Relations between Forest officers
    Forest Service as a profession
        Standing of Forest officers
        Opportunities for advancement
    Suggestions to new Forest Assistants assigned to National Forests.

Other Courses.

Certain other courses are very desirable, such as:

1. Elementary business law.
2. Park development and street and park trees.
3. Fish and game.

Of these the conference made the course on elementary business law of at least 25 hours a requirement for all schools, and while they expressed themselves as to the desirability of courses in fish and game protection, in street and park trees, it left them optional with the different schools.

Some schools give other special and advanced courses in certain subjects, depending usually on the specialties of the instructors. Then again, some institutions may be able to give to their students some assistance in practical things which will aid them in their work in the woods. Thus it is very desirable that a student should know how to ride and handle horses, to handle boats, and to shoot. In connection with their work in the lumber woods, students should have an opportunity to learn to handle an axe, and accustom themselves to the life of the woods. A knowledge of commissary work, camp cooking and camp hygiene are all important. Institutions should consider the possible aid they can give the students along these lines. All of this, however, should be supplemental to the curriculum rather than a part of the regular educational work of the school.

Method of Teaching.

Teaching in forest schools should first of all aim to stimulate the capacity for logical thinking and train and discipline the analytical faculties rather than merely test the assimilative capacity and memory of students. To accomplish this, it is desirable to limit the number of lectures and increase the independent work of the students by critical analysis of phenomena observed in the woods and laboratory, and by demonstration of large amount of material with necessary explanations. The lectures should not compete with the textbook. They should be a necessary supplement and expansion of the book. The lectures must to a large extent be devoted to explaining the difficulties which the students encounter in their practical work, and serve as a guidance towards future work, and not be merely a repetition of information which can be readily secured from textbooks. Under such conditions, the importance of practical, or laboratory and field work becomes self-evident.

It should also not be overlooked that only during the academic time most students have better opportunity of becoming acquainted with the literature on their subject, and hence as much as possible use of this literature beyond the mere textbook should be encouraged.

While the committee lays a great deal of emphasis on the need of practical work of the student under the immediate guidance of the instructor, the proper balance between class and field work in its opinion should not be overlooked.

Training in forestry involves no new principles of education. It finds a close analogy in civil and mining engineering. In both there is a great pressure on institutions to make the instruction intensely practical, by which is meant that class work should be subordinated to field work. Full weight must be given to the practical field work, but such work must serve a definite purpose; it is not an end in itself. That school which gives the greatest amount of field work is not thereby the best school. In the desire to win the applause of so-called practical men, there is sometimes a tendency to overdo the field instruction at the expense of class and laboratory work. Sometimes the muscular side of the profession is made to overshadow its intellectual requirements. Often instructors pride themselves on the hard work their students are doing in the field, when it is more physical than mental work which is being done. Frequently time is wasted in the field because the work is poorly organized, or many hours are spent in travel. Every teacher must combat the temptation to make his instruction entertaining rather than instructional. The average student would rather be entertained than grind through the hard work necessary really to learn. It is easier for a teacher to lecture than to quiz; and easier for the student to take notes than to be quizzed. It is easier for the student to be told something than to work it out himself, and easier for the teacher also. Graduates of schools will be judged by what they know and by their trained capacity to apply their knowledge. Let not the forestry teacher be deceived in thinking that such training can be given by superficial observation of plantation, logging operations, sawmills, etc. It can only come by hard work on the part of the student under systematic instruction. The Committee pleads for the application of true educational methods to field instruction in forestry.

RANGER SCHOOLS.*

By Henry S. Graves.

During the past few years forest schools have been rapidly increasing in numbers. About twenty forest schools, giving degrees, are now aiming toward the high grade professional training. They purport to give a full training of advanced grade or to prepare for post graduate work. The other institutions give courses supplemental to agriculture or other major subjects. Several western institutions are giving short ranger courses covering three or four months. These courses are of very great help to the Forest Service. Many rangers take furlough to attend them. But our greatest defect in forest education is the lack of local ranger schools to train men not only for public but private service. Our educational training is utterly out of balance, being top heavy with high grade instruction.

Character and Location of School. In general, I believe that the ranger school should be a separate school or academy, and not a co-ordinate part of a university or college. I do not mean that colleges or universities should not have charge of ranger schools, but that the work should be separate and preferably in a different location. The instruction is secondary in character and it is, therefore, not feasible to make it a part of a college course with its high educational requirements. Students who have reached the college grade are ambitious for higher training and will demand it. Colleges are ambitious and will in every case strive to develop advanced courses if there is any excuse for it. I believe that we have too many schools trying to give high grade instruction and that the attention of some of these institutions should be directed to developing ranger schools. It would be a great deal better if we had say ten advanced forest schools and twenty or thirty ranger schools.

The short ranger courses given at the western colleges in co-operation with the Forest Service are good for the particular purpose for which they are designed, namely, to supplement the

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*Read before the Conference of Forest Schools, December, 1909.

knowledge already attained by the forest rangers attending them. But we need a larger course, and one differently organized. The best plant is to have a school or academy located in the forest, as, for example, is the Academy at Mont Alto, Pennsylvania.

Admission Requirements. I would make the admission requirements very easy. I would not place the general educational requirements beyond that required for entrance to the high school. There should be a minimum age limit, say 17 years.

Length of Course. The regular course should cover a period of one year.

The Curriculum. The course of instruction will necessarily vary widely in different schools, and in each case be adapted to local requirements. It should not be the aim to train the students for work everywhere in the country, but there should be in each forest region one or more schools training men for the needs of that particular locality. In general the instruction would fall under the following heads:

1. *Elementary Surveying.*—Including the use of the compass, hand level, clinometer, and barometer; the construction of simple maps; and enough of the elements of topographic surveying to enable the student to use topographic maps.

2. *Forest Measurements.*—This should include scaling, estimating, cruising; the use of volume tables, and elementary work in growth studies.

3. *Dendrology.*—This course should teach elementary forest botany, including the classificaton and identification of the local species.

4. *Silviculture.*—There should be instruction in elementary silvics; practical training in distinguishing forest types, and in forest description; seed collecting; nursery work; seeding and planting; marking for reproduction and improvement cuttings.

5 *Forest Protection.*—The chief work would be training for fire protection, including fire plans, organization of fire patrol, organization of fire fighting forces, equipment for fire patrol and fire fighting, methods of fire fighting, etc.

Enough work on forest insects should be given to enable the ranger to recognize the damage, to interpret instructions regarding selection of trees for cutting and their treatment, and to report on threatened injury to the forest.

There should be some elementary instruction in tree diseases, with special reference to external signs of decay.

6. *Forest Products.*—This course would cover the uses of the local woods, possible markets for them, specifications required by different classes of woods and their value. It should comprise also elementary instruction in wood preservation, with special reference to simple methods of treating ties, poles, and posts.

7. *Lumbering.*—The student should be given practical instruction in the methods of logging used in the locality where the school is located and in the determination of the cost of logging and value of stumpage. He should have also practical training at the mill, with particular reference to the bearing of lumber manufacture on logging, stumpage, and the practice of forestry.

8. *Law.*—The student should be given some simple business law, with reference to contracts, deeds, titles, etc. He should understand the local forest and land laws. If in one of the public land States, the instruction should cover the necessary information regarding the homestead, mineral, and other laws which the ranger is likely to be called upon to execute or to give information about.

9. *Forest administration.*—Ranger schools in the West should provide instruction regarding administrative problems on the National Forests. This would include administrative problems connected with grazing, settlement, claims, trespass, free use, timber sales, etc.

10. *Construction work.*—The ranger school curriculum should include ample training in the construction of roads, trails, telephone lines, watch towers, bridges, cabins, fences, etc.

11. *Fish and Game.*—The ranger should be informed not only regarding the game laws, but should understand the propagation and care of fish and game.

Miscellaneous Subjects.—The ranger must be a trained woodsman. Attention and time may, therefore, be given to camp outfitting, camp hygiene, cooking, shooting, packing, trapping, etc.

Character of Instruction. The ranger school should be a field school. Well organized, practical field instruction with frequent quizzes should be dominant. When possible, simple textbooks, or, in their absence, mimeographed instructions should be used. Lectures and note taking should be put in the background. The ranger must be taught to do things. He must learn by doing the work itself under intelligent and systematized instruction. Thus in construction work he should not only lay out trails, but himself build sections of trails under different conditions. Practical work after learning methods in order to increase facility should be a strong element in the organization of the field training.

FOREST ASSISTANTS IN THE FOREST SERVICE.

By Theodore S. Woolsey, Jr.

The question of personnel is one of the important problems of the Forest Service. The Supervisor is demanding a better class of Rangers and Forest Assistants, because the District office necessarily must insist on better results from the Supervisors, due in turn to the requirements of the Washington office. Two years ago the demand for Rangers and Forest Assistants could not be filled; last year a number of Rangers were furloughed and there was a Forest Assistant waiting list. This "waiting list" is going to result in an automatic raising of the entrance standard, because it will mean that only the better qualified men can secure positions. It will also turn a considerable number into private work as consulting foresters and "lumbering assistants"—an excellent thing for private forest management. No boudt we shall see within the next ten or fifteen years a corps of private foresters, even more practical and as good silviculturists as those who enter the Federal Service, if not better. The private land owners of Austria have, it is believed, secured fully as progressive men as has the State, and perhaps more so.

Yet there will always be competition for the federal vacancies and consequently it may be timely to review briefly why some of the recent forest school graduates have failed to measure up to the requirements. One officer puts the case thus:

> "It is not often that Forest Assistants fall clear down, but sometimes during the first year and in some cases the first two years, a great deal of their work is wasted and advancement is delayed by their lack of sympathy and understanding of the class of men with whom it is necessary for them to work, both as Rangers and users of the Forests."

Another officer writes:

> " * * The personal make-up of the men seems to be largely the reason for the lack of success of some *."

and

> " * * most valuable is the one who has a thorough grounding in emergency and silvical work and who at the same time has the right personality * *."

It is my own experience that if a man is a "good mixer" he can succeed on a western Forest even if he is not particularly brilliant. In fact, if a man has the good will of the men with whom he works, they will have the tendency to minimize his technical shortcomings. At least, a man who does not get on has all his technical defects exposed and exaggerated.

A rather general review of the causes of temporary or permanent failures in the past shows four main shortcomings: Personality; training; judgment; improper assignment.

When men "fall down" permanently their misfortune is usually due to lack of adaptability to western conditions. A new man must try to adapt himself to the west and try to appreciate the point of view of Forest users. To be officious is fatal to success. A man who does not tacitly acknowledge his ignorance in some of the practical every-day problems of western life often appears in a false light. Loyal co-operation with superior officers is naturally to be expected.

The older forest schools are turning out better trained men every year. Yet, in some districts, Forest Assistants have suffered from a lack of business training, and because they have not been schooled in the first essentials of woodsmanship. Some men from well known schools have been unable to make a simple estimate, to run a compass line except under ordinary conditions, to map, or to analyze logging cost. Even written reports and every day diaries have shown, in some cases, a woeful lack of training in the routine of a forester's early work. Inaccuracy and ignorance of some of the chief western problems can usually be charged up to superficial preparation at school. When a man "soldiers" his work and lacks ambition and energy it is perhaps because he did not understand before going west that there must be tiresome routine work in the ranks, often with no social diversions to break the monotony.

The forester's judgment must, of course, be gradually developed by experience, but it is too costly and wholly unfair to expect the Forest Service to excuse some of the mistakes due to lack of common-sense judgment that have occurred. A man must appreciate the economic limitations which prevent the adoption of some technical measures, no matter how desirable they may seem. A frequent mistake in marking or in the details of any timber sale administration is often due to the fact that the Forest Assistant tries to do something which is not possible under the contract. If the contract in reality means that only five seed trees can be retained and the officer marking the timber keeps ten, naturally it leads to a complaint, since the lumberman's rights must be respected. Theory must be adapted to practical conditions and its effect on closely related policies thoroughly studied out. The exclusion of sheep from important grazing districts, when it is clear that they are causing damage, must be gradual and so arranged that no undue hardship will be worked on local interests. Since most of the silvical problems are far from solved, snap judgment is all the more to be avoided.

Frequently men have been assigned to silvical investigations when they would have done better at engineering or cruising. Perhaps administrative duties have by force of circumstances devolved upon the silvical expert who cannot handle Rangers. This error in assignment is an administrative mistake that can be and is being corrected by a study of the assignment problem. The result no doubt will be systematic study of new men under the most favorable conditions and will lead to their assignment to the work for which they are best fitted. In case a man is proved to be unsuited to his first job, he should under ordinary circumstances be given another chance in the line of work to which he is best adapted.

To succeed in the West—or anywhere, in fact—one must have "sand", and must be willing to put up with hardships and discomforts. This is easy for the man who really loves the work and the frontier life. Accuracy, energy, and perseverance coupled with an intelligent initiative ought to lead to aggressive constructive work. "First acquire knowledge and experience and *until then* sink your individual views"—as one man puts it.

There are plenty of places in the Forest Service for the well qualified men; they can look forward to earning an honest livelihood and to a life of interesting and useful service, provided—and there's the rub—they first learn the West and its men.

TEACHING STUDENTS HOW TO CONSERVE ENERGY.

S. B. Detwiler.

There is a need in our colleges, particularly in the professional schools, for instructing the students in the art of note-taking and note-keeping, and in general business methods. College is primarily intended to give the student a broad foundation for his future work and to teach him the best methods of solving the concrete problems which he will meet in his profession. It is not possible nor desirable for the student to acquire a great mass of detailed information, since this has a tendency to cause him to lose sight of the main purpose of his college work. Yet, it is evident that the greater the student's mastery of the details of his profession and of business methods, the more rapid will be his progress when he begins practical work. It is also evident that the greatest saving of energy will result from systematizing routine work, which in the case of the student consists largely of note-taking and reference reading. Frequently this work is made more laborious and of no permanent value because of lack of a definite system.

Science is defined as classified and systematized knowledge. It appears to be the duty of the college to teach the student of the scientific branches, at least, how to classify his knowledge, and to aid him in organizing some permanent system which will form the nucleus of a readily available encyclopædia of knowledge. System and orderliness do not make the man, but they do save his time and are almost indispensable to success in practical work. The subject seems of sufficient importance to have a place in the college curriculum, or to be taught by special advisers.

A good system of filing information must be compact, condensed, capable of unlimited future growth, and broad enough to cover the whole field of the profession. Above all things, it must be so arranged that the information it contains is available without waste of time. Experience has shown that the card system is a very satisfactory method of filing, and it fills all of the above requirements. Notes on lectures, in this system, are condensed on 4 by 6, or 6 by 8 library cards of good quality. One card should treat of but one subject, and the proper heading should be written plainly at the top. Through a careful classification of the subject headings, an undue multiplication of cards is avoided. Each card should bear the date of the lecture. A digest of reference readings is condensed on cards and filed in the same manner. Author, title and page should always be given, and the card classified by subject. Specially important information may be placed on red or blue cards to make it more conspicuous. The preparation of these cards gives the student valuable training, and helps to fix the information in his mind, and it also points out subjects in which he lacks information. With such a system, cramming for examination is not needed.

The cards may be filed in a vertical filing cabinet, or they may have holes punched in one end and be kept in a loose-leaf note book cover. After the course is finished, the cards, or such of them as it is desirable to keep, are placed in the permanent file under their proper headings. For foresters, the following adaptation of the decimal system of classification is suggested:

Classification of Forestry.

00-09 General Forestry
- 00—General Works
  - 000—Miscellanies
  - 001—Trade Catalogues (under suitable heads, e g. nursery)
  - 002—Documents and Reports (not elsewhere provided for—file by counties and years)
- 01—Essays, Papers, Addresses
- 02—Societies, Associations, Conventions
- 03—Biography
- 04—Forestry Education
  - 041—Forest Schools
  - 042—Arbor Day
  - 043—Nature Study
- 05—General Description of Countries
- 06—Popular Forestry
- 07—Illustrative Material (Photographs, etc.)

10-19 Forest Engineering
- 10—General
- 11—Plane Surveying
  - 11.1—Instruments, Theory of Surveying
  - 11.3—Land Survey
  - 11.3—Boundary Survey
  - 11.4—Topographic Survey
  - 11.5—Forest Reconnaisance
- 12—Mapping
- 13—Designs, Specifications, Contracts
- 14—Construction
  - 14.1—Roads and Trails
  - 14.2—Fire Lines
  - 14.3—Bridges

- 14.4—Telephones
- 14.5—Houses, Cabins
- 14.6—Reservoirs, Dams
- 14.7—Drains, Ditches
- 14.8—Fences
- 14.9—Nurseries

15—Mechanics

19—Camp Management

- 19.1—Equipment
- 19.2—Dietary

19.3—Medical Notes

19.4—Veterinary Notes

20-29 Forest Botany

20—General

21—Forest Geography and Physiography

- 21.1—Arboreta (lists of native, planted and introduced species)

22—Silvics

23—Dendrology

- 23.1—Morphology
- 23.2—Physiology
- 23.3—Anatomy
- 23.4—Taxonomy

24—Tree Studies (Silvical and Commercial)

- 24.1—By Species

  Where data is sufficient use following sub-heads under each species:

  1. Miscellaneous
  2. Taxonomic Description
  3. Range and character of distribution
  4. Habit and size
  5. Soil and Moisture requirements
  6. Tolerance
  7. Reproduction and Seedling development
  8. Growth and Yield
  9. Dangers and Diseases
  10. Propagation, Planting and Thinning
  11. Properties of wood
  12. Uses and commercial value

- 24.2—By Groups of Species
- 24.3—By Regions

30-39 Silviculture

30—General

31—Arboriculture

- 31.1—Landscape Gardening
- 31.2—Notes on Ornamental Plants (by uses and classes)
- 31.3—Farm Forestry
- 31.4—Cultural Methods
- 31.5—Tools and Implements

32—Artificial Forest Regeneration

- 32.0—General
  - 32.00—Outlines
  - 32.01—Planting Plans
  - 32.02—Results of Planting
  - 32.03—Nursery and Planting Reports
- 32.1—Seed Collecting, storage and testing
- 32.2—Nursery Practice
- 32.3—Field Planting

33—Natural Forest Regeneration

34—Tending of Forests

40-49 Forest Protection
- 40—General
- 41—Fire
- 42—Climatic Injuries
- 43—Parasitic Plants, Fungi, Forest Weeds
  - 43.1—By Host Plants
  - 43.2—By Species of Attacking Plants
  - 43.3—By Groups, Regions, Gen. Reports
  - 43.4—Forest Weeds
- 44—Insects
  - 44.1—By principal food plants
  - 44.2—By species of common names
  - 44.3—By Regions, Classes, or Groups
- 45—Animals
- 46—Storms, Wind
- 47—Avalanches, Floods, Erosion, Shifting Sand
- 48—Smoke, Gases, Poisons
- 49—Injuries by Man
  - 49.1—Trespass
  - 49.2—Improper Utilization

50-59 Forest Management
- 50—General
- 51—Forest Mensuration
- 52—Forest Organization
  - 52.1—Principles of Working Plans
  - 52.2—Working Plans for Special Areas
- 53—Forest Administration
- 54—Forest Valuation
- 55—Forest Finance

50-59 Wood Technology
- 60—General
- 61—Wood Technology
  - 61.1—Wood Anatomy
  - 61.2—Timber Physics
  - 61.3—Seasoning
  - 61.4—Durability
  - 61.5—Heating Power
  - 61.6—Defects
- 62—Wood Chemistry
- 63—Wood Preservation
- 64—Wood Substitutes

70-79 Forest Utilization and Exploitation
- 70—General
- 71—Encyclopaedia of Forest Products and By-products
  - 71.7—By Species (alphabetically)
  - 71.2—By Industries and Uses (alphabetically)
  - 71.3—Grading and Inspection, Requirements of Trade
  - 71.4—Stumpage and Lumber Prices
- 72—Logging
- 73—Transportation
- 74—Saw-mills (Labor, Power and Machinery, Market, Costs)
- 75—Other Wood Manufacturing Industries (alphabetically)

80-89 Forest Economics
- 80—General
- 81—History and Status of Forestry (country divisions)
- 82—Forest Influences
- 83—Forest Economics
- 84—Forest Conditions (forest resources, growth, prices)

90-99 Forest Policy
- 90—General
- 91—Forest Law
  - 91.1—Fish and Game Laws
- 92—Governmental Policy (country divisions)
- 93—Conservation of National Resources

Books, bulletins, pamphlets or other publications which the student desires to retain in his library should be indexed on cards and the latter placed in the file under the proper subject headings. The usual author and title cards may be made out, and kept in a separate file from the subject index. Cards for specially important subjects in books and bulletins may also be made out, but if this cannot be done, write a short resume of the work, or give the chapter heads on the cards.

Useful clippings may be pasted on cards and placed directly in the file, or they may be pasted on sheets of paper of uniform size and filed in folders. A vertical letter file is the best way to file unbound publications, notes and clippings which cannot be placed on the library shelf. Each bulletin may be given a serial number as it is indexed, and all the cards made out for it given the same number. The bulletins may also be filed in the drawers under the same subject heads as are used in the file. The Cornell system of filing bulletins in card-board cases open at the back, may also be recommended, but the vertical file case has the advantage of being free from dust, and the publications can be found more quickly; the greatest advantage, however, lies in the fact that the bulletins, etc., can be so quickly returned to their exact place in the file.

THE APPLICATION OF SCIENTIFIC MANAGEMENT TO FORESTRY.

By Karl W. Woodward.

Foresters, like the men of most other scientific professions, have felt very little interest in so-called scientific management. It has seemed to them to consist of methods applicable only in the relatively simple and easily standardized conditions of factory work. The claims of Mr. Taylor and his associates that scientific management will solve the labor problem, while of vital interest in the business world, have obscured for the professional man the underlying principles of scientific management. He feels that he has no labor problem, and why, therefore, bother to discuss methods which seem peculiarly adapted to businesses where the employee is endeavoring to render as little service as possible.

The first objection to the introduction of scientific management is the common one raised against it everywhere. Even the factory manager's first reply to the suggestion of introducing these principles into his shop is almost invariably, "Our business is too complex. I can see very well how it would work in bricklaying or something like that, but you can't standardize our operations." Of course, the answer to this is that it *has been* successfully introduced into even the most complex industries and professions.

The objection that a profession without labor troubles has no need for scientific management is also founded on a misconception of the fundamental principles of the subject, because the possibility of solving the labor problem is only one of the incidental advantages of scientific management. Every worker, professional or otherwise, does need methods that will enable him to work more effectively, to turn out more work with less effort and with less cost. That is the reason why scientific management should appeal to every forester.

Scientific management can best be defined as the application of the scientific method to the conduct of any business. Mr. Taylor explains it by enumerating four principles as follows:

1. The development of a true science.
2. The scientific selection of the workman.
3. His scientific education and development.
4. Intimate friendly co-operation between the management and the men.

For our purposes these principles are somewhat too inclusive. They emphasize the need for preventing "soldiering", the ever present problem in large industrial establishments. Our problem is simpler because, at least among professional foresters, there is no desire to turn out a small amount of work. Rather the days are not long enough nor their strength great enough to do the tasks they would like to accomplish. This paper will then attempt to show how scientific management can be applied to the problems of the forester and enable him to turn out more work in less time and with less effort. It may be likened to a piece of machinery the first cost of which is great, but, where the volume of work is large enough to justify its purchase, by it the output can be doubled and trebled and the cost per unit materially reduced.

Expressed in another way the most pressing problem for the forester is the development of scientific ways of doing things. Having no serious labor problem he may concentrate his attention for the time being upon the first of Mr. Taylor's principles and neglect the other three until he has scientific methods firmly entrenched in the higher grades of the profession. Of course, it will be necessary ultimately in order to get the best results out of a large organization like the National Forest Service to apply the last three principles laid down by Mr. Taylor, but before selecting and teaching the rangers scientifically it is necessary to convince professional foresters that the principles of scientific management are applicable to the problems of the profession.

Since the definition given above explains scientific management as the application of the scientific method to business it is first necessary to explain what is meant by the scientific method. This may be epigrammatically defined as the way in which science is carried on. But this needs further elucidation because various sciences are in various stages of development. For example, the methods and objects of such a mature science as astronomy are entirely different from those of a comparatively youthful science like psychology. Not only are all the stars catalogued but their movements are known so well that their exact positions may be calculated for years ahead. In psychology on the other hand many of the properties of mind are not even named while only a few can be discussed with certainty. The differences between different sciences of varying ages is similar to the differences in the methods and ideals of a single science which have occurred during its development. Take botany for example. Linnaeus was mainly concerned with cataloguing plants. Now that we know fairly well what plants there are on the earth's surface, we are concerned mainly in determining how they act under different conditions, and in some cases these reactions to stimuli are so well understood that the behavior of a plant may be predicted. The most recent investigations have gone even a step further and have produced new species because of the complete knowledge of the behavior of plants under given conditions.

These illustrations will serve to show that the methods of science vary with the stage of development of the science. Every highly developed science may be said to have three periods of growth. In the first, or "bug hunting and rock naming" stage, its devotees are mainly concerned in taking stock. After finding out what there is, there follows a period which is characterized by great activity in experimentation whose purpose is the determination of how species respond to given stimuli, what happens when certain chemical elements are brought together, and the solution of like questions. Then in the final stage having determined and classified the species or elements with which the science deals, and found out how they act and react, it is possible to formulate laws and to predict what will happen under given conditions, or in some cases even actually to produce new species or elements. Briefly put, no science may be said to be fully developed unless it can answer three questions in regard to the elements, species or phenomena with which it deals:

1. What are the elements? 2. What are the conditions which govern their actions? 3. What are the laws which govern their actions under given conditions?

Having defined the scientific method, its application to business management must now be discussed. In this connection it will be most convenient to sub-divide the discussion into the five following parts:

1. Sequence of time activities. 2. Equipment. 3. Straight line methods. 4. Progress records. 5. Maintenance of efficiency.

While these sub-divisions are more or less arbitrary, without sharp dividing lines, and are mutually interdependent they can be recognized in any sort of business management, and form convenient headings about which to group the different parts of the discussion.

Under the first heading are included the determination of such questions as:

(1) How long will the job take? and (2) In what order shall the different parts of the task be taken up? These must be answered before the job is begun. It might very well happen that it would be inadvisable to start a piece of work at all because it could not be finished in the time available. Likewise, the determination of the sequence in which the parts of the task are to be completed is of prime importance in order that there may be no delays by reason of the lack of an important part at the proper time. That questions like these cannot be decided intelligently without much experience does not do away with the need of answering them, or realizing them consciously or unconsciously, at the start of any piece of work.

Under the heading of "Equipment" are grouped all the mechanical appliances which are used in any piece of work. This also seems the most logical place to consider factors like light, heat and ventilation which are governed mainly by physical laws. The striking advances in efficiency which have been made in the past have been almost altogether improvements in equipment, or "inventions." This is natural for the reason that the means of measuring mechanical effects were the first to be developed because the laws defining the actions of inanimate things have been fairly well understood for a much longer period than the laws governing the phenomena of life.

The third division, "Straight line methods" includes a field of endeavor which has only recently been cultivated because our knowledge of psychology has been so very meager until within the last few years. Probably the best way to explain what is included under this heading will be by an illustration of a simple mechanical operation. A man who was making screw eyes by bending a straight piece of wire with a machine which he operated with his right hand had his pile of unbent wire on the right side of his machine. Simply by putting the unbent wire on his left side so that he did not have to reach across, his efficiency was increased one-third. Wasteful ways of doing things like this may involve either simple mechanical operations like that in the illustration, or complicated mental processes. As an example of the latter may be cited the effect of worrying about not having time enough to complete the task in hand. This means that one is not only trying to do the immediate task but reaching forward and forecasting the difficulties of the next job. The essential thing here as with the man making staples is to determine the simplest, straightest, and most direct motions whether they be mechanical or mental, eliminate all non-essential motions, and make the straight line motions sub-conscious.

In the determination of straight line methods the time study and the motion study are very helpful. By careful analysis of the different steps in an operation, and the timing of each step wonderful improvements have been effected. One of the most striking instances is that of Mr. Gilbreth's work in bricklaying. He has succeeded in reducing the motions necessary to lay a brick from eighteen to five per brick and increased the number of bricks laid per man per hour from 120 to 350.

Having determined the proper sequence of the time activities, the best equipment, and the straight line methods, it is necessary in order to insure continuous and rapid progress to have records which will show what advances are being made. Such records are especially valuable during the experimental stage because they furnish the acid test by which the value of new methods can be determined. They are, therefore, of permanent usefulness for purposes of comparison because there are always new methods to be tried out in a business or art which is keeping abreast of the times. These progress records should show what is being done and how and where it falls short of the ideal sought. To do this concisely is often difficult and requires special study in each case because of the variation in the aims desired.

The fifth and last subject which needs to be investigated in applying scientific management to any art or business is the one in which Mr. Taylor and his associates have achieved such marked success, viz: maintaining efficiency. Where there is little or no professional pride to keep men up to the mark this is, indeed, the most difficult problem. The forester has to face it where he deals with large bodies of men who merely wish to get their wages, as for example in fire fighting. While chances to encourage healthy competition, house or firm loyalty, and professional pride are not neglected, Mr. Taylor places his main reliance on the selection of suitable workmen, adequate instruction in the best methods of work, and a high rate of wages. Probably the most notable contribution in this line is the development of the concept of functional foremen. These foremen are teachers who specialize on some particular branch of the work and replace the foremen of the old school who were supposed to know everything and for that reason could do nothing thoroughly.

To repeat, then, the formulation of a scheme of scientific management, presupposes the application of the scientific method to the investigation of these five main sub-divisions of any art or business: 1. Sequence of time activities. 2. Equipment. 3. Straight line methods. 4. Progress records. 5. Maintenance of efficiency.

This means that for each of these divisions the investigator must find out:

1. What is being done? 2. What are the most favorable conditions? 3. What should be accomplished under the most favorable condtions?

In order to show how this works out in actual practice it is proposed to give two illustrations of the application of scientific management to work in forestry. It is to be regretted that it has not been possible to fully complete these investigations but enough has been done to indicate the methods of attack and forecast the results attainable.

The first illustration is a study of a supervisor's office duties in the management of a National Forest in the West. Obviously the first thing to do is to find out how he spends his time. Averages covering a long period and a wide range of conditions showed the time distribution to be as follows:

Case preparation,	70%
Conference,	20%
Dictation and signing mail,	10%

By "case preparation" is meant all those activities which precede the final dictating of a report or letter. In a supervisor's office this would include a wide range of subjects from such comparatively simple matters as the location of a sheep driveway to elaborate reports like those on questions of forest management. Although unlike in substance their method of preparation is identical. First the main points at issue must be determined, all subsidiary questions arranged in their proper perspective, the data collected to answer the points at issue, and definite conclusions reached in regard to them.

Under the heading "conference" is included the time spent in answering callers, and conferring with associates.

The terms "dictation and signing mail" need no explanation other than to say that they are restricted to the time actually spent in dictation and signing and do not include any case preparation.

Having determined the main divisions of a supervisor's time there follows next a list of the items which need to be investigated by the scientific method under the three main divisions of case preparation, conference and dictation. It is to be regretted that instead of a mere list of what needs to be investigated it is not possible to give the results of such studies, but there has not been time enough to complete the long investigations which will need to be made before definite conclusions can be reached in regard to some of the items. An outline of the points to be studied, however, will illustrate what should be done.

Analysis of Case Preparation.

Sequence of time activities.
- How long will the task take?
- It what order should the parts be considered?
- What degree of polish will the time available justify?
- During what part of the day should it be considered?

Equipment.
- Is the light good and from the right direction?
- Is the ventilation good?
- Is the desk appropriate for the task
- Does the chair give proper support?
- Are the writing materials adequate and well arranged?
- Are the reference data like files, books, card catalogues, and maps adequate and well arranged?

Straight line methods.
- Has the main issue been determined?
- Have the side issues and distractions been eliminated?

Progress records.
- How does the output compare in quality and quantity with what should be done?
- Are the exceptionally good and bad performances clearly shown up?

Maintaining efficiency.
- Is there adequate instruction in new methods?
- Is there esprit de corps?
- Is there professional pride?
- Is there suitable reward for efficiency?

Analysis of Conference.

Sequence of time activities.
- Duration of task.
- Proper sequence of parts.
- Suitable finishing off.
- Best time of day for performance of task.

Equipment.
- Light.
- Ventilation.
- Chairs.
- Reference data.
- Refreshments—cigars, etc.

Straight line methods.
- Concentration on main issue.
- Elimination of side issues.
- Frankness.
- Polite but effective termination of interview.

Progress records.
- Comparison of output with quantity and quality standards.
- Showing up of exceptionally good or bad performances.

Maintaining efficiency.
- Adequate instruction.
- Promotion of esprit de corps.
- Promotion of professional pride.
- Adequate rewards.

Analysis of Dictation.

Sequence of time activities.
- Duration of task.
- Proper sequence of parts.
- Suitable finishing off.
- Best time of day for performance of task.

Equipment.
- Light.
- Ventilation.
- Chairs.
- Desk.
- Writing materials.

Straight line methods.
- Concentration.
- Elimination of side issues and distractions.
- Clear enunciation.
- Arrangement of papers.

Progress records.
- Comparison of output with quality and quantity standards.
- Showing up of exceptionally bad or good performances.

Maintaining efficiency.
- Adequate instruction.
- Promotion of esprit de corps.
- Promotion of professional pride.
- Adequate rewards.

In order to illustrate how scientific method of management can be applied to field work an outline is given below which lists the main points to be investigated in compass work:—

ANALYSIS OF COMPASS WORK.

Sequence of time activities.
- Duration of task.
- Proper sequence of parts with different sizes of crew.
- Adequate finishing off.

Equipment.
- Compass—size of needles, stadia telescope.
- Tripod or jacob staff.
- Chain, tape, or stadia.
- Clinometer for reading slope angles.
- Pins or tally register.
- Note book and pencils.
- Mapping materials.

Straight line methods.
- Concentration on task.
- Elimination of side issues and distractions.
- Best method of setting up compass.
- Best method of measuring.
- Best method of keeping notes.
- Best draughting methods.

Progress records.
- Comparison with quantity and quality standards.
- Showing up of exceptionally good or bad performances.

Maintaining efficiency.
- Adequate instruction.
- Promotion of esprit de corps.
- Promotion of professional pride.
- Adequate rewards.

To sum up, scientific management is in brief based upon the application of the scientific method to the investigation of the different parts of any art or business in order to determine the best methods. The scientific method is made up of three steps. In the first of these the material or phenomena in hand must be classified. The second step consists in determining the behavior of the elements under different conditions. In the last stage as a result of the two preceding steps it is possible to formulate laws which enable one to predict what will happen under any given conditions.

The most striking immediate result of the inauguration of the scientific management in any business is the great increase of overhead expense through the need of having a larger force to plan the work and keep progress records; for example, one plant increased its foremen and clerks from four to twenty-five and decreased its workmen from 125 to 75. But the output was tripled so that the cost per unit after all fell off greatly. Expressing this in terms of the individual worker rather than for a larger organization, scientific management shows that he should spend less time trying to do, and more time finding out how to do things in the best way.

If the subject has been successfully presented the reader will have been impressed first of all with the essential simplicity of the method proposed. Science is merely classified common sense. But the scientific method also typifies system, thoroughness, and close attention to details. That such careful analysis of business methods is worth while the great success of scientific management in some establishments has amply demonstrated. What many have failed to realize in the past has been the possibility of universal applicability of scientific management because it is merely the application of the scientific method of business management. With a better understanding of the methods of science and greater refinement of its tools scientific management is bound to play a rôle of increasing importance in the conduct of all arts, trades, and professions.

EUROPEAN STUDY FOR FORESTERS.

By A. B. Recknagel and Theodore S. Woolsey, Jr.

Most professional foresters will agree that a thorough knowledge of home conditions is the first requisite; therefore if a forest school graduate must choose between a first hand knowledge of his own country and a trip abroad, he should by all means first become acquainted with the Pacific Coast, the Rocky Mountains, the Southern Appalachians, the Southern pineries, and the hardwood, pine and spruce forests of the North. In other words it is usually advisable to defer study abroad until a few years after graduation. Then too the man fresh from his schooling is satiated with theory and requires a year or two of practice. He soon finds that the practice of forestry is limited by what *can* be done under the local conditions. He soon discovers that his theory is merely a crude foundation upon which he must build little by little. He must learn the exceptions, often by making mistakes. He must appreciate that nature has the final word and that nature has no exact rules. The prevailing wind which may govern the progress of the felling series may blow from the opposite direction just when a stand is vulnerable. But if theory does not hold good, why study the theory in the practice of the older countries? Because one has the limitations driven home time and again, because one's judgment is broadened, because one learns a great many "tricks of the trade" that can be applied directly in America. Especially if a man is assigned to a Western Forest, his work may be so narrowed that his horizon will be reams of accounts, letters for dictation and other deadening red tape. To sum up, a forester would gain more from a trip abroad if he waited, say two or three years after graduation—not long enough to get hopelessly in a rut but long enough to have put into practice some of the school theory.

Naturally there are a great many men who cannot travel until after five or ten years and then only for a short trip. Even three months would fully repay such a man for the trouble and expense. The Government Employee, the State Forester, the Consulting Forester, and particularly the Professor would do well to look forward to European study. There are drawbacks; the general character of innkeepers abroad does not improve one's disposition unless one simply gives up all idea of economy and allows petty thieving as a matter of course. Trips often are slow in materializing; perhaps a wait of two or three days is necessary before the proper official can find time to accompany one. The stops for "tea" may occur just when one is most anxious to push on and see some interesting stand, yet the official guide may be thirsty and that of course ends the question. Delays of any duration can be profitably filled in by reading and study, or if one prefers, there are almost always galleries, historic ruins or cathedrals to fill in the gaps.

Cost. In attempting to give any figures of cost, the motive is that of helping the prospective traveler to guage, at least approximately, what his expenses will be. In no instance should they be followed blindly; for, even more than in estimating timber, they "vary with the idiosyncracies of the assessor."

The figures of cost are aranged under three headings: *minimum, average,* and *generous. Minimum* involves second class on steamers, third class on railroads, stopping at the cheapest hotels (at least in Germany) and generally "roughing" it—which should not, however, prove a deterrent to the ambitious young man who has no social obligations nor any official or other position to maintain.

Under *Average* the figures are intended for the man of more mature years and means sufficient to support his social and professional position. (The importance of this phase will be discussed under "Etiquette"). It means first-class travel on steamers, second-class on railroads (at least for longer stretches) and stopping at second-rate hotels.

The figures given as *Generous* are for those whose means are not restricted, and who demand the best in their travels—first-class steamer, hotel and railroads.

No attempt is made to include the cost of sightseeing, guides, amusements, souvenirs, etc. For the last it will be well to set aside a definite sum before starting; for the former, follow Polonius' example and "put money in thy purse".

	Minimum.	*Average.*	*Generous.*
Steamer—return trip—			
Summer Season, both ways,	$140	$225	$320
Summer Season, one way,	120	212.50	250
Off Season, both ways,	100	175	200
Railroad per mile (average),	.01¼	.02	.03
Meals on diner—			
Breakfast (coffee and rolls),	.35	.35	.35
Luncheon,	.70	.70	.70
Dinner	.80	.80	.80
Baggage—(always extra, except in France where 80lbs. are free).			
Hotel—			
Room,	.50	.75	1.50
Breakfast,	.25	.37½	.50
Luncheon,	.20	.50	1.00
Dinner,	.30	.50	1.50
Average current expenses daily, aside from steamer,	$1.50	$2.50	$7.50 to $10

The above figures are apt to prove misleading unless they are supplemented by explanatory statements. In the first place, no inexperienced traveler should be ashamed of his ignorance—such false shame will cost him dear. Innumerable pitfalls beset the unwary and often lead the harassed American to conclude that everybody is trying to "do" him. It is undoubtedly true that our fellow countrymen are directly responsible for the universal syllogism: "you are an American: all Americans are rich: therefore you are rich." It is not that the foreigner is essentially dishonest, but simply this "rich American" notion combined with a carelessness on the part of our travelling compatriots leads to overcharges. Therefore, shun not the study of Baedeker nor be ashamed to peruse Cook's guide books and to be seen in Cook's offices. Experience is a forceful teacher, but he certainly is expensive!

As to the choice of steamship lines little can be said, except to point to the obvious fact that it is bad economy to take a poor steamer. The "golden mean" is never more advisable than in the choice of steamers—neither the fastest nor the slowest, neither the largest nor the smallest. Unless one's time is very precious, one can well afford ten days on the ocean.

It is so customary as to be practically obligatory to tip the stewards on shipboard. This will probably be the first inauguration into European tipping. The European tips profusely, but not extravagantly. At a restaurant 10% of the bill is the usual tip, 10 Pfennig, 10 Centimes, or its equivalent, is the minimum. At hotels the chambermaid, the "boots", the elevator boy, and the grandiosely uniformed "Portier" or "Concierge" all expect their moiety—20 Pfennig (or five cents) per day is usual for the Chambermaid, 2½ cents per pair of boots cleaned, a few cents to the elevator boy and perhaps a dime or quarter to the portier, depending on the length of stay and the services rendered. As a general guide, ten per cent. of the bill is expected in tips for a short stay; 5% suffices for a longer stay. In pensions (boarding-houses) there are fewer to tip and hence 1% or 2% of the amount of the bill suffices. No one of an inferior social caste is degraded, in Europe, by receiving a tip; on the other hand he who refuses to tip will be looked down upon—and feel thoroughly uncomfortable, if he refuses the toll of these few coppers. "When in Rome, do as the Romans"—and tipping is part of the game.

Because no baggage goes free— except the blessed 80 pounds in France!—it is advisable to travel as light as possible and take what one can as hand baggage. The commodious racks of the Continental Compartments are accustomed to being treated like furniture vans. Upon arrival at a station all but the "Minimum" class will find it advisable to entrust their belongings to a porter who for 2 or 2½ cents* per piece will carry the luggage to the cab, omnibus, or street car, or even to the hotel if it is near by. Cab's are cheap in Europe—almost all have taximeters—but omnibuses and street cars are even cheaper. The minimum fare in a cab is usually 12 to 20 cents, depending on the class of the vehicle. Luggage, including trunks, is usually put right on the cab. Hand luggage had best be piled *inside*, unless one has as-

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* In the large stations the usual fee is 20 Pfennig for the first piece of luggage and 10 Pfennig for every additional piece.

certained that placing it outside involves no extra expense. Street cars and Omnibuses usually charge a minimum fare of 2 or 2½ cents. It is a curious custom in Germany and Austria to give the conductor a tip, of 5 Pfennig in Germany, 2 Heller (four tenths of a cent!) in Austria, if he has to make change of a "Mark" or a "Krone", or if you ask him for any special information, such as to be notified when the place of destination is reached. It is customary to give Cabbies approximately 10% of their fare as a tip.

The rate per mile for railroad travel given in the table is for III, II, and I class, respectively; it does not include the extra fare charged on "D" trains and "L" trains. "D" trains are corridor trains—i. e., the cars are connected each with the other, by means of vestibules, making it possible to walk from one end of the train to the other. The extra fare is never excessive, and since "D" trains are always faster and the cars better than accomodation trains, it is distinctly advisable to take them whenever available. "L" trains—so-called "luxury" trains, however, are exceedingly expensive. For example the fare from Munich to Vienna, a whole day's trip, is exactly double on the "L" train what it is on the "D" train, and the difference in running time is only two hours. "D" trains always carry I and II and sometimes III class, whereas "L" trains have only First-class Carriages.

Sleepers are always extra and are much like ours except that one lies across the car instead of lengthwise. In France, only first-class ticket admits to a sleeper; in Germany and Austria, a second-class ticket suffices. A night in a second-class sleeper costs $2 to $2.50 depending on the mileage covered. Reservations must always be made in advance.

France has no IV Class, neither has Austria, hence travel there in the II Class is almost a necessity except for the "Minimum". Germany puts its "great unwashed" in the IV Class, and hence the III Class is very clean and, except for the absence of upholstery, as comfortable as the II Class.

It is strongly advisable for the novice in European travel to secure his ticket and place reservation, if a "D" train, well in advance from Cook's or some other reliable tourist office. They do not charge one cent extra. It is also advisable to buy a railroad guide—either Cook's Continental Railway Guide—or, if one is master of the vernacular, any of the standard railway guides in French or German, such as Hendschel's "Telegraph" (Price 60 cents) or Storm's "Kursbuch" (Price 24 cents). Most of the Continental Railways are owned by the State and do not issue time tables gratis. Except in Germany, it is cheaper to buy a return ticket—but of this and the governing conditions any Cook's office will inform.

It is inadvisable to carry much cash. For a longer stay a Letter of Credit is strongly advisable; for shorter trips American Express Company Checks or Cook's coupon system is advised. The rates of exchange in the chief countries of Europe are, approximately:

France, Belgium and Switzerland,	1 Franc	=	$0 20
Germany,	1 Mark	=	24
Austria,	1 Krone	=	20
Holland,	1 Gulden	=	40
Italy,	1 Lire	=	20
Sweden and Norway,	1 Kroner	=	25
Russia,	1 Rubel	=	50

All Cook's offices have exchange bureaus attached and give the most favorable rates. It is hardly necessary to warn the tyro to scrutinize his change closely in order to avoid getting bad money.

Thanks to the persistency of our British cousins one can travel anywhere in Europe with the English language. It is, or course, eminently desirable to acquire the vernacular, but in hotels, restaurants and representative shops there is almost sure to be someone who maltreats English. This fact helps the American over many rough places in dealing with hotels and restaurants, but a few general facts should go as commentaries to the room and meal prices given in the table. Most hotels require that one eats at least breakfast there. In France and Austria, it is customary to have breakfast brought to one's room, but not always without extra charge; in Germany this is optional and usually costs a trifle more. Except at Pensions, light and heat are usually included in the room price; baths are always extra ($37\frac{1}{2}$ to 75 cents) and are, sad to say, considered a luxury, (except in the public baths). At restaurants an extra charge is made if nothing to drink is taken—wine and beer is so cheap that one saves by ordering a glass even though it is left untouched. Most restaurants have both table d'hote and à la Carte. Avoid carefully restaurants which give no prices on their menu, unless one belongs in the "Generous" Class; avoid, also, ordering anything which is not on the menu, for the chances are that one will pay dearly for his fancy. For a longer stay, try and secure Pension rates from the hotel ("Arrangement," the French call it) or else go to a regular Pension which is generally cheaper than a hotel.

If traveling with reasonable comfort (II or I*) Cook's hotel coupons are often a saving especially for the green traveler. Yoy pay cash at any Cook's office *for first-class accommodation,* \$2.50 per day or \$2.00 without luncheon. You receive in return hotel coupons for lodging, light and attendance; for breakfast; for luncheon; and for dinner. The advantages are manifold. Not only does one save money but one is relieved of all worry regarding overcharges. Often if the room is marked \$1.40 one receives it for the room coupon which is nominally worth only \$1.00. As a comparison one of the writers compared the cost in Vienna, (a very expensive town by the way), between the (a) hotel prices and (b) the cost of the coupons. The room (a) \$1.47 (b) \$1.00; breakfast (a) \$.30 (b) \$.20; luncheon (a) \$.60 (b) \$.50; dinner (a) \$1.00 (b) \$.80. A total saving of \$.97 with the coupons. The hotel must pay 10% to Cooks on all coupons but in return they secure the trade of a great many English and American tourists. A favorite method of overcharging is to say that all the reasonable rooms are taken and that only a \$2.00 room remains. One disadvantage these coupons are said to have is that one usually gets the poorest rooms during the rush season.

On the whole, Austria is more expensive than France or Germany. Living in a German town like Dresden costs at least one-third less than in Vienna. One always has to be on the lookout for extras. If one happens to pine for a drink of Scotch and the waiter brings one small "Club" decanter, don't rejoice at its reasonably generous proportions (for one drink) but pour a taste into the diminutive measure, (which looks like a thimble) and pay for one drink instead of five!

Etiquette. The etiquette in professional circles in Europe is

*In Germany, the saying is that only foreigners and actors travel I class.

rather stringent, and hence it is well for the visitor to post himself in this regard. He will be received with the utmost courtesy and even hospitality *if* he has the proper entree. Hence, before leaving home it is well to supply oneself with letters of introduction both specific and general. It is also well to have regular credentials so that one may at any time "legitimize" oneself. A government commission or a Consular letter serves this purpose. In almost every country of Europe one must, on entering a hotel, fill out a police blank stating name, age and residence, profession and rank. This is not for purposes of espionage but merely "to keep track" of the coming and going of strangers. No register, in the ordinary sense of the word, is kept at any of the hotels.

In France and French Switzerland, the general prefix "Monsieur" suffices, but in Germany, German Switzerland and in Austria it is distinctly de rigueur to address every man by his proper title. This applies even in hotels and restaurants. e. g. one calls *any* waiter "Herr Ober"—which is short for Oberkellner (head waiter), just as it is usual to address an ordinary policeman as "sergeant". Incidentally, it should be remembered that in addressing European policemen—they are always safe and courteous guides—it is customary to touch one's hat first, whereupon they will salute, and then give the information requested.

In the Forest Services of Europe, a sharp line is drawn between Rangers and the Administrative officers. In this respect it is like the difference between our army officers and enlisted men. In France, at least, it is customary to tip Rangers for any service performed, such as carrying coats, cameras, guns, etc.

Even in France, if aware of a man's exact title, it is customary to give it to him—e. g.: "Monsieur le Conservateur", "M. l' Inspecteur", etc., but, if only the gentleman's name is known, it quite suffices to merely call him "Monsieur X". Not so in Germany and Austria. There family names are seldom used. The proper form of address is the man's title with "Herr" before it, thus: "Herr Oberforster." As a guide to this the ranking titles in Germany and Austria with the approximate American equivalents follow:

German.	*Austrian.*	*American.*
Oberlandforstmeister,	Sectionschef,	Forester.
Landforstmeister,	Hofrat,	Assistant Forester.
Oberforstmeister,	Hofrat,	District Forester.
Forstrat,	Oberforstrat, Forstrat,	Assistant District Forester.
Forstmeister,	Forstmeister,	Forest Supervisor, (Senior).
Oberförster,	Forst u. Domänen, Verwalter (Oberf.),	Forest Supervisor, (Junior).
Forstassessor,		Deputy Forest Sup. or Forest Examiner.
Forst Referendar,		Forest Assistant.
Revierförster,		District Ranger.
Förster, Hegemeister,	Förster, Heger, etc.,	Ranger.
Forstaufseher,	Forstlehrling, Gehilfe, etc.,	Forest Guard.

Ladies of the household are addressed at "Gnädige Frau" (Gracious lady) or "Gnädiges Fräulein" (Gracious Miss); if in doubt whether married or unmarried, the address simply is "Gnädigste." In France, "Madame" and "Mademoiselle" are used. The older generation in Germany still address married ladies by their husband's title—e. g.: "Frau Oberforstmeister", but "Gnädige Frau" answers equally well and is always used in Austria, where however an equally strange custom persists among the older generation—namely the address in the third person. Not, e. g.: "Werden Sie mitgehen, Herr Hofrat?" (Will you go along, Mr. Assistant Forester?) but "Werden Herr Hofrat mitgehen?" (Will the Mr. Forester go along?) This also persists in letter writing, the common superscription being Euer (abbreviated "Ew.") Hochwohlgeboren"—(Your highly well born). Among servants the address in the third person is everywhere common. In France: "Quest-ce que Monsieur veut?" ("What does Monsieur wish?") In German: "Was wünscht der Herr?" (What does the gentleman wish?") etc.

Special Objects of Trip. European Forestry is too broad a field to be covered thoroughly in a short trip. A general trip is of great value and interest but the most good will result if the visitor specializes along one or more lines in which he is particularly interested.

These particular lines may be roughly divided into: Education, Forest Experiments, Administration, Silviculture (including Planting), Forest Management (working plans), Forest Protection, and Technology, (especially Wood Chemistry). Of course these subjects grade into each other and it is not possible—nor desirable—to confine oneself to a single subject to the exclusion of all others.

For the teacher of forestry a trip to Europe is almost a necessity. As Mr. Graves once said: "In my trips abroad I have found that it was a great benefit to me to see things about which I had read. It gave me confidence in my own knowledge to have verified information first hand." Unquestionably it broadens the educator's point of view and puts him in touch with all that has been and is being accomplished in Europe.

For the specialist in Forest Experiments a trip to Europe is also of great value. European foresters have, for decades, been conducting systematic experiments along lines which our experimenters have also adopted.

The man engaged in active administration should of course study similar work in Europe and find much of value. In common with all other foresters he should see as much as possible of the work along lines of Silviculture, Forest Management and Forest Protection. For the specialist in any of these three subjects there are superb opportunities for detailed study.

Similarly the specialist in the uses of wood—particularly from the chemical standpoint—will find the progress of European foresters along these lines immensely stimulating.

Unless one has a very long time—several years—to spend in Europe and a thorough mastery of the language concerned, it does not pay to enroll at a University with the end in view of obtaining a doctor's degree there. If the stay is confined to the time necessary to get the degree, (a year at least) it involves remaining in one place most of the time and hence only a comparatively narrow grasp of European forestry in general is obtained. Even for the educational specialist this fact should offset the lure of the Dr. title, unless, as stated, he has ample time and means to combine travels with his studies. Incidentally, it is unfortunately true that the leading forest schools at present, are not connected with any university but are separate "Academies" which do not confer the Dr. or any other degree. Similarly, it is not advisable to enroll as a "special" at one of the Academies, unless the stay abroad is to be for a twelve-month at least, or the purpose is merely to freshen up the mind on technical matters and to get in touch with the current and past forestry literature. A semester or even half that time is ample for the purpose and thereafter the studies can be carried on quite independent of any curriculum, and really to better advantage. The lectures, in themselves, are seldom very stimulating but the acquaintance with the instructors—who are the leaders in European forestry—is most stimulating and an invaluable initiation into the study of forestry abroad.

Places to Visit. The places of particular interest to the visitor, will, of course, vary with his specialty. Under the subjects given above, they may, however, be grouped somewhat as follows:

Education: Forest schools both separate and in connection with Universities. The more important of these are, in France, the "Ecole Nationale des Eaux et Forets" at Nancy; in Germany, the Saxon Academy at Tharandt—the oldest in Europe, which celebrates its centenary in 1916—the Prussian Academies at Eberswalde and Münden, and for Bavaria, the University at Munich; in Austria, the highest ranking school is at the Hochschule für Bodenkultur in Vienna, but, of special interest are the "intermediate schools" at Bruck an der Mur in Steiermark, and at Weisskirchen in Mähren (or ae). Of great interest, also, is the excellent Ranger School at Templin near Berlin.

Forest Experiments. This work is organized on an international co-operative basis, and annual meetings are held at designated places. The leading Experiment Stations are at Zurich in Switzerland, at Eberswalde in Prussia (headquarters of Dr. Schwappach, that veteran leader among experimenters), at Munich, at Mariabrunn near Vienna, and at Nancy in France (possibly to be removed to Paris and its scope greatly extended).

Administration: The visit of the various executive bureaus—Paris, Munchen, Dresden, Berlin, Vienna, etc. and especially the visiting of headquarters and Ranger stations on representative forests in each country. Needless to say this involves the most complete credentials. For those interested in matters of Forest

Policy, a visit to the distinguished authority, Professor Endres at the University of Munich is very advisable.

Silviculture must be studied in the field, and every forest offers something of interest in this line. In the next sub-heading (Special Points of Countries) an attempt is made to give the most characteristic silvicultural and other achievements of each country. It is important, however, that the visitor does not confine his studies to Nationally-owned forests, but include those owned privately and communally. Commercial nurseries and seed-extracting plants should not be omitted by the silviculturists. Perhaps the finest seed-extracting plant is that at Annaburg, between Berlin and Dresden, though what is claimed will be an even better one, is being built at Konitz in West Prussia. Both these "Darren" are government-owned, but permission to visit them is readily granted upon presentation of proper credentials.

Forest Management—that is Forest Regulation and Working Plans—can best be studied, as far as the theory is concerned, in conjunction with one of the principal forest schools. The leading authority on this subject is undoubtedly Professor Dr. Martin at Tharandt near Dresden. For the actual application, any executive bureau through its Section of Working Plans will gladly furnish examples of typical working plans and these can then be studied on the ground. In order to obtain a broad grasp of the manifold variations of this fascinating subject, the specialist should aim to pursue his studies in France, Germany and Austria, and should single out typical instances of their characteristic methods of regulating the yield.

For a study of the engineering features of Forest Management, the Engineering Section of any of the District offices of the Austrian Forest Service will prove particularly profitable. A mastery of German and French is almost an essential to the Specialist in Management; in the former, German script must also be learned since almost all the working plans are written in that peculiar chirography.

Forest Protection is usually to be studied as a concomitant of Silviculture and Administration but to the Specialist in this subject are especially recommended: Protection from Erosion—the

Pyrenees and French Alps and the Austrian Alps; Protection from Drifting Sands—the seacoast Dunes of Western France, Northern Germany (also Holland and Belgium); the interior Dunes and shifting sands of Prussia (vicinity of Eberswalde) and of Austria (Adriatic, and Ungarisch Hradisch on the Austro-Hungarian border north of Vienna); Pathology—a visit to Prof. Tubeuf at the University of Munich, the greatest vegetable pathologist since Hartig's death; Protection from Fire—the pineries of South-Central France. Perhaps the most extensive fire protective system is the Forest of l'Esterel which can be visited from Frejus near Cannes. Algeria has a distinct fire problem; the law governing Algerian forests will be translated into English within a year and published in America; Forest Entomology—the combatting of the gypsy moth in Silesia, Saxony and in North Central Bavaria. The insect damage at Nurnberg is interesting; Protection against smoke and gases—this can be studied to excellent advantage in the vicinity of Dresden, Freiberg and other industrial towns of Saxony. Prof. Wislicenus of Tharandt is a recognized authority on the subject.

Forest Technology has advanced farthest along the lines of wood chemistry. Perhaps the best laboratory to study this specialty is at Tharandt Forst Academie (near Dresden) under the guidance of Prof. Wislicenus. The turpentining in Southern France and near Vienna is a well-developed industry.

Special Points by Countries.

France.

In general, French forestry is distinguished for its originality, its *naturalness* and its comparative freedom from red tape. The Frenchmen seems always to feel what the forests need.

In *Silviculture,* France is the best exponent of the Coppice systems and their conversion into high forest (Nancy). Thinnings from above * are also a French specialty which can best be studied at any of the beech-oak forests given in the appended list. The thinnings in France are usually marked in part under technical supervision, while in Austria, for example, they are

**Eclaircie par le haut.*

marked by the rangers and sometimes by the woodsmen! One finds more natural regeneration in France than elsewhere, partly because the species and soil (and especially the climate!) is better adapted to it.

In *Forest Protection*, France is probably the best exponent of methods of correcting disastrous floods. The Pyrenees and the Alps are the places to study this.

In the control of dunes, France offers an excellent field for study along its western coast.

Officers interested in an intensive fire control should not fail to visit the Forest of L'Esterel which is reached from Frejus near Cannes on the French Riviera. The pine and corkoak forests have been difficult to protect during the dry and windy fire season from May to September. Perhaps the most instructive point about the system is the object lesson on the high expense of cleared fire lines.

In *Forest Management,* France shows much that is original and its "Methode de Masson" and "Methode de 1883" well repay careful study of both theory and practice.

In *Forest Technology,* the turpentine industry of Southern France (vicinity of Bordeaux) stands pre-eminent.

Corsica and Algeria present special problems; probably the study of the Eucalyptus planting in these lands would be worth a trip. In Algeria the fire problem was legislated against in 1893; this legislation is instructive and of course can be best understood after a trip in the field.

Germany.

In general it must be conceded that Germany has advanced further along the lines of theoretical technical forestry than any other country, and has reached a stage of intensive development which no other can rival. From the standpoint of Administration the superb organization of the Prussian Forest Service or that of Alsace-Lorraine is probably unsurpassed. In matters of Forest Management, Germany is in the throes of a conflict between Soil Rent and Forest Rent—radical against conservative—which is of deep economic importance. Prussia is typical of the conservative side, accentuating material production, Saxony of the radicals who judge the success of forestry by its return in dollars and cents.

In *Silviculture* some of the special points of interest are:

Management of Scotch Pine in Eberswalde (Prussia); management of Norway Spruce in Saxony (Tharandt); management of Oak in Bavaria (Spessart); Management of Beech in Bavaria (Spessart); management of mixed stands; spruce and fir dominating in low mountains—the Black Forest, in high mountains—Bavarian Alps.

Natural regeneration: by selection system and shelter wood selection system—spruce and fir—Black Forest, (Baden); by shelterwood system—spruce and fir—Black Forest (Würtemberg); by shelterwood strips and by groups—spruce and fir—Bavarian Alps; by border cutting—spruce—especially near Trypstadt in Württemberg (Wagner's Blendersaumschlag).

Artificial Regeneration: clear cutting and restocking: Pine in Prussia (Eberswalde)—Spruce in Saxony (Tharandt).

Improvement Cuttings: thinnings from below—everywhere; for pine—Prussia (Eberswalde); for spruce—Saxony (Tharandt).

Seed extracting and storing: Prussia (the "Darren" at Annaburg and Konitz).

Nursery practice—commercial nurseries of J. Heins Sons, (Halstenbek near Hamburg).

Underplanting—beech and other hardwood under pine—Prussia (Eberswalde); under spruce—Saxony (Tharandt).

In Forest Protection some of the most noteworthy achievements in Germany are: against game—Black Forest; against insects—Gypsy Moth in Silesia, Saxony, Bavaria, etc.; against fungi—Prussia, cutting of infected trees; against shifting sands—dunes on the coast of the Baltic Sea; interior sands in Prussia, near Eberswalde; against smoke and gas—Saxony (Dresden, Freiberg, Tharandt, etc.).

In *Forest Management,* Saxony is probably the most advanced in modern methods of yield regulation and its method by stands (Judeich's "Bestandswirtschaft") is worth particular study (Tharandt, Prof. Dr. Martin). Prussia is typical of the hidebound volume and area method ("Fachwerk"), but here Prof. Dr. Schwappach, Eberswalde, has done some splendid work in

Forest Mensuration—Yield Tables, etc.—; Baden, and recently Bavaria also, are exponents of Heyer's formula.

In *Forest Technology*, Germany offers little aside from the great strides made in wood chemistry (Prof. Dr. Wislicenus, Tharandt near Dresden).

Austria.

In general, Austria is of especial interest because of the great variety of conditions it presents, grading from mere exploitation of virgin stands to the most intensive management.

In *Silviculture*, Austria offers many examples of skillful adaptation to varying conditions. Thus, under more intensive methods the natural regeneration in fir, spruce and beech by shelterwood cuttings is noteworthy (Austrian Alps, Lower Carpathians) and the clear cutting and planting (chiefly spruce) on large areas where conditions are extensive, these areas becoming constantly smaller as economic conditions improve (Alps and Carpathians). The leaving of larch as scattered seed trees on clear cut areas (Alps, especially Steiermark) is particularly successful in securing admixture of larch into the otherwise artificial restocking.

In planting and seeding and nursery practice, Austria has a specialist of international fame—Oberforstrat Reuss in Mährisch Weisskirchen, 3½ hours North of Vienna. Reuss' natural method of planting is particularly valuable; his pamphlet on root damage because of poor technique in planting is well worth reading.

Instances of successful planting on adverse sites are numerous in Austria. Perhaps the reforesting of the Karst near Triest is the most remarkable, though of course too intensive to be applicable in America.

In *Forest Protection*, Austria offers excellent examples of flood control in the Austrian Alps, Tirol and in Galicia (Carpathians). The control of drifting sands on the shores of the Adriatic and at Hungarian Hradisch one hour North of Vienna, is also worthy of note.

In *Lumbering*, Austria alone of the European countries has something to show in the exploitation of remote stands in the Alps and Carpathians (and Bosnia). The government policy of timber sales in the latter (Bukowina) is also of especial value to the American federal forester engaged in similar problems of making remote stands accessible and profitable without undue investment on the part of the government.

In *Forest Management*, Austria shows a splendid development along original lines and a wide variety of adaptations to varying conditions. Its Working Plan Organization is among the best in Europe and the gigantic task of making a plan for each forest has been pushed to completion. In its engineering features, Austrian management probably stands pre-eminent in Europe.

In *Forest Technology*, Austria offers little except the declining industry of turpentining in the pineries South of Vienna.

Perhaps Austria deserves a visit most of all because of the large area privately owned most of which is under the best possible technical control consistent with reasonable financial returns. It is believed the management of these private forests is financially more profitable than that of the State forests and therefore all the more interesting to Americans.

India.

A trip across the Indian Ocean is expensive (about $225) and to really see the best of the forestry in British India would mean at least five months to and from the time one left Marseilles. To make the trip comfortably would cost from $200 to $300 a month unless a man put up with some hardship, a difficult thing to do in India where the caste lines are drawn so strictly; there are only certain forms of manual labor that a white man may perform. For a month's tour in the mountains ("hills") one must have four or five servants; a man to bring wood, another to carry water, a grass cutter, a cook, and, if one travels like an Englishman, a personal "bearer" or valet. In addition, the necessary number of packers figuring 80 ℔s. to the man. While the pay is small ($4 to $5 a month for a cook who boards himself on this pay) yet when one realizes that it takes a man for each kind of work the trip, all in all, becomes expensive. There is a great deal to learn in the way of intensive fire protection, working plans and general administration but it is believed the same amount of time spent in a tour of the United States would be more profitable. For further information the reader is referred to the forthcoming, tropical number of "Forestry Quarterly".*

*The next issue is expected to be mainly devoted to tropical forestry subjects.

Other Countries.

Japan would be interesting (as for example if taken during a convalescence) but here, as in India, the low labor cost enables methods which would be far too costly in the United States.

If a student decided to see the best of all that there is in each country his tour must certainly include *Switzerland;* the intensive management of the Sihlwald near Zürich, the Experimental work at Zürich and the treatment of high mountain forests near tourist centers where avalanches are to be feared.

Russia; Extensive management, sowing and natural reproduction. Yet there is a great deal of doubt whether Russian forestry is up to the supposed standard. It has been alleged that the field practices do not correspond to the description on paper, much of which has been borrowed from Germany.

Denmark is noted for its intensive management; here the intermediate yield from thinnings, etc., bears a higher proportion to the final yield than in any other European country. The thinnings in beech are especially intensive.

The conditions in *Holland* are analogous to those in Denmark.

In *Sweden* and *Norway* one sees the very extensive management of coniferous species and large scale logging operations. Unfortunately in the past, the Swedish forests have been mismanaged under private control so perhaps the chief lesson to learn would be what to guard against.

Italy, Spain, Greece (like Dalmatia) are object lessons because of past mismanagement and overcutting due in part to the disturbed internal conditions through which these countries have passed. Some writers state that the decadence of these nations is due to the destruction of their forest wealth—but is it not rather just the opposite that is true?

Those visiting Italy en route to or from America should certainly visit the school at Vallambrosa. To see and describe some of the once splendid forests of Spain and Greece, now ruined, would be an object lesson which would stamp itself indelibly upon the mind of American readers.

Both the writers are planning to return abroad during their next "sabbatical" year to explore more of the regions but little known.

Lists of Forests.

The best way to decide what forests one wishes to visit is to first visit the State Forest Academy and get from the director the names of the most instructive forests rather than trust altogether to the State officials. The forest students are continually making tours and consequently know where the interesting work is being carried on. In France, it is doubtful if a list could be obtained at Nancy except through the central administration at Paris owing to official ètiquette.

The partial list of interesting forests that follows may be of some assistance in the planning of a tour:

Germany.

	Nearest Town.
Prussian pine region: Oberförsterei Eberswalde—	Eberswalde near Berlin.
" Biesenthal—	Eberswalde.
" Freienwalde—	Eberswalde.
" Chorin—	Chorinchen near Eberswalde.
Saxon spruce region: Forstrevier Grillenburg—	Tharandt near Dresden.
" Tharandt—	Tharandt.
Black Forest—Baden............Forstamt Bühl—	Bühl near Baden-Baden.
" Herrenwies—	Forbach near Baden-Baden.
" Forbach I—	Forbach.
" Forbach II—	Forbach.
City Forest of Baden—	Baden-Baden.
Black Forest—Württemberg—Forstamt Schönmünzach—	Forbach near Baden-Baden.
Spruce foothills—Württemberg—Forstamt Gaildorf—	Gaildorf near Karlsruhe.
Northern Bavaria............Forstamt Spessart—	Lindenfurt near Darmstadt.
Bavarian Alps.............Forstamt Tegernsee—	Tegernsee near Munich.

Austria.

Austrian Alps—Fürst Liechtenstein possessions—	Semmering.
(Steiermark)—Revier Frauenwald, Rettenegg via Steinhaus—	Semmering.
School Forest...............Bruck an der Mur—	Graz.
Bürgerwald........Communal Forest in Leoben—	Graz.
Vicinity of Vienna-Wienerwald-(Vienna Forest)—	Just W. of Vienna.
Pineries near Wiener Neustadt—	Just South of Vienna.
Bohemia.......Fürst Schwarzenberg possessions—	Wittingau.
Mähren..........Fürst Liechtenstein possessions—	Olmütz.
Bukowina......Possessions of the Greek Church—	Czernowitz.

France.

The forests of France proper may be divided into (1) plain and (2) mountain forests. Under (1) may be included the Parisienne zone, the Gironde, the Provencale; under (2) the Vosges, Jura, Alpes, Plateau Central and the Pyrenees. The subdivision of these zones (as given in Les Forêts) follows:

Parisienne zone	1. *West* (1. Perche, Bretagne).
	2. *Center* (2. Sologne).
	3. *East* (3. Argonne, Langres, Lorraine, Franche Comté, Bourgogne).
Gironde zone	1. Oaks of Adour.
	2. Maritime pine (Sands) Landes, Gascogne.
Provencale zone	(Nice to Port-Vendres).
Vosges zone	Lorraine Plaine.
	Basses-Vosges.
	Hautes Vosges.
Jura zone...........	1. Plateau.
	2. (500-600 M.) Mountains.
	3. (800-900 M.) Mountains.
	4. High Mountains.
Alpes zone	North (to Pelvoux).
	South (Pelvoux à medit).
Plateau central zone.	(Mts. of Morvau; Cevennes).
Pyrénées zone	1. Montaigne Noire (department Aude) dividing line basin of l'Aude et Ariège).
	2. (Luchon, Barèges, Couterets).

Algeria and Corsica should be considered as special studies. As a personal favour to one of the writers a French forest officer compiled the list of interesting national forests given below. It includes Corsica (Corse) but does not include the Landes near Bordeaux nor Algeria. The abbreviations used under "Methods of Treatment" are : F—High forest; C—Conversion from Coppice to High forest; T. S. F.—Coppice under standards; T—simple coppice; F. J.—Selection high forest.

Forèts domaniales de France.

Conservation	Depart.	Name of the forest	Area.	Chief species.	Method of Treatment	Remarks.
Numero et residence du conservateur			Hectare			
1. Paris	Oise	Compiegne	14414,90	oak, beech, elm	F.	2 Cantonnements
		L' Aigne	3865,26	"	C.	
		Halatte	4255,59	"	C.	
		Ermenonville	2969,93	oak, pine birch	C.	
		Herz-Froidmont	1673,63	beech, elm	F.	
	Seine et Marne	Fontainebleau	16817,87	oak, pine, birch	T. J. F.	2 parts.
	Seine et Oise	Senart	2582,46	oak, chestnut, elm	"	
		St. Germain	4191,56	oak, elm	C.	
		Marly	2176,07	oak, chestnut, birch	T. S. F. & C.	
		Rambouillet	5703,17	oak, pine	T. S. F.	2 parts. 5470 (b) 320 (a)
2. Ronen	Euze et Seine inf.	Lyons	10616,75	oak, beech, elm	F.	2 parts.
	Seine inf.	Roumare	4064,37	oak, beech, elm, pine	F. & C.	
3. Dijon	Cote-d' or	Chatillon	8731,60	oak, beech, elm	C. & T. S. F.	2 parts.
4. Nancy	Meurthe et Mosel	Champenou	1418,68	oak, elm	C.	
		Haye	6532,71	oak, beech, elm	T. S. F. C. & T.	
7. Amiens	Aisne	Retz	13023,17	oak, beech, elm	F. & C.	2 parts.
8. Troyes.	Aube	Clairvaux	4248,37	oak, beech, elm	T. S. F.	
9. Epinal	Vosges	Rambervillers	5540,59	fir, beech, pine	F.	
		Champ	1988,65	fir, pine, spruce, beech	F.	
		La Haute Meurthe	1883,97	fir, spruce, beech	F. & F. J.	
		Gerardmer	4749,23	"	"	
12. Besancon	Doubs	Lever	2723,82	fir	F.	
14. Grenoble	Isere	La Grande	6753,77	spruce, fir, beech	F. F. J. & S. F. T.	
15. Alencon	Orne	Belleme	2439,89	oak, beech, pine	F.	
		Berce	5446,80	oak, beech	F.	
	Sarthe	Perseigne	5068,98	oak, beech, birch	F.	

Conservation	Depart.	Name of the forest.	Area.	Chief species.	Method of Treatment	Remarks.
18. Toulouse	Haute Garonne	Bagneres de Luchon	1138,40	fir, beech	F.	
19. Tours	Indre et Loire	Chinon	5226,82	oak, pine	F.	
	Loiret	Montargis	4118,70	oak, elm, beech, birch pine	C.	
20. Bourges	Indre	Chateauroux	5144,34	oak, beech, elm	T. S. F. & C.	
21. Moulins	Allier	Troncais	10434,98	oak, beech	F.	
25. Carcassonne	Aude	Callong	226,03	fir, beech	F.	
		Comefroide	251,83	fir	F.	
		Picaussel	429,72	fir	F.	
		Fanges	1120,13	fir, beech, Scotch pine	F.	
25. Carcassonne (suite)	Pyrenees Orient	Barres Chemin	990,82	"Hook Pine" Scotch Pine	T. & F. J.	
		Ramode	1600,00	"Hook" pine	"	
		Coste del Parme	3039,98	"	"	
		Coume de Ponteils	1200,00	"	"	
26. Aix	Vaucluse	Luberos	3164,39	oak, Aleppo pine	C.	
27. Nimes	Lozere	L' Aigonel	268,94	beech	F.	
		Mercoire	262,69	beech, Scotch pine, spruce larch	T. & F.	
30. Ajaccio	Corse	Aitone	1707,86	Laricio pine, beech	F.	
		Naldonielle	4637,91	Laricio pine, fir, beech	F.	
		Nizzarona	1381,64	Laricio pine, beech	F.	
		Marmano	2031,34	Laricio pine, Maritime pine	F.	
		Barella	1086,34	Laricio pine, Maritime pine, live oak	F.	
23. Nice	Vaz	Le Malpey de l'Esterel	4890,00	Maritime pine, Aleppo pine, cork oak, live oak	F.	
10. Gap	Hautes Alpes	Boscodon	349,16	fir, spruce, Scotch pine, larch	F. & F. J.	
	Diome	Nercors	3939,03	beech, fir, spruce	F. J.	

Conclusion.

Notwithstanding the desirability of European study how few men are taking the time even for a short trip! Certainly the United States cannot afford to make the technical mistakes which other nations have made during their early development. England has sent her forest students to France and Germany; Japan has sent men for periods as long as three years. The Forest Service is of course the largest employer of foresters in America and can do—a great deal to encourage European study by advocating, at the proper time, salaried furloughs to enable say a three months' "study trip" on full pay. It seems that this would be profitable and would do a great deal of good in the West in preventing supervisors (especially those at isolated posts) from becoming stale through long continued routine unbroken by the stimulus of study. American foresters will not be content merely to follow European teachers, and it seems reasonably certain that within one or two decades the American profession will be making a name for itself by its progressiveness. But to do this, our technical leaders at experiment stations and elsewhere must be thoroughly familiar with the latest results in Europe; and can a man really understand and apply results without having first seen conditions?

Conversion Table.

Festmeter per hectare	=Cords per acre.
1,000 B. M. per acre	=Festmeters per hectare.
Festmeters per hectare × 11,	=Raummeters.
1,000 B .M. per acre × 6,	=Festmeters per hectare.
Cords × 3.62,	=Festmeters.
Cords per acre × 9.1,	=600 Kilograms=1.320 ls.
Cubic feet × .03,	=Festmeters.
Cubic Yards × .76,	=Marks per hectare.
Dollars per acre × 9.9,	=Marks per festmeter.
Dollars per cord × 1.1,	=Marks per festmeter.
Dollars per cubic feet × 140,	=1 2/3 cubic meters.
1 ton,	
Festmeters per hectare × 0.17,	=1,000 B. M. per acre.
Festmeters per hectare × 14.3,	=Cubic feet per acre.
Festmeters × 35.31,	=Cubic feet..
Festmeters × 31,	=Cubic yards.
Hectoliters × 2.84,	=Bushels.
Raummeters × 2.47,	=Cubic feet.
Square kilometers × 24.7,	=Acres.
Marks per Festmeter × .007,	=Dollars per cubic feet.
Marks per Festmeter × .9.	=Dollars per cord.
Marks per hectare x .1,	=Dollars per acre.
Raummeters × .28 (.276),	=Cords.
Hectares × 2.471143,	=Acres.
Acres × .40467,	=Hectares.

FOREST TYPES OF BADEN.

By E. C. V. Gilman, *Assistant Conversator of Forests, South Nigeria.*

Baden possesses a great variety of forest types. Almost every type to be found in Germany is represented here. Now, it is often the custom of students of European forestry to travel over the whole of Germany and a large part of Europe in order to study these types. In the present article the writer has endeavored to show that it is not necessary to make extensive tours throughout Europe, as they can all be seen within quite a small range.

It will not be possible within the limits of this article to give a detailed description of every type, but the principal ones will be dealt with in turn and a few silvicultural remarks will be added as to their treatment, past, present and future.

The forests in Baden may be divided into the following 10 different types: 1. Fascine Forests (Coppice); 2. Middle Forests (Coppice with standards); 3. Pine Forests; 4. Bauland Forests; 5. Oak Forests; 6, Foothills of Black Forest; 7. Silver Fir of Black Forest; 8. Spruce of Black Forest; 9. Selection Forests; 10. Grinden Forests.

1. Fascine Forests (Coppice). These forests are situated on alluvial deposits in the valley of the Rhine, and the soil in most places consists of little more than gravel. In former times, before the channel of the Rhine was controlled, the water level was much higher and every year inundations took place, and the river used to cut out new channels for itself year after year. In order to avoid this the banks were built up and protected by fascines of Willows and Poplars which were cut from the coppice growth found in the neighborhoood, and hence the name Fascine Forests was adopted for this growth.

Nowadays, these forests are no longer used for this purpose as the engineers have constructed stone embankments, and the river which once took long winding curves and flowed slowly and gradually out towards the sea is now forced to take a straighter course. The effect of this was to turn the river into a raging torrent which year by year cuts itself out a deeper bed, and year by year brings down the water level to a lower depth.

By nature, on this poor soil, a growth of Birch, White Alder, Black and White Thorn and Sallows is original. In the moister parts we get in addition a growth of Willows and Poplars. In former times there was a considerable industry carried on for the manufacture of baskets out of the better class of Willows, whilst the others were used for fascines. Now, however, the soil has deteriorated too much to produce Willows of this quality.

These forests are treated as coppice with a rotation of only 5-10 years, but a few overholders of Birch, and here and there an Aspen or Poplar, are always left. It is quite impossible to attempt any planting on this soil as the ground is too dry, but now and then natural seed regeneration of Birch and White Alder takes place and wherever it is found it is saved. Owing to the drying up of the soil, however, it becomes rarer year by year.

During quite recent years a goldenrod, *Solidago virga-aurea*, has appeared in this coppice growth. It spreads enormously and grows so quickly that it crowds out all other plant growth. It can, however, be cut and used for bedding material. This is in fact now made use of, and quite a considerable revenue is derived from this source.

The future outlook for these forests is not a very hopeful one, as without irrigation the country will be converted into a desert by the continual sinking of the water level.

2. The Middle Forests on the Rhine (Coppice with standards). This type occupies the low grounds in the vicinity of the Rhine, but the soil here differs from that of the Fascine Forests in containing more sand and loam. This deposit therefore is a mixture of loam, sand and gravel.

As before mentioned, the Rhine used to continually cut out new channels for itself and consequently left many lagoons representing the old bed. Now these lagoons became gradually filled up by deposits from inundations of the Rhine and of small feeders from the Black Forest, and brought about the present formation. On this soil, which is generally much moister and more fertile than the last type, the coppice with standards is at home.

The standards are:—Oak of various ages up to 120 years; Ash to 80 years; Elm to 80 years; Black Alder to 60 years; Poplar to

45 years; Linden to 70 years; Birch to 50 years; Acacia to 50 years; Hornbeam to 50 years; Scotch Pine to 60 years.

The coppice consists mainly of stump sprouts of all the above species, except, of course, Scotch Pine, and in addition Hazel and White Alder, but nearly every European species is to be found.

This coppice is treated generally under a rotation of 20 years and at the end of that period has a volume of about 60 cubic meters per hectare (858 cubic feet per acre) and the standards have then a volume of about double that amount, a total volume of about 180 cubic meters per hectare (2,575 cubic feet per acre). When fellings are made the whole of the coppice is first cut over, and then 67 to 70 cubic meters (one-half the volume) of the standards are removed in the following manner: First, unsound trees are selected; secondly, groups are broken up when the trees are too close together; and lastly, trees which are ripe for the axe, according to the ages mentioned above for the different species, are felled.

Now, the ground in these forests appears to be perfectly level, but this is not really the case. The ground level although altering but slightly here plays an extremely important part. The water is in nearly every case quite near the surface, but a rise of a few meters entirely changes the character of the soil, and hence the great variety of species to be found growing in such close proximity.

We may divide these forests into 6 site classes varying from a quite wet to an extremely dry soil as follows: 1. Quite wet soil (producing Black Alder and Willow); 2. Moist soil (producing Poplar and Ash); 3. Fresh soil (producing Oak, Elm, Ash, Linden and Poplar); 4. Rather dry soil (producing Acacia and Hornbeam); 5. Dry soil (producing Aspen and Hornbeam); 6, Very dry soil (producing Birch and Scotch Pine).

As is not uncommon in forestry our ideas as to the treatment of these forests have changed considerably from those formerly accepted. At one time planting in Middle Forests was not even attempted, and it was said that we got quite enough young growth by natural regeneration. Then from this extreme, foresters flew to the other till the planting was greatly exaggerated. The system now generally adopted is the most rational one, based on the ideas of Forstmeister Hamm, formerly Oberförster at Kippenheim.

He prescribes planting, but only moderately, namely 150 plants per hectare (60 per acre). This may perhaps be rather too little, but 300 per hectare would be in any case enough. He says further, that only strong plants, about 5 feet high, should be used, as the young trees have in their early life to struggle for their existence against the rank growth of grass always to be found in a Middle Forest. The minimum distance at which plants should be set out from overholders must not be less than 2 meters, and from a stump sprout 1.5 meters. As long as this rule is conformed to the planting may be done either singly or in small groups. Cleanings must be made in favor of this young growth for the first few years, and the grass should not then be cut but the entire sod removed and turned over. Lastly, whenever it pays (i. e. when the forest is in the neighborhood of a town), light thinnings should be made. Two such thinnings may be made during a rotation of 20 years.

In these forests, Beech is never planted as it shades out too much, and Oak is now nearly given up. Oak has a long tap root and therefore cannot be transplanted, and as has already been said sowing is excluded. In addition to this we get much better returns on this moist soil from Ash, which is a workwood from the beginning, than from Oak. Ash and Canadian Poplar are the best species to plant and those now generally chosen for this purpose.

The great disadvantage of a Middle Forest is that it produces a larger percentage of brushwood, at least 40% of the total output, whilst the workwood percent is very low and never more than 25%. On account of this the Middle Forest system has in many places been given up and the High Forest system with a lower story adopted.

It is the custom in these forests to cut the grass yearly for bedding material. Now, where yearly inundations take place, there is nothing to be said against this usage as the revenue obtained is considerable and the soil is always moist and kept in good condition by the deposits of silt from these inundations. Where, however, these inundations do not take place, and they are far less frequent than formerly, this practice is deterimental and will eventually utterly ruin these forests.

Finally, we may note that the Middle Forest system will pay only on very moist soils, and to these it is nowadays confined.

3. The Pine Forests on the Rhine. Of this type are the forests in the first uplands in the valley of the Rhine. The soil here consists of a somewhat older formation than that occupied by the previous two types, and is diluvial sand and gravel.

These forests are now almost entirely composed of Scotch Pine, but this was not always the case. Years ago they were beautiful broadleafed forests of Oak, Beech and Hornbeam, with Linden and Elm in addition. However, owing to the drying up of the soil caused by the regulation of the river and consequent soil changes of which we have already spoken, Scotch Pine is the only workwood tree which it now pays to grow here.

This change has been so complete that the present generation has no idea that anything but Scotch Pine ever grew in this district. Nevertheless, about 20 years ago the last of the old broadleafed trees were cut and there were then to be found beautiful Oaks as much as 30 meters (100 feet) high, but already stagheaded and showing signs of decay, and Beech as much as 42 meters high (138 feet). Such trees were only to be found on the moister soil and as the ground gradually rose so did the height growth fall off.

The soil higher up the Rhine is loam and coarse gravel, whilst lower down towards Mannheim it is a very sandy loam, in some cases almost pure sand, and consequently unless the water level is rather near the surface will not support any good forest growth.

The present Pine forests extend from Rastadt to Mannheim and are treated under a rotation of 100 years, but owing to the amount of snow breakage many stands are cut over much sooner whilst others in good condition are left for a longer period to acquire a heartwood.

The immediate effect of substituting coniferous trees for the broadleafed ones was to lower the revenue, as the old Oaks fetched very high prices. In order to bring the revenue up to its former figure heavier thinnings were made and it was found that these thinnings so far from deteriorating the stands, on the contrary, improved them.

Natural regeneration is excluded here, and clear cutting and planting is everywhere practiced. The system adopted in most cases is as follows: Strips of the best soil are marked out on the area to be regenerated and the litter is then removed and put up at auction. After the stand has been cut over and the stumps removed, the purchaser of this litter has then to dig over and prepare the soil, any roots that he may extract becoming his property. The price obtained for the litter under such conditions is naturally small. This area is then sown with Pine seeds broadcast. The yearling Pines are afterwards transplanted in the neighborhood on plats from which the litter has also been removed but without any subsequent preparation of the soil.

Some years ago attempts were made to form a number of mixed stands in this district by planting alternate rows of Scotch Pine, Austrian Pine, Hornbeam and Oak, but the effect was merely to produce rather roomy and knotty Sctoch Pine stands which species has overtopped and crowded out the others.

We find in the older Scotch Pine stands a lower story of broadleafed species from natural regeneration of the old broadleafed stands, but this is quite absent in the younger stands. The latter should now be underplanted with Hornbeam, as the soil is too dry and sandy for Beech.

It has been found that in pure coniferous stands the needles will not easily disintegrate and unless mixed with broadleaf foliage will sometimes produce a raw humus and cause a formation known as "hard pan," three feet or so below the surface of the soil. In addition, unless there is an admixture of broadleafed species, the soil becomes so dry that all insects find good winter quarters there, especially *Gastropacha pini,* the Pine Moth.

As to the financial results of these forests, we find that they produce a net revenue per year and hectare of 70 marks ($6.75 per acre). The forest capital may be estimated at 3,000 marks and the soil valued at 500 marks per hectare, a total capital of 3,500 marks ($289+48=$337 per acre), which, therefore, pays only 2%. The sales from litter are not here included as they exhaust the soil and should be given up. The average return from minor produce is about 12 marks per hectare ($1.15 per acre).

4. The Forests of the Bauland. The Bauland or farmland, the undulating upland country to the north of the Black Forest varies in height from 100-300 meters and consists of a deep layer of loess, from 3-15 meters overlying a Triassic formation of red sandstone, shell limestone and keuper.

In the middle ages these forests were pure broadleafed forests of Beech, Oak, Hornbeam, Linden, Aspen and Birch, but no conifers, and were treated in an irregular way as selection forests. Oak and Beech were the species most favored, the former for building purposes and also on account of the acorns produced for the pigs, and Beech because it produced the best fuelwood and litter. There was always pasture land in these forests, and the litter has been raked from time immemorial.

Two hundred years ago these forests were divided up into felling areas and treated under the middle forest system or coppice under standards. The annual cut was confined to one felling area every year, the whole of the forest being cut over in about 30 years.

As standards in a middle forest, only light needing species with light crowns are suitable. Beech is not good for this purpose and, therefore, Beech was largely cut out. Linden was also cut away in favor of other species, as it had no value at that time, and at the present time it is hardly found here at all.

After the Linden and so many of the Beech had been cut away the Aspen and Birch increased enormously and the soil became covered with weeds and grass. From decade to decade a larger percentage of the area became occupied by these light needing species and the soil lost a good deal of its yield capacity so that the standard Oaks became stag-headed. The soil in these forests is, however, so well adapted to the production of Beech that there was always a good deal of natural regeneration of it and it could not be crowded out like the Linden.

The condition of these forests finally deteriorated so much that it was found necessary to adopt another system and to convert them into high forests. Previous to this system being finally adopted, more and more overholders were annually left so that the final conversion was greatly simplified. Since the last 20 years these forests have been treated entirely as high forests. Consequently, we now find an upper story of Beech and Oak, with a few Hornbeam and Birch, from 70-150 years old, and a lower story of stump sprouts of Beech and Hornbeam with a few Oak, Aspen and Birch.

The form of the overholders here is in the shape of a middle forest tree, reaching in a short period rather large dimensions. Beech may attain a diameter of 50-70 centimeters (20 to 28 inches) in 100 years in many parts of these forests, as the soil is extremely fertile. The heights, however, are seldom more than 23-29 meters (30 feet). The crowns in most cases extend to about 40-50% of the total height.

In a somewhat longer period, the Oaks also will attain similar dimensions to the Beech if they are seedling trees, but the majority of them are only stump sprouts, and this fact becomes evident after they are felled. The shafts of the Oaks are seldom clean on account of being too much exposed during the middle forest cuttings when they become covered with water sprouts. Most of these sprouts were afterwards pruned, but with no good effect, because when an Oak is pruned so late in life it always produces knotty timber.

The former coppice has been much reduced and plays now the role of a soil cover and nurse.

Beech is everywhere the prevailing species, though there is quite a large percentage of Oak in the older stands. In the younger stands we find admixtures of Spruce, Silver Fir, Larch, Scotch Pine, White Pine and here and there Douglas Fir, and amongst broadleafed species Oak, Ash, Maple, with a little Walnut and Poplar. These species are generally mixed after the ideals of Gayer.

Although the number of trees per hectare are too few in the older stands and the crowns are too large, the forms are nevertheless to be preferred in most cases to those of the high forests where thinnings have been neglected for years and where the diameters are extremely small. Heyer says, that no species is so well suited to heavy thinning as Beech and that over-cutting in Beech stands is to be very much preferred to neglected thinnings.

One of the chief difficulties that the foresters have to contend with in this district is the rapid formation of a grass cover which on this limestone formation, in the neighborhood of so much agricultural ground, is at once produced whenever sufficient light is let in. A good many mistakes have been made here in latter times by planting pure cultures of light needing species, such as

Larch, Ash, etc. This is always a mistake and particularly so in this soil as such a quantity of grass is produced that the cultures become infested with mice during winter which destroy the young plants. In addition, under such circumstances the danger from frost is increased.

Owing to the configuration of the ground many frost holes are to be found in these forests due to the fact that the air in winter is almost wind still. The Oaks therefore have in such places often suffered from frost cracks, and hence also owing to natural selection we find frost hardy species such as Hornbeam prevailing.

Another mistake which has been very frequent during the last few years is the leaving of young or middle-aged Oaks as overholders over the naturally regenerated Beech stands with the idea of keeping them for the end of the next rotation. This is a very great mistake as such Oaks become almost immediately covered with watersprouts and produce bud and knotty timber. In addition such trees have been found to attract the May beetle *(Melolontha vulgaris)*, become stagheaded and lose nearly all their increment.

The market conditions should be good in these forests as they are very favorably situated with regard to the large towns, nevertheless nearly all the Beech is converted into firewood. Only an absurdly small percentage of workwood is at present produced, but on the other hand the firewood prices are extremely high.

In conclusion, we may add that the most suitable way to treat these forests would be to recognize three different quality classes, or rather three different sub-types. The best site class should be reserved for Oak, as this species requires a better soil, more light and a longer rotation than Beech or most of the Conifers. The next site class should be retained for Beech, where natural regeneration of that species is possible, the fail places being planted up with conifers. Lastly the poorest soils, those where natural regeneration of Beech has failed or is impossible, and frost holes, should be planted up with conifers.

Not only the soil, but the present condition of the stands, will force the bringing in of conifers; for instance, on site classes not quite good enough for Oak but where that species and Hornbeam are prevailing with only a few Beech. In such a case of course it would be absurd to attempt natural regeneration of Beech.

5. *The Pure Oak Forests.* In the neighborhood of Badenweiler, in the foothills of the Black Forest, we find a few pure Oak forests on a limestone formation.

This pure Oak type could be extended considerably as the best quality classes of the Bauland are quite suitable for the production of pure Oak stands. At the present time, however, this type is confined to quite a small area in the Southern Black Forest, and plays only a small part compared with the main forest types of Baden.

These stands have nearly everywhere a soil cover of Beech. In some cases there is a slight admixture of Beech in the upper story, and these mother trees have now naturally regeneratd the area under the Oaks so that we may find in fact three stories. This is a good arrangement, as the intermediate story forms a stem protecting wood which is very necessary with Oak, the species being liable to produce epicormic branches (watersprouts) if allowed too much lateral light.

The silvicultural system adopted is most suitable for Oak. Moderate thinnings are made in very short intervals and, when the stands are about 40 years old, they are underplanted with Beech according to the French system, which is very inexpensive, using about 4,000 plants per hectare ($6.00 to the acre). The rotation under which these forests are treated is generally about 150 years.

About 30 years ago some of these stands were underplanted with Silver Fir, but this was given up on account of the expense, which was great, first, owing to the original cost of the plants, which is always rather high, secondly, owing to the more careful system of planting which was necessary, and lastly, owing to the cultures being browsed by deer so that the ultimate cost of the cultures was four or five times that of Beech.

However, in some of these stands in the neighborhood of the Silver Fir forests, perfect natural regeneration of that species under the Oaks is secured from the adjoining woods. This protects the soil quite well, but it is probable that when the Oaks are cut the Silver Firs will be left and then the Oaks will be ousted from the area. This is a pity as the area under Oak cultivation is decreasing and soils suitable for its production are not too frequent.

6. The Foothills of the Black Forest. A broad leaf forest type occupies the foothills of the Black Forest from Ettengen to Rastadt in the North and from Lahr to Emmendingen in the South. The intermediate area is occupied by coniferous species and will be included in the Silver Fir forests of the Black Forest. The underlying soil is red sandstone and a little limestone. The prevailing species is Beech with a little Oak and a few conifers. The type differs, however. distinctly from that of the Bauland by having always been High Forest.

A comparison of this type with the forests of the Bauland is very interesting. The silvicultural system adopted has been till lately that of the old High Forest system in which scarcely any thinnings at all were made and with only one story. It will be found on comparison that the forms in this type compare very unfavorably with those of the Bauland. The diameters are very small and though having a slightly better height growth the trees are not so cylindrical, since the bad forms were never cut out. It may here be noted, however, that the sandstone formation of these hills is not quite so suitable for the production of Beech as the limestone formation of the Bauland, but this has only a minor influence on the stands when compared to the silvicultural system adopted. This fact is clearly demonstrated by one or two high Beech forests (such as Heidlesheim near Bretten) to be found in the Bauland.

The rotation in these forests is 100 years and in a few cases up to 120. Up to 40 years ago the forests were treated as pure Beech forests for the production of firewood, but after 1870 the price of coniferous timber increased so much that a good coniferous species was widely planted, and in 1880 the mixtures of Gayer were favored.

The great drawback to most of these mixtures is that often species were planted together whose silvicultural requirements as to condition of moisture, light, rotation, etc., were quite different.

Some Spruce has been planted on these hills, but does not appear to be doing well especially when planted on a Southern aspect. The temperature in summer is too hot, and the soil too dry on these low sandstone hills for this species, and Silver Fir is undoubtedly the most suitable coniferous species to plant here.

We have natural regeneration of Beech under the shelterwood system and the fail places are filled up with conifers whilst a few species are brought in by natural regeneration.

The natural regeneration of Beech is too prolific and more conifers should be planted, but the money available for this purpose is not always forthcoming and cultures of Silver Fir are expensive.

Thinnings, which have been sadly neglected up till now, should be made regularly and the present stands underplanted with Beech. In fact the rules which apply to the Bauland when converted into High Forest are equally applicable to this type, except that these hills should produce chiefly Silver Fir and Beech. Spruce and Oak are generally not suitable whilst the elevation is still too low to exclude snow breakage from Scotch Pine stands, which but for this disadvantage would do well here especially when admixed with Beech.

7. The Silver Fir Forests of the Black Forest. Silver Fir is the most characteristic species of the Black Forest though Spruce is the prevailing species in the higher altitudes and to the East.

The formation in the Northern part of this territory is granite with standstone at the higher elevations, and in the Southern part Graywacke above and Gneiss in the lower part. The elevation runs from 320 to 1499 meters or right up to and beyond timber limit. This limit is considerably lower in the Northern Black Forest (1,200 meters) than in the Southern where the limit is as high as 1,400 meters (4,670 feet).

We will here speak only of those forests in which Silver Fir prevails. The optimum for this species is found at an altitude of 300-700 meters. Above that line it is seldom found in pure stands but in the Northern territory is mixed with Beech and Spruce, and in the Southern with Beech but no Spruce. It prefers the southern and western aspects of the mountains, and on the eastern slopes and at high altitudes we find the pure Spruce forests of which we will speak later. On the southern aspects at low altitudes we find the Silver Fir mixed with Oak especially in the southern territory.

The Silver Fir is a very valuable timber tree, producing nearly as much workwood as Spruce, but when regarded from a silvicultural standpoint is in every way superior to that species although it is unable to withstand quite such low temperatures as the latter. It is able to withstand a considerable amount of maltreatment when young, and will recover after being suppressed for many years.

Now, in mountainous districts it is always necessary to have a somewhat long regeneration period, since it is difficult otherwise to extract the timber quickly enough on account of the lack of roads. Fortunately, Silver Fir is able to stand a very long regeneration period on account of the two qualities mentioned above and also owing to its extremely slow growth in youth. Too much advantage has, however, been taken of these qualities and the stands have suffered in consequence.

The official rotation adopted for these forests is 120 years with a regeneration period of 40 years so that when regeneration fellings are commenced we should find all age classes from 80-120 years and after complete regeneration all age classes from 1-40 years old on the same area.

This period is in any case too long as too much damage is done to the young growth when the fellings are spread over so long a period, but in nearly all the stands there is at present a surplus of growing stock and owing to the low fixation of the cut and the lack of proper roads in some of the higher altitudes both the rotation and the regeneration period are often much longer.

Though we find in many parts of the Black Forest some of the best forest roads in existence, the lack of sufficient roads is still the chief obstacle which the foresters have to contend with when endeavoring to treat these forests under a good silvicultural system.

The bad effects of an overlong rotation and regeneration period may be seen in those places where the roads are still bad or insufficient. Here we find a very large percentage of cancerous and half-rotten trees, and very often under these a young stand of Silver Firs several meters high. Silver Fir is unable to stand a long rotation, for after 100 years the per cent. of rotten timber increases greatly. At that age under modern treatment it can attain the dimensions of a first-class coniferous tree (i. e. in Baden a diameter of 30 centimeters at a length of 18 meters—12 inch at

58 feet). Again after the trees have reached an age of 100 years the reproductive power begins to fall off and in a few of the old stands natural regeneration is no longer possible.

Unless allowed to become too old, Silver Fir reproduces abundantly and owing to its shade enduring qualities no preparatory fellings are made, because whenever a little light is let in, by windfalls or the cutting of cancerous trees, advance growth follows almost immediately. Fellings are afterwards made in favor of these groups and the stands regenerated under a system which is a combination of the group and the shelter wood compartment systems. Accidental fellings, which are always rather high in coniferous forest, are especially plentiful here owing to the number of trees which become attacked by cancer or are blown down by wind during such a long rotation.

No preparatory fellings are therefore necessary, and at least 25% of the area is usually occupied by advance growth before regular regeneration fellings are commenced. It is only in the least accessible districts, where the old cancerous trees have been left and have escaped the effects of wind, that advance growth is not found and natural regeneration is excluded.

There are many drawbacks to this system of regeneration, the chief being that the timber must be extracted through so much young growth; however, the timber can be and generally is let down by slides. Another drawback is that it is necessary to prune the big trees before felling to prevent them damaging the young growth. This is both expensive and dangerous. In fact if the cost of pruning were added, as it should be, to the cultural costs, it would be found that natural regeneration under this system cost more than artificial cultures under the clear cutting system.

It is said in favor of this system that the trees acquire light increment during this long regeneration period. But this is not exactly true, as the trees have not been prepared for it; it is only when a tree has a large spreading crown that it is possible for it to take full advantage of an increase of light.

The following are a few suggestions as to the best method of treating these stands under the present system of regeneration, the period of which should, however, be shortened:

1. Too much should not be cut at once or it will not be possible to stack it for transport.

2. All unsound and malformed trees should be cut.

3. As many first-class trees as possible should be cut as they no longer have any quality increment.

4. Advance growth should be favored. The presence of just a little grass favors natural regeneration, but there must not be too much.

5. In mixed stands Beech should be cut out first, or else owing to its rapid growth in youth it will crowd out the young Firs. One or two trees per hectare (3 to 5 per acre) are quite sufficient to produce a desirable admixture of Beech by natural seed regeneration.

6. Fellings should be repeated at regular intervals to avoid stepped growth.

7. Repair plantings of Spruce should follow immediately after regeneration has failed. Silver Fir is not so suitable for planting, owing to the slowness of its early growth and hence the amount of grass produced, the higher cost of the young plants, and the danger of being browsed by deer.

Under these conditions a period of 20 years would be sufficient for regeneration.

In Württemberg the silvicultural system is different. Here, the stands are regenerated in strips, and fellings are not made in favor of young growth unless it is within a distance of 30 meters of the strip to be regenerated. The period of regeneration is about 20 years.

There is no doubt that this system is superior to the Baden system* for stands in good condition, but care must be taken that rotten trees are cut out of the stands not under regeneration, and this has been neglected in some of the Württemberg stands in the Black Forest. In fact in many places the percentage of rotten trees is so high that no other system than the Baden system is possible.

8. The Pure Spruce Forests of the Black Forests. This type extends over a very large area of the Black Forest but is more generally found to the East or on the high undulating country on the top of the Northern Black Forest mountains.

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*The two slopes of the Black Forest, like that of any other mountains lying across the moisture bearing currents are climatically different: what can be done in Baden is not suitable in Württemberg and *vice versa*.—Editor.

Spruce is perhaps the most important workwood tree of Europe and is able to withstand much lower temperatures than Silver Fir, but is a somewhat more exacting species and demands especially a good deal of moisture. On these high mountains the rainfall is very much heavier than on the plains or in the lower altitudes, but it falls off again on the Eastern slopes.

The seed production of this species is very good but it is a difficult species to regenerate naturally owing to the amount of moisture required by the young seedlings and their inability to survive a dry summer, and on the other hand the necessity of a considerably greater amount of light than is required for Silver Fir. In addition, as this species is shallow rooted, the stands cannot be opened much, unless the trees have been educated for this purpose by a system of heavy thinnings and have become windfirm. Consequently the silvicultural method almost universally adopted is that of clear cutting and planting.

This is the simplest of all methods, but its chief disadvantage is that with this species, which has a wide spreading root system near the surface of the soil, the young rootlets are apt to become cramped or damaged during the process of planting. The bad effects of this maltreatment are not immediately visible, but it has been shown that such rootlets rot and give an opportunity for fungi to obtain an entrance. The growth of these fungi is very slow, and it is not until the first thinnings are made when the trees have reached an age of 30-40 years, that the damage becomes visible on the tree itself, and before the stands are ripe for the axe it will be found that such trees are completely rotten.

When, however, careful methods of planting are resorted to, there is not much danger from this cause especially as at this high altitude Spruce is able to shake off the attacks of most diseases more readily. The young transplants used are 4 years old, and nowadays about 6-7,000 plants per hectare (2,600 per acre) are planted. The rotation varies between 100 and 120 years, and might be reduced everywhere to 100 years.

The thinning in these stands are not heavy enough and should be increased and the stands underplanted with Beech, as the admixture of a broadleafed species keeps the soil in good condition and prevents the formation of moss and raw humus. The fellings are made in summer and in the beginning of winter, and the stems left long are then transported over the frozen snow to special forest depots and these sold by sealed tender. The quality of this Spruce grown high up in the mountains is excellent, as it has the narrow annual rings so much prized by the timber merchant.

9. The Selection Forests of the Black Forest. The Selection Forests of the Black Forest occupy only about 2% of the total area and the most famous of these is the forest of Wolfach which was treated by Schätzle under the selection system.

A great deal has been written in modern times in favor of the selection system but *its disadvantages are almost innumerable, and it is difficult to understand how in these more or less enlightened days anyone can be found to speak seriously in favor of it.* It has all the disadvantages of the long regeneration period in the Silver Fir stands of the Black Forest, only very much more exaggerated, for here we may consider the regeneration period as equal to the rotation. Control under this system is almost impossible. In fact an equally good name for this system would be the *Neglecting System* as in many cases in the Black Forest these forests are nothing more or less than neglected forests.

For instance we find such selection forests on steep slopes where there are no roads and where the timber is difficult to get at. In fact anywhere where fellings are made in an irregular way.

As we have before said, the most famous of these forests is the forest of Wolfach. Now Schätzle treated this forest in an excellent way and improved it considerably, but it was already a neglected forest when he first took charge of it and no other system but the selection system was open to him.

He found here when he first took it over a forest of very old stands containing a large number of rotten Spruce (caused by resin tapping) and cancerous Silver Firs. The first necessity was to cut out the old and rotten trees, and after these were removed young growth of Silver Fir sprang up in the gaps. This system has been continued since Schätzle died, and we now find young growth from 1-60 years old and old growth from 110-160 years old.

Under this system, big trees, malformed trees, thinnings and in fact all the fellings in silviculture, are made at the same time, and in a period of 10 years the whole forest should be cut through and the process repeated. This forest should now be gradually converted into a regular High Forest.

Perhaps the only instance where the selection system is excusable in the Black Forest is in the forests near timber-line. Here the increment is only about 1 to 4 cubic meters per hectare (15 to 60 cubic feet per acre) and the stands consist of Spruce and Scotch Pine with here and there a Silver Fir. These stands are open, or the trees stand in small groups and allow no heavy fellings, nor is it possible to make cultures, hence irregular fellings are made here and there of trees of the best class.

10. The Grinde Forest. This type consists of great moors covered with open stands of Mountain Pine, and Scotch Pine, with a few Spruce, Moutain Ash, *Sorbus aria*, Birch and Alder.

They are considered as hunting grounds, but 30-40 years ago attempts were made on a somewhat large scale to drain these peat bogs and sow Spruce on artificial banks. This was a failure and a mistake.

To begin with the increment in these high altitudes is so small that the financial results from the cultures would be absolutely nil, and secondly the existence of peat moors in this locality is of much greater economic value than the presence of a few half crippled Spruce stands, as the former act as water reservoirs from which the forests on the whole mountain sides derive an enormous benefit during the dry weather.

It may be noted that these attempts at cultures have been given up many years ago, as it was found they would not grow, and the forest has been left to assume its original character which is that of a natural park and an excellent hunting ground.

This completes the general description of the forest types in Baden, but, of course, there are many modifications of these types, and in many cases they merge into one another so that the boundary line between two different types is not clearly defined. Nor does the writer intend to infer that such methods of silviculture as he may have criticized are the methods everywhere practised in Baden without exception, but he has only written his impressions of the forests he has seen, and has criticized the methods usually in force.

A METHOD OF INVESTIGATING YIELDS PER ACRE IN MANY-AGED STANDS.

By Herman H. Chapman.

A crop of timber is the total quantity of material which can be grown on a definite area in a given period of time. The three factors involved are volume, area and age. When stands of timber are even-aged and fully stocked, yields can be determined quite simply by laying off plots, measuring the contents of the timber, and cutting a tree or two to get the age of the stand. Such figures or yield tables give the only scientific basis for determining the productiveness of forest land, for fixing the length of the rotation and solving important problems in forest valuation.

Unfortunately, a large proportion of our native forest areas do not permit of the use of this method. Age classes are intermingled in such an irregular manner, that it is difficult to lay out even small plots with any assurance that the timber so included will be of the same age. Under these circumstances the method has been to fall back on a study of current growth, based on diameter, and by determining the growth for 5 to 10 years in board feet, or even by growth per cent., draw conclusions as to the probable yield per acre. That this method is unreliable and a misleading makeshift must be evident from the well-known relation between current growth and mean annual growth, namely that the former diminishes for some time before the latter has culminated.

Nor will the mere study of growth of trees as individuals, suffice to prove the yields that can be expected on an acre. The number of trees which can grow on an acre differs too much with age and has too great an influence on yields to be ignored in this manner.

In studying the relation of production to age it is worth bearing in mind that growth is the result not of mathematical laws but of natural forces. The determination of the amount of space in square feet which a tree is actually occupying at various ages is the fact upon which the yield per acre hinges. If we could get at this one fact for average trees of different ages it would go far towards solving the whole problem.

In humid regions this depends largely on the spread of crowns and crown space occupied. But in dry regions, and on dry soils in regions that may suffer from droughts during the growing season, the determining factor is not crown but root spread. This is true of Longleaf and to a lesser extent of Shortleaf Pine in the South, and of Western Yellow Pine, of the junipers and other western species.

The principal danger in the sample area method even in evenaged stands lies in the probability that, trying to secure fully stocked stands, in reality the plots so selected may be abnormally well stocked. And when this method is attempted in dry regions, the impossibility of determining the degree of stocking that constitutes normality causes the method of small plots to break down. Large plots would have an advantage over small ones in any study, the results of which are intended to apply to natural stands and not artificial plantations, for it is impossible under natural processes to secure stands which at maturity are free from small blanks and which will not fall slightly below the best yields obtainable. On a 40-acre plot, to be sure, average yields could be obtained. The only difficulty with large plots is the age question. Evenaged stands of 40 acres may be found for certain species but not for those mentioned, nor for many others. To retain the advantages of the large plot and at the same time determine the area occupied by each age class in a managed forest, is the purpose of the plan here suggested. The principles made use of are:

1. Average age may be found for trees which form a rough age class by determining the age of trees which have the average volume for the class.

2. The area of these rough age classes may be mapped on a large plot, in considerable detail, and the total area for each age class in the plot may be thus determined.

3. Where it is impossible to do this, the relative crown space occupied by trees of different age classes furnishes a means of getting at the per cent. of the total area which the age class occupies.

Applied to Shortleaf Pine in Arkansas, in stands where the age classes were mixed in a very irregular manner, the following detailed plan was used.

The age classes decided on were four in number; veteran timber, which was past its prime and decadent; mature timber, of large size but sound and growing; young merchantable timber, above the diameter limit of 12" at breast high but not large enough to be classed in the mature group; immature timber, all below 12", including seedlings and saplings. This group could be further subdivided if necessary. The veteran timber was distinguished wholly by the appearance of the crown and bark, size being an aid. All trees were tallied as veterans, even if not of the largest diameters, if they appeared to belong to this age class. On the other hand, no attempt was made to distinguish the mature trees from those younger, by appearance. This distinction was based solely on diameter, by deciding certain limits which were to constitute the young merchantable group, while those above this size but not classed as veterans formed the mature group. The justification for this method of distinguishing age classes lies in the fact that diameter as an indication of age is more reliable with young trees than with old trees, since the latter have had time to differentiate more widely in diameter. On the other hand, appearance is a distinguishing character of old trees, but would not serve with younger classes to the same extent; and finally, while the age of any single tree does not depend on diameter, and cannot even for an even-aged stand be so determined, the average age of a stand which contains several age classes can be found on a diameter basis with a fair approximation of accuracy, since it will contain both younger fast growing trees and older more stunted trees in the same average.

Plots of 20 acres were laid off. Crews of two men covered the area. One, with a staff compass, ran strips lengthwise of the plot, which measured 40 by 80 rods. Each strip was made 10 rods wide, taking four to complete the area. The compassman paced his lines, and mapped the outlines of areas occupied by all groups of veteran timber, and even by single trees. The scale of the map, 1 inch to 20 rods, made this easily possible. Great care was exercised to get these areas large enough to coincide with the spread of the roots of these old trees. The tallyman recorded the D. B. H. of trees as veterans which were indicated by the compassman, so that the map and tally agreed. All other trees of merchantable size were tallied by D. B. H., but in a separate column.

At the same time, the areas occupied by immature timber were mapped out. Some care was necessary here not to give too much or too little area to small timber, but with a little practice it was not difficult to decide on the proper amount of space which was actually claimed by young trees and was not being utilized by older timber. The most difficult problem was presented by groups just maturing, or having a large sprinkling of merchantable trees among a majority of immature trees. Here an arbitrary decision was needed, and the area was divided between the age classes according to the best judgment of the investigator.

The separation of these extreme age classes left the two middle groups occupying the remaining area of the plot. Since the dividing line between these was an arbitary diameter limit, it would have been quite difficult to try to sketch in accurately the areas for each of these two "age" classes. So the separation of areas was based on the second consideration, that of relative crown space. The diameters of the crown of a large number of trees of each age class were measured by pacing, one man directing the work from a distance while the other paced across under the crown. The exact area occupied by the crown was not sought, but the average relative area. So, each crown diameter was squared to give it its proper weight on an area basis. The average crown area was then obtained for trees of each age class. This average area must then be multiplied by the number of trees of the class in the plot, and the resultant total represents the areas for each of the two age classes.

These results give what is wanted, the proportion or per cent. of the acreage, which must be assigned to each age class. The value of this simple method lies in the fact that no attempt is made to measure or assume the actual number of square feet of growing space taken by either the crowns or roots of the average tree of a class. It is merely assumed that the growing space will be proportional to the square of the crown diameters. In multiplying the diameters squared by the number of trees for both classes, the total area so obtained does not and need not equal the area mapped as being occupied by the sand. But if the one fact holds good, that the *proportion* existing between the total crown cover for each class can be so determined, all that remains is to multiply the actual total area by the per cent. for the class, to get its acreage. In this way, the blank area is properly distributed proportionally to the age classes, or in case of overlapping crowns the excess is properly reduced. It seems as though this principle might be applied in many cases, and it might ultimately serve as the key to the determination of such difficult problems as for instance growth per acre based on age in many-aged stands of Engelmann Spruce.

The proportion occupied by average crowns can be obtained from the results of the average trees before multiplying by the number of trees in the stand. An illustration of this method is given below.

Crown space for average mature trees, 1925 sq. ft.
Crown space for average young tree, 762 sq. ft.
Proportion of crown space, 2.5 to 1.
Number of mature trees, 66.
Number of young trees, 262.
Proportional space for mature stand, 66x2.5=165
Proportional space for young stand, 262x1=262

427 square feet.

Resultant proportion of total space:

For mature $\frac{165}{427}$ or 39%.

For young $\frac{262}{427}$ or 61%.

By these means, a very fair map and division of area between these rough groups may be obtained. The field work proceeds rapidly and will prove to be practical and economical in application.

A still further modification of the method of mapping is possible. In mapping areas of veterans it frequently happens that scattered trees belonging to younger age classes stand on blocks that would otherwise be mapped as solid veteran areas. It seems unadvisable to map out the crowns of these small trees. In fact, one of the points in the method is to simplify the map of age classes as much as possible. So the areas are mapped as being occupied by veterans, but the stragglers which do not belong there are kept in a separate tally. When the areas and number of trees of each age class are determined, it is possible to correct the mapped areas by eliminating a proper amount of space from the veteran area for younger trees, and adding it to the classes below. To find how much space to eliminate, divide the total known area mapped as "mature" trees by the number of "mature" trees occupying it, and the result gives the space taken by an average mature tree. This space multiplied by number of mature trees on the veteran areas indicates the correction in area. There is no doubt that this correction enables one to greatly simplify the field work of mapping, which is the fundamental point in the whole plan. Its application is merely a matter of a little computing.

The second essential is now secured, the area occupied by each age class. To get the third, the age, two plans are possible. The first is to determine the volume of the average tree for an age class, get its diameter, and fell one or more trees of this diameter to determine the age. This age is taken to be the age of the class. This plan should be used whenever there is no logging operation going on in timber growing in the vicinity on the same type and quality of soil. Its drawback is the danger that the tree or trees cut will show faster or slower growth than the average for the stand.

The second plan is to determine the diameter of the average tree, but instead of felling trees to get the age, this is taken from a curve of growth in diameter based on age, prepared from 100 to 200 stumps measured in the vicinity, and corrected to D. B. H. and for the age of the seedling. If the timber is of the same type throughout, this plan is best, as it produces tolerably surely average growth figures and gives average age.

In either case, the method of finding the diameter of the average tree can be the same. Averaging diameters directly is admittedly a wrong method. Determining the average basal area and from it determining the diameter is theoretically sound, but this method is used only to determine cubic contents. For board feet, this determination should be made with the aid of a volume table based on diameter and height. To get the volume of the stand originally, the volumes of all trees in the stand have been computed from such a table by first preparing the curve of average height to diameter. Volumes from this volume table can now be written in on this height curve, since with height determined, a tree of a given diameter can have but one volume in the table. The point on this curve of height and volume, which coincides with the volume in board feet, of the average tree for the class, indicates the average diameter, and this diameter in turn gives the age by either of the two methods described, namely either from felled sample trees or by using an age curve.

With age determined, the yield per acre of each of three age classes is determined for the forty—or twenty-acre plot studied. Twenty acres is a large enough plot except in very open, old or irregular stands. These data give three points in a yield table. Since the sizes, average volume, and age of these rough age classes will differ on each forty, there is no difficulty in getting enough points for a curve of yield based on age.

This system was first tried at Doucette, Texas, in 1909, in Longleaf Pine, and was described in the FORESTRY QUARTERLY (vol. VII, 385ff.) in that year. It has since been tested on Longleaf Pine at Clarks, La., in 1910, on Shortleaf Pine at Trinity, Texas, in 1911, and, in the present year, on Shortleaf Pine at Crossett, Arkansas. Each year, the method has shown the same flaws and the same strong points, and each year it has been possible to get, by its use, a yield table which in its general results, bears a striking similarity to those of the other seasons. In other words, the method works, whatever its faults.

The flaws lie in the apparent fact that at several stages the results obtained may be greatly altered on the same plot by differences in judgment of different crews. Wide latitude is allowed as to what shall constitute a veteran tree, and what range of diameters shall be included in young timber. Then in mapping, crews may differ radically in their judgment of areas to assign to veterans, or to immature timber, so much so that the resulting yields may bear very little resemblance to each other. But the strong points of the method lie in the fact that errors are revealed by the method itself. The most serious error is in mapping the areas; all other parts of the problem take care of themselves, if only reasonable care is used. But it is possible, especially the first time the method is tried, to be greatly deceived as to the actual facts, and to note too much or too little area on the map for a given age class. If this is done on a twenty acre plot, when the *whole area* is distributed between the different age classes, too large an area given to one class is sure to mean that too much is taken from one or more of the other classes. The abnormality is indicated almost without exception as soon as the results are worked up. A second trip to the field, and a new map fo the same plot, with the previous error in mind will result in a much closer approximation of the facts and will go far towards giving the needed experience.

Differences in the work of two crews, which are caused by different standards or limits for age classes are immaterial. If one crew includes twice as many trees in the veteran class as another, their average volume will be smaller, as smaller trees will be taken. This gives a lower age, and a different yield per acre. The area mapped will naturally be larger, to include the extra trees. The result is simply that a different point in the yield table is obtained.

This method seems to open up many possibilities in the study of growth, provided investigators will not allow themselves to be frightened off by its apparent flaws. Owing to the importance of the results attained, one illustration is appended, of a twenty-acre lot studied by three crews. The difference in results obtained may serve to illustrate the elasticity of the method and bring out its good and weak points.

AGE CLASS DISTRIBUTION.

Crew.	*Diameter Limits for Young Merchantable Timber.*	*Number of Trees Tallied in Age Classes.*		
		Veterans.	*Mature.*	*Young Merchantable.*
1	12″ to 16″	48	93	218
2	12″ to 18″	32	66	262
3	12″ to 17″	20	103	237

Crew No. 3 put only the largest timber into the veteran class. Crew No. 2 included probably too great a proportion of the stand in the young class.

AREAS MAPPED IN FIELD, AS FINALLY CORRECTED, IN ACRES.

Crew.	*Veterans.*	*Mature and Young.*	*Immature.*
1	2.26	13.28	4.46
2	3.73	7.81	8.45
3	3.33	9.67	7.00

Crown Space Computation.

Crew.	Proportional Crown Space of Average Mature and Young Trees.	Relative Total Space.		
1	2 to 1	218×1 =218	404	53%
		93×2 =186		47%
2	2.5 to 1	262×1 =262	427	61%
		66×2.5=165		39%
3	2.7 to 1	237×1 =237	515	46%
		103×2.7=278		54%

Apportionment of Areas Between Young and Mature Timber.

Crew.	Area, total.	Mature.		Young.	
		Per cent.	Acres.	Per cent.	Acres.
	Acres.				
1	13.28	47	6.24	53	7.04
2	7.81	39	3.05	61	4.77
3	9.67	54	5.22	40	4.45

Resulting Distribution of Areas.

Crew.	Veteran.	Mature.	Young Merchantable.	Immature.	Total.
1	2.26	6.24	7.04	4.46	20.00
2	3.73	3.05	4.77	8.45	20.00
3	3.33	5.22	4.45	7.00	20.00

It appears that Crew No. 1 has mapped a much smaller area to veterans, and also to immature timber, than Crews 2 and 3. When the yields were computed, it was seen clearly that this crew had been mistaken in their judgment on both points.

VOLUME PER ACRE, IN BOARD FEET.

Crew.	*Veteran.*	*Mature.*	*Young Merchantable.*
1	13,273	5,771	4,061
2	14,603	14,673	8,073
3	10,847	12,559	7,505

VOLUME OF AVERAGE TREE.

Board Feet.

1	1,442	426	111
2	1,671	678	148
3	1,790	625	141

DIAMETER OF AVERAGE TREE. [From Volume Table and Height Curve.]

Inches.

1	30.5	20.3	13.7
2	32.1	23.5	14.7
3	31.7	22.8	14.6

AGE OF AVERAGE TREE. [From Curve of Diameter to Age.]

Years.

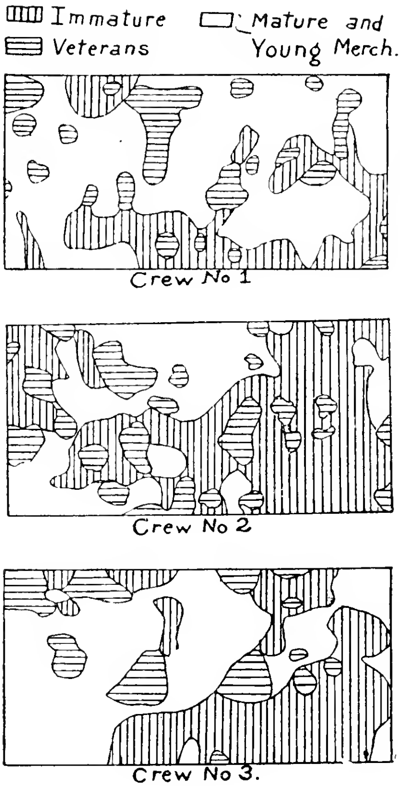
1	215	97	62
2	230	125	65
3	210	210	65

MEAN ANNUAL GROWTH.

Board Feet.

2	145	59	65
2	62	125	124
3	51	105	115

The results of the error made by Crew No. 1 are at once apparent. The mean annual growth of veterans is seen to be too large compared with the younger classes, while that of the mature and young is correspondingly too small, due to the incorrect balancing of areas. One error has produced another and each tends to show up the other. Compared with this the results of Crews 2 and 3 show good judgment and figures which differ from each other only by the margin that may be expected between any two men in solving such a problem. The maps showing the areas assigned to each age class, for the same 20 acres, by each of the three crews, are shown below. The variation in the areas assigned to each age class is due first, to the difference in the number of trees included in these age classes, and second, to differences in judgment as to the proper space to assign to the class. Most of these differences in mapped area are offset or compensated for by differences in the tally. But in case of map No. 1, the area mapped to veterans and immature, is seen to be much smaller than the same areas in maps 2 and 3.



This method as described, is recommended for Western Yellow Pine. With modifications, it may be possible to use it in many-aged stands of spruce, or in mixed stands containing several species. As of interest in this connection the following tables are appended.

Shortleaf and Loblolly Pine Mixed.

Ashley County, Arkansas.
[200 Trees].

Diameter Increment.

Age.	*D. B. H. Inches.*	*Age.*	*D. B. H. Inches.*
10	2.0	120	22.9
20	4.7	130	23.9
30	7.3	140	24.8
40	9.5	150	25.5
50	11.6	160	26.1
60	13.6	170	27.3
70	15.6	180	28.0
80	17.5	190	28.8
90	19.2	200	29.5
100	20.6	210	30.0
110	21.8		

Yield of Shortleaf Pine.

Ashley County, Arkansas.

Age.	*Yield, B. F. (Doyle rule)*	*Mean Annual Increment.*	*Age.*	*Yield, B. F. (Doyle rule)*	*Mean Annual Increment.*
50	5,000	100	150	17,200	115
60	6,600	110	160	17,600	110
70	8,100	116	170	17,600	104
80	9,600	120	180	17,400	97
90	11,000	122	190	16,900	89
100	12,400	124	200	16,200	81
110	13,600	124	210	15,200	75
120	14,800	123	220	13,800	63
130	15,800	121	230	12,200	53
140	16,600	118			

CONVENIENT HOLDER FOR STEM ANALYSIS BLANKS.

By S. B. Detwiler.

The illustration shows a means whereby a light tally board may be attached firmly to the arm, leaving the hand free, to overcome the difficulty of holding a tally board while taking stem analysis measurements. Two ordinary steel-spring bicycle trouser guards are riveted to the back of the tally board. When the springs are slipped over the coat sleeve just above the wrist, they hold the tally board firmly in place and permit the free use of the hands. For a stem analysis blank, the writer uses a 4 x 6 filing card similar to the one shown in the accompanying cut. This is convenient for filing purposes and has proved satisfactory for stump analyses as ordinarily made by following after the saw crews. The title headings are self-explanatory, except that in the column headed "Sec." the stump measurements are entered in the line opposite "Stp." In the line below, the length and top diameter measurements of the first log are entered opposite "Tr." Other logs of the trunk are entered in the lines below this, and a diagram of the tree drawn under "Form." If logs are cut from branches, "Br. 1", "Br. 2", etc., is entered in the column headed "Sec."

For use with the 4 x 6 stem analysis cards the tally holder shown in the accompanying cut is best. This is made from a piece of heavy sole leather fitted with four triangular tin corner clips, which hold the card firmly. On the back of the piece of sole leather, two strong spring clips are riveted in such a way that the trouser guards are held firmly when slid between the leather and the clip. In this way the trouser guards may be removed and the tally board carried in the pocket.

SPECIES DATE NO.

D. B. H. in. Stp. Ht. ft. PLACE

Average diameter, inches				
	20	30	40	50
60	70	80	90	100
110	120	130	140	150
160	170	180	190	200
210	220	230	240	250
Age sap	W'd.sap	Class	Den	Form
T. Ht.	Cl. Lgh.	L. Cr.	W. Cr.	
Vol.	Tot. cu. ft.	Mer. cu. ft.	Mer. bd. ft.	Mer. Cords
Stem				
Branch				
Total				

Sec.	L'g't'h	D. O. B	Bk.	D. I. B	Cont. cu. ft.	Cont. bd. ft.	Defects	In.
Stp								
Tr								

FORESTRY ON INDIAN RESERVATIONS.

By J. P. Kinney

Three centuries have passed since the adventurous Cavaliers at Jamestown and the conscience-pressed Puritans at Plymouth boldly began the work of making America a white man's country. At that time the forests of the United States formed a practically unbroken cover along the Atlantic coast from the St. Croix River to the river St. Johns, and westward to an irregular line far beyond the mighty Father of Waters, spread a verdant blanket over both slopes of the Rocky Mountains, and along the Pacific coast attained a magnificence unequalled in the whole world. These forests, extending over an area of more than one-half billion acres, all belonged by right of possession to the red man.

What has the Indian to-day?

The latest statistics gathered by the Indian Service show that there are in the United States approximately 300,000 Indians holding about 72,000,000 acres of land, more than three-fourths of which was never forest land within historic times. Of these 72,000,000 acres over 40,000,000 have been allotted; the remainder is held in common by the various tribes.

Nearly 170,000 allotments have been made varying from 40 acres to 320 acres each, or even more, according to the character of the land and the special legislation passed for the allotment of particular tribes. Somewhat less than one-half of these allotted lands is held under trust patents, with the fee in the United States. The work of assigning individual allotments of land to Indians has been in progress for more than twenty years. During the fiscal year ending June 30, 1911, nearly 14,000 allotments, embracing over 2,000,000 acres, were made in the field. There are 120,000 Indians who have not yet received allotments.

By implication the General Allotment Act of 1887, known as the Dawes Act, did not include timberland. However, upon reservations where there was an insufficiency of agricultural land to supply all members of the tribe with allotments, where the better agricultural land was covered with timber, where practically all the lands were forested or where the allotment was made under special acts, timberlands have been allotted. There can be no question but that because of the cupidity of the Indians and mistaken ideas on the part of allotting agents, timbered allotments have in many instances been assigned where lands better adapted to agriculture were available.

There are no satisfactory statistics in regard to the extent and value of Indian timberlands. From such information as the writer has been able to acquire, the conclusion is reached that the amount of allotted timberlands is about 1,500,000 acres, and the amount of unallotted approximately 6,500,000 acres. The amount of timber on allotted lands may be given at 5,000,000,000 board feet, with a value of $12,000,000, and that upon unallotted lands as 36,000,000,000 board feet with a value of $72,000,000,

Comparatively small amounts of timber have been cut from reservations in the Rocky Mountain and Pacific States, but lumbering on reservations in the Lake States has been in progress for thirty years. From the Bad River Reservation in northern Wisconsin alone nearly 1,000,000,000 board feet have been cut since 1893.

The question which will naturally arise in the mind of the reader will be "Is the lumbering on Indian lands conservative or destructive?" The question should be fairly met. The greater part of the lumbering which has been done on Indian reservations in the Lake States has not been conservative in the sense in which this term is generally used in forestry literature. However, during the last eight or ten years it has been conservative in the sense that very little has been wasted. Everything merchantable has been cut and paid for. This method has, of course, not been conducive to a reproduction of forest crops. The criticism which has been passed upon this system has arisen, undoubtedly, from an entire misunderstanding of conditions.

Practically all of the land within Indian reservations in Wisconsin and Minnesota, except on the Menominee and the Red Lake reservations, has been allotted. The majority of these allotments are still held under trust patents or patents with restrictions on alienation. Nevertheless, these allotments are individual property. The area of these allotments varies from 40 to 160 acres. An individual Indian cannot be expected to practice forestry upon its allotment. To any one having the slightest acquaintance with the character and mental make-up of the Indian, it should be at once apparent that co-operative management of allotments as forest lands is impracticable. Many of these allotments are held by old men and women who have never adapted themselves to the habits of the white. Hundreds of them live face to face with destitution. The only means that the Indian Service has through which to keep these unfortunate people from starvation is to derive as large a revenue as possible from their timber. Another class consists of young men and women who desire money for educational purposes, for the building of houses, or for the purchase of farming equipment. The Government would not be justified in insisting upon the practice of a highly intensified forest policy under such circumstances. As many of the allotments will be alienated within a few years to whites and be turned into agricultural uses, the State as well as the Indian might suffer a loss through the additional expense involved in a conservative logging and a retardation of clearing and agricultural development. Within the Lac du Flambeau Reservation in Wisconsin there are about 20,000 acres of lands claimed by the State under the swamp lands grant which has not been alloted. This land is quite generally massed in the northern half of the reservation. Unfortunately scattered allotments have been made throughout this area. The writer is of the opinion that arrangements could and should be made under which the State of Wisconsin might be given control of these swamp lands and might purchase most of the scattered allotments within the area mentioned. The individual Indians and the tribe should receive a just compensation for these lands, which lie at the very headwaters of two of Wisconsin's important rivers and are adjacent to the State forest reserves.

Under the Act of March 28, 1908 (35 Stat. L. 51), and the amendment of March 3, 1911 (36 Stat. L. 1076), the Indian Service is conducting logging operations on a large scale on the Menominee Reservation in Wisconsin. A sawmill having a capacity of 40,000,000 feet per annum was built in 1908-09 where the Wisconsin and Northern Railroad crosses the West Branch of the Wolf River. About this mill has grown up the little village called Neopit, in honor of a former Menominee Chief. The Menominee Reservation, perhaps, contains the largest body of virgin timber in the State of Wisconsin. White Pine of the quality found on this reservation is now exceptionally rare and the Norway Pine, basswood, birch and oak are equal to any timber in the State. There is also a very heavy stand of good quality hemlock. The total amount of all species is over 1,500,000,000 board feet. In addition to the thoroughly modern sawmill, planing mill and all ordinary accessories, the lumbering equipment includes about seven miles of railroad track, two locomotives, forty Russell cars, and two log loaders. Although the operation is conducted under the supervision and control of the Department of the Interior, the mill and all equipment is the property of the Menominee tribe of Indians, and the business is conducted under the name "Menominee Indian Mills."

Prior to 1910 the Indian Service had devoted comparatively little attention to the forests in the Rocky Mountain and Coast States. The Indian reservations in those States were rather inaccessible and the economic development had not reached the point where there was any strong demand for the exploitation of the timber resources of the Indians. It has been often and openly said that fires were very frequent in Indian reservations, were allowed to burn unmolested, and yearly did immense damage. It is undoubtedly true that altogether too many fires have been permitted to burn themselves out on Indian reservations. On the Crow, Blackfeet, Warm Springs, and Klamath reservations the writer has observed the destructive work of fires that could doubtless have been controlled in their incipient stages. However, observation of the evidences of former fires on Indian reservations as compared with those on public lands and National Forests, a careful consideration of the records of the Indian Office, and a knowledge of the character and habits of Indians, leads the writer to the conclusion that the white man has in this matter as in many other matters, heaped upon the Indian a reckless and unjustified criticism. I have no hesitation in saying that, considering his limitations as to intelligence and education, the Indian is far less addicted to the evil of forest burning than the white man.

On January 22, 1908, the Secretary of Agriculture and the Secretary of the Interior entered into a co-operative agreement under which the Forest Service was to undertake the administration of Indian timberlands. On July 17, 1909, this agreement was rendered ineffective through a determination by the new administration in the Department of the Interior that the arrangement was illegal. During the eighteen months that this agreement has been in effect an attempt had been made by the Forest Service to extend its administration so as to cover the work of fire protection and timber utilization on Indian reservations. Little had been accomplished when the action of the Interior Department brought these efforts to an end.

After the abrogation of the co-operative agreement the Indian Office began to take steps toward increasing the efficiency of the forestry work on Indian reservations through its own official force. In February, 1910, the writer entered the Indian Service as Assistant Forester, and undertook the work of organizing the forestry work both in the Office and in the field. It was understood at the time that the writer would have charge of the Office administration while the field work would be under the direct supervision of a Forester in the Indian Service. There was considerable delay in the execution of plans, but with some changes the organization then outlined has been gradually put into operation during the past two years.

This plan contemplates a forester, assistant forester and superintendent of logging, whose duties are those of general inspection and supervision; three men having similar duties within three assigned portions of the United States which may be described as comprising the Southwestern, the Northwestern and the Central States; about a dozen or fifteen forest assistants and lumbermen in charge of the forestry work on the more important timbered reservations under the jurisdiction of the superintendents of the reservations, and a force of about 112 forest guards and rangers under the jurisdiction of the superintendents on about forty reservations having large forest interests. In addition to this force there is available on each reservation a protective and executive force consisting of white farmers, stockmen and others, employed in the Indian Service, and the local Indian police and line riders. It is believed that the efficiency of this force for fire fighting is very satisfactory.

During the spring of 1910 the writer started the work of building telephone lines for forest protection purposes on Indian reservations. More than 1,500 miles of telephone line, about 50 cabins, and many miles of fences and trails were constructed during the succeeding 12 months. These means of protection proved of great value during the fire season of 1910 and 1911.

Prior to 1910 no general policy as to dealing with Indian timberlands had ever been formulated. It had been the custom to act upon each individual question as it was presented. So long as nearly all timber questions related to large sales on tribal lands or to group sales from allotments this system could be used without serious difficulty; but it was apparent that as the segregation of individual holdings multiplied the detail connected with sales of timber from allotments and as the settlement of the western States increased the demand for small sales from tribal lands the work connected with the handling of all detail at Washington would be insurmountable. It was for this reason that the writer prepared the general regulations and instructions for officers in charge of forests on Indian reservations, which were approved by the Department of the Interior on June 29, 1911, and issued in a small booklet for general distribution to special forest officers, superintendents, forest guards, farmers and others in the Service.

One of the important innovations of these regulations was the establishment of the rule that individual Indians who are permitted to cut timber from tribal lands for sale must pay a stumpage charge for the benefit of the tribe. Under the conditions obtained in the past the practice of allowing the more progressive Indians a rather free hand in cutting tribal timber for sale may have been excusable as a means of enabling and encouraging Indians to procure a living. The rapid rise of stumpage values and the need of protecting the interests of all the Indians against the desire for gain which civilization is sure to arouse in the more aggressive required that the exploitation of tribal timber be placed upon a business basis as far as practicable.

The regulations require that all cutting shall be done under a permit or a regular contract. A considerable discretion as to small sales is left with the local officials. General instructions as to advertising, making of contracts, marking and scaling, were incorporated in the regulations. The sawmill feature of forestry work in the Indian Service has no counterpart in the forestry work of the United States Department of Agriculture. The government has need of large quantities of timber at various agencies and schools, for building construction, fencing, irrigation flumes, etc. Lumber is also needed for the construction of houses and barns for Indians. Upon Indian reservations about 30 Government sawmills were operated during the fiscal year 1911. These are all small mills cutting from 2,000 to 20,000 board feet per day of eight or ten hours. They are operated largely by Indian labor and afford a means of industrial training for the Indians in addition to acting as an incentive to the improvement of housing conditions on the reservations. As Indian labor is usually 20 to 40% less efficient than white labor and as these mills must almost of necessity be operated for short day periods, the successful commercial operation of the mills is difficult. In most instances their maintenance must be justified on educational and social grounds rather than economic.

And, now when every Indian shall have received an allotment, what is to be done with the surplus timberland? This question can be answered only by the Congress of the United States. On about a score of reservations in the western States there are large areas of timberland which will not be needed for allotment and which are not adapted to agriculture. These timberlands include high mountain slopes, as on the Flathead and Warm Springs Reservations, volcanic ash land which is not subject to irrigation and is wholly unfit for agriculture, as upon the Klamath Reservation, or natural forest soil, as on the Quinaielt. These areas should unquestionably be maintained as forest lands. The regulations approved June 29, 1911 and the general forms of contract adopted earlier in the same year, make provision for the conservative cutting of timber from all areas of this character. Although the ultimate status of these lands is yet undetermined, the writer is confident that the forest cover will be maintained whether the lands shall continue to be held as Indian tribal property or be acquired by the United States for National Forest purposes.

UTILIZATION AT THE MENOMINEE INDIAN MILLS, NEOPIT, WISCONSIN.

By Nelson C. Brown.

In these days of extensive forestry and until the problems of forest taxation and fires are solved, and the market conditions improve, we can practice just as good forestry by making careful use and taking care of what we already have as in growing new timber. It has been estimated that in the United States only 37 per cent. of all the wood that is grown is actually used whereas in some countries of Europe about 96 per cent. is used. This is the best explanation of both the amount of damage done by fires and the prodigal waste of our timber supply. The burden of this discrepancy however, lies with the enormous waste both in the woods and at the saw mills rather than with fires and insect damage.

Careful utilization, moreover,, to be successful must be profitable and throughout the country the big saw mill operators particularly are coming to realize the benefits from developing special markets for their by-products, not only of the mill itself but of the species in the woods which formerly have been considered of little or of no value. Profitable utilization of by-products is usually dependent upon the following factors:

1. Markets or demand.

2. Transportation facilities or cost of placing the product on the market.

3. The labor question or cost of handling which is closely related to the second factor.

Perhaps one of the best examples of utilization in this country is found at Neopit, in east central Wisconsin where the United States Indian Service during the fall of 1908 constructed a large band saw mill and planing mill to cut the timber belonging to the Menominee Indians. For this enterprise the funds of the Menominee Indians were used and they are therefore the real owners of the operation. The area of the Menominee Indian Reservation is approximately 10 townships or 230,400 acres and contains a total stand of nearly two billion feet board measure or about 8,000 board feet per acre. The approximate composition is as follows: 40 per cent. Hemlock, 15 per cent. Basswood, 15 per cent. Hard Maple, 10 per cent. White Pine, 6 per cent. White elm, 5 per cent. Yellow Birch, 3 per cent. Soft Elm, 2 per cent. Norway Pine, and the remaining 4 per cent. is composed of White and Red Oak, White Cedar, White Ash, White Spruce, Balsam Fir, Tamarack, Beech, Butternut, Hickory, and Popple. An idea of the size of this timber is best gained from the log run which averages about 10 logs per thousand board feet. The conifers are much larger than the hardwoods and the log run varies from 6 to 33 per thousand. Only the mature timber or that which has been fire damaged is logged. All cutting is done under approved methods of forestry practice which insure the reproduction of the forest and up to the present date a rough adaptation of the selection system has been used. Although no careful measurements have been made of the annual growth on the Reservation, yet, care is taken, based upon conservative estimates, that the annual cut does not exceed the annual growth so that the mill which has a daily capacity of 120,000 board feet in a single shift will not exhaust the available timber supply.

Besides all of the ordinary grades of lumber which are sold by competitive bids, a great number of different lines of utilization of wood products have been developed at this operation. Only the utilization of the minor products will be discussed in this article, including the following: hemlock bark, cordwood, lath, shingles, crating material, basswood and popple bolts for excelsior, pine bolts for pail stock, ties, cedar poles and posts, and picket stock.

Hemlock Bark. This is peeled during the spring and early summer when the bark slips most easily, and is done in one operation, that is, the peelers fell the tree, saw it up into logs, and then peel the bark. The bark is sold by the cord and after drying brings $7.50 per cord f. o. b. at Neopit. It costs $2.96 to peel and pile into cords and $2.40 to haul and load, including overhead charges which amount to 70 cents. These charges embrace depreciation on tools, machinery, equipment, horses, camps, and general expenses. Thus the profit on this operation is $2.14 per cord. Last year 12,118 cords were sold. The market price however on Hemlock bark fluctuates between $6.00 and $8.00 per cord.

Cordwood. The operation pays 80 cents a cord for cutting to the Indian contractors. Everything from 16 inches to 48 inches in length is taken and all cordwood over 10 inches in diameter is split. The contractor cuts up only the tops and dead and down material left in the woods after logging, and no stumpage is charged for this material. "A face cord" in this region equals a stack of wood 4 feet high, 16 inches wide and 8 feet long. Both this short sized wood and the regulation 4 foot cord lengths are commonly sawed. It costs on an average 60 cents per cord to haul to the tracks and load on the cars. The operator receives from $2.00 to $3.00 per cord f. o. b. at Neopit depending upon the character of the wood. $3.00 per cord is received for maple and birch sound body wood, that is, clear material free from knots or defects. All other hardwoods bring $2.00 per cord. The more valuable cordwood is used for special kiln and charcoal work. The profit on this class of product is therefore very high. About 2,000 cords were sold during the past year yielding a profit of from 60 cents to $1.60 per cord. This market is just being developed and as the quantity consumed by the market is almost unlimited, the cutting of this product can be increased in very much larger quantities.

Lath. As the slabs, trimmings, etc., come from the slasher they are picked first for lath, then for picket stock and last for crating and box material. All species go both into lath and board material, but only pine and basswood are used for picket stock. The average cost of lath per thousand is $1.34. Average sales are $2.34 giving a profit of $1.00 per thousand. The average cost includes manufacturing, yarding, shipping, sales, insurance, etc., but no stumpage, inasmuch as that is taken care of by the lumber product. The annual output is about 10,000,000 lath.

Shingles. Only White Cedar is used for shingles. The cost per thousand pieces including $3.35 per thousand board feet for stumpage is $1.66. This embraces cutting, hauling, booming, manufacturing, yarding, shipping, sales expense, insurance, etc. The average price received per thousand is $2.19 giving a net profit of 53 cents per thousand. The usual three grades of shingles are made, and the majority is of the first grade. The annual output of the mill is about 10,000,000 shingles.

Box Board and Crating Stock. All species are used for crating stock. Slabs, edgings, and any defective logs which when sawed will hold a nail are used after first being picked over for lath and picket material. The average cost of manufacturing, yarding, shipping, etc, etc., including sale expenses, depreciation on machinery, etc., is $1.65. The average price received is $2.00 per thousand pieces giving a net profit of 35 cents per thousand. No charge is placed against stumpage since that is taken care of by the lumber obtained from the logs. The annual output of the mill is about 4,000,000 pieces of box board material, which vary in size according to order.

Basswood and Popple Bolts for Excelsior. Basswood bolts cost $3.00 per cord to cut, make, peel, and pile in the woods. A cord is considered a stack 4 feet high, 8 feet long and 54 inches wide. It costs 50 cents to $1.00 per cord to haul out of the woods and load on the cars depending upon the length of the haul which varies from 1 to 3½ miles. The price received is $7.50 per cord f. o. b. at Neopit, giving an average profit of about $3.75 per cord.

Popple bolts are made for $2.50 per cord unpeeled, or $3.50 per cord, peeled and delivered at the tracks for these prices. These bolts come in two lengths, 37 and 54 inches. $5.25 is received per cord for the 54 inch stock and $4.75 per cord for the 37 inch stock. Both lengths are sold on the basis of 54 inch face cords. The average profit per cord is about $1.50.

Pine Bolts. Pine bolts for pail stock cost proportionately about the same as Basswood bolts delivered on the cars but are made in lengths of 13 inches or multiples thereof. These bring about $3.00 a face cord f. o. b. at Neopit. They are made from both Red and White Pine, and the profit is much less than from the Basswood bolts, the average being about 55 cents a face cord. A face cord is considered a stack of wood 4 feet high, 8 feet long and 52 inches wide.

Railroad Ties. A standard tie, that is, one 8 feet long, 6 inches thick and having at least a 6 inch face cost 12 cents to make and land at the tracks. This work is all done by contract labor. It costs 2 cents to load and a stumpage price of 6 cents per tie which is at the rate of $2.00 per thousand board feet, is charged. These ties bring 32 cents f. o. b. Neopit which leaves a profit of 12 cents per tie. Hemlock constitutes 90 per cent of all the ties. Tamarack and Red Oak, Elm and Cedar ties bring 42 cents a piece.

White Oak ties bring 65 cents a piece. Most of these ties are cut from fire damaged or cull timber in connection with logging.

Cull ties, that is, those below the standard specifications bring 12 cents for cedar, elm, hemlock, and tamarack and 25 cents for White Oak. All cull ties are used on the operation since it does not pay to sell them. There are about 100,000 standard ties made annually.

Telegraph Poles. Poles on this operation are made of White Cedar exclusively. It costs from one cent to four cents per foot to make and haul to the tracks, depending upon the length. All lengths from 20 to 55 feet are used. The average pole between these dimensions costs 68 cents to make and haul to the track including stumpage. The average pole brings about $2.75 f. o. b. Neopit, yielding a profit of $2.07 per pole. A 20 foot pole, 3 inches in diameter at the top, brings only $0.20, whereas a pole 55 feet long and 7 inches in diameter at the top brings $10.00 All poles are peeled in the woods when felled. During 1911, 1,257 poles were made.

Posts. All posts are made of White Cedar and by contract labor. It costs from 2 to 4 cents to make and haul posts to the track depending upon the distance. Two sizes are used as follows: 7 feet long, 3 inches in diameter at the top, and 8 feet long and 5 inches in diameter at the top. The prices received for these poles are from 4 to 12 cents a piece f. o. b. Neopit depending upon the size and quality. The average cost of making, hauling, etc., including stumpage is $5\frac{1}{2}$ cents a piece, yielding an average profit of $2\frac{1}{2}$ cents a piece. Last year 2,000 posts were cut.

Picket Stock. This material is largely made from Red and White Pine and Basswood. The prices received for this stock vary from $1.71 per thousand for pieces, 1 by 1 inch wide by 20 inches long, up to $14.70 for pieces $1\frac{1}{2}$ by $1\frac{1}{2}$ inches wide by 48 inches long. All of this stock goes into window shade material.

Slat stock which is always associated with window shade material brings $1.72 per thousand for pieces $\frac{3}{8}$ by $1\frac{1}{2}$ inches by 40 inches long, and $2.45 for pieces $\frac{5}{8}$ by 1 inch by 48 inches long. Up to the present date the mill has not turned out a sufficient amount of picket stock on which to base any fair estimates of cost but it is beyond question a paying proposition.

Besides the above various lines of utilization the operation is planning to turn out a special stock of maple and birch for wooden ware material, and to utilize the slabs and waste of certain species for paper pulp. In addition, it will dispose of all kinds of hardwood material for chairs, tools, furniture, and special wooden ware manufacturing.

Material.	*Species.*	*Unit.*	*Unit Profits.*
Hemlock bark,	Hemlock,	Cord,	
Cordwood,	Maple and Birch,	Cord,	$2.14
	All other hardwoods,	Cord,	1.60
Lath,	All species,	Thousand pieces,	.60
Shingles,	White Cedar,	Thousand pieces,	1.00
Box Boards or crating,	All species,	Thousand pieces,	.53
Excelsior bolts,	Basswood,	Cord,	.35
	Popple,	Cord,	3.75
Pail stock bolts,	White and Red Pine,	Face cord.	1.50
Railroad Ties,	Hemlock 90%,	Piece,	.55
Telegraph Poles,	White Cedar,	Piece,	.12
Posts,	White Cedar,	Piece,	2.07
Picket stock,	Red and White Pine and Basswood,	Thousand pieces,	.025 (Unknown)

The above figures are intended to show the excellent profits possible from utilizing by-products of a large lumber operation. Neopit is on the Wisconsin Northern Railroad about 20 miles from Shawano. Here it connects via the Chicago and North Western Railroad with the wood markets in the larger cities of Wisconsin. However, much of the above material, besides the lath and shingles, is consumed outside the State. Several markets have been developed in Chicago and even as far away as the central prairie states and New York, proving that the transportation and market problems are not prohibitive. The labor used on this operation is about equally divided between Indians and Whites. The latter have proven to be the more ancient of the two classes.

A WORKING PLAN FOR WESTERN YELLOW PINE LANDS IN CENTRAL COLORADO.

By P. T. Coolidge.

The Colorado School of Forestry owns a tract of 9,640 acres in the mountains about twenty-five miles northwest of Colorado Springs. This tract is in a wide valley, through which there flows northward a small tributary of the South Platte. The valley is bordered by low hills on either side, the elevations over the entire tract varying only from 7,500 to 8,800 feet.

The forest consists of a nearly pure (97%) stand of Western Yellow Pine. The remaining 3% is Douglas Fir. The trees are not large for Colorado, but the stand is unusually dense, and reproduction is abundant in most openings and especially on the north exposures where Douglas Fir occurs. This type of Western Yellow Pine forest occurs in extensive areas in this portion of Colorado, in the Black Hills, and elsewhere, and is due to a cool, moist climate. The tract owned by the Colorado School of Forestry—known as the Manitou Park Reserve—has nearly all (92%) been culled lightly and irregularly during the last twenty or thirty years for the best saw trees and for ties. The resulting forest, therefore, consists of a large proportion of timber just approaching maturity, a small proportion only of overmature stands, and an abundant scattering of old trees of quality too poor to interest the earlier lumbermen.

In the spring of 1910, students prepared a working plan. In brief, it was found that of the 9,640 acres, 6,640 acres were timbered, the remainder being open agricultural or grazing land. The total stand was estimated to be 10,060,000 feet board measure,—a rather uniform stand of about 1,500 feet per acre. The rate of growth per acre was obtained by the usual empirical yield table method—multiplying the number of trees of each diameter class by their rate of volume (in board feet) increment as shown in the following tables, based on 210 dominant trees, except that figures for heights for the several diameters breast high were obtained from 424 trees.

TABLE I.

Western Yellow Pine.

Diameter and Height.

Age years.	*Height feet.*	*Stump Diameter.* *Diameter inside bark—inches.*	*Diameter outside bark —inches.*	*Diameter breast high —inches.*
10	2	1.3	1.4	
20	8	3.0	3.2	
30	15	4.6	5.0	
40	20	6.0	6.6	
50	25	7.3	8.1	
60	30	8.5	9.5	8.5
70	34	9.6	10.8	9.8
80	37	10.6	12.0	10.9
90	40	11.5	13.1	11.9
100	43	12.4	14.1	12.8
110	46	13.2	15.0	13.6
120	48	14.0	15.9	14.4
130	55	16.2	18.1	
140	53	15.5	17.4	
150	57	16.8	18.6	
160	57	16.8	18.6	
170	59	17.3	19.1	
180	60	17.8	19.6	
190	61	18.3	20.1	
200	62	18.7	20.5	
210	64	19.0	20.8	
220	65	19.3	21.1	

TABLE II.

Western Yellow Pine.

Rate of Growth.

Diameter Breast High, Inches.	*Years to give one inch in diameter.*	*Average volume* board feet, Scribner, Decimal C.*	*Average growth in 10 years board feet.*
6	8		
7	8		
8	8		
9	8	18	10

Diameter Breast high Inches.	*Years to give one inch in diameter.*	*Average volume* board feet, Scribner, Decimal C.*	*Average growth in 10 years board feet.*
10	9	28	14
11	9	40	17
12	10	55	19
13	11	73	20
14	12	94	20
15	13	118	20
16	15	145	20
17	17	175	19
18	20	208	18
19	24	244	17
20	28	283	15
21	33	325	13
22		370	
23		418	
24		469	
25		523	

Note: No studies of volume of sufficient extent for the preparation of an accurate volume table have been made on the Manitou Park Reserve. The volumes have been obtained by application of volume tables in common use for Western Yellow Pine to the data obtained from a study of heights and diameters of 424 trees.

TABLE III.

Growth in 20 Years—Virgin Forest.

From 34 acres.

Diameter Breast High.	*No. of Trees.*	*Per Tree.* Growth in 20 years, board feet, Scribner Decimal C.	*Per Acre.* Growth in 20 years, board feet, Scribner Decimal C.
6	7.8*		
7	4.6*		
8	5.7*	33	188
9	5. *	31	155
10	7.0	30	210
11	4.9	36	176
12	4.5	39	175
13	2.7	40	108
14	2.2	40	88
15	.8†	40	32

* Reproduction averaged for all types.
† Low, probably on account of culling for ties.

Diameter Breast High.	*No. of Trees.*	*Per Tree.* Growth in 20 years, board feet, Scribner Decimal C.	*Per Acre.*
16	1.7	39	67
17	1.1	38	42
18	.9	36	33
19	.5	33	16
20-25	.8	30	24
			20) 1314
			65.7

Less decay in virgin timber, probably about 10%, ... 6.5

Growth per acre, per year, board feet, ... 59.2

TABLE IV.

Growth in 20 Years in Culled Timber—From 184 Acres.

Diameter Breast High.	*No. of Trees.*	*Per Tree.* Growth in 20 years, board feet, Scribner Decimal C.	*Per Acre.*
6	7.8		
7	4.6		
8	5.7	33	188
9	5.0	31	155
10	5.8	30	174
11	5.9	36	212
12	5.2	39	151
13	2.9	40	116
14	2.3	40	92
15	1.2	40	48
16	1.5	39	57
17	.6	38	23
18	.6	36	22
19	.2	33	7
20	.3	30	9
			20) 1254
			62.7

Less decay in culled timber, probably about 5%, ... 3.1

Growth per acre per year, board feet, ... 59.6

TABLE V.

Growth in 20 Years on Land Cut Over by College—From 26 Acres.

Diameter Breast High.	*No. of Trees.*	*Per Tree.* Growth in 20 years, board feet, Scribner Decimal C.	*Per Acre.*
6	7.8		
7	4.6		
8	5.7	33	188
9	5.0	31	155
10	6.8	30	204
11	3.1	36	111
12	2.4	39	94
13	.2	40	8
14	.9	40	36
15			
16	.2	39	8
			20) 804

Growth per acre, per year, board feet, ... 40.1

No deduction on account of decay as the stand consists of vigorous trees only.

TABLE VI.

Growth in 20 Years in Douglas Fir Type—From 10 Acres.

Diameter Breast High.	*No. of Trees.*	*Per Tree.*	*Per Acre.*
6	7.8		
7	4.6		
8	5.7	33	188
9	5.0	31	155
10	14.6	30	438
11	6.6	36	238
12	4.0	39	156
13	2.0	40	80
14	1.5	40	60
15	.7	40	28
16	.4	39	27
17	.1	38	4
18	.1	36	3
			20) 1377

Growth per acre, per year, board feet, ... 68.8*

*Note: The growth of Douglas Fir is not quite as rapid as that of Western Yellow Pine, probably because it occurs in cooler situations. The result is therefore high, and only approximately correct.

The annual growth on the tract at present, therefore, is about 400 M. feet, board measure.

It is interesting to attempt to forecast probable future diameter limits. For this purpose measurements of the crown areas of 216 trees were made, the following results being obtained:

TABLE VII.

Crown Space per Tree.

Diameter—inches.	*Crown Space—Sq. Feet.*	*Number of Trees measured.*
8	120	13
9	145	24
10	170	22
11	200	19
12	235	17
13	280	29
14	330	25
15	390	25
16	460	24
17	540	9
18	620	7
19	700	2

Comparison of Tables Number I and VII shows the areas required for the production of merchantable material by trees of different diameters. The results may be arranged in the form of a table:

TABLE VIII.

Diameter	*Average growth in ten years, board measure.*	*Crown Space*	*Area required to produce one board foot in 10 years. Square feet.*
9	10	145	14.5
10	14	170	12.2
11	17	200	11.7
12	19	235	12.4
13	20	270	13.5

It will be seen that the eleven inch trees are the most productive for the area occupied and it is probably safe to assume, allowing an inch growth for quality, that the diameter limit of the future will be twelve inches, requiring a rotation of ninety years. The dense reproduction which follows cutting should develop into stands of clean boled, slightly tapering trees well suited for ties and rough lumber. It may be noted that the crowns occupy only a small proportion of the total area. In Western Yellow Pine the chief competition is in the roots, but it is believed that the crown measurements indicate the relative demands on the situation of trees of different sizes. The growth is too slow to warrant holding more than a very small proportion, if any, of the stands as reserves for quality. Western Yellow Pine in this region will produce only ties and rough lumber.

Although an approximate twelve inch diameter limit may be adopted in the future, the business of the School in its cutting now is to improve the vigor of the stand by removal of mature and defective trees,—in other words to cut on a silvicultural rotation. The silvicultural rotation is from about one hundred and twenty to one hundred and fifty years, and requires a diameter limit of from fourteen to sixteen inches. This diameter limit, in practical forestry, would, of course, be considered approximate only, in actually marking trees for cutting, and the vigor of the trees would determine very largely whether or not they should be cut.

The silvicultural method is simply shelterwood. If only the mature and defective trees are cut, immature trees will be left in sufficient numbers to insure seed and to insure protection for seedlings. The mature and defective trees comprise about 50% of the stand. In marking, the only question, therefore is, whether or not each tree is more valuable now than it will be later. Trees with spike tops, cat faces in which decay is liable to begin, mistletoe infestation, irremediable crooks, small, unproductive crowns, and trees showing signs of maturity, should be cut. Trees without defect, with crooks that in time will be somewhat corrected by diameter increase, and with large vigorous crowns, should be saved.

Douglas Fir on account of its durability is in greater demand than Western Yellow Pine. It occurs in limited quantities and as its stumpage value is probably about $1.00 higher than that of the pine, it should be disposed of conservatively.

One of the chief purposes in the preparation of the working plan was the determination of the annual cut necessary for a sustained yield. Computation based on the abundance of reproduction from six to ten inches in diameter indicates a slightly increased (5%) growth after forty years. The average density, .7, also promises increase in growth as soon as reproduction is established, but it would be probably nearly one hundred years before there would be a full stocking of timber of merchantable size. It should be noted that a study of density in an open forest like that of Western Yellow Pine requires the keenest observation.

On the other hand, in the determination of the annual growth, the reduction in growth on cut-over lands must be considered. It is felt that however fascinating the determination of the exact sustained yield may be, the time has not yet come when it is worth while in practical American forestry on a small tract, even for educational purposes. In so far as the tract serves as an object lesson, the management would be of greater value if practical rather than theoretical. For example, in the winter of 1910-11 about 350,000 ft. board measure was logged, but in 1911-1912 market conditions were so discouraging that only 70,000 feet were logged. Prices will rise unquestionably, and it would be impractical to sacrifice present stumpage values for the sake of greater uniformity in the yield. The policy decided on therefore was to cut at as near the rate of growth as market conditions permitted. It is scarcely worth while to try to determine the proper cut for more than a few years, especially in the West where the rapid growth of the country is almost certain to upset all exact calculations.Careful selection of the trees for cutting in accordance with the best silviculture is much more important than uniformity of annual yield.

Is forestry on ordinary private lands in this region practical? As everywhere, stumpage is being held for higher prices. When a tract is marketable, however, all merchantable timber is cut. The reasons are, as is shown by the tables above, that the growth is too slow and prices are insufficient to warrant holding any of the trees for a second cut. The increase in stumpage prices is too slow to induce holding of marketable timber, and the growth is so slow that even small trees, yielding small profit to the logger of to-day will not improve sufficiently in quality to be held for the future.

Stumpage on the Manitou Park Reserve is worth an average of $4.00 per M. feet, board measure, although present contracts in the more accessible portion of the tract stipulate $5.00 per M. The cost of producing ties (7″x7″x8′) is about as follows:

Hewing	13 cts.	(1st class 15 cts., culls 6 cts.)
Skidding	3 cts.	
Hauling	9 cts.	(6 miles, 1 trip, daily, 60-70 ties each.)
	25 cts.	
Value	41 cts.	(1st class 45 cts., culls, 20%, 25 cts.).
Net	16 cts.	

The following tables indicate the relative values of trees at different ages for ties and saw timber.

Diameter.	*Age.*	*Years to grow one inch in Diameter.*	*Volume Board feet.*	*Value at PE per M.*
6		8		
7		8		
8		8		
9	64	8	20	10 cts.
10	72	9	30	15 cts.
11	81	9	40	20 cts.
12	90	10	50	25 cts.
13	101	11	70	35 cts.
14	113	12	90	45 cts.
15	126	13	120	60 cts.
16	141	15	150	75 cts.
17	168	17	180	90 cts.
18	188	20	210	$1.05
19	212	24	240	1.20
20	230	28	280	1.40
21	263	33	330	1.65

TABLE IX.

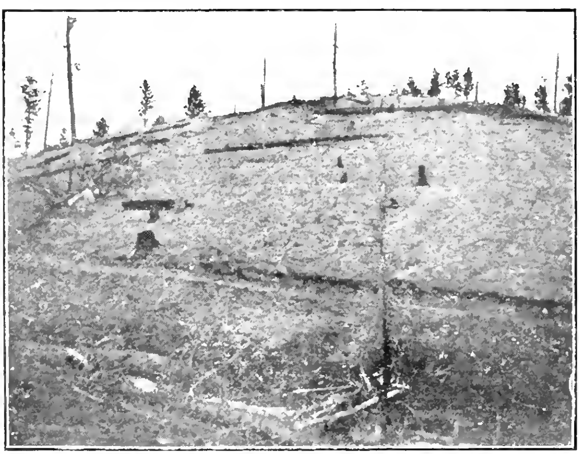
Value of Trees for Sawlogs and for Ties Compared.

Diam. Inches.	*Average No. of Ties in trees with 1-16-ft log.**	*2 16-ft. logs.**	*Average.**	*Value. 1-log trees. For ties.*	*For logs.*	*2-log trees. For ties.*	*For logs.*	*Average. For ties.*	*For logs.*
9	1.5		1.5	24 cts.	10 cts.			24 cts.	10 cts.
10	1.7	2.0	1.75	27	15	32 cts.	15 cts.	28	15
11	1.85	2.25	2.05	29	20	36	30	33	20
12	1.95	2.50	2.30	31	25	40	35	37	25
13	2.00	2.65	2.60	32	30	43	45	42	35
14	2.05	2.80	2.85	33	35	45	60	46	45

*These tables are based on measurements of 100 trees. Saw timber is estimated at $5.00 per M., stumpage; ties at 16 cts. stumpage.

Gully, the result of destruction of forest and sod by fire.

Reproduction in opening, Western Yellow Pine, following culling of saw timber, 20 years ago. Trees in background, tie size.



Meadow silted over, result of overgrazing.

MONTOU PARK RESERVE.

This table shows that up to thirteen inches in diameter trees are more valuable for ties than for saw timber.

Referring to the above tables, it is plain why the average owner does not hold his 65 year old trees (9 inches in diameter), that he can get 24 cts. in ties for now, until they are an inch larger and worth 28 cts. in ties. That would give him only 4 cts. interest on 24 cts. in 8 years, or slightly more than 2% simple interest. Neither, for example, taking the age of most rapid advance in value for saw material alone, is he going to save trees 14 inches in diameter, worth 90 cts. for logs now for 12 years, or until they are worth $1.20. That would yield only 30 cts. simple interest on 90 cts. in 12 years, or 2.8%. The average owner therefore cuts all trees as soon as they are large enough to yield ties. In fact the results obtained in Table VIII prove that the average owner is correct in cutting trees at 11 or 12 inches diameter, or about as soon as they are merchantable, but the objection to present methods of cutting is that they seriously injure the productive capacity of the forest and therefore the future prosperity of the region. Even in a region so favorable to forest growth, the cutting of all merchantable material does not leave sufficient trees for seed and protection, and therefore for prompt and sufficient reproduction. If reproduction occurred promptly, it would require 65 years before it would produce ties. Lighter cutting would permit logging again in 10 or 20 years. Thus the cutting away of the remnants of the virgin forest, means the cessation of wood using industries in the region for many years.

Although clearing improves grazing conditions, fire kills the grass even more completely than the forest. Accompanying illustrations show the ruin of grazing lands by fires. On account of the dry porous soil originating from disintegrated granite, forage conditions in this region must be protected from fire. Fortunately for forestry as well as for the grazing industry, sheep and hogs have never been run in the region. They would destroy the scattered grasses at once.

Are there possibilities of improving conditions on private lands? The presence of the National Forests in most parts of this region gives fairly good fire protection to adjoining private lands. But there should be better fire protection outside of the National Forests. This is a matter of State activity and could easily be arranged by co-operative agreements for expense sharing.

An important part of the work of fire protection is disposal of slash. The method known as lopping and scattering although fairly cheap, greatly increases the fire hazard in the few years before the yellow pine brush, which is so resinous, rots away. The stands are too open and the snow too irregular to permit burning of green brush in winter as the trees are cut. Experience proves that the best method of brush disposal in this kind of timber consists of (1) trimming the tops of the trunks so that they will fall flat on the ground where they will rot rapidly, (2) piling the brush away from living trees. This costs 35 or 40 cts. per acre, a sum that compounds at 4% to $1.20 in 20 years, 20 years being probably the longest interval between cuts under conservative management. As the growth of timber in 20 years is worth about $6.00 per acre, the cost of piling brush is within the bounds of financial practicability. It is important to have the tops of the trunks left flat on the ground where they will rot quickly because these snags are dangerous in fires on account of their spark-emitting capacities. Much latitude is allowed in the shape and size of brush piles provided they are not close to living trees. After the brush is dried a little, the loosest piles will burn hotly. The danger in all methods of brush disposal is that more stress be put on the neat appearance of the woods than on the economy and efficiency of the method for protective purposes. As a matter of fact, it is not important that the brush piles be burned. The prime advantage of piled brush is that it gives space for making a stand against fire. On the Manitou Park Reserve some brush has been burned for purposes of instruction.

Taxes are not excessive in this region. They do, of course further too early cutting. A tax on logs at the time of cutting would be an improvement over the present system of taxing standing timber.

Competent technical advice is necessary for both adequate fire protection and for tax revision. If the state wishes to maintain the population and industries of its forested district, it should undoubtedly give technical advice free to all who may be interested in forestry. Free technical advice is the first step towards better methods of cutting. Fortunately these smooth, brush-free lands can be logged as cheaply for a portion of the stand as for the whole, except in so far as more frequent mill-sets are necessitated. That permanance of industry and of population are worth while, need not be argued with any who is familiar with the demoralization in decadent mining and lumbering camps.

CURRENT LITERATURE.

Identification of the Economic Woods of the United States. By Samuel J. Record, Assistant Professor of Forest Products, Yale University. New York. John Wiley & Sons, 1912, 8vo. vii, + 117 pages, text figures 15, half-tone plates 7. Price $1.25.

This is a timely book got up in first class style, which aims to give the much needed help to teachers of wood structure and to students of forestry. Also, the book may well serve as a guide for the lumberman or wood user who wishes to get acquainted with the characters helpful in distinguishing the chief commercial woods. A book of this character has long been needed, and the wonder is that the need has not been met before this time.

The book is divided into two parts. Part I contains, among other matter, excellent and helpful chapters upon vessels, tracheids, wood fibers, wood-parenchyma fibers, pith rays, and resin ducts. The physical properties of wood are treated under the headings of density and weight; shrinkage, warping and checking; hygroscopicity; penetrability; conductivity; resonance; color; gloss or lustre; scent or odor; and taste. The author does not dwell upon a discussion of general detail, nor has he pet theories to exploit. On the contrary he condenses the material as much as possible, consistent with clearness, the idea being to furnish the student with helpful information concerning the structure of wood and to emphasize points of differences. A thorough knowledge of the subject set forth in Part I is essential to the full understanding of the key which constitutes Part II.

In the key, on the other hand, there has been no attempt at brevity. Instead, all or most of the important characters are given, since in practice it is the use of several features taken together rather than one alone that makes identification sure. The key, being descriptive, points out the structural properties of the woods and compares them. This allows any wood to be contrasted or compared with another wood in any part of the key. It also permits the rearrangement of the key, in the event anyone wishes to make use of only a portion of it, as well as allowing the introduction of new woods. The fact that gross characters are used as far as possible should appeal to the layman who may omit the microscopic features entirely and still be able to identify a large number of our native woods. The letters placed after the names in the key indicate in a general way the range of the species, and this often helps in separating the woods, if the structural characters are not sufficiently distinct to make identification certain.

Whether for educational purposes or practical use it would have been preferable to give separate keys for genera and for species is a question which may be settled by use of the present key.

The principal use of the key, however, is in forest school laboratories. Hand specimens can be taken up and studied in the order given, furnishing a good opportunity to become thoroughly familiar with all of the commercial woods of the United States. The layman may feel that Part I is burdened with the technical names of trees. This criticism could have been avoided by using both common and scientific names in the text. Common names alone are confusing, for the reason that one name is often applied to a great many different woods. Both common and botanical names are given in the key, but elsewhere in the book the reader is obliged to look up the Latin name in the index, and then turn to the key to find the corresponding common name.

There is appended an extensive bibliography made up of books, which will be very helpful to those who wish to refer to a more complete discussion of certain woods. Not only are the most familiar books cited, but also a large number of more or less obscure works which offer excellent means for further reading of a more technical character. A number of the German and French works named are not readily accessible, however, and can be of use only to the few who are favorably situated near large libraries.

The illustrations are numerous, wisely chosen, and well executed. The pen drawings of the microscopic structures, though diagrammatic, are excellent, and all the half tones are clear. In addition to the valuable plates showing transverse and longitudinal sections of the chief commercial woods, is a small map of the United States showing the natural forest regions. A slight error occurs in the legend to the frontispiece, where the large ray is described as on the "left" instead of the right side.

Another minor mistake, which we mention to have it corrected in the next edition, is the name of "soft wood" on page 78 instead of in one word to correspond with Hardwood on p. 87.

This book will do its greatest service in helping teachers and students to observe in the most logical manner the principal facts and characters used in identifying our timbers of commerce. It is especially important because the author has gleaned and brought together into one key information which is so widely scattered in trade and technical papers as to be inaccessible to most teachers. It may be confidently predicted that it will be found very serviceable in all our forest schools.

C. D. M.

Earth Worms and Their Allies. By F. E. Beddard.
The Natural History of Clay. By A. B. Searle.
The Migration of Birds. By T. A. Coward.

These handy little volumes of less than 200 pages 12°, at 40 cents per volume form part of a series—The Cambridge Manuals of Science and Literature—have just come from the press of Putnam's Sons. They are commendable in giving in condensed form, written by British experts, in simple language yet with scientific accuracy, the essential information on each subject, for laymen not only but also for those who have need of acquaintance with the subject in their professional work and wish a quick reference. The value of the booklet is increased not only by good indexes, but by lists of literature referring to the subject.

We regret, however, not to find in the volume on Earth worms a chapter devoted to their usefulness in influencing soil structure, etc., the volume being entirely devoted to their natural history and distribution. Similarly the volume on Clay is written rather from the standpoint of the use of the material in keramic art and brick making, the author being professor in that subject, than from the point of view of the ecologist, although in the chapter on Clay and Associated Rock brief references to agricultural value of various clay soils are made. In other words, the subjects are treated from a limited point of view, which in the small compass was perhaps a necessity.

The bird volume, being limited by its title, is most satisfactory and interestingly written.

B. E. F.

Logging and Lumbering, or Forest Utilization. A text book for forest schools by C. A. Schenck, Director, Biltmore Forest School. Pp. 189. Ilus. Price $5.00.

A highly illustrated volume in two parts; namely Logging Operations and Manufacture of Wood-Goods.

Under the head of Logging Operations the author treats, in a brief way, of the various methods and equipment used in the harvesting of timber. Under the head of Manufacture of Wood-Goods there is a discussion of sawmill plants, technical uses of woods, machinery for wood working, veneer, and box, cooperage and vehicle factories; also numerous other plants concerned in the manufacture of minor products. Minor industries also receive consideration. The author does not touch upon the application to forestry practice of the logging methods described but contents himself with a brief discussion of the methods only.

The book appears to be chiefly an elaboration of a previous volume issued some years ago.

R. C. B.

Alumni Reunion, Yale Forest School, New Haven, Dec. 20-21, 1911. Yale University Press, 1912. 107 Pp.

This is a complete report of the proceedings of the first meeting of alumni of Yale Forest School (some 67 present) after an existence of nearly twelve years. The profession at large as well as the school is to be congratulated on the occasion, and on the contents of the volume, not so much for the wisdom which it contains but for the spirit which pervades it. It is naturally to a large extent of a personal character, a record of very informal talks, interspersed with discussions of some technical, some historical, some administrative questions. Its main value, however, lies in the personal and historical side, as exhibiting the early development of the personnell of the profession. It is full of crudities, which might have been edited, but thereby would have been lost the spontaneity of the expressions and the informality.

It is significant to note that two alumni of the ill fated New York State College of Forestry were present, among them the first graduate of any forest school on this continent, and he a professor in the Yale school of the most practical subject, logging. The significance of this last fact comes home to those who recall that the argument for the establishment of the Yale school announced in so many words by President Hadley was that the Cornell school did not teach practical forestry.

B. E. F.

Timber Bonds as Investment Securities. Supplement to Annals of American Academy of Political and Social Science. May, 1912. 80 Pp.

This supplement to the annals is one of unusual interest to foresters inasmuch as it deals with the subject of investments in timber lands. The supplement contains nine articles on various phases of timber bonds, all written by experts in their particular lines. The contents of this interesting number are: "Timber Bond Features", by T. S. McGrath, author of the recent book on Timber Bonds; "The Science of Timber Valuation", by James D. Lacey, of the well known firm of timber estimators with whom there are several technically trained foresters formerly in the employ of the Federal Forest Service; "Questions of Law Encountered in Timber Bond Issues", by Edward E. Bartheil; "Timber Bonds as Investments", by Calvin Fentress; "The Accountant's Relation to Timber Bond Issues", by Arthur F. Jones; "Timber Bonds as Legal Investments for Michigan Savings Banks", by W. A. Hamlin; "The Timber Cruiser: His Relation to Timber Bonds", by Thomas R. Cummins; "Timber Bonds as Investments for Insurance Companies", by William K. Hoagland; "Waste Material as a Source of Profit and Added Security on Timber Bonds", by W. J. Cummings; altogether the volume will be of decided interest to American foresters and can be read by them with both interest and profit since it deals with very important business questions intimately related to the profession of forestry and too often slighted in the past by the strict silviculturist.

J. D. G.

The Forest Club Annual, Volume IV, 1912. The University of Nebraska. 159 Pp.

This publication emanating from the students' organization of the forest school of the University of Nebraska contains a number of very interesting articles worthy of a wider circle of readers than are likely to be reached. The papers are furnished, we take it, mostly by outsiders.

Mr. Sampson's article on grazing investigations undertaken by the Forest Service sheds light on the importance of these investigations as regards the future both of the range and the forest. So far, it appears the reproduction of Sugar Pine and Western Yellow Pine is not seriously affected by the presence of sheep or cattle. "Where serious injury has resulted it is rather due to faulty handling, such as premature grazing and overgrazing." Indeed as a means of preventing running fires the author considers moderate grazing an advantage.

In a paper enumerating the tree species, native and exotic, to be found in Omaha, the respectable list of 171 appears. Interesting especially is the report of thrifty conifers of considerable height Abies, Cupressus, Dammara, Juniperus, Larix, Picea, in several and Pinus in many species, Pseudotsuga, even Taxodium, Thuya and Tsuga are represented.

The "forest conditions of Northwestern Nebraska" develops the region as a bluff mountain country with pine clad slopes, three types of *Pinus ponderosa* forest, the illustrations reminding one of Rocky Mountain scenery.

Other articles of note are a description of Methods of Reconnaissance, which gives cost of various methods (rather imperfectly); Forest Roads and Trails, also with costs of actual operations, which in the absence of practical literature on the subject is very welcome; Some Permanent Sample Plot Studies, bringing interesting data in Jeffrey Pine and White Fir reproduction; and Notes on Bark Structure, by Theodor Krueger, which has also appeared as a separate. Several other readable articles complete this very commendable volume. A list of 47 alumni of the forest school is added.

B. E. F.

Eleventh Annual Report of the State Board of Forestry of Indiana, 1911. By Chas. C. Deam, Secretary. Indianapolis, 1912, pp. 372, Ill.

The actual report of the State Forester of Indiana covers a scant 20 pages. The bulk of the book (272 pages) is devoted to a compilation of data regarding the trees and larger shrubs of the state. There are also special articles on, "Some Features of the Climate of Indiana" (pp. 49-58); "A Preliminary Report of the Wood-Using Industries of Indiana" (pp. 59-66) based upon fragmentary and very inadequate returns from a number of the smaller concerns; "The Rate of Growth of Certain Species of Native Trees of the State Reservation" (pp. 67-85), a contribution of considerable merit. In addition, there are four prize essays by school girls on the subject "To What Extent Should Indiana be Reforested?"

The annual appropriation of the General Assembly in 1909 for forestry purposes was $6,858.28, of which $3,000 was for the forest reservation. This reservation consists of 2,000 acres located in the extreme southern part of the state. Most of the work of the State Forester is devoted to the management of this tract, leaving practically untouched the essential forestry problem in Indiana—the woodlot.

While in general, a state policy of purchasing lands only suited for forestry purposes is to be commended, the way in which it has been applied in Indiana is regrettable. Small demonstration state forests, one or more located in every county would be far more suitable for an essentially agricultural state, than the present arrangement of one relatively large reservation located in a section where the forestry problems are far from average for the entire state.

A sounder policy must be inaugurated and less time and money spent on such trifling investigations as experiments to "determine the periodicity of growth" and "whether the lobing of the catalpa leaf has a specific significance, and to what extent the lobing is influenced by cultivation, pruning, and the age of the tree", before the state forestry work in Indiana can compare favorably with similar work elsewhere.

R. C. H.

Wood-Using Industries and National Forests of Arkansas. Part I—*Uses and Supply of Wood in Arkansas,* By J. T. Harris and Hu Maxwell; Part II—*Timber Resources of the National Forests in Arkansas,* by Francis Kiefer. Bul. 106, U. S. Forest Service, Washington, D. C. 1912, pp. 40.

This bulletin illustrates the great difficulty of obtaining accurate and reliable data from manufacturers through correspondence alone. "Fifteen oaks grow in Arkansas, but the manufacturers reported only two, white and red. The State has half a dozen species of hickory, all of commercial importance, but all are grouped as one; three kinds of maple are cut, but are sold as one; three or four of ash, but only one is recognized in the market; but not one manufacturer reported loblolly pine though a comparatively large amount is cut in Arkansas."

Blunders have crept in here and there in reference to the occurrence of pines in Arkansas. For example, longleaf is credited with a large stand and yield, when as a matter of fact the species is not found within the State at all. The writers seem under the erroneous impression that Cuban pine is indigenous to the State and predict a possible future for this coastal species.

While loblolly pine is not considered important enough to warrant a descriptive paragraph, although 27 other woods are so distinguished, it is a well-known fact that this tree is the most important pine in the southern half of the State. As one approaches the Louisiana line he finds that the proportion of the total stand made up by loblolly is 70 per cent. or more. This directly challenges the statement on page 24 of this report: "It (loblolly pine) may do well in Arkansas, but has not yet done so."

"The total annual drain upon the forests of Arkansas is not much, if any, short of 5,000,000,000 board feet. Latest returns credit the State with a lumber output of 2,111,300,000 feet; cooperage, lath, veneer, shingles, etc., 114,312,000 feet; firewood, 2,581,674,000 feet; and crossties, poles, cross arms, and wood distillation unknown. The enormous quantity of forest material annually supplied by Arkansas is not exceeded by that of more than two or three other States."

Part II deals with the timber on the National Forests of Arkansas and the means of purchasing it. It is well written and contains a great deal of definite information of much value to prospective purchasers. Having been prepared by one thoroughly familiar with actual conditions and based upon careful surveys and field studies this part of the bulletin may be considered thoroughly reliable.

S. J. R.

Strength Tests of Cross-Arms. By Thomas R. C. Wilson, Cir. 204, Forest Products Laboratory Series, U. S. Forest Service, Washington, D. C. 1912, pp. 15.

Tests were made on 84 six-pin cross-arms $3\frac{1}{4}$ x $4\frac{1}{4}$ inches by 6 feet. This number was made up of seven groups and comprised four species: Douglas Fir, Shortleaf pine, longleaf pine, and southern white cedar.

"In nearly all cases the principal failure was at the first pin-hole from the center, though in many cases the first failure was apparent as a cracking at the center bolt hole. In view of these facts it is recommended that, in grading or selecting arms, particular attention be given to defects near the center or the first pinholes. Knots on the upper sides of the arms at these points are especially to be avoided."

"All points considered, cross-arms of the species and the dimensions tested are strong enough for ordinary use; with longer arms the strength is relatively of more importance. With the standard 6-foot cross-arm, however, the question of strength need not enter into calculations of line construction, except in the rare cases of abrupt change of grade. The ability of the timber to resist decay, and methods of preventing decay, are considerations of greater importance."

S. J. R.

Quebracho Wood and Its Substitutes by Clayton D. Mell and Warren D. Brush. Cir. 202, U. S. Forest Service, Washington, D. C., pp. 12, pl. 2.

"Quebracho *(Quebrachia lorentzii* Griseb.) a South American wood yielding a very valuable extract much used in the United States for tanning high-grade leathers, is not the only wood known by the name. Two other and inferior species, *Aspidosperma quebracho-blancho* Schlecht and *Aspidosperma quebracho-colorado* Schlecht, are called white *quebracho, or quebracho blancho',* and red quebracho, or 'quebracho colorado', respectively. These two, however, belong to an entirely different family. *(Apocynaceae),* including the common dogbane or Indian hemp, from the true quebracho, which is a member of the sumac family *(Anacardiaceae).* The name quebracho is derived from two Portuguese words 'quebrar,' meaning break, and 'hacha,' are an allusion to the extreme hardness of the wood. At one time nearly every South American wood that quickly dulled an ax was called quebracho, but to-day the three woods mentioned are the only ones of commercial importance to which the name is applied. This indiscriminate use of the name quebracho naturally has resulted in much confusion regarding the identity, distribution, and uses of these woods, and the purpose of this circular is to give the uses and distinguishing characteristics of each."

The circular concludes with a key for the identification of quebracho wood and its substitutes, and two plates showing photomicrographs of transverse, tangential and radial sections of the wood of quebracho and white quebracho.

S. J. R.

Quantity and Quality of Creosote Found in Two Treated Piles after Long Service. By E. Bateman. Cir. 199, Forest Products Laboratory Series, U. S. Forest Service, Washington, D. C., 1912, pp. 8.

"This circular gives the results of analyses of the quantity and quality of creosote found in two treated piles after long service. The piles were of pine (probably longleaf), and had been in the teredo-infested waters of the Gulf of Mexico for about 30 years.

One was perfectly sound, but the other had been attacked, particularly at the water line. The analyses were made to determine whether the difference in the durability could be accounted for by a difference in the amount or character of cresote in the wood.

"The piles had been treated by the old Bethell process, but no treating records are available, nor is it known where the creosote was obtained."

"Practically no light oils (oils distilling below 205° C.) were found in the piles after their long period of service. If originally present, they were lost by volatilization and leaching.

"The creosote in the pile which was perfectly preserved contained originally at least 40 per cent. of napthalene fractions, a large proportion of which remained in the wood. The creosote in the pile, which was less perfectly preserved, contained little or no napthalene.

"The pitchy matter, which on distillation formed the residue above 320° C., is seemingly of an inert character and little objectionable to the teredo. A heavy treatment with creosote consisting largely of this material did not entirely save the pile from attack.

"Loss of oil from that portion of the pile in the water, in the case of the creosote in pile No. 1 [the one that was not attacked]. which is a pure coal-tar creosote, apparently occurred only in the fraction distilling below 225° C."

S. J. R.

Second Growth Hardwoods in Connecticut. By Earl H. Frothingham, Bul. 96, U. S. Forest Service, Washington, D. C., in co-operation with the Conn. Agr. Exp. Sta., 1912, pp. 70. Ill.

"In dealing with forests among the essential things to know are the rate at which they grow, the value of the standing timber for different uses, and the method of management which will give the maximum yield of the most valuable material in the shortest time. To tell these things for the forests of Connecticut, especially for the predominating types—second -growth chestnut, oak, and mixed hardwoods—is the purpose of this bulletin."

This purpose is well carried out in the publication which is divided into four parts as follows:

Part I, Present Forest Conditions in Connecticut.

Part II, Market Conditions, Logging Cost, and Value of Standing Timber.

Part III, Yield of Different Forest Types.

Part IV, Methods of Management.

It may occasion surprise to those familiar with Connecticut's thickly settled condition and enormous manufacturing interests to learn that over one-third of the state, due to poor soil or broken and steep topography, is unsuitable for agriculture. The forests are divided into swamp and upland types, the latter being of chief importance. Among the upland types, even-aged hardwood occupies the dominant position and it is with this type that this bulletin chiefly deals, although Part II contains much information of value in connection with other forest types.

Parts II and III and the appendix are replete with tables giving volumes, yields, and various cost figures. These should prove of great assistance to all foresters working in Connecticut, and while in some cases they are rather too involved for general use by the layman, on the whole they will be of material service to the farmers and woodland owners. It is the opinion of the reviewer, judged entirely by personal experience, that the yield tables for the oak type are based upon too narrow range of soil qualities and do not fairly represent third-quality soils, the yields given being too high.

Under methods of management, clear cutting with sprout reproduction (coppice system), and the pole-wood sprout system are recommended. Where too far from markets to dispose of small trees, the cutting of the larger ones only is advised, being in effect a rough selection system.

Not enough emphasis is placed on the advisability of changing the hardwoods type to mixed hardwoods and conifers, or to pure conifers. Such a change from the slow-growing hardwood species affording at best a relatively low yield per acre, to fast-growing stands of conifers with large yields per acre must, in the opinion of the reviewer, take place before the business of growing trees will be an attractive investment for the people of Connecticut.

This bulletin is one of the best that the Forest Service has issued in recent years both in the quality of the work upon which it is based and in the probability of it being of practical value to a large number of people.

R. C. H.

Forestry: an Elementary Treatise. By Hermann H. Chapman. American Lumberman, Chicago. 1912. Pp. 79. Price $1.25.

A volume covering in a very elementary way the broad field of forestry. It will be of interest to beginners in forestry, for it discusses in a simple, brief way some of the phases of forestry science.

The Logged-Off Lands of Western Washington. By H. F. Giles. Published by Bureau of Statistics and Immigration, State of Washington. Olympia. 1911. Pp. 71, illus., 1 map.

A brief recital of the agricultural possibilities of cut-over lands in the state.

Key to the Wild and Commonly Cultivated Trees of the Northeastern United States and Adjacent Canada. By J. F. Collins and H. W. Preston. New York. 1912. Pp. 184. Price 40 cents.

This book is to serve as a guide for the layman who wishes to distinguish the trees. It is based primarily upon leaf characters, to which the authors adhere consistently throughout, using other characters as seldom as possible, though in some cases their means of separation ("ear marks") would be easier for the unscientific reader. The key is well arranged, well balanced in detail, free from technical terms, etc., very satisfactory to the user in the directions with which he can determine the species.

The book deals with 211 species, illustrated by 279 cuts of leaves and bark. It is of handy pocket style and should prove a popular guide.

J. H. W.

OTHER CURRENT LITERATURE.

Fire Warden's Hand Book. Oregon's Forest Fire Laws, State Board of Forestry, Oregon, 1912. Pp. 45.

The Wood Using Industries of Tennessee. By Clark W. Gould and Hu Maxwell, U. S. Dept. of Agriculture. Reprint for Southern Lumberman, Nashville, Tenn. May 25, 1912.

Price List of Philippine Photographs for Sale by the Bureau of Science. Manila, P. I. (Effective Feb. 1, 1912.)

Contains a few photos of scences of interest to foresters. The majority deal with the native people and their customs.

Forest Products of Canada 1911, Pulpwood. By H. R. MacMillan assisted by E. G. McDougall and W. Guy N. Boyce. Dept. of the Interior, Canada, Forestry Branch. Bulletin No. 30. Pp. 17. Ottawa, Government Printing Bureau, 1912.

The Classification of the Black Oaks. By William Trelease. Reprinted from Proceedings of the American Philosophical Society, Vol. LI, No. 204, April—June, 1912. Pp. 167-170. Plates X to XIII.

A brief classification to "illustrate the synthesis of generic concepts out of specific characters."

The Conservation Law in Relation to Fish and Game as amended by the Legislature of Nineteen Hundred and Twelve. Pp. 284. Albany. J. B. Lyon Company, State Printers, 1912.

A booklet containing the State laws relating to forest, fish and game.

Reforesting Waste and Cut Over Lands. Circular No. 2, New Hampshire Forestry Commission. March, 1912. Pp. 4.

Contents:

- State Forest Nurseries.
- Kind of Trees to Plant.
- How to Secure Trees for Reforesting Land.
- List of Trees That Can be Obtained from the Forest Commission.
- Reforesting Operations.

Laws of New Jersey Relating to Forestry. Forest Park Reservation Commission, State House, Trenton, 1912. Pp. 35.

Proceedinsg of the Forestry Association of Vermont, 1911. Burlington, Vt. Free Press Printing Co., 1912. Pp. 31.

Contents:

Forestry in its Relation to the Farmer and the State.

Is State Control of Private Forests Desirable?

A Summer School of Forestry and Horticulture to be held at The Downer State Forest, Sharon, Vt., under the direction of the State Forester in co-operation with the University of Vermont and State Agricultural College, Aug. 13th to 24th inclusive, 1912. Forest Service (Vt.) Publication No. 10, April 1912. Pp. 10. Illus.

Vermont State Forest Service, Burlington, Vt.

Forestry Card No. 9, *Yellow Birch Volume Table.*

Forestry Card No. 10, *Beech Volume Table.*

Forestry Card No. 11, *Value (f. o. b.) of Second Growth White Pine.*

Forestry Card No. 12, *Accumulation of Taxes on a Pine Forest.* Issued May 1, 1912.

Experiments with Jack Pine and Hemlock Mechanical Pulp. By J. H. Thickens. U. S. Dept. of Agriculture, Forest Service. Forest Products Laboratory Series. Issued June 11, 1912. Pp. 29. Plates XV.

Description of methods and equipment used, and results secured. Samples of paper with these species used in various mixtures, accompany the report.

The Blue Pine "Polygraphus" Bark Borer. Leaflet No. 5. Series Forest Zoology. Issued in February, 1910. Calcutta. Supt. Government Printing, India. Pp. 7. Illus.

Trees of the Tasmanian Forests of the Arden Myrtaceae. The Genus Eucalyptus. By L. Rodway. Bull. No. 17. Agricultural and Stock Dept., Tasmania. Pp. 15.

New York State College of Agriculture, Announcement for

1912-13. Aug. 1, 1912. Published by Cornell University, Ithaca, N. Y.

Contains the prescribed course of study in the new department of Forestry.

Notes on Bark Structure. By Theo. Krueger. Reprinted from Forest Club Annual, University of Nebraska. Vol. IV. 1912.

Contains a discussion of bark stucture in general, and also for specific genera with a key for the identification of several genera.

Report on Platt and Wind Cave National Parks, Sullys Hill Park, Casa Grande Ruin, Muir Woods, Petrified Forest, and other National Monuments, including list of Bird Reserves. 1911. Compiled in the office of the Secretary of the Interior, Washington, Government Printing Office, 1912. Pp. 46. Illus. Maps.

Brief facts in regard to the establishment of the various National Monuments mentioned, and mention of some of the features of interest in them; also regulations governing their use.

Methods of Clearing Logged Off Lands. By H. W. Sparks. State College of Washington, Pullman. Bulletin No. 101. 1911. Pp. 28. Illus.

Contents: Methods of Burning Logged Off Lands; The Char pit Method of destroying Stumps; Results of Experimental Work; Directions for using Char pit Method of destroying Stumps.

Insect Damage to Mine Props and Methods of Preventing the Injury. By T. E. Snyder. U. S. Dept. of Agriculture, Bureau of Entomology. Circular No. 156. Issued July 13, 1912. Pp. 4.

Contents: Injury to unbarked, round, and split props before placement in the mine; Injury to props after placement in the mine; Prevention of injury before placement in mine; Prevention of injury after placement in mine.

Second Growth Hardwoods in Connecticut. By Earl H. Frothingham. Bulletin 96, U. S. Forest Service, Washington, D. C. 1912. Pp. 70. Illus.

An excellent publication dealing with the present conditions of the timber resources of the state, local market values of forest products, value of standing timber, yield, and management of the forest. An appendix contains volume tables for cordwood, lumber, ties, and poles.

Utah Juniper in Central Arizona. By Frank J. Phillips and Walter Mulford. Cir. 197, U. S. Forest Service, Washington, D. C. 1912. Pp. 9. Illus.

Contents: Distribution; Silvical Characteristics; Growth; Volume; Utilization; Management.

Commercial Creosotes with special reference to protection of wood from decay. By Carlisle P. Winslow. U. S. Forest Service. Circular No. 206. Issued July 18, 1912. Pp. 38. Illus.

A discussion of the source of creosote, compositions and properties of the various creosotes, prices and consumption.

Bark-Boring Beetle Attack in the Coniferous Forests of the Simla Catchment Area, 1907-1911. By R. S. Hole. Forest Bulletin No. 10, Calcutta. Superintendent Government Printing, India. 1912. Pp. 21.

A Further Note on Some Casuarina Insect Pests of Madras. By V. Subramania Iyer. Forest Bulletin No. 11, Calcutta. Superintendent Government Printing, India. 1912. Pp. 9. Ill.

Commercial Guide to the Forest Economic Products of India. By R. S. Pearson, Calcutta. Superintendent Government Printing, India. 1912. Pp. 155. Ill.

Assistance to Private Owners in the Practice of Forestry. Cir. 203, U. S. Forest Service. Washington, D. C. 1912. Pp. 8.

Cost and Methods of Clearing Land in Western Washington. Bulletin No. 239, Bu. Pl. Industry. Washington. 1912. Pp. 60. Ill.

Evaporation from Irrigated Soils. By Samuel Fortier and S. H. Beckett. Bulletin 248, Office of Exp. Sta. Washington, D. C. 1912. Pp. 77. Ill.

The Wood-Using Industries of Michigan. By Hu Maxwell, U. S. Forest Service. Pub. by Public Land Domain Com. & the Land Office of the State of Michigan.

New Jersey Forest Fire Manual. By Forest Park Reservation Commission. Trenton, N. J. 1912. Pp. 38.

The Preservation of Mine Timbers. By E. W. Peters. Bulletin 107, U. S. Forest Service. 1912. Pp. 27. Ill.

Notes on the Antiseptic Treatment of Timbers in India, with special reference to Railway Sleepers. By R. S. Pearson, Indian Forest Record, Vol. III, Part II. Calcutta. 1912. Pp. 107. Ill.

Canadian Forestry Association *Brief Report of the Thirteenth Convention and Annual Meeting held at Ottawa, Feb. 7-8, 1912.* Pp. 20.

Forests and American History. By Hugo Winkenwerder. Reprint University of California Chronicle, Vol. XIV, No. 2. 1912. Pp. 30.

Reafforestation and the Hardwood Supply (In Relation to North Coast Forests). By E. H. F. Swain, District Forester, New South Wales. Sydney. 1911. Pp. 8.

Studies in Soil Physics. By E. E. Free. Reprint from the Plant World, Vol. 14, Nos. 2, 3, 5, 7, 8. 1912. Pp. 42.

Forestry Annual, The Penn. State Farmer. Vol. V, No. 5. May, 1912.

Ray Tracheids in Abies. By W. P. Thompson. Reprint Bot. Gazette, Vol. LIII, No. 4, April 1912. Pp. 331-338. Ill.

Protest Against Further Diversion of Water from Lake Michigan for the Chicago Drainage Canal. By Com. of Conservation, Canada. Presented at Washington, D. C., March 27, 1912. Pp. 27.

Sixth Annual Report of the Commissioner of Forestry made to the General Assembly at its January session, 1912. By Jesse B. Mowry. Providence, R. I. 1912. Pp. 35. Ill.

Trees and How to Know Them. By W. A. Lambeth. Atlanta, Ga. 1911. Pp. 52. Figs. 48.

Trees and Forestry. By Mary C. Dickerson. Guide Leaflet 32, American Museum. Nat. History. 1910. Pp. 104. Pl. 1. Figs. 77.

The Distribution of Woody Plants in the Pikes Peak Region. By E. C. Schneider, Sci. Ser. 12, No. 6. Colorado College. 1909. Pp. 137-169. Map 1.

PERIODICAL LITERATURE.

BOTANY AND ZOOLOGY.

Limits of Distribution of Species

On not less than 67 pages, Prince Windisch-Graetz tries to re-establish the original field of distribution of *Abies pectinata*, which through human influence has been greatly altered; and that curiously enough in the direction of reducing it, although this species excels in quantitative production, in resistance to wind and snow, insects, and in soil improving qualities. Naturally, a good deal of economic history is involved in the discussion and the author has with much care and detail brought together what is known in the present and past of this species.

We are not interested in the detail, but a few of the results of the study are of general interest. The idea that the fir at its limit gives preference to certain soil-formations is not borne out by the facts, but its need of depth and freshness increases at the limits so that at the lower (altitudinally) limit in warm climates it thrives even on wet soils. But here it produces poor growth and is short-lived. As regards aspects, in its optimum it is not choice, succeeding on south slopes as well as on others. But at the limits, in the mountains at 5000 to 5200 feet as well as at 650 to 1000 feet it decidedly avoids south exposures.

The angle of slope has no influence provided there is depth and freshness of soil; on the plain it is only frost danger that circumscribes it.

As cause for the retrogression of the species the author cites especially the clear-cutting system and the acidity of soil, and raw humus formation in consequence of growing extensive even-aged stands, also weed growth, pasture, and damage from game which concentrates on the openings made under the clear-cutting system. Being extremely shade enduring, it is a most desirable species for selection forest management.

This study suggests the propriety of starting with our important species early an inquiry of similar character, while knowledge of the field of original distribution is still alive.

Die ursprüngliche natürliche Verbreitungsgrenze der Tanne. Naturwissenschaftliche Zeitschrift für Forstund Landwirtschraft. April-May, 1912, pp. 200-267.

Periodicity in Life Processes

Two articles based on investigations, are devoted to a discussion of the periodicity of the taking up of mineral salts and the formation of food materials in trees. Kuebler used two-year-old beech, some grown with mineral fertilizer, others without fertilizer. He describes his method of analysis and the weather conditions. During the month of April a loss of dry substance amounting to from 15 to 32% of the various salts in the unfertilized, and from 0 to 30% in the fertilized material. This shows that while outwardly still at rest the chemical processes are by no means stopped, respiration using up reserve materials, sugar and water being the end product. It is suggested that this water may go from the root into the soil. Other chemical processes take place and are explained. After the period of vegetation is ended similar processes take place. During the budding forth of the foliage a further loss from the perennial issues of stem and root is recorded, the roots not being able to supply all the consumption. Hence this part of the growth depends upon the growth conditions of the previous period of vegetation.

Here the difference between unfertilized and fertilized plants appears. Soon after leafing the former are entirely dependent on the soil, having exhausted their reserve material in the formation of foliage, while the fertilized plants, with a considerably larger store of reserve material, produce first a larger amount of foliage and then supply the same with more materials. The former made only 1.8 of foliage per 100 plants, the later 93.4 g, and in addition increased their dry weight by 4%. On unfertilized soil the foliage of the plants represented 16% of the total weight, on fertilized soil 33%, a great advantage for assimilartory activity. From middle of May to middle of July the analyses show relatively little difference in the percentic increase of dry substance, but a noticeable difference in nitrogen contents, the unfertilized plants showing considerably less; and most of it in the leaves, the stem retaining 33%, the root, nothing. The fertilized plants also take up less nitrogen than other salts, half of it in the leaves, and little in the roots.

Only from the middle of July does the fertilizer become effective, a remarkable difference between the two sets of plants being exhibited, the difference in dry substance formed or absorbed in 1000 parts, being as follows:

	Whole Plant.	*Stem.*	*Root.*	*Foliage.*
Fertilized,	683	685	525	328
Unfertilized,	164	147	158	59

Here the practical suggestion as to use of fertilizer suggests itself. A comparison of the two sets of plants showed at the beginning for the unfertilized plants 118g, for the fertilized, 335.5g, the difference of 217.5g being the effect of two years fertilizer. During the year of investigation the following changes took place setting the unfertilized equal to 100:

Before leafing out 100 : 297.
After leafing 100 : 259 (—38).
Middle of July 100 : 317 (+58).
Middle of September 100 : 683 (+366).
End of vegetation 100 : 485 (—198).

It is only after the middle of July that the beech utilizes the fertilizer, and by middle of September it has attained six times the weight of the unfertilized. The greater leaf fall brings about the greater loss of the fertilized specimens. Ample tabulations and diagrams illustrate the detail.

A similar inquiry is made by Bauer on the oak, except that only one set of nursery grown material was analyzed, in addition to his former investigations on Ash, Alder, Maple, Elm, Larch, Spruce. In all these species as long as loss by respiration was demonstrable this loss was supplied by the root much more than by the stem, so that this may be assumed as a law. The root respires, but does not assimilate, hence this loss. The same progress of changes in substance as in beech is noticeable, except in those oaks which have August shoots. These produce a secondary annual ring as is well known, and also a repetition of the cycle of weight production which is exhibited through the season by those trees who do not form these autumn shoots. There is, however, a variation in detail: while in the spring as regards potash and phosphoric acid absorption is negative and of nitrogen unusually large, after the autumn shoot the former culminate and nitrogen becomes almost nil. Lime and magnesia behave exactly opposite. The analyses also show that the early foliage is impoverished to furnish the materials for the autumn shoot.

Die Periodizität der Nährsalzaufnahme und Trockensubstanzbildung von zweijährigen Buchen.
Zur Periodizität der Stoffbildung und Nährstoffaufnahme in jungen Laubhölzern.
Naturwissenschaftliche Zeitschrift für Forst-und Landwirtschaft. April-May 1912, pp. 161-199.

Causes of Leaf-fall

That the fall of leaves, which is an annual occurrence in the temperate climates is even here not due to external conditions alone has been shown by Dingler. Observations on trees in Ceylon which regularly shed their leaves (17 species out of 280) show that they lose their leaves mostly in January or February, shortly before the dry hot season of Februay and March, sometimes as early as December. In April they bud again. Trees pruned in October in the botanical garden, however, retained the newly formed foliage through the dry period, and even in May were still in full foliage, while all the specimens of the same species which had not been pruned lost their foliage and remained naked during the dry season. From this again the deduction is made that the exterior conditions which the dry season brings is not the immediate cause of the normal leaf-fall of these trees.

From Naturwissenschaftliche Rundschau in Centralblatt f. d. g. Forstwesen April 1912, p. 196.

"Cellar-Fungus" Coniophora Cerebella

Wehmer amplifies his brief 1910 article on this subject by a comprehensive description of the development peculiarities of *Coniophora cerebella* A. & S. as compared with other wood-destroying fungi found in buildings. He shows that the ability of Coniophora to produce abundant aerial mycelium in unventilated places is a diagnostic character of the fungus. When a culture in an ordinary test tube plugged with cotton is placed in a vessel sealed from the outer air the fungus at once grows up through the cotton plug and out into the larger vessel, where it continues to grow over any object within reach, and even attacks and decays air-dry wood under such circumstances. If other tubes of different fungi be present Coniophora will grow down through the plugs of such tubes and contaminate the cultures and gradually replace them. The essential feature is that the air in the larger vessel be stagnant.

Since other fungi, such as *Merulius lachrymans,* etc., do not behave in this manner, in doubtful cases this character is often as good as microscopic distinctions. In the civil suits which frequently arise in Europe over the decay of building timbers the determination of the causal organism is of prime importance. As Coniophora commonly remains sterile in buildings, it was formerly often taken for *Merulius lachrymans,* and so reported. Only within the past few years has it been properly identified with serious decay in such structures, both on upper and lower floors. At the present time it seems to be notoriously frequent. It only requires a little moisture and stagnant air to produce a destructive rot of conifers and certain hardwoods, avoiding oak. Whenever a sufficient circulation of air is admitted around the decaying timbers so that they dry out, the author affirms that the fungus is killed in a short time.

Kulturen einiger Holzpilze, Merulius lachrymans Coniophora cerebella, und Polyporus vaporarius. Jahresbericht. Vereinigung angew. Botanik. 8: XIX-XX. 1910.
Hausschwammstudien. I. Zur Biologie von Coniophora cerebella A. et S. Mycologisches Centralblatt. Feb. 1912. 2-10, figs. 1-4.

SOIL, WATER AND CLIMATE.

Lime Soils and Vegetation

According to Dr. Schwarz, the first botanist to bring flora and soil into relation was Franz Unger in the thirties of last century, who divided plants into *bodenvage* (vague as to soil relations), *bodenholde* (having preferences for certain soils), and *bodenstete* (dependent on given soils). The latter class is rare; but there are plants which avoid lime (calcofuge) soils, and those which prefer them (calcophil). The need for lime is, however, a very variable one even in these latter and these may occur also on sandstones, etc.; the preference becomes first visible when competition of plants enters into the problem. If *Rhododendron hirsutum and ferrugineum* occur in a region together, the first is found only on lime, the second on lime-poor soils; if, however, only one of them is endemic, it occurs on either soil.

There must be recognized the indirect effect of lime on the soil, and the direct effect on the life processes of the plant. Carbonate of lime has most significant influence on physical and chemical conditions of soil and its presence expresses itself in the vegetation directly. The detail of this influence of carbonate of lime is discussed: it counteracts acidity; it influences solubility of other important minerals; it promotes granular structure and thereby moisture conditions favorably; it promotes greatly activity of bacteria and prevents formation of dry turf and promotes favorable humification. Every lime soil is, however, not rich in carbonate of lime, and hence does not exhibit these advantages.

As regards the direct influence of lime on plants, there is still more hypothesis than demonstrated fact to be had, some investigators trying to establish such a direct relation, others considering the influence entirely indirect. Gràbner's hypothesis divides plants into entrophic and oligotrophic, i. e. those making large requirements on minerals and those having a small requirement, and asserts that lime soils abound also in other minerals, hence entrophic plants are found on lime soils. But the assertion of the presence of large quantities of minerals in lime soils does not always coincide with facts.

All plants need lime for their development, although according to Hausteen much less than other minerals. Indeed, some fungi and algae can dispense entirely with it. Even calcofuge plants like *Pinus pinaster* and *Castanea vesca* absorb considerable quantities of lime. Only these calcofuge plants are more easily injured by excess of lime. Kerner's experiments are convincing in this respect. The investigations of the behavior of sphagnum species, which are considered most calcofuge, by several authorities are contradictory, but it would appear that the degree of acidity stands in relation to the sensitiveness to lime reaction. Apparently the presence of potash also has an influence upon the effect of lime. Engler is cited with the statement that calcofuge Castanea thrives on very limy sandstones and marl, if these are rich in potash or silicates rich in Kalium. On the other hand, lime may counteract the poisonous effect of magnesium and potash salts. Apparently all the evidence seems to show that not the quantity of lime present but the relation of lime to other minerals is the important feature determining its effect. According to Loew, Cryptomeria, Thuya, *Pinus densiflora* succeed in limestone if the quantities of magnesia present are small; and the favorable relation of these varies with different plants.

Lime under circumstances impedes water absorption considerably, whereby also the absorption of minerals is changed. Altogether, the lime problem remains still unsolved.

An interesting statement, which lends color to the assertion of the reviewer—that the physical condition of most limestone formations in connection with the root system has at least for arborescent forms the most important influence—is that the calcofuge Chestnut will grow well on limestone if grafted on oak roots.

Einfluss des Kalkes auf das Wachstum der Pflanzen. Zeitschrift für Forst-und Jagdwesen. May, 1912. Pp. 316-330.

SILVICULTURE, PROTECTION AND EXTENSION.

Type Classification

In a book of 115 pages, Professor Cajander, of Helsingfors, proposes to make the three following main forest types for Germany named after prominent plants in the ground cover:

1. Oxalis type.
2. Myrtillus type.
3. Calluna type.

Subtypes under each type are distinguished which are to be made the basis for description and management, and especially for the construction of yield tables, each type varying in regard to increment while also a maximum height in each is typical.

Ueber Waldtypen. Forstwiss. Centralblatt. Feb., 1912. Pp. 99-102.

Effect of Moss on Increment

A three year experiment by Bôhmerle to determine whether the removal of moss would effect tree growth gave the result that, in the dry year 1908, the plots on which the moss had been killed and burned over showed considerably better increment than the plot with the ground cover undisturbed. Hence periodic removal or deadening of moss cover is advocated.

Moosdecke und Holzzuwachs. Forstwiss. Centralblatt. Feb. 1912. Pp. 110-11.

Humus and Soil Preparation for Planting

Through the efforts of Professor Moeller and demonstrations at the experiment garden of the mycological laboratory at Eberswalde a revolution in the practice of planting pine and in the appreciation of the value of raw humus (dry turf) has been brought about. Ten years of repeated experiments have proved that "the method of planting pine in furrows turned over by the forest plow is extraordinarily bad, yea nonsensical; and that it is a mistake anywhere to make seedbeds on turned over soil so that the surface soil of 4 inches consists of non-humose sand, although this furnishes a beautiful bed for manipulation."

The most satisfactory tool, which, at no more expense than a turning plow, mixes humus and soil perfectly is Geists's Wuhlgrubber (mole plow; see F. Q., vol. VII, p. 339). That even the worst form of raw humus under proper conditions can be used as fertilizer for conifers with an effect which no other fertilizer can produce has been amply demonstrated (see F. Q., vol. VI, p. 291).

The use of the humus fertilizer in seedling nurseries, as well as field plantations, avoiding the use of plows has in Eberswalde produced the result, that the size of plants which formerly anywhere would have been considered extraordinary have become mere average plants.

Demonstration und Vortrap im Versuchsgarten, etc. Zeitschrift für Forst-u. Jagdwesen, May, 1912. Pp. 330-332.

Testing Pine Seed

In an exhaustive report (also appearing as a separate) from the Mycological Laboratory at Eberswalde, comprising not less than 65 pages, Oberfôrster Haak discusses in detail the conditions and results of a series of most careful investigations to determine methods of testing Scotch Pine seed; much of this presumably can be utilized for other species.

He starts out with the statement that in former investigations (see F. Q., vol. V, pp. 204 ff.) it was proved that the *actual use value of pine seed increases and decreases in much more rapid progression than the germination per cent. indicates.* A similar indication was worked out with spruce. In this latter experiment the following results were recorded:

I. Sandsoil.

Seed *Number*	*Germination per cent.*	*Plant Per Cent.* *Under Favorable Conditions*	*Under Unfavorable Conditions*
2000	38	7	5
4000	68	21	12
8000	91	55	26

II. Loamsoil.

10,000	30	14	
30,000	75	42	
10,000	80	48	
40,000	84	57	

The practical importance of this fact and the practical objection that seed tests are notoriously uncertain, which the author flatly negates, justify the careful investigation into the factors influencing germination tests and results. The Prussian and Württemberg forest administrations insist upon making the germination per cent. a basis for price.

The long but highly interesting detail of the expose is divided into seven sections, besides the summary.

1. Influence of the season on the results of germination tests; 2. Influence of moisture; 3. Influence of temperature; 4. In-

fluence of light, in which the question of light and dull days, artificial and natural light, color of light, intensity and duration are subdivisions; 5. Influence of certain chemicals; 6. Time required and method of stating test results; 7. Amount of inevitable errors, which section is considerably elaborated on the mathematical side.

Four hundred different experiments with 160,000 grains have given the basis of the following practical conclusions.

1. A reliable test, always giving the same result, of pine and spruce seed is possible in any season provided that always the same conditions of moisture, temperature and light are given.

2. The base for the test (filter paper best) must not be too small, at least 50 *sq. cm.* for 100 grains. This size prevents danger from infection of sound grains by infected ones and avoids the need of changing the paper during the test.

3. In lower temperatures germination begins considerably later and proceeds much more slowly than in higher temperatures. Otherwise, the same germination per cents. are obtained in either temperature. It is, however, desirable to conduct the test under or near optimum heat when the rapidity of germination is assured and no danger from deterioration in high humid temperature is to be feared. This optimum is not the same with rapidly and slowly germinating seeds, nor with germination in the dark or under light. For pine and spruce, a constant temperature of 25°C is most practical.

If pine (not spruce) seed is exposed to changing high temperatures a stimulus advancing germination is exercised; similar to the stimulus of light, but not so vigorous.

4. In pine seed tests under influence of daylight, the result is sometimes stimulated by the intensity and by the duration of its influence. This influence is not strong, but on short, dull days it must be taken into account. The germination of pine seed is favorably influenced by all rays of the spectrum, least, however, by the short wavy, blue rays. Spruce seed reacts much less to light, and the blue rays are indeed directly harmful. Hence red lights should be used if artificial light is applied. Continuous lighting is not necessary, 8 to 10 hours a day suffices. To be

really effective the intensity must be such as is needed for comfortable reading; beyond this, the intensity has hardly any influence. No difference is observed, if the desired intensity is used, between natural and artificial light, which latter is commendable in scientific investigations and large seed-testing establishments.

For seed tests under natural light, rooms looking north are desirable; on no account should there be a direct sunlight strike the tests, since that excludes control of temperature; glass-covered hothouses are therefore also not desirable for finer tests.

5. Pure air is to be continuously had in the test laboratory.

6. The progress of germination (number of seeds germinated per day) of any seed under continuously equal conditions is represented in a curve whose last end is precisely indicated by the front end, which after long enough observation of the beginning of the curves can with certainty be mechanically drawn (a large number of curves are represented). The best most expressive form of a seed test certificate is the germination curve; it gives an absolutely clear picture of seed quality, such as a common 10 or 20 day germination per cent. secured under varying temperature conditions cannot give.

Where briefly a judgment is to be given, the rapidity of germination is better expressed by the time it took under the stated temperature to bring half the germinative seed to the germination, instead of the usual 10-day statement: E. g. $84\% \frac{(25^\circ)}{5.8} = 84\%$ seed, which in 25° C took 5.8 days to bring 42 seeds to germination. Usually 12 days will suffice for this purpose. Most simply the curve of these 12 days gives the information.

7. The germinative energy of useable pine seed, if determined by a sufficient number of seeds can even in simple test laboratories be determined with such certainty as is possible within the theory of probable error.

Die Prüfung des Kiefernsamens. Zeitschrift fúr Forst-u. Jagdwesen, April-May, 1912. Pp. 193-222, 273-307.

Seed Supply

Based upon wide acquaintance with the field of distribution of the Scotch Pine and its behavior in all parts from southern France to northern Russia Dr. Schwappach combats the idea that, because seed from a given region transplanted to a climatically different region produces bad form, the assumption is correct that such bad form represents the characteristic form in the region from which the seed is derived. The French pine from Auvergne, deservedly hated in Germany for the crooked form its seed produces there, shows in its native field faultless form.

All observations show that it is desirable to use seed from home sources; only the limits of the favorable development of single races are still doubtful. Good and poor development may be found in any field of the same race, due to variety of soil conditions and other circumstances.

Einige Bemerkungen zur Provenienzfrage. Zeitschrift fúr Forst-u. Jagdwesen. June, 1912. Pp. 376-378.

Sowing Board.

A favored apparatus for sowing nursery beds—used in Württemberg and invented by Forstwart Spranz—consists of a wooden frame, 3 feet by 7 inches, to which an iron sheet is attached, perforated regularly to permit the seeds to fall through. A hopper-like wooden box fitted to move between the sides of the frame is used to distribute the seed over the iron sheet, the rapidity of motion gauging the quantity of seed discharged and falling through the holes in three or four rows. A second board placed against the first produces the spacing between the sets of rows. The advantages of the tool are a very uniform distribution of seed and hence a roomy stand of the seedlings, a condition producing from the start a good development, almost every seedling developing into a vigorous plant. Compared with handsowing a saving of from 50 to 100 per cent. is effected. Only one person is required to handle the board and it works fast. An illustration is given.

Der Spranz sche Saeapparat. Allgemeine Forst-u. Jagzeitung. April, 1912. Pp. 142.

New Method of Sowing in the Mountains.

The essential part of this new method is the use of an instrument by which the seed may be thrust into the ground with a motion of the foot. The depth to which the seeds are put is easily regulated and the rapidity with which the seeds come from the reservoir can also be adjusted. In principle this instrument somewhat resembles a corn planter but is especially adapted for use with small forest seeds which do not require a large reservoir but which must be sown in a shallow manner and not too close together.

Eine neue Saatmethode im Gebirg. Forstwissenschaftliches Centralblatt, April, 1912. Pp. 207-217.

Packing Seedlings.

The best package for shipping seedlings so far in general use are willow baskets, but they are expensive, require storage room, and do not last long if used for reshipping. It is difficult to secure their return. Neuhaus reports the use of wide-meshed wire netting, such as is used for training vines. The material can be kept in rolls near the packing place, is light, cheap and easily handled. At the end of the netting an inch stick is pushed in, long enough to project 4 inches on either side; the netting then is covered with fine hemlock or balsam brush and moss; the bunches of seedlings, 100 in the bunch, are placed, 10 bunches or 1000 plants for a set, root against root and tips outward. A second stick is pushed through the netting at the outer edge of the pack, the netting it cut, the two sticks drawn together and tied together with wire four times—a handy, cheap and efficient package.

Neue Verpackungsmethode fúr Pflanzen. Schweizerische Zeitschrift fúr Forstwesen. June, 1912. Pp. 195-196.

American Species in Germany.

A smile came over the face of the reviewer when reading in the exposé of Prof. Schwappach, that, because *Betula lenta* does not succeed on soil of III site. "According to recommendations of Fernow, in its place *Betula lutea* MIGHT BE preferable." The confusion in nomenclature—Cherry Birch of the botanist, so-called from the cherry-like bark, and Cherry Birch of the logger, so-called from the reddish appearance of the wood of fast grown Yellow Birch,—has misled our German friends, who were looking for the highly prized wood of the latter, to introduce widely the small nearly useless *Betula lenta.* When praising *Betula lutea* for planting on fire lines, it appears to us that another mistake is made, for this birch very differently from the European White Birch, which is planted on such strips on account of its scanty foliage, is rather densely foliaged and, similarly to the White Pine among the pines, the most shade enduring, i. e. densely foliaged, among the birches.

Carya is said to require good fresh soil, will stand even compact loam but needs protection for the first 6 to 8 years because of slow development. After that slow juvenile period follows a very rapid height growth. It is advocated to grow the same in rather open position, since it cleans easily but needs much room for the development of its mighty foliage and remains slender and bends over if grown in dense position. At the age of 20 years it requires at least 6 to 8 feet spacing. It is easily damaged by mice.

No satisfaction has been had in Freienwalde with *Juglans nigra,* owing to soil conditions, (hard marl sub-soil) ; it requires deep mild soil. Similar behavior is noted for *Fraxinus alba,* and it is recommended for use in overflow lands (? Ed.).

A word of praise is given to *Thuya gigantea,* which seems to thrive on better, fresh loamy soils and excels by its rapid growth.

Die Ausländerkulturen in der Oberförsterei Freienwalde. Zeitschrift für Forst-u. Jagdwesen. June, 1912. Pp. 385-386.

Aspen in Russia.

In a publication devoted to form classes and form tables for Scotch Pine, Baron Krüdener from the Imperial Forest administration in St. Petersburg brings interesting data, as reported by Guse, regarding the development of Aspen in northern Russia, which in part are applicable to our own, except that *Populus tremula* grows into a larger tree as a rule, than *P. tremuloides.*

"If one were to attempt a characterization of all the forest types in which the Aspen occurs, it would be necessary to include almost all species. The aspen accompanies the conifers to the farthest north. It tolerates shade like spruce and fir (not ours!)

and loves light like pine and larch; it goes with oak, elm and maple to the farthest limits of the savannah where birch has long disappeared; it is inseparable from linden, occurs with ash, alder, poplar and hornbeam, ascends to sandy hills, descends to boggy lowlands, stands the severe frost of the Northeast, and the sunscald of the plains. Yet in some directions it is selective. On dry sands it vanishes earlier than the birch, it does not stand stagnant water, not even in the sub-soil, but it can support changing and temporarily deficient moisture. Its best development it attains on the fresh loam soils of the north with a high groundwater table. No distinction is made in its north and south distribution, except that its growth in the southern field of its distribution is slightly retarded."

Krüdener then makes four form types: I. Well formed branchless stems with high crowns, $\frac{1}{4}$ to $\frac{1}{2}$ of the upper bole; form factor 517 to 419. Crown cover .8 to 1. IIa. As before but the crown occupying fully half the bole. Form factor 457 to 401. Branches thin and without shoulders. Stem visible to the top through the branches which appear as if only pasted on. Crown cover .6, small side shade. IIb. Crown more than half the bole, stouter branches with shoulders. Form factor 437-397. Impression as if bole divides up into branches. Taper not gradual but in steps above each branch. Strong light, crown cover .4. III. Crown, $\frac{3}{4}$ of bole. Taper rapid by steps. Bole conical; the farther up the more dividing into branches. Roomy stand, .1 to .3.

The age 45 to 80 is the important one, when growth is so uniform that in the tables no differentiation appears. After the 85th year form factor falls off rapidly. Krüdener has prepared volume tables for Aspen based on thousands of measurements for which these types or form classes have served; also tables of assortments, for pure and mixed stands.

Klassen-und Abfalltabellen für die Kiefer, etc. Zeitschrift für Forst-u. Jagdwesen. July, 1912. Pp. 453-455.

Thinning Results after Borggreve and Others.

Dr. Schwappach reports on results of two sample thinnings in beech, one a selection thinning à la Borggreve, the other, close by, according to old style in varying degrees, i. e. without removing poorly formed dominant trees. The thinnings were made in 1886/7. Six areas were involved and the data and changes from time to time are noted in a table.

It appears that the selection thinning as far as volume production is concerned has won the day.

At the beginning of the experiments the stands were even-aged, 75 years. The area, severely thinned, still contains 105 trees (at 97 years), among which branchy forms and double leaders, with an average diameter of 14 inches, while the selection thinning has reduced the number of trees only to 150 trees of only scant 12 inch diameter with poorly developed crowns, hence the effect is as if this area were younger than the other. But the increment of the selection thinning area exceeds that of the severely thinned by 27%. Although 1100 cubic feet more wood had been removed here, (3782 cubic feet against 2688), the cross section areas of the two stands are nearly the same (248 against 268 square inches in the severely thinned stand).

The question arises, what now? At the last thinning in 1908 it was difficult to find sufficient number of poorly formed trees in the stand which had been treated by selection thinning and now the stoutest stem classes consist entirely of well formed, thrifty individuals which have both satisfactory volume and value increment. Since a diameter of 16 inch is the most desired one, and 1 inch in 10 years is all that can be expected, 25 years will be required before the average tree will have secured that most valuable dimension. Hence Schwappach is inclined to now apply the French method *par le bas.*

Another set of thinning experiments in 76-year-old stands comprises *(a)* one severely thinned, *(b and c)* two opened up, and *(d)* one treated according to Seebach's modified beech forest, severely thinned and underplanted. Stand *(a)* was brought to a cross section area of 265 square inches and kept there as near as possible. In 1908, after the last thinning, it had still 234 square inches with 63 trees and 17 inches average diameter at 97 years; the current increment having increased in the last 12 years to 163 cubic feet per acre per year.

The stands *b* and *c* were brought to 80% of the cross section of *a*, and the stand *d* also gradually near that figure, namely 180 square inches. During the first eleven years the increment on *b* and *c* was greater than on *a*, in the next five years about equal, in the last five years less; the total performance during the 21 years came to about the same. The decline on the *b* and *c* areas was, however, gradual, while the increase in the last period on *a* was sudden, namely from 234 to 265 square inches. The Seebach experiment behaved somewhat like stand *a*, but as here the expense of underplanting came in, and on the stands *b* and *c* weedgrowth and uneven regeneration has established itself, it appears that the method of severe thinning gives the best result.

Bestandespfaege in Buchenbeständen, etc. Zeitschrift für Forst-u. June, 1912. Pp. 386-390.

Nursery Troubles in Sweden.

Lagerberg reports the first appearance in Sweden of the destructive nursery fungus, *Pestalozzia hartigii Tub.* The disease was discovered in 1910 in a forest nursery near Halmstad, where about 15% of the wild Silver Fir seedlings were attacked. In Germany the disease is known as "Einschnürungskrankheit" on account of the girdling at the base of the young stems, due to the death of the cortex at that point.

After a discussion of the general characters of the trouble as described by Hartig, Tubeuf, Rostrup and others, the author minutely records his own observations. All of his material was devoid of spores but he readily developed both conidia and closed pseudo-pycnidia by placing the affected stems in a moist chamber. These organs developed from the swollen portion of the stem just above the girdle. Sometimes, in nature, the fungus will produce spores the same years as the infection, at other times it takes longer, particularly with older plants. The stem lesions were typical and the effect was the usual one which accompanies girdling, with the consequent interruption of water and food supplies. In the efforts to heal, a sort of sleeve of new tissue pushed down from the swollen callus above the lesion, so that the diseased area partly healed over, the new tissue forming both xylem and phloem.

A description of culture experiments is given, in which variations in growth and spore characters is very marked under the different conditions. In some cases the conidia are the same as in the form-genus Monochetia, while in starved cultures the hair-like appendages are frequently lacking, thus passing into the Hendersonia type; other spores are identical with those produced by the close relative, *Coryneum pestalozzioides Sacc.*

The ordinary recommendation for the control of the disease is to burn all infected plants, but this is not enough. The conidia adhere to the plants and are washed down to the soil by rains and dew, which fact probably largely accounts for infection at the base of the stem. To overcome this difficulty the soil, in bad cases of the disease, should be turned under.

Pestalozzia hartigii Tubeuf. En ny friende i vara plantskolor. Skogsvards föreninger. Tidskrift. May 1911. Pp. 183-195, figs. 1-10.

Damping-off of Seedlings.

Another paper on this topic from Carl Hartley, who has been investigating nursery troubles for the office of Forest Pathology for the past three or four years, should be of great interest to all engaged in raising forest seedlings. The paper presents the latest results on chemical soil treatments to prevent damping-off. The work was conducted at the Halsey nursery in the Nebraska sand hills, where the soil is sand with considerable humus in the upper layers. *Pythium debaryanum* is the most serious fungus, although *Rhizoctonia sp.* and *Fusarium sp.* cause some damage. The two former kill germinating seed as well as seedlings. Thirteen chemicals and seven combinations have been tried. It was found unsafe to apply fungicides after germination. Formalin or mercuric chloride can kill even dormant seed. The application of sulfuric acid 3/16 fl. oz. per square foot, to the seed beds proved most satisfactory, both as to its immediate effect and its subsequent ability to prevent re-infection. Acid injury to the young roots was obviated by light sprinkling twice a day during the germination period to prevent the capillary rise of the acid in the soil. Commercial hydrochloric and nitric acids are about one-fourth as effective as sulfuric, while formalin was about one-half as efficient.

Nine series of tests, with three species of pines, during two seasons' use of sulfuric acid, show 65% better germination on treated plots than untreated, while the loss from damping-off averaged less than 45% of that on the control plots, and the final stand was over 4½ times as great. The author does not recommend sulfuric acid as a general soil fungicide. It is probably not adapted to limestone soils or applicable to Angiosperms.

Use of Soil Fungicides to prevent damping-off of coniferous seedlings. Proc. Soc. Am. Foresters. Pp. 96-99. March, 1912.

New Disease of White Pine.

Professor Fink reports a disease of the leaves and twigs of mature trees of *Pinus strobus* on the college campus at Oxford, Ohio, due to the discomycete, *Cenangium abietis (Pers.)* Dub. A group of six trees was affected, the injury being on the northeast side and embracing the lower half or two-thirds of the crown. The twigs bearing the dead leaves were provided with erumpent blackish tubercles which expand into the saucer-shaped fruit-bodies when moistened. The terminal bud was dead in all cases, which seems to indicate that infection occurred at or near it. The diseased trees were on the crest of a hill and were probably rendered susceptible by the severe drought of the previous year, for other near by specimens on lower ground were still healthy.

This appears to be the first report of this fungus playing a part in the death of trees in North America, although it has been noted in Maine, Alabama, Colorado, Nevada and California. The author cites Brunchorst's investigations on the destruction of Austrian Pine in Norway in 1887, and Schwarz' admirable monograph on the same disease on Scotch Pine in Germany in 1891-2, both of whom lay the blame on Cenangium. Owing to the lack of viable spores when wanted Professor Fink did not conduct infection experiments. He does not concern himself with nomenclature, but says that, according to the recent rules, the fungus would be known as *Cenangium ferruginosum Fr.*

Injury to Pinus Strobus caused by *Cenangium abietis.*. Phytopathology. Pp. 180-183, pl. 26. Dec., 1911.

Catalpa Rot.

Neil E. Stevens of the Kansas Experiment Station presents the results of an investigation of the diseases of Hardy Catalpa in Kansas plantations. It was claimed in Bulletin 37 of the Bureau of Forestry that no fungus was known to grow on dead catalpa timber. This statement is shown to be erroneous. Although, in many instances, the fungi do not produce fruiting-bodies, still enough of these organs have been found to prove that *Polystictus versicolor, Schizophyllum commune, Polyporus adustus* and *Stereum albobadium* attack the wood in varying degree. The former is known as a wound-parasite of catalpa and often develops after the timber is cut, the greater part of the decay being probably due to this species. It fruits on heartwood as well as sap, while all the other fungi mentioned are confined to the sapwood. To show the relative activity of the two more common species, the author made test tube inoculations on blocks of *Liriodendron tulipifera.* In six months *P. versicolor* occasioned a loss of 59% of the original weight of the wood, as against 37% for *Schizopyllum commune.*

Wood Rots of the Hardy Catalpa. Phytopathology. July, 1912. Pp. 114-119, pl. 10.

Oak Mildew.

Much has been written regarding this interesting forest disease but the literature largely consists of speculations concerning the origin and systematic position of the fungus. Neger, however, demonstrates by field and laboratory experiments the form in which the mildew survives the winter, and makes recommendations for combating the disease in nurseries.

The perithecial form being extremely rare, it is of no practical significance in the life cycle. Experiments with conidia (summer sports) show that they rapidly lose vitality and undoubtedly do not live over winter; while investigation of the peculiar knotty swellings found on the mycelium, first observed by Ferrari, who termed them "gemmae", and later explained by Foëx as the stalks of broken conidiophores, also do not germinate, and their significance as resting spores is untenable. The mycelium in the buds, however, persists through the winter and readily infests the young shoots which develop from them in the spring.

The effect of the fungus is to distort or kill shoots developing in May or June. In case they are not killed before autumn the immature wood is often caught by the frost. Nursery experiments, using lime-sulfur spray and powdered sulfur to control the disease, resulted in the recommendation of one or two applications of the former in strengths of 1:30 of the so-called normal solution. The remedial effect was very striking, as evidenced by the healthy matured shoots of the sprayed plants. Since conidia do not live over winter it is of no use to burn leaves and detritus.

Die Uberwinterung und Bekämfung des Eichenmehltaus. Tharandter forstliches Jahrbuch. 1911. Pp. 1-9.

Protection of Shade Trees.

Carl Bannwart, Secretary of the Newark Shade Tree Commission, New Jersey, presents a timely and popular, yet forcible, plea for the better protection of our shade trees against the evils of the curbstone which he considers their greatest enemy. He states quite aptly that "the present day curb descends from a barbaric age when everything was sacrificed to compactness."

As a remedy for the difficulty, in order to conduct sufficient water to the tree roots, he recommends several devices, the keynote of which is a grating, either in the curb or in the sidewalk, or even between the trees, within which is an area of cracked stone to catch water from rains or street flushings. The author illustrates his ideas by drawings. Washington, D. C. is cited as a city in which the engineers consider the needs of the trees. The attempts of the Massachusetts and New Jersey officials to accomplish the same end are briefly outlined.

Greatest Enemy of the Shade Tree. Municipal Journal and Engineer. April, 1912. Pp. 619-621.

Combating May Beetle.

Prof. Decoppet from the Swiss Experiment Station makes a preliminary report of experiments in getting rid of May beetle larvae which have lately become very destructive in forest nurseries.

The experiments carried on since 1904, mainly with carbon-bisulphide lead to the following conclusions: Not only are insects in part killed but the fertility of the nursery is increased, whereby the plants become more resistant. The best method of application is to use 1½ to 1 3/4 ounces per square yard and squirt it into six or eight holes not deeper than 6 inches. The ground must not be freshly worked or worked after treatment. Too dry and too wet soils are unsuited to the treatment. The cost was such as to increase the cost of plants 9 to 10%.

Experiments to prevent oviposition were also made. Sunny spots induce the depositing of eggs. An ill smelling tar preparation was used with advantage; but neither this method nor covering with gravel or leaf litter produced uniform results. A number of excellent illustrations bring the results of the poisoning readily to view.

Die Vernichtung der Engerlinge in den Forstgärten. Schweizerische Zeitschrift. April, 1912. Pp. 122-129.

Drought in German Forests.

The long dry spell of the summer of 1911 had the most effect upon shallow rooted conifers like spruce and larch. The other coniferous species, White and Scotch Pine and fir, did not suffer severely unless growing on shallow soils.

The hardwoods showed less bad effects than the conifers although this immunity must be partly ascribed to the good sites upon which they were growing. Beech leaves turned yellow and fell early, while the mast was short in quantity and poor in quality. Oak, ash, alder, and hornbeam stood the drought well. The locust proved to be especially resistant.

The well weeded and cultivated nurseries sustained little damage.

Die Durre des letzten Sommers im Walde. Forstwiss. Centrablatt. Feb., 1912. Pp. 81-89.

Effects of Drouth.

Although the results of last summer's drought were discussed from several points of view in a series of articles reviewed in the preceding issue (p. 283) one more by Klemp merits notice. This sets forth the effects of the heat and drought in two more Hessian reviers where plantations and thickets covering some 200 acres were destroyed.

This was all planted, natural regeneration not being practiced here.

The greatest loss occurred toward the end of the season when, late in August and in September cold and even frosty nights began to intervene between the severely hot days. Dry cold weather and wide differences between day and night temperatures have previously proven especially harmful to spruce and White Pine in their first summer.

In point of relative drought resistance the species planted here stood as follows: The most resistant first: Oak, Scotch Pine, European Larch, Norway Spruce, White Pine *(strobus)*. Some Japanese Larch had been planted and these were all killed. On the other hand the green or Colorado variety of the Douglas Fir withstood the drought quite well. Beech occurs here only as an underwood and suffered practically no damage. No Scotch Pine over twelve years was killed but Spruce up to fifteen years and even older was killed in some places. The greatest loss occurred in conifers from two to eight years old, that is to say, before the crown cover was established. Besides trees killed outright many have been weakened and are falling prey to insects and fungi so that they must soon be removed.

On the basis of his observations the author lays down the following principle:

Practical procedure is properly based on the weather of ordinary or normal seasons and not on exceptional years either good or bad. This region is undoubtedly the driest in all Germany but the season of 1911 has never been paralleled in the memory of man.

The current practice of planting in furrows well cleared of grass and weeds shows no need for improvement. Grass is especially harmful to young plantations by depriving the trees of a large part of the soil moisture, and through its evaporation, by cooling the air more rapidly and so favoring frost. The whole result is that the closing of the crown cover is delayed and the stand is longer exposed to injury. Cultivation of the whole area would undoubtedly be still better but at present the necessary labor is not available.

Mixture of broadleaf and coniferous species is worthy of further trial.

For clearing the larger areas of dead thickets for replanting, fire seems to offer the cheapest method. The smaller areas of dead trees cannot be attended to at all. Pine stands must be cared for first. Spruce and White Pine should be used for this purpose despite the fact that they suffered so severely the past season.

In general a temporary reduction of the felling budget must be made in order to maintain the stock in the face of the losses in stock and increment and to avoid further increase in the area to be planted.

Wirkungen der Hitze und Dürre im Sommer 1911 in Grossh. Hesse. Oberförster Langen. Silva. Jan., 1912. Pp. 1-2, 9-10.

Damage by Lightning.

Forest trees are not infrequently struck by lightning. The results of a stroke vary all the way form a scarcely preceptible cleft in the bark following a non-explosive discharge to the breaking of the bole to splinters by a heavy stroke. More rarely still the tree is set on fire.

The injury done trees by the quiet discharge has been the subject of considerable discussion in the past. Also differences have heretofore been noted in the effects of the ordinary stroke on trees and these differences explained as due to variations in the trees as regards the soil on which they stand. But the discharge itself seems to vary as the following account by Joseph indicates. On a July afternoon in 1910 during a thunderstorm lightning struck two pine trees in the same stand and only eighty rods apart. The immediate effects were well marked and exactly the same on the two trees. Both remained apparently unhurt until the following spring. Then the bark loosened around the base of both boles and before the end of summer the tops were dead and dry. In the case of one tree this was the entire loss. The other tree was killed likewise, but not alone, for by the end of August 1911 fifty other trees standing about it within a radius of two and a half to three rods were also dead and dry. Similar examples of lightning killing a whole group of trees by striking one have been reported before but the two phenomena have never been observed so nearly at the same time and place before. The assumption that there are two kinds of lightning strokes seems irresistible.

Blitzschläge im Kiefernwald. Silva. Jan., 1912. Pp. 27.

Effect of Tarring Roads on Vegetation.

In a series of articles in the Comtes Rendus on the deleterious action of road tar on neighboring trees and other vegetation several French writers have developed quite a controversy. While it is generally admitted that, at least under certain conditions, a stunting of shoots and leaves, usually associated with discoloration, is produced, the discussion still wages around the point as to whether it is the dust particles from the tarred roads, or the vapors, which produce the injury.

Mirande holds to the latter view, and thinks that the vapors released at ordinary temperatures penetrate the leaf cells and kill them by plasmolytic rupture of the plasma membrane, causing a discoloration and often a liberation of certain gases. These phenomena he thinks due to a diffusion, after death, of cell substances which react chemically (most often by diastatic action) to produce new compounds, some of which are freed at the surface. With certain leaves, such as cherry laurel, which contain glusosides of hydrocyanic acid, a blackening occurs, together with a liberation of HCN.

He studied the action of a large number of organic vapors on such leaves, among them being the various tar constituents, other hydrocarbons and derivatives, alcohols, phenols, acids, ethers, aldehydes, ketones, amines, amides, and nitrites, and showed that the discoloration, with or without the evolution of HCN, is produced by a great number of widely different chemical compounds. Fine dust of tar, asphalt, and bitumen gave no appreciable results, even in strong sunlight. From these laboratory experiments he concludes that vapors from tarred roads, when sufficient in amount, as in dry, warm weather, with calm air, especially along narrow roads lined with vegetation, can produce injurious effects, and thinks that tarring should be done with circumspection.

Griffon investigated the problem from 1908 to 1910 and secured laboratory results similar to Mirande. However, he contends that laboratory data derived from bell-jar experiments cannot be safely applied to field conditions. He bases this opinion on certain of his open air experiments, and states that his personal inquiry in the suburbs of Paris, southern France and England, speaks entirely in favor of tarring, at the same time admitting that the proceedure may be unsuitable in certain cases.

Gatin has studied the morphological and anatomical changes in affected trees under natural conditions and finds a considerable stunting, with the leaves frequently wrinkled and spotted, at times lacerated and falling prematurely, while the shoots of the year are less vigorous, the higher parts of the crown being attacked more than the exposed lower parts. Histological study shows that stunted limbs of the year (Catalpa) have a cortex of the usual thickness, altho the subepidermal cork layer is much better developed. The endoderm is not specially differentiated, while the central cylinder is much smaller. The medullary rays are scarcely noticeable and the pith cells are small. October branches are almost devoid of starch, while sound ones are richly supplied. A study of flower stalks yields similar results.

In the case of Pelargonium, Sycamore Maple and Aesculus the plant reacts by cork formation on leaves.

Experiments to determine the relative importance of vapor versus tar dust particles were carried out on several species of trees and shrubs by dusting the leaves in the evening once a week from July 1 to 18, then two to three times a week up to September 15, in every case preceding the operation with a light sprinkling. All the trees were affected, the injury varying from a browning, or perforation, of the leaves to a stunting of the young branches. These results contradict the experiments of Mirande noted above.

Mirande, M. *De l'action des vapeurs sur les plantes vertes.* Compt. Rend, Acad. Sci. Paris) Aug., 1910. Pp. 481-483.

Mirande, M. *Les effets du goudrounnage des routes sur la vègetation.* Ibid. Nov., 1910. Pp. 949-952.

Griffon, E. *Influence du goudronnage des routes sur la végetation avoisinante.* Ibid. Dec., 1910. Pp. 1070-1073.

Gatin, C. *Influence du goudronnage des routes sur la végétation des arbres du bois de Boulogne.* Ibid.July, 1911. Pp. 202-204.

Gatin, C et Fluteaux *Modifications anatomiques produites, chez certains vègétaux, par la pouissiere des routes goudronnèes.* Ibid. Nov., 1911. Pp. 1020-1021.

Gatin, C. *Reproduction expèrimentale des effets du goudronnage des routes sur la vëgëtation avoisinante.* Ibid. Oct., 1911. Pp. 688-690.

MENSURATION, FINANCE AND MANAGEMENT.

New Forest Organization.

Several of the German forest administrations are at present in the throes of a thorough revision of their antiquated forest organizations. Thus the Bavarian administration is now revising its organization which has served for 80 years. We have briefed a longer article on the new propositions in Vol. IX, p. 327 ff. The same subject based upon the official instructions, laid down in a pamphlet of 54 pages and 32 schedules, is so clearly discussed again in the *Schweizerische Zeitschrift* that we repeat a few of the interesting points.

The objects of forest organization are very precisely stated to be: "to furnish a clear comprehensive picture of the entire economic conditions of the units of management; from these actual facts and the objects which the forest is to serve to deduce the aim of the management; to develop principles of management and to determine the felling budget; to formulate working plans for the next short period; to make sure of the carrying out of the prescriptions and demonstrate the effect of the management."

The subdivision starts with the stand (not below 2.5 acres), uniform in species, age and condition, as unit combined into "divisions", these combined into "districts" and finally into management classes (Betriebsverband), usually the forests of one "circle" (Kreis), for which a special working plan is made.

Careful *ascertainment of conditions,* including records of past history is prescribed in detail. In the age class determination a reduction is to be made if it can be shown that unfavorable influences and damage has retarded the development of the stand. This does not influence the budget calculation since the average increment based on age is considered only as a check and secondary determinant. In selection forest the average age not only is to be estimated but also the age limits. A participation of the different age classes by area (as proposed by Mr. Chapman in this issue) is suggested.

For high forest a stock map, showing not only age-class distribution but species, form of stand, site, quality and stock density is required.

Average height or mere estimate is used in determining site classes, and only *three site classes* are required: good, medium, poor.

Special investigations are to be made on *nichtstandortsgemässe Bestockungsteile*—stands which are not stocked in adaptation to the site—and on health conditions, so that in the felling plans these can be specially considered. The graphical representations of these conditions help to bring to recognition the amount of these anticipated fellings. Altogether every flaw in the whole sustained yield plans must be laid open. The present condition of a polewood, e. g., allows us now to recognize whether the decade to which it is assigned or in which it becomes mature will be favored in the budget or curtailed.

The *volume determinations* are as a rule confined to the stands which are to be cut in the next decade. In evenaged close stands mere ocular estimate, using experienced felling yields or yield tables as a check; otherwise a sample area method is to be used, or in very uneven stands calipering all trees. For determining the rotation special measurements by the Urich method are to be made.

The *increment* is to be taken either from suitable normal yield tables or the *current* increment is to be measured by the use of Schneider's formula $\left(\frac{400}{nd}\right)$ either on sample trees measured in middle of tree length or on standing trees breasthigh. This actual increment is compared with what it should be by division with the factor of density. Similarly the normal use per cent. secured by comparison of normal stock and normal increment from normal yield tables is placed in comparison with the actual.

Value increment is based on diameter increment, distribution of assortments and quality number. These data are to be graphically shown: progress with age or average diameters of stands for each species and site class; workwood per cents. and other assortments; from the latter and the wood prices of the *current* year, the quality number is figured. It is interesting to note under the question of system of *silviculture* that the *selection forest* is suggested only for small forests near cities and health resorts; not even for the mountain forests!

Rotation is to correspond to the aim of the management which is stated to be "the largest production of the most marketable assortments and securing under economically sound conditions the highest possible money yield". For the basis of rotation are to be ascertained: the proportions of different assortments in the timberwood yield; their net average stumpage price; the average price per unit of timberwood; the volume yield per unit area; the value of intermediate yields per unit area for the whole "growth time" (rotation); the decennial value increment per unit area; the net forest rent during the decades and its decennial increase. In addition, the Pressler increment per cent. is to be ascertained in order to come to an appreciation of the relation between value increment and cost of production. Other considerations not mathematically expressible enter in determining the rotation, which is to be chosen so as to be divisible by ten (hitherto in Bavaria the duodecimal system was in vogue). In selection forest instead of a rotation "the average breast high diameter which promises the relatively highest yield" determines the felling time.

Budget regulation is done mainly by area with the very general instruction that "an uneconomic accumulation of overmature stands on larger areas is as far as possible to be avoided; the budget area should also as a rule not be larger than the total area of the stands that need to be cut, that are mature or will become so in the next 20 years", the condition of the older stands being of first consideration, although if age classes are unevenly distributed deviations from the normal felling area are permissible. The felling plan is made for only ten years, based upon the total felling area determined for the 20-year period. The assignment of stands to be cut is made under the usual sequence of selection. No requirement is made for equalization of volumes or for reserves.

The plans are to be revised every ten years.

We see that the strict sustained yield management is given up as far as volumes are concerned. This on the ground that on large forest areas volumes are equalized if areas are nearly equal, an argument which the reviewer considers dangerous, where a surplus of old stands exists. He also questions the practicability of securing all the data needed to determine the stand values and forest rent, and as to securing the most marketable dimensions, who can predict which they will be at the end of the rotation?

He criticizes the inadequacy of methods to be used for determining stock and increment and of site classification and the rotation, and looks with apprehension on the whole performance.

"In this instruction are domiciled, as in olden times in the head of the great philosopher, two opposing concepts, the 'pure' and the 'practical'. Each tried to prevent the other from entering and after all both came in; but the 'pratical' must be satisfied with a little corner in the transition regulations."

Anweisung für die Forsteinrichtung in den Kgl bayerischen Staatswaldungen. Schweizerische Zeitschrift für Forstwesen. February, 1912. Pp. 56-63.

Statical Formulae.

Dr. Martin in his usual, clear and direct style sets forth the value and proper application of the formula he has developed in his classical volume on Forestal Statics, in defense against a reviewer who charges that thereby the author abandons the soilrent theory. The author refutes this charge but claims that for purposes of forest organization his formula is superior to the soil expectancy formula.

The formula translated into our notation reads

$$Y+T-(c+a)=S+St$$

and places into relation the annual net income to the soil and stock capital as a means of determining felling age and of other problems of forest organization. The general discussion on the use of formulae is especially good reading for those who place too much or too little value on them. The author points out that "the securing of the highest possible net yield is undoubtedly the most important economic principle of soil culture". All other factors of economic production change in the course of time: labor increases, capital grows, the forces of nature come more and more under more thorough utilization, but the soil in its quantity remains the same and largely also in its character; the soil becomes rarer and hence more expensive, hence it must be treated so as to secure the highest rent from it—the highest soilrent. While the theory of highest soilrent is a clear economic principle of general application, the method of application may be at fault. Surely, economic problems cannot be solved in a one-sided mathematical manner. Many things which have an influence on the soilrent are not capable of mathematical treatment, or only conditionally so. There are always a number of unknown quantities in the equations which represent economic relations. This is especially true in soil values and stand values; both are cause and result interchangeably. The rotation also shows this causal relation: on one side it is the effect of the interest on the stock and hence of the stock itself; on the other side, it is the cause of the amount of stock. This peculiar connection of cause and effect renders the mathematical treatment of economic problems in connection with organic nature so difficult, sometimes impossible. Similarly agricultural soilrents are a result of grain prices and at the same time the soilrent is figured as part of the price.

Nevertheless, in forest valuation for purchase, sale or exchange, definite data must be found, i. e. certain assumptions must be and are made on which the calculation progresses; e. g. the assumption is made generally that the error in the use of present values may be compensated by using lower interest rates: it is impossible in such valuations to get away from the subjective conceptions of the valuer; hence there are always various values figured even if the data or facts are the same.

The above formula, however, was to serve not in purchases or sales but in forest organization, when data are handled differently: mathematical calculations become of minor import, soil physics, physiology, economy which cannot be expressed by mathematical signs, become more prominent and expert opinion will prevail in making working plans, in choice of species, of methods of management, rotation, etc., but it is desirable to base as far as possible the expert opinion on carefully ascertained economic data, especially as regards volumes and values of the stands and their increment, and place them into a formula for precision of expression, not, however, making the formula paramount. He refers on this position to the well-known statement of Karl Heyer, whose budget formula employed in the sense of its author will remain as useful as will Martin's own formula.

Compared with the soilrent formula, derived from single, regular stands unchanging in their condition and in intermittent management—not necessarily a strict sustained yield management the single stands the author claims his formula, in spite of its defects, superior wherever, as in large State administrations, annual management—not necessarily a strict sustained yield management —is the rule.

The advantage of the formula is that conditions as they actually are at present enter into its make-up. Theoretically, it is true that a management class is made up of a number of single stands and the whole must be equal to the sum of its parts, but while this is mathematically true, it is not so economically; and this is illustrated in actual forest management. A single stand does not permit of an annual management, while a management class in age classes does, the latter exhibits a stock capital, which is unknown in the former case. Other managerial differences are pointed out. Heyer's attitude that the stock must be figured at cost value is combated, since for most older stands it would be impossible to state its actual cost value; moreover, if a stand had an actual stock value of $3,000, nobody will place its value at $6,000, even if that were its cost of production, or at $1,500, if by good chance it had only cost that sum to produce it.

The formula, which is really derived from one of Gustav Heyer's, is applicable to normal as well as actual conditions, and it forces, indeed, investigation of these conditions in a direction which corresponds to the needs of practical forest management. It gives expression to the most important problems of the soil-rent theory, namely to secure or demonstrate a proper relation between yield and capital involved. The latter is the actual not potential capital. The soil capital is as a rule relatively so small that it has little influence on the result. The stock is the important part, but in most German administrations no account of it is given; instead, age class distribution gives an approximate idea of its make-up, which is, to be sure, also desirable. For calculating the stock no generally applicable rules can be given; it will vary according to silvicultural practices, natural regeneration or clear cutting, and according to other conditions. Site and age classification are, of course, unavoidable in these calculations. "In spite of the difficulties of estimating the stock values, it is nevertheless an important requirement of a good working plan: it is better to have a statement which is faulty than none at all."

In the end, such valuations are practical necessities not only for good management but for taxation, etc.

Die Formel, etc. Allgemeine Zeitschrift für Forst-u. Jagdwesen. April, 1912. Pp. 109-119.

Forest Valuation.

In the valuation of a normal management class a different value should be given the material cut from that assigned to the stock because the latter is made up in part of immature age classes which are generally less valuable. The yield from thinnings, however, will always be less valuable than the growing stock, and thereby the value of the total fellings will not differ very much.

These statements are used to prove the contention of Eberbach, that as a rule the money rate of interest is smaller than the increment rate.

Ueber die Beziehungen zwischen der Massen und der Geldverzinsung in Hochwaldbetriebsklassen. Forstwiss. Centralblatt. Feb., 1912. Pp. 77-80.

Value of Christmas Trees.

That the careful removal of Christmas trees is a financial advantage and if properly done, is no harm appears from the receipts of a certain forest district in Austria from Christmas trees which ran as follows:

1903	$828 31
1906	6165 56
1910	5080 96

The small trees used for this purpose were taken out without harming the future stand.

Erlös aus Weihnachtsbäumen. Forstwiss. Centralblatt. Feb., 1912. Pp. 110.

Results from Small Communal Property.

As an encouragement for commercial forest management the results attained in the small canton of Aargau, which may be compared to any of our counties, noting the changes within 50 years is of interest.

In spite of the fact that the cut was reduced by 8% in order to save previous overcuts, and in spite of an increase of expenditures by 98%, the net income per acre has increased by 9.1%, and per cubic foot of wood by 18%, the total net income being $45,-600. The greater income is only in part accounted by increase in wood prices by 36%, improved forest conditions account for most of it; while in 1861 only 53% was high forest and 47% coppice, the latter had been practically all transformed into high forest; consequently the workwood per cent. had been changed from 29 to 35.8%.

The small municipalities within the canton own more than ten times the area of the cantonal forest and show similar changes.

Year	Forest Area.	Cut per Acre.	Net Yield per Acre.	cu. ft.	Expense per acre.
1861	78,857 acres	81.5 cu. ft.	$3.58	44	$1.07
1910	86,445 acres	84.5 cu. ft.	5.53	66	2.92

Here also the change from coppice to high forest has mainly produced the better result (54%), in spite of the great increase of expense (173%), the change being from 38% high forest and 62% coppice to 85.8% high forest.

In the cost of logging, the workwood, better fuelwood, and brush stand as 1 : 2 : 4, while the prices naturally go in reverse order, quite nearly as 1 : $\frac{1}{2}$: $\frac{1}{4}$.

These forests are worked under sustained yield principles, as near as possible annual, while the 18,000 acres of private forest are worked intermittently in selection forest with corresponding poor results.

Die Entwicklung des aargauischen Forstwesens. Schweizerische Zeitschrift für Forstwesen. June, 1912. Pp. 189-193.

STATISTICS AND HISTORY.

Saxony Statistics. The complete statistics, by district and range, for the year 1910 have been compiled by Vogel. The summary shows the following results:

Forest Area: 426,105 acres.

Fellings (Timberwood): 30,533,265 cubic feet, of which 84% workwood.

Income for wood: $3,735,952 (12¼ cents per cubic foot gross).

Byproducts: 28,040.

Woodchoppers' wages: $551,280 (1.8 cents per cubic foot).

Improvement works (including planting): $293,580 (69 cents per acre).

Current expenses: $108,845 (25½ cents per acre).

Administration: $606,960 ($1.38 per acre).

Total Expense: $1,560,665 ($3.60 per acre).

Total net yield: $2,203,327 ($5.17 per acre; 7.21 cents per cubic foot).

Forest Capital: $100,780,000 ($237 per acre).

Interest paid: 2.19%.

There were planted and sowed during the year 6,669 acres (only 286 sowed) at an average cost of $14.50, including all incidental expenses, cost of plant material, etc., the planting itself costing on the average $10.25, but varying for different districts between $8.12 and $12.44.

Tharandter Forstliches Jahrbuch. 1912. Pp. 144-157.

Hesse Statistics.

A more complete, official report of the results of a small forest administration, that of Hesse, for the year 1910 develops the following data.

Some tabulations give insight into general conditions; another series exhibits details of the domain administration; another, details of the communal forest administration. A number of diagrams give the progress made in certain directions for a series of years. In these latter we note the following interesting facts: forest misdemeanors and torts in the whole dukedom have fallen off during the last 30 years from year to year in regular progression from over 50,000 cases to less than 7,500 cases; the cut in the domanial forests has increased in quite even progress, with one extraordinary rise in 1901, from 72.6 cubic feet in 1895 to 89.6 cubic feet per acre, while the workwood per cent. rose from 21 to 31 per cent., largely due to railroad tie and mine timber production; in some districts this per cent. is over 50. Stumpage net results rose from $3.26 per acre to $4.43 with several years in excess of this figure up to $4.50 in 1908, due to wood prices. Prices during these 15 years have not changed much; indeed workwood in 1910, with 9.5 cents per cubic foot net stumpage, was lower than in any preceding year, the price in the years 1899 to 1901 having been 11.5 cents. Fuel-wood shows less variation and at the end of the period, with 3.5 cents per cubic foot is about the same as at the beginning. The last year of the record shows a decline of wood prices for workwood of 4.5% over the previous year.

A remarkable change has taken place in the relation in which thinnings stand to final harvest budgets. While in 1880 thinnings represented about one-third (32%) of the total cut, in 1910 the relation had almost been precisely reversed, the thinnings representing nearly two-thirds (64%) of the total cut, a steady rise in this relation being exhibited in the curve. In some districts this proportion rises to over 80 and 90 per cent.

Cultures average 50 cents per acre over all, a very high cost.

The total forest area of the dukedom, 31.7% of the whole country, comprises 602,528 acres, slightly less than half an acre per capita. Of this 30.8% is crownlands, 38% communal forest. Of the remaining 31.2% of private forest 21.8% are I class, i. e. managed by technically educated men, hence hardly 10% of the forest area is without technical administration. Government foresters almost invariably look after communal woods or private forests besides their own revirs, not quite 5,000 acres coming in the average under the Oberfôrster's care, permitting very intensive management.

The 218,256 acres of communal forest compares well with the crown forests; the average cut was 83.6 cubic feet; the gross income per acre was $5.54 as against $5.77 in the crown forests, and the average price per cubic foot was a little higher, namely 6.9 cents as against 6.7 cents in the crown forests.

Mitteilungen aus der Forst-und Kameralverwaltung des Grossherzogtums Hesse. 1912. 43 pp.

Russian Statistics.

The latest statistics of Russian forests are published in the Yearbook of the Forest department at St. Petersburg for 1909, and are reproduced by Guse. They are in two volumes, the second in tabular form, giving by districts and governments (counties?) total areas, total forest areas, forest per cent., population and the per capita relations. The six districts are European Russia proper; Poland; Finland; Caucasia; Siberia; Central Asia. The totals, translated into English measure, are:

	Land Area square miles	Forest Area 1,000 acres	Forest per cent.	Population 1,000 total	Population per sq. mi.	Forest per capita
Asiatic Russia	6,166,000	1,363,240	36	15,683	2.5	86
European Russia	2,208,000	461,375	34	133,617	60.5	3.4
	8,374,000	1,824,615	35	149,300	17.8	12.15

Uneven distribution of forest and population are striking. In European Russia 21 districts show below 1 acre per capita as against 325 in Archangelsk, 52 in Wologda, and 38 in Olonetz, the forest counties. Similarly the forest per cent. varies from 0.82 to 82. Next to these forest counties, Finland with 46,956,800 acres forest and only 2,857,000 people is the most densely wooded large section of the country both per capita (16 acres) and in forest per cent. (59).

Central Asia compares in forest per cent. (3.8) with the plains country of Southern Russia, while Siberia with 45%, varying from 20 to 91, resembles Northern Russia. Here, with 216 acres per capita over a total area of 4.8 million square miles, a large surplus of woodland is found. Nothing is said beyond the figures, hence we cannot judge as to the timber value of this large forest area. The actual productive forest soil, however, is stated in round numberr as 210, 7.7 and 218 million acres respectively in Europe, Caucasia and Asia, or altogether 436 million acres.

The first volume brings in 9 chapters the details of administration. The forest service is in the Ministry of Agriculture under one director and 1010 employees; the provincial administrations occupy 340 higher officials, 990 Oberförsters, 1720 assistants, altogether 3059 employees. Lately the size of the districts have been greatly reduced, the number of district officers having been trebled from 741 to 2,363, more than half of these in Asia. The area under government administration is about five million acres less than one round billion, of which one-quarter in European Russia. If, however, muskeags and tundra are excluded to the extent of 175 million acres, the average forest district in Europe comprises 165,000 acres, in Caucasia 130,000, and in Asia 3,330,000 acres. It is recognized that these districts are too large, and for the next decade the formation of 1,000 new districts is provided. Under the district officers there are 25,274 forest guards in Europe, 1,864 in Caucasus, in Asia 6,801, making the average range 12,000, 6,800 and 156,000 acres respectively, a much better proportion than the districts.

Although the felling budget had been placed at over 7,000 million cubic feet, only slightly less than one-third of this amount was sold; the remainder seems to have been left in the hands of the government (or was it not cut, or the proceeds pocketed by someone else?). In some districts an overcut is reported. Besides, some $2.8 million worth of bark and dry wood was disposed of, and $50,000 came from byproducts. Altogether, the total income was $33 million, the bulk in European Russia, the expenditure of $10 million leaves net $23 million. The highest net yield is recorded from Poland with $350 per acre, but negative results are reported from other districts.

Forest fires are reported on 700,000 acres causing a damage of $820,000, while the loss by insect damage, floods, winds, etc., is placed at $78,000.

Some 63 commissions with a crew of over 500 estimators and surveyors are at work gathering material for working plans. Some 20 million acres have their investigation completed and for 3 million acres a budget regulation exists.

Regeneration has been for a long time unsuccessful, natural methods failed and for planting there was no money. The planting tax imposed on wood buyers, $4 per acre, was either insufficient or else not used for the purpose, over 5 million acres of slash and openings await reforestation in Europe alone. Now the State collects the tax and appropriates definite sums; for 1909 the appropriation for planting and improvements was $800,000.

There is now only one higher grade forest institute at St. Petersburg with 576 students in 1909, 178 graduating. The expenses for this school are $96,000, of which $20,000 come from the institute itself.

For lower forest schools, there is remarkable provision, namely 97 schools with an expenditure of $112,000, where in 1910, there were 690 attending, 596 being educated free or partially so at State's expense.

Something is being done to assist private forest owners by money prizes and medals for plantations and distributing seed and plant material partly free, partly at reduced prices. The conservation commissions have also been active; their activity has been exercised over 140,000,000 acres; working plans were authorized for 2 million acres; reforestation ordered on 12,000 acres; change of use permitted on 685,000 acres.

Altogether, the impression is left of activity in all directions.

Die neueste Russische Forststatistik, and Jahrbuch des Forst-departements, etc., für 1909. Zeitschrift für Forst-u. Jagdwesen. May, July, 1912. Pp. 313-316-456-458.

Swiss Statistics. Twenty-three per cent. of the total area of productive soil is devoted to timber crops. Of this the State forests occupy 5%, the communal and corporation forests 69%, and private woodlands 26%. The character of the forested area is shown in the following table:

	High Forest.	*Coppice.*
State forest,	94.9%	5.1%
Communal and corporation forests,	88.6%	11.4%
Private wood lands,	89 %	11.0%

The good effects of technical management are brought out by the yield figures given below. While the average return from the State forests is a little below that of the technically managed communal and corporation forests, the latter probably occupy the better sites.

Yields per hectare in 1908

Average for whole country,	2.42 cubic meters
State forests,	4.08 cubic meters
Communal and corporation forests, technically managed,	4.29 cubic meters
Communal and corporation forests, not technically managed,	2.46 cubic meters
Private wood lands,	1.55 cubic meters

Seventy-six per cent. of the wood used in Switzerland is grown at home while the remaining 24% has to be imported.

Forstataitisches aus der Schweiz. Forstwissen. Centralblatt. March 1912. Pp. 160-162.

Conditions in Finland.

With 63% of the total area wooded lumbering is the main industry. The principal species are pine, spruce, and birch. There is also some red and white alder and aspen. Growth is slow on account of the adverse climatic conditions. In the southern part the average length of time required to grow a sawlog 7 meters long and 25 centimeters in average diameter is 111 years for all species and 116 years for spruce. To attain the same dimensions in the middle of Finland 142 years are necessary on the average and 153 years for spruce. In the northern part the average time for all species is 175 years and 202 years for spruce.

Between 1870 and 1908 the number of sawmills increased from 132 to 159 and the output of sawtimber over 200% from 1885-1908. In the wood pulp industry there has been a like increase. In 1885 there were only 11 mills producing 16,458 tons while the 42 mills in operation in 1908 turned out 119,488 tons of pulp. However, with the increase of the exports of sawtimber and wood pulp the naval store industry has diminished. The minor forest products are birch bark, pine cones, charcoal, peat, and berries.

There is no export duty to Russia but a tax is placed upon pine and spruce shipped to England, France, Holland, and Germany. These countries take most of the larger timber, while firewood is sold to Russia and Sweden.

Die Holzlieferung des Grossfürstentums Finnland. Forstwissen. Centralblatt. March, 1912. Pp. 175-176.

POLITICS AND LEGISLATION.

Forest Area in Bavaria.

With approximately 37% of its total area devoted to raising forest crops Bavaria is thought to have reached the point where its agricultural area cannot be further diminished. From 1895-1897 $2\frac{1}{2}$% of the total area was converted into forest area, military reservations, etc.

Feld-, Wald-, und Forstpolizei in Bavaria. Forstwiss. Centralblatt. March, 1912. Pp. 134-140.

Property Conditions in Switzerland.

In a brief consideration as to what might be done for the small farmer (Bauer-peasant) to induce him to manage his woodlot better, Greyerz gives us incidentally a few interesting glimpses into the history and present conditions of property rights in forests still to be found in Switzerland. He uses them to show the difficulties that meet the proposition to induce such management with regular annual sales, etc.

"Narrow and primitive—often uneconomical—are the conditions of the small Alpine farmer, yet there is a certain poetic glamor, the fascination of a dumb yet expressive language of the past, which binds the son of the mountains to his glebe, his patrimony."

In 1400, one of the barons in financial need proposed to sell one of the villages which owed him allegiance, Frutigen, to the city of Bern. The people of Frutigen did not like to be sold and bought themselves off at a big price—an exhibition of the jealousy with which they guarded their institutions. In the 16th to 18th century the forest properties of such communities, although paid for by them, were declared public forests by the cantons, and only in the middle of last century were the communes and peasants rehabilitated in full ownership; the public forest idea, however, remaining in so far as the support of the school and church, bridges, etc., still rested on them. These communal forests in some communities are limited in ownership, that is; the use of the forest is a right attaching to given farms; in others, "whoever is 20 years old, and puts up his own hearth and light in the realm of the community" participates in the usufruct of the common property.

In Frutigen, the old rights of user of the 14th and 15th century were renewed in the sixties of last century. Here the ownership was limited, i. e. attached to the owners of certain farms. The forest was intended to furnish materials as needed, but with conditions. "Who with his possessions borders on a mountain or communal forest may not take wood farther away than two klafter from his fences; also time and manner of exercising the rights circumscribe them; and commissioners determined to how much, according to his special needs, this or that peasant might be entitled to. Presents might also be made to some adjoining community damaged by fire, with corresponding reductions of the lots assigned to the home people—a truly communal spirit! Naturally, since all are interested in the forest itself the owners are inclined to keep it up in condition. Yet the rich associate may build a splurgy house and get the material, while the poor, who has no direct use for it may sell his assignment, as well as the widow, who cannot cut it. Here, it would be better for the forest and the associates to have at least part of the harvest put up at auction or sale. Some peasant may have his farm located high up the mountain above the common forest, and therefore can economically draw only on his own woodlot above, and in general his personal woodlot may suffice for his needs. A curious objection to the sale proposition is that the Bauer would rather have wood than money, being afraid that the latter is too easily dissipated. Moreover, he is afraid of innovations and the ideas of modern forestry are looked upon with doubt.

Die Forstverwaltung waldarmer Berggemeinden. Schweizerische Zeitschrift für Forstwesen. May, 1912. Pp. 149-153.

Forest Law of Italy.

Italy, which has excelled in good forest legislation without execution, has in 1910 improved upon the law of 1877, which has not abated the damage by floods, landslides, and torrential action. The main feature of the new legislation is the creation of an independent administration of the State forests, which "by increase, by forbidding their sale and by the good example of their rational management are to promote the development of a national forest management as well as trade in forest products." [With the present area of a little over 100,000 acres and no money in the Treasury an unrealizable wish!]

The State property is to comprise: (a) the present State forests declared inalienable; (b) the forests at present administered by the Finance department; (c) the absolute forest soil belonging to the State; (d) newly acquired forest lands; (e) newly reforested, or by special legislation ordered to be reforested by the ministry of public works, which the ministry of agriculture may deem desirable to be added to the State forests. These forests are to be managed under working plans approved by the ministry of commerce and industries. [It is difficult to see who is on top!] Important is the clause giving the forest administration the right to secure from the agricultural and soil credit banks and from savings banks loans or advances.

The forest belonging to municipalities, provinces, public institutions, corporations, associations, stock companies are to be managed according to prescriptions by the forest administration. To promote reforestation of devastated areas technical advice free of charge and premiums of $4 to 8 per acre may be granted; and waste lands so planted are to be exempted from taxation, for 15 years if in coppice, for 40 years if high forest. Small owners in the mountain districts are to be assisted free of charge and associations of them to be encouraged.

For the first five years $6.6 million are set aside to carry out this law; after which regular appropriations in the agricultural budget are to be provided.

Several other propositions regarding reorganization of the provincial conservation commissions, e. g. abolishment of the chestnut limit, regulation of pastures in mountains, reorganization of forest school, institution of experiment stations, etc., do not seem to have been enacted into law.

Die neue Forstgesetzgebung Italiens. Schweizerische Zeitschrift für Forstwesen. Jun, 1912. Pp. 196-198.

Forest Administration in Prussia.

Those interested in administrative organization will find many interesting suggestions in a series of articles which have lately appeared in the Zeitschrift für Forst und Jagdwesen regarding a proposed reform in the organization of the Prussian Forest Service. The starting point is furnished by Forstrat Laspeyres in the February number, and in each subsequent issue—April, May, June, July—the discussion has been taken up by others. The discussions are naturally mostly too local to make their briefing in this journal desirable; but the illustrations of the principles behind them may pay the reading by those specially interested in such questions as the position of a forest service in the government administration in general, and the relation of that service to private forest owners; whether within the service a collegial or a prefectorial (directorial) form is preferable, and who is to exercise the direction; in other words the function and relation of different officials; the size of districts, managerial, inspectorial, administrative, etc.

Zur Reform der Staatsverwaltung, etc. Zeitschrift für Forst-u. Jagdwesen. February, April, May, June, July, 1912.

MISCELLANEOUS.

Adalbert Schiffel.

Those who would like to know how in Austria leaders in forestry are formed, will find interesting reading on the few pages devoted to an account of the career of one of the great leaders of forestry science in the world. The subject of the sketch is now professor of forest mensuration and forest finance, replacing v. Guttenberg. Schiffel is known to American readers as an investigator in the field of mensuration not only (form quotient!) but also of silviculture, and as a suggestive writer on forest organization and indeed on a wide variety of forestry subjects.

Centralblatt für das gesammte Forstwesen. April, 1912. Pp. 153-156.

NEWS AND NOTES.

From a list of the German Foresters Associations—all of which are professional—we learn that there are at least 16 such with a total membership of 5,643, the largest being, of course, the general one, Deutcher Forstverein. The three oldest associations persistently in existence are the Badish Association, founded in 1839, the Silesian one in 1841, and the Thuringian in 1849. The list which is to be found in Zeitschrift fur Forst-und Jagdwesen, May, 1912, also gives the dates of the last and coming session, the presiding officers, the place of publication of proceedings—and all of them publish—and the subjects discussed at the last sessions.

There is apparently enough association life among American foresters to make it desirable to keep track of it in a similar manner. The FORESTRY QUARTERLY offers its pages for the purpose.

A curious news item is the formation at Ilmenau Thuringia of an "association of friends of natural regeneration." The association is formed to take position against the spread of the method of clearing and planting and to advocate natural regeneration wherever possible. This is, indeed, a crowning of the association bugaboo! Every intelligent silviculturist knows that natural regeneration is possible wherever seed trees are left. The question can only be, do we know how to secure it practically successfully? And the practical success is measured not only by the physical but by the financial result.

The advantage of the artificial method is that its physical success at least can be forced and apparently its financial success is also demonstrable. Natural regeneration requires not only more knowledge and skill, but is uncertain in its result. Indeed, in many localities its success is a matter of luck dependent on the weather. We would advocate to try our luck first, but, if not successful at once, like a wise man, force the luck by planting. We are inclined to welcome this new association as an economic joke!

A preliminary statement issued by the Census Bureau shows the consumption of pulp wood for the years 1908 to 1911, to have constantly increased by 981,099 cords or 29.3 per cent. to 4,328,-052 cords, the increase of consumption in 1911 over 1910 being only 5.7% with a decrease of active mills from 272 to 268. The increased consumption was quite general through the States, Texas making the greatest stride with 122.7 per cent. Spruce is still the most important species, furnishing 58.1 per cent. of the total of wood, while this is 1 per cent. above 1910, it is a considerable falling off against former years, 1909 with 60.5, 1908 with 64.5, and 1907 with 68.2 per cent.

Curiously enough the increase in the consumption of spruce is entirely from domestic supplies. A small increase in the consumption of slabwood (68%), which is however, greater than the increase in all wood, is noted with 280,534 cords. The output of pulp in 1911 was 2,686,134 tons, an increase of 6 per cent. over the previous year.

Another advance Bulletin from the same source gives the statistics for the Census year (1909) of the timber and timber products, which took third place in value compared with all other industries.

In 1909 there were in the United States 40,671 establishments; 784,989 persons engaged in the industry, of which number, 48,-825 were proprietors and firm members, 19,340 were salaried officers, superintendents and managers; 18,088 were male, and 3,717 female clerks. The average number of wage-earners was 695,019; the number in the maximum month, November, was 739,160, and in the minimum month, January, 649,239. The total number of wage-earners on December 15, 1909, or the nearest representative day, was 838,160, of which number, 826,978 were males, and 4,027 females, all being 16 years of age and over; while 6,886 males, and 269 females, were under 16. The capital invested was $1,176,675,407. The total expenses were $995,622,839, of which the officials received $29,448,332, clerks $17,979,364, wage-earners $318,739,207, fuel and rent of power $5,082,287, other materials $503,035,292, rent of factory or works $2,623,146, taxes including internal revenue $9,863,304, contract work $32,491,242, and other miscellaneous $76,360,585. The primary horsepower was 2,840,082. The value of products $1,156,-

128,747. The value added by manufacture, which is the difference between cost of materials and value of products, was $648,-011,168.

The number of wage-earners and the value added by manufacture are, on the whole, a better measure of the relative importance of manufacturing industries than the gross value of products. In some industries the value of the materials used constitutes by far the larger part of the total value of products, the manufacturing process involving the addition of only a small amount of labor cost and other expenses and of manufacturer's profit to the cost of the materials. Moreover, in some of the industries there is a much greater duplication in the gross value of products than in others, such duplication being due to the use of the product of one establishment in the industry as material for another establishment. This duplication, of course, does not appear in the value added by manufacture.

In average number of wage-earners, the first of the ten leading states was Louisiana with 46,072; then Washington 43,749; Michigan 35,627; Wisconsin 34,093; North Carolint, 34,001; Mississippi 33,397; Arkansas 32,932; Virginia 33,287; New York 27,471; and Pennsylvania 26,873.

In value of products, the ranking order was: first, Washington $89,154,825; New York, $72,529,813; Louisiana, $62,837,912; Michigan, $61,513,560; Wisconsin, $57,969,170; Pennsylvania, $57,453,583; California, $45,000,276; and Minnesota, $42,352,507; Illinois, $44,951,804; Mississippi, $42,792,844.

In value added by manufacture, the first was Washington $52,275,954; then Louisiana $39,681,716; Michigan $32,471,918; Wisconsin $32,381,700; New York $30,824,722; Pennsylvania $30,139,347; Mississippi $28,586,246; California $26,631,376; Arkansas $26,340,660; and Virginia $21,962,911.

Under Order 16,570 of the Board of Railway Commissioners for Canada, issued under date of May 22, 1912, fire patrols have been established covering the forested sections of British Columbia, Alberta and Manitoba, along the lines of the Canadian Pacific, Great Northern, Grand Trunk Pacific and Canadian Northern Railways. The details of the patrols were worked out in conference between Chief Fire Inspector Clyde Leavitt, the representatives of the Provincial or Dominion Forestry or Parks Branches concerned, and the representatives of the various railway companies affected, designated for this purpose. The bases for the discussion at the various conferences were the plans submitted to the Board of Railway Commissioners by the Dominion Forestry Branch and by the Department of Lands of the Province of British Columbia, in connection with the application for the issuance of an order by the Board covering the railway fire situation. In general, the plans adopted provide for a specially-organized force of patrolmen, who devote their whole time to this work. However, under certain circumstances the patrol work is performed by the regular employees of the companies, such as section men, track-walkers, bridge and tunnel-watchmen, etc., as a part of their regular work. For the most part, the patrolmen travel over their districts by means of velocipedes, otherwise called speeders or jiggers. Under some circumstances, power speeders (gasoline) are used, while on the steepest grades the patrolmen must travel on foot. The patrols cover those portions of the lines under construction as well as the parts under operation. In this way, what is in many cases the most dangerous period of a railway's history from the point of view of fire, is safeguarded as adequately as possible. The entire railway organization is brought into play in connection with fire-fighting work, and all employees are made available in case of need.

The field administration of the regulations is provided for through a plan of co-operation between the Board on the one hand and the Forest Branch, Department of Lands of the Province of British Columbia, and the Forestry and Parks Branches of the Department of the Interior of Canada, on the other. In pursuance of this plan, certain officials of the co-operating organizations have been appointed officers of the Board of Railway Commissioners, for the purpose of supervising the work of the railway companies under the Order and under the instructions of the Chief Fire Inspector. In a number of cases, men devote their whole time to this class of inspection work, while in others the work is done as a part of their regular duties. The field officers are given wide authority to deal directly with the railway companies, and in this way prompt and efficient action is made possible.

The construction of fire guards is also being handled under Order 16570, in the Provinces of Alberta, Saskatchewan and Manitoba. A plowed strip sixteen feet in width on each side of the track, at a distance of less than three hundred feet, is required, throughout the three Provinces, except where a satisfactory showing is made by the railway company that such construction is either unnecessary or impracticable.

Notice has been served by the Solicitors for the Canadian Pacific, Grand Trunk Pacific and Canadian Northern Railways, of the intention of these Companies to appeal to the Supreme Court of Canada from certain features of Order No. 16570 of the Board of Railway Commissioners for Canada, issued under date of May 22, 1912, and covering the prevention and control of railway fires in the Dominion. The specific points with regard to which appeal is to be taken are as follows: (1) The provision in Regulation 4 which requires that each railway company shall provide inspectors for the inspection of locomotive equipment in use upon its own lines; (2) The provision in Regulation 5 that engines found defective with regard to fire-protective appliances may be removed from service by any authorized officer of the Board; (3) Regulation 8, which prohibits the burning of lignite on locomotive engines; (4) The provision of Regulation 14, which prescribes the duties of certain railway employees in case a fire is discovered along the right of way.

It does not appear that the railway companies are attacking the authority of the Board to require the companies to establish fire patrols, to extinguish fires along the rights of way, and to construct fire guards, which are really the fundamental features of Order 16570.

At a preliminary hearing held August 8, leave to appeal was refused with regard to Regulations 4 and 14. The other points to which exception is taken by the railway companies will be considered at a later date.

An interesting color print accompanied by a pamphlet, comes to us from the Netherlands, which would seem more appropriately to have originated from Canada or the United States. It shows a forest on fire and calls on the people to prevent forest fire, giving advice how to do so. One hardly expects such necessity in an old settled country!

We have also similar educational matter from Oregon and Pennsylvania.

A movement is on foot to establish Mount Olympus, National Park, in the State of Washington, Congressman Humphrey having introduced a bill in Congress to that effect. The area is known to be one of the most rugged and picturesque regions on the continent. We believe, it is included in a National Forest, and if this is so, there is perhaps no need to alter its status except for the money to be spent in order to make it accessible.

A most successful forestry conference was held in July in the White Mountains, bringing together under the auspices of the Society for the Protection of New Hampshire Forests, directors of the American Forestry Association, representatives of the Association of Northeastern Foresters' of New Hampshire Timberland Owners' Association and New Hampshire Forestry Commission.

It is a matter for congratulation to the forestry world to note the solid progress which in the last few years has been made in New Hampshire in establishing a forest policy, engaging the national government, as well as private citizens and corporations in the effort to save the beauty and the value of the White Mountains. The most important results of the agitators is the efficient protection against fire which the Timberland Owners' Association has organized in co-operation with the State, and the reservation of considerable areas of timberland, some of which were visited. The most important part of the proceedings was a symposium on forest taxation in which members of the recently created State Tax Commission took part.

An annual convention of the Canadian Forestry Association is announced to take place on September 4, 5, 6, at Victoria, B. C.

The newly created Forest Service of the Province in charge of Mr. H. R. McMillan under the active Minister of Lands, Hon. W. R. Ross gives special point to this meeting.

An interesting article on prevention and fighting forest fires by

Professor Kienitz is printed in translation by Mr. Ellwood Wilson in the Canadian Forestry Journal for May—June, 1912.

"Forest Leaves" brings in the October number of 1911 an account of the Forest School at Tharandt. In it the writer, an instructor at the Mont Alto Academy, calls this latter "the only technical State school in America" and Tharandt its model! What would the professors of Tharandt think if they saw their offspring? How far does the Academy reach up to the standard set in this issue? These questions do not propose to reflect upon whatever good work the Academy is doing, but upon the mistaken notion of its position.

Some years ago a Russian entomologist reported on partially successful experiments in the use of vaccine to combat insects. We, now, are in receipt of an advertisement by W. Osmer Majilton, M. D., of New York, claiming a successful application of vaccination in case of elm blight, hickory borers, fruit tree blight and San Jose scale. The vaccine is a patent and its nature not disclosed.

The Appleton & Sewall Co. has closed its New York office. Mr. James W. Sewall, formerly of this firm, has opened an office at Old Town, Maine, to carry on forestry work, having associated with him almost the entire woods force of the Appleton & Sewall Co.

Among the literature, that is most useful, but can receive only occasional mention by us are the various "Rangers" issued at the headquarters of National Forests. These are unique undertakings to keep the force on the Forest informed not only of doings in the District, but also of the practical literature, in addition to bringing articles from the practical field, containing many useful suggestions.

There is even style to these modest journals, as the last number of the "Sierra Rangers", testifies, not to speak of its contents which as the name and the red looks of the number implies—Forest Fire Number—is given up to this most important subject. A blue print of a newly designed (McLeod and Gray) combination fire tool looks as if it should become known to wider circles. It combines a scratching rake with a spade-like blade, or hoe. Hoe and rake weighing 5 pounds, 6 ounces.

Another publication of very neat make-up that comes to our desk is *The Pine Cone*. It is sometimes amusing, as when writing on Low Price of White Pine, but it appears always frankly as an advertising scheme. It is rather interesting to note that white pine manufacturers find it necessary to make this special effort to praise their ware. The probability is that just because White Pine is not so low in price, wavering between Cherry and Walnut in market value, many wood users look for cheaper substitutes, and hence must be shown the error of their ways. In the article referred to it is asserted that in the early days of lumbering white pine lumber could be sold at the mills for $7.50 to $9.00, while this latter figure now represents the stumpage price alone, and the cost of lumber at the mill $19 to $20. It sells, however, for different grades at from $23 to $99.

A PROPOSED COLLECTION OF FOREST VERSE.

It may be known to some few of the readers of the Forestry Quarterly that the writer has been for some years making a collection of verses and songs relating to the life in the Forest Service and the life and work of the American forester. This collection now includes some one hundred or more selections, good, bad, and indifferent. During the past two years, since the practice has become common of issuing news letters from most of the National Forest headquarters, the quantity of this verse has greatly increased. Some of it may be considered of high merit; some of it is too crude to be considered. While the appeal of the greater part of what has been written is local, still the work on all of the National Forests is, in general, so similar, the duties of forest officers so much alike, whether the National Forest be located in Alaska or Florida, that it is believed that the time has come to bring together and issue in a small volume the verse that can be brought together and that may be considered worthy. It is believed that such a volume, modest though it may be, will tend to further increase the *esprit de corps* that has characterized the men in the federal forest service as well as foresters generally. Ours is a new profession in America and yet in the comparatively few years that the work has been going on wonderful strides have been made in the actual practice of the profession as well as the placing upon permanent record some of the results of such progress.

Are we not far enough ahead now that we should begin to collect the songs, the verses, and the stories that have grown up about the life—in short, to start to record the non-technical literature, if you please, of the American forester?

The different forest schools in the United States have naturally contributed in large measure to the forest songs now extant. Many of the songs are parodies, but some are worthy to last; some are original—these certainly deserve a permanent place in any collection of American forest verse. Some of the verse is crude, illy rhymed, some of it is written by technically trained foresters, a good deal by the forest ranger on the firing line.

While the collection is fairly large at present still it is felt that there is much material that should be included which the writer has not had an opportunity of obtaining and which he is extremely anxious to secure, especially verse that has appeared in the various forest news letters issued by forest supervisors. This note is intended as a plea to every reader of the Quarterly, as well as every member of the Forest Service and anyone interested in the plan, to send to the writer at the address given below any and all verse that reflects in any way the life or work of the forester or forest ranger. It is a broad field, including the United States, Canada, Alaska, Hawaii and Philippines. It is proposed to give the name of the author of each selection, unless the author prefers to have his name withheld. The writer will undertake the collection and editing of the material for the volume, with the hope that the booklet when it appears may find a place for itself with the men of the U. S. Forest Service and with every forester and forest ranger, whether he be in the federal forest service or not.

JNO. D. GUTHRIE,
Springerville, Arizona.

COMMENT.

The Editor is overwhelmed by the mass of good printed material that comes to his desk and should receive recognition and reference in the QUARTERLY. The technical home literature is growing so rapidly, not only in bulk but in quality, that the Editor must acknowledge his utter inability to do justice to it, especially as long as the publisher or business manager insists that the size of the magazine, the subscription price, and the subscription list are growing utterly out of relation. Yet, if the magazine is to fulfill what is perhaps its most useful function, namely, record for reference, all important development of the technical side of the profession, it must expand the space for this purpose. At the same time, without any solicitation, original articles written specially for the QUARTERLY are also multiplying and clamoring for space. So far the Editor has not considered it safe to exercise his function of scrutinizing for quality very vigorously, and has printed nearly all that has been offered, in order not to discourage the good will behind the effort. There is no thought of in anyway reflecting upon the work of the contributors of the past, who deserve only credit, but, since the quantity is growing at a geometric ratio, it may be proper to give warning that it may become necessary to refuse acceptance of manuscript, which is too diffuse or of too temporary value, or of minor interest.

All this development is, of course, a matter for congratulation! That in the short space of ten years, without any extraordinary attempt at pushing matters, this magazine has grown from 172 pages to over five times that size, is a sign of the rapid development of the profession, and of the existence of at least a few devoted adherents who see benefits in keeping abreast with the growth of technical knowledge. The subscription list has, however, not grown in the same ratio. Beginning with barely over 100 readers when it was a one dollar student publication, it has not quintupled its bona fide subscription list, although its distribution reaches nearly the figures of 900. That each annual balance under these circumstances should still be on the wrong side is not so creditable to the professional spirit or interest.

Perhaps the management is to be blamed for not exploiting the field more assiduously, whereby the subscription list might be enlarged, and with it the advertising. But so far there have been several practical difficulties in the way of employing paid labor, hence the business conduct as well as the editorial work has had to be done by busy men as a side show, a work of love; and the routine work has absorbed all surplus energy of Editor and Manager.

To sum up, the QUARTERLY has run away from its editor and publisher, and it becomes necessary to corral it, and organize anew its business conduct as well as its literary side, and place it on a manageable basis.

The completion of the tenth volume with the end of this year furnishes the special occasion for this long needed re-organization.

The first step, however, will be taken at once by returning the publication office to its original home, Ithaca, thus accentuating the revival of the school, albeit in different form, which gave the incentive for beginning this magazine.

Another step, which denotes the closing of a decade rather than the beginning of a new one, is also under way, namely the preparation of an index covering the first ten volumes. This will greatly increase the value of the set. The business manager would like to know, how many copies of probably 100 pages at probably $1.00 subscription may be wanted. *Write him if you want one!*

Write also the Editor your views as to the following points:

In what respects does the QUARTERLY need improvement most urgently?

How do you think such improvement can be most readily secured?

Should the subscription price be increased?

How is the subscription list to be increased?

As to the last point, do you realize that if, persuaded that this journal is a good thing to have, each of the present subscribers sets out to find one other, new subscriber, the trick is done of securing 1000 subscribers which in entire modesty we believe we are at present really entitled to.

Think it over, and act!

The present issue may be called an educational number, just as the first issue of volume VIII was, which brought reports of the first school conference, and whoever wants to complete this educational literature will also do well to refer to several articles in volume VII, No. 1.

We feel sure that the voluminous report of the Committee on Standardization for the completeness of which the Chairman, Mr. Graves, deserves full credit, is an important contribution to American forestry literature and will be most helpful not only to teachers of forestry but to students. Even the practitioner in the field may find it useful reading in clearing up some hazy notions he had secured in the class room.

The thoughtful reader may come to the conclusion that the minimum standard is set rather high, and to do the work well rather more time is required than is assigned. To this objection the rejoinder is that not all things can be learned in school, some must be left to self-study, and it is the business and art of the teacher to find the limits of the possible, keeping in mind that to develop capacity for self-help, rather than filling up with information is his task.

There is much time given to "practical" work—over 60 per cent. of the total time. This is the time which is capable of more wasteful use than the class-room work, and it is apt to be wasted, unless it can be, or much of it, concentrated. On closer analysis it is indeed not such a large allowance as it appears, and most of the higher grade schools provide for more field work than this allotment contains. The 65 hours in dendrology represent only twenty odd forenoons or afternoons. There are, indeed hardly 600 hours for real fieldwork. Those institutions which have a spring or fall camp for practice work and a 10-day visit to lumber camps will readily live up to the total hour requirement, even though it may be differently distributed.

The facilities for practical work will vary considerably with different institutions. This should not, however, discourage those who are not so conveniently located. They will have to make their theoretical teaching so much better realizing the fact, that practical men are not made in school anyhow, where they can only acquire ease of manipulation, but in practice, and then only those who are practically inclined by nature. In the end the theoretically well taught are better fitted to become really practical, i. e. able to apply their knowledge to a purpose and invent new applications.

We hope that what has been done in the report for clearing-up the hazy conceptions of what forestry teaching involves for the higher grades may now be done for the lower grades, which need most serious attention.

The rain makers are at work again, this time in Michigan, in the city which is noted for other fads, Battle Creek, and that under the auspices of the Industrial Association of the place whose duty is to advertise it, supposedly hard-headed business men. They send out clippings and other paraphernalia giving account of a successful rain produced by explosives (dynamite) on July 23.

Shall we say, the crop of fools never dies out, or is always reproduced? No, we will not say that, for, sometimes, what could not be done at one time may even by a really foolish misconception of conditions become possible at another time. From the evidence received we are, however, still inclined to side with the doubting Thomases. We see no reason for believing that the problem is solved; certainly the explanation of the rainmaker as regards his success is contrary to all other physical knowledge.

We have ourselves passed, in 1891, through a period of trouble in holding up the standard of scientific truth, when Congress appropriated money for rain-making experiments to the Forestry Division. The arguments against the expectation of forcing the large masses of air that must be influenced to do our bidding are laid down in the annual report of the Division and will make now again interesting reading. We cannot afford the space to recite them. Meanwhile the Weather Bureau which has come in for a good deal of abuse in connection with the matter will go on predicting rain, about 80 per cent. correct, and sometimes 90 per cent., and not, as the ignorant burghers expect, always.

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Volume X No. 4

FORESTRY QUARTERLY

A PROFESSIONAL JOURNAL

Subscription Two Dollars per Annum

ITHACA, N. Y.

1912

Application pending for entry as second-class matter.

FORESTRY QUARTERLY

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

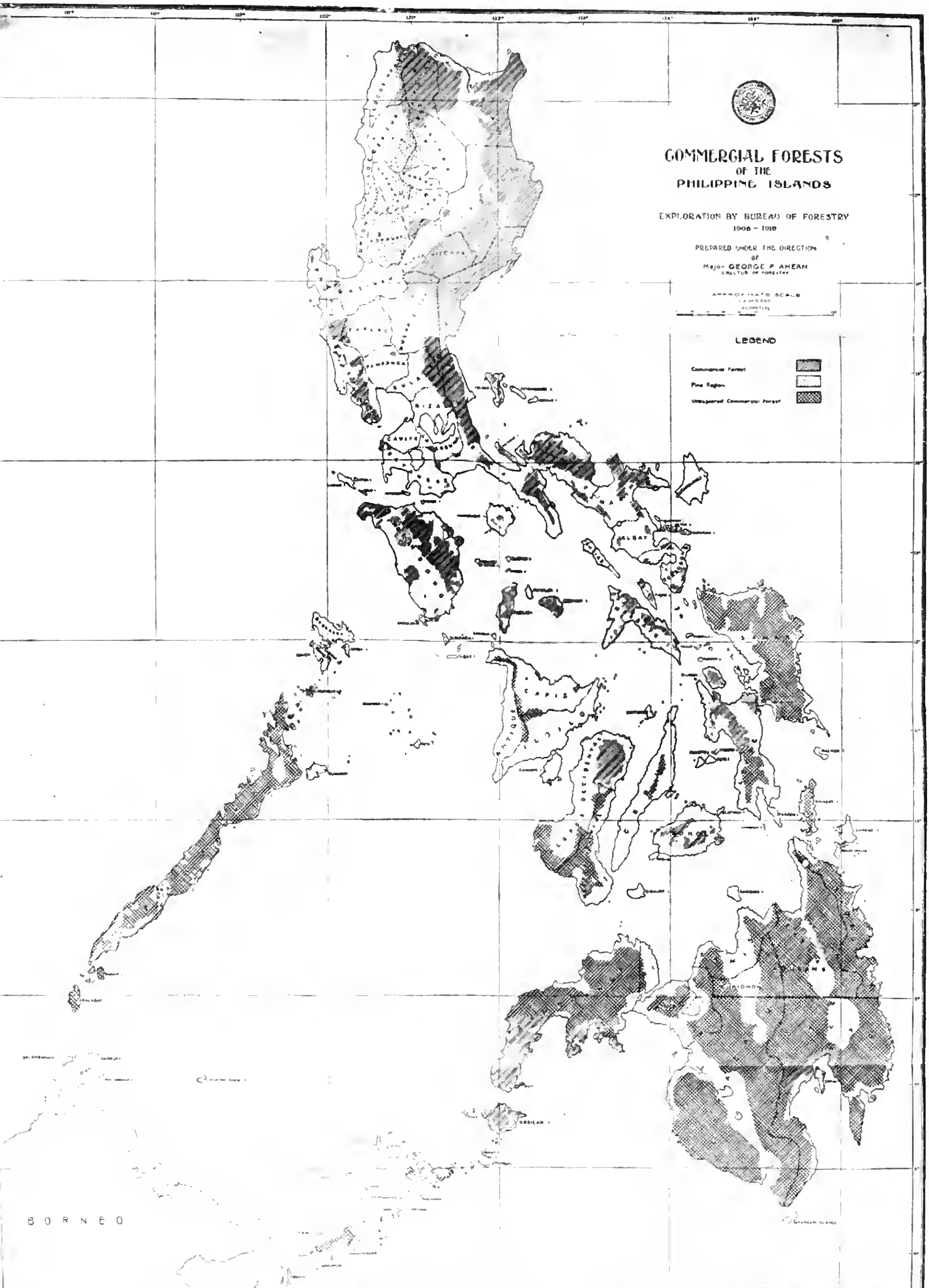
To offer an organ for the publication of technical papers of interest to professional foresters of America.

To keep the profession in touch with the current technical literature, and with the forestry movement in the United States and Canada.

Manuscripts may be sent to the Editor-in-Chief at the University of Toronto, Toronto, Canada, or to any of the board of editors.

Subscriptions and other business matters should be addressed to Forestry Quarterly, Ithaca, N. Y.

Press of
Watchman Printing House
Bellefonte, Pa.
1912


COMMERCIAL FORESTS
OF THE
PHILIPPINE ISLANDS
EXPLORATION BY BUREAU OF FORESTRY
1906 – 1910
PREPARED UNDER THE DIRECTION
OF
Major GEORGE P AHERN
LEGEND
CAPIS
ANTIQUE
BORNEO

FORESTRY QUARTERLY

VOL. X.] DECEMBER, 1912. [NO. 4.

THE FORESTS OF THE PHILIPPINES.

[Extracts and condensations from *The Forests of the Philippines*, by Dr. H. N. Whitford, Bulletin No. 10, Bureau of Forestry, Department of Interior, Philippine Islands, 1911.]

BY M. L. MERRITT.

The compiler having spent several years in the Philippine Islands has excerpted such points from the valuable publication by Dr. Whitford as may give a sufficiently clear idea to American readers of forest conditions in that country.

I. CLASSES OF VEGETATION IN THE PHILIPPINE ISLANDS.

1. General.

There is little question but that practically the entire land area of the Philippines, from sea level to the highest mountains, was originally covered with unbroken forest growth of some kind. The following represents the present classes of vegetation, with the estimated area of each:

Classes of Vegetation.	*Area (square miles.)*	*Percentage.*
Virgin forests,	40,000	33 1/3
Second-growth forests,	20,000	16 2/3
Grass lands,	48,000	40
Cultivated lands, a	12,000	10
Total,	120,000	100

a It is difficult to estimate, even roughly, the area under cultivation. The above is probably not far from the total amount that has been cultivated some time within the last twenty years. Probably less than half of this is actually under cultivation at any one time.

Put in another way, the land area of the Philippines is about equal to that of the State of New Mexico, while the virgin forest area is approximately equal to the entire area of the State of Kentucky.

2. Grass Lands.

The large grass areas, called *cogonales,* are covered principally with two species—cogon grass *(Imperata exaltata)* and talahib *(Saccharum spontaneum.).* Such areas are known as *cogonales.* They are mainly the result of a shifting system of agriculture, which is prevalent throughout the Tropics and known in the Philippines as caiñgin making.*

Cogonales originate in the following manner, and remain as such so long as fires prevail. Usually a small portion of original or second-growth forest is cut during the dry season, the timber and brush are allowed to dry, and are then partially burned. The area thus prepared is planted with rice, sweet potatoes, corn, or other crops. Cultivation then practically ceases, and the jungle growth, consisting of grass, weeds, and tree species, quickly gains ascendancy over the planted crops, and at the end of the first, second, or third year the caiñgin maker abandons his clearings for a new one in another patch of forest. If the jungle growth is set on fire, as is frequently done, nearly all plants except the grasses are killed. In this way through many years vast areas of forest lands have been converted into *cogonales,* and repeated firings have prevented any change in their vegetation. Abandoned areas, formerly more intensively cultivated, have also become changed to grass lands in the same way. It is surprising how quickly this grass will become dry enough to burn. Three or four rainless days will permit it to burn with sufficient heat to kill nearly all the seedlings of woody species. Grass lands are prevalent on land of nearly all types of topography, from sea level to the tops of the mountains. In the pine region of central and northern Luzon other species of grasses frequently take the place of the cogon, although these grass lands originated in the same way.

3. Second-growth Forests.

The 20,000 square miles of second-growth forests in the Islands, like the grass lands, are due in the main to the caiñgin

*Known in India as taungyas.

system of agriculture. If fires are not started when the caiñgin is abandoned, the woody species quickly gain the ascendancy and shade out the little grass that has obtained a foothold. Here, as in temperate regions, certain species of little value enter the freshly deforested regions, giving rise to subtypes of forest known under the Tagalog name of "calaanan," the Visayan name of "late," and the Moro name of "boog." On freshly exposed soil, the first stages of this reforestation process are remarkably similar throughout the Islands. At first, the composition is very simple, being made up principally of the following species: Hamindang *(Macaranga bicolor)*, binunga *(Macaranga tanarius)*, hinlaumo *(Mallotus ricinoides)*, alim *(Mallotus moluccanus)*, and balanti *(Homalanthus populneus)*, all belonging to the Euphorbiaceae; anabion *(Trema amboinensis)*, belonging to the Ulmaceae; and anilao *(Columbia serratifolia)*, belonging to the Tiliaceae. For small areas, sometimes one—sometimes another—of these trees are found in almost pure stands. This is particularly true of hamindang, binunga, anabion, and balanti. All these trees are capable of producing seeds within a year or two after germination. Some are edible, and are thus quickly scattered by birds and animals; others have fruits adapted to wind distribution. Most of them mature early, are light loving, and are replaced by a more complex stand, composed of shade enduring species. Ultimately, these second-growth forests may re-develop into forests whose composition is much like that originally destroyed.

In the natural re-forestation of the grass lands, another set of species first gains entrance. In the high regions of central and northern Luzon, the Benguet pine *(Pinus insularis)* is the pioneer species. In the lowlands among those that first gain entrance are binayuyu *(Antidesma ghaesembilla)*, alibangbang *(Bauhinia malabarica)*, duhat *(Eugenia jambolana)*, acleng-parang *(Albizzia procera)*, and others. The first two of these are especially able to resist the effect of fires, and thus can occur as scattered trees through the grass lands. When fires are checked for several years, these trees often form the centers for closed stands, and eventually cover large areas. These sub-types become gradually more and more complex, the rapidity of the process depending on their distance from seed-bearing trees, and, of course, the composition varies according to the character of the species of the seed-bearing centers. Thus so many sub-types exist that it is difficult to make generalizations. Advance stages in the development of second-growth forests are so mixed with tangles of climbing bamboo and other vines that they are difficult to penetrate. Such forests often cover large areas, and are the so-called jungle growths of the Philippines. They often alternate with patches of grass, with which they make the vegetation known as *parang*. Forest fires such as exist in drier portions of the Tropics and in temperate regions do not exist in the Philippines. Surface fires run through the pine forests, destroying young trees and injuring somewhat the older ones. Outside the pine regions there are practically no forest fires, only "prairie" fires and burnings of timber that has been felled previously. These may injure the edge of the original forests, but do not penetrate them and produce conflagrations such as are known in the coniferous forests of the temperate regions. The *parang* districts often show kaleidoscopic changes, due to the rapid development of jungle growth where the fires are checked and the entrance of grass or second-growth forests in newly abandoned caingins. In the more thickly settled portions of the Islands, and along well-traveled trails, practically all the original forests have disappeared, giving place to grass or second-growth forests. The second-growth forests in newly abandoned caiñgins. In the conveyed the wholly wrong impression that the forests of the Philippines, and, it is believed, of the Tropics in general, are a densely overgrown mass of impenetrable jungle. Little is seen of the original forests of the interior, for the jungle growth on its borders tends to discourage efforts to penetrate within. Over one-half (approximately 68,000 square miles) of the area of the Islands is covered with grass or with second-growth forests. The prevention of further destruction of the virgin forest, and the reforestation of the grassy regions on non-agricultural lands, both by the prevention of fires and by planting, are the greatest forestry problems of the Philippine Islands.

4. Virgin Forests.

Virgin forests are those which either have been undisturbed by man, or have been so little exploited that their original character has not been materially changed. They form the source from which the inhabitants of the Islands may draw and are drawing their main supplies of timber, and also include the protective forests of the high mountain regions. They cover approximately one-third of the total area of the Islands.

II. The Climate of the Philippines.

The average annual rainfall of the Philippines shows pronounced variations in different parts of the Archipelago, ranging from 900 millimeters (36 inches) to 4,000 millimeters (160 inches). The heaviest rains occur during the summer and autumn months (June to October), which is properly called the rainy season. The entire Islands are well watered during these months. During the winter months (November, December, January and February) the northeast monsoon rains continue to water abundantly the eastern and northern coasts, thus giving the Pacific coasts and the islands bordering the large inland seas a prolonged or second rainy season. The western half of central and northern Luzon, the western coasts of Mindoro and Panay, the Calamianes group, and small areas in other portions of the Islands receive little rainfall from this monsoon, because of intervening mountain masses. Thus a prolonged, comparatively dry season with only occasional showers prevails in these regions for the six months from November to May. In the other portions of the Islands, this dry season varies from two to four months and is more frequently interspersed with showers. In some places the showers are so frequent that there is an entire absence of a dry season. Thus, it will be seen that there are two distinct climates, one in which the dry season is long and pronounced and another in which the dry season is shorter and less pronounced and sometimes wanting. In the former region, the forests during this season shed a portion of their leaves, and some trees are even entirely defoliated for a short time; in the latter, the forests are generally evergreen. Though grass areas are found in both, they more quickly establish themselves in the drier belt. It is a general rule that throughout the Islands during the long or short dry seasons the amount of rainfall in local showers, and the relative humidity, is less in the lowlands than in the high altitudes; consequently, the forests of the low altitudes may show a much less evergreen appearance than the forests of higher altitudes of the adjacent interior mountain passes.

The monthly distribution of the rainfall should be considered, because some localities in the regions of a long dry season receive a greater annual rainfall than others in the region of a short dry season. Thus Balanga (Bataan), in the region of the dry season, has an annual rainfall of 2,394 millimeters (94 inches), of which 83.5 per cent. falls from June to October; 5.4 per cent. from November to February; and 11.2 per cent. from March to May. On the other hand, Jolo, in the Sulu Archipelago, with no dry season at all, has an annual rainfall of only 1,666.8 millimeters (65.7 inches), of which 49.2 per cent. falls from June to October; 83.5 per cent. falls from June to October; 5.3 per cent. from from March to May.

Although the Philippines have a range of latitude from 4.5° to 22° north, the variation in the temperature is believed not to be great enough to have any pronounced direct effect on the vegetation below 500 to 600 meters (1,640 to 1,968 feet) in altitude.

III. Philippine Forest Types.

To one unfamiliar with tropical regions, the forests of the Philippines present, in many places, such a tangled and luxuriant mass of growth containing such a variety of tree species and other plants that one is at first utterly confused and bewildered. Systematic study, however, reveals the fact that here, as elsewhere, differences in environment produce differences in forest growth; that forest types are generally well defined; and that often the lines of distinction are clearly drawn.

Five principal types of forest (one of these being really a combination of four types) may be distinguished. The following table names and gives a rough estimate of the area occupied by each as well as their estimated volume in cubic meters and board feet:

Type.	Area. Per cent.	Square miles.	Acres.	Hectares.	Volume of standing timber. Per unit: Board feet per acre.	Cubic meters per hectare.	Total volume: Billion board feet.	Million cubic meters.
Dipterocarp,	75	30,000	19,200,000	7,770,000	10,000	100	192,000	770,000
Molave,	10	4,000	2,560,000	1,036,000	3,000	30	7,680	31,080
Pine,	5	2,000	1,280,000	518,000	2,000	20	2,560	10,360
Mangrove,	2	800	512,000	207,200	2,000	20	1,024	4,144
Mountain,	8	3,200	2,048,000	*828,800	......	....	....	....
Total,	100	40,000	25,600,000	10,360,000	......	....	203,264	822,584

Dipterocarp Types.

General character.—Covering 75 per cent. of the virgin forest area or 30,000 square miles, and containing approximately 95 per cent. of the total amount of standing timber in the Island, the dipterocarp types are pre-eminently the most important. They are found on nearly all types of topography, from immediately behind the frontal zone of the beach to an altitude of approximately 800 meters (2,624 feet) on the slopes of largest mountain masses. From the standpoint of the botanist, the composition of these forests is complex; but from the standpoint of lumbermen it is comparatively simple. As the name implies, the members of the dipterocarp family constitute the prevailing class of timber. Taking it as a whole, it is estimated that 75 per cent. of the 192 billion board feet, or 144 billion board feet, are dipterocarps. The remaining 48 million board feet in the dipterocarp forests are divided among a large number of species, representing many families.

Practically all the species of the dipterocarps are large trees, reaching heights of 40 to 50 meters (131 to 164 feet) and diameters of 100 to 150 centimeters (39 to 59 inches) or more, and it is not rare to find even these dimensions exceeded. They have straight, regular boles, resembling in size and shape the *Liriodendron tulipifera* (yellow poplar or tulip tree) of the United States. Some species of other families have a size and form similar to and codominant with the dipterocarps, but by far a greater majority are subdominant species, many of which have

*Purely protective.

ill-formed boles, much smaller in diameter and length. Underneath the dominant and sub-dominant species are a large number of undergrowth tree species which do not attain more than 10 centimeters in diameter when mature, and a height of 10 meters or less. From a botanical point of view, these add greatly to the complexity of the forests, but for commercial considerations they should be called undergrowth trees. Within the forests there are comparatively few shrubs, or bushes, and herbs.

All the types of dipterocarp forests contain climbing palms (rattans), but the number and size of other large vines (lianas) seem to diminish with the prominence of the dipterocarps. Artificial and natural openings in the forests are often covered with a jungle of climbing bamboos and other large lianas, and the edges of the forests, especially along the streams, present breastworks of twisted vines which are very difficult to penetrate; but as soon as the interior is reached it is easy to pass through the forest with only the occasional use of a bolo (machete).

Practically all the dipterocarps are evergreens, for the new leaves are formed before the old ones drop. In some of the types discussed below, a few of the dipterocarps and many of the other tree species are partially deciduous, dropping a portion of their leaves during the dry season; some species, including one dipterocarp, may become entirely defoliated for a period varying from one day to two months.

These dipterocarp forests show more or less distinct types which are here given the common names of the most numerous species found within them. These, in turn, might be divided into subtypes but, except in limited regions where intensive work has been done, little attempt has been made to distinguish them. The following division of the dipterocarp types is provisional only, but it is believed that the classification will in general hold good, and that future changes will be mainly in the nature of a division into subtypes.

Lauan type.—To this type is given the name "lauan" because several species producing similar woods having the trade name of lauan predominate. It represents the most successful commercial forests in the Philippines, and is confined to regions with a short or no dry season. It reaches its best development on the more gentle slopes near the base of the moutain masses, usually extending to altitudes of 300 to 400 meters (984 to 1312 feet) at which height it merges gradually into the tanguile-oak type. In regions of rougher topography it does not produce such heavy stands. In favorable soils it may occupy the low coastal hills, although usually near the sea it merges into the vacallauan type or the molave forest. The relative proportion of the dipterocarps is usually heavier in this than in any other type, and the total volume of timber is greater. An indication of the composition and stand of the forest can be illustrated by the following table, which is based on the results of valuation surveys.

VOLUME OF TREES 40 CENTIMETERS AND OVER IN DIAMETER IN NORTHERN NEGROS.

(Average of 54.65 hectares [135 acres]).

Scientific name	*Common name*	*Volume per hectare (cubic meters)*	*Stand per acre (board feet)*
Shorea sp.	Red lauan	185.18	18,518
Shorea furfuracea	Almon-lauan	92.02	9,202
Dipterocarpus grandiflorus	Apitong	66.63	6,663
Shorea polysperma	Tanguile	50.93	5,093
Pentacme contorta	White lauan	25.23	2,523
Parashorea plicata	Bagtican-lauan	25.23	2,523
Total Dipterocarpaceae		428.99	42,899
All others (estimated)		22.58	2,258
Total		451.57	45,157

This type of dipterocarp forest is comparatively free from jungle undergrowth. It contains a very complex small tree flora and a great many climbing palms. Erect palms, some of them reaching the height of subdominant trees, are everywhere present. Contrasted with other types, it presents a more closed canopy and consequently a regular profile. On its borders and in natural or artificial openings, lianas grow in great profusion, but while lianas occur within the forest itself, they are reduced to a minimum in numbers, and especially in size, because of the dense prevalent shade. The forest floor contains a very scanty growth of herbaceous vegetation. The undergrowth of the forest is not an impenetrable jungle. One can pass through it in all directions, encountering difficulties in the way of obstructive vegetation only in artificial or natural openings where light permits the jungle growth. In short, the dominant trees, nearly all dipterocarps, form and maintain a successful forest of trees, which produce a shade so dense as to crowd out many light-demanding species. These are either forced to the edge of the forest, or else exist in the interior in a sickly condition, awaiting as it were the chance entrance of light to permit them luxuriously to fill up the opened space. Stripped of its ornaments of palms, lianas, epiphytic orchids, and ferns, whose importance is exaggerated in the eyes of the inhabitants of the temperate regions, the lauan type bears striking resemblance to the commercial forests of the temperate zone. In simplicity of composition of the dominant trees, and in volume of wood produced, it approaches in value the famous coniferous forests of the more northern latitudes.

It is not possible to estimate the area that this type of forest occupies. It covers a very large part of the entire forests, and probably formerly occupied extensive areas which are now in cogon or second-growth forests, or under cultivation.

Lauan-hagachac type.—This type, like the preceding, is confined to regions where the dry season is short or wanting. It is restricted to areas where the water level is near the surface of the ground, reaching its best development in river bottoms, especially on slightly raised deltas, and often extending in narrow strips along the smaller streams through the lauan type, in which latter situations it is often difficult to distinguish.

In composition it differs from the previous type mainly in the presence of hagachac *(Dipterocarpus affinis)* and a much larger number of co-dominant species of other families. The volume of timber is seldom equal to that of the lauan type. The following table is an estimation of the volume of a forest of this kind.

VOLUME OF TREES 40 CENTIMETERS AND OVER IN DIAMETER ON A DELTA PLAIN IN EASTERN MINDORO.

(Average of 42.4 hectares [105 acres])

Scientific name	*Common name*	*Volume per hectare (cubic meters)*	*Stand per acre (board feet)*
Dipterocarpaceae:			
Pentacme contorta	White lauan	55.83	5,583
Shorea guiso	Guijo	14.5	1,450
Dipterocarpus sp.	Apitong	7.42	742
Dipterocarpus affinis	Hagachac	16.03	1,603
Total Dipterocarpaceae		93.78	9,378
Leguminosae:			
Pterocarpus indicus	Narra	8.76	876
Anacardiaceae:			
Koordersiodendron pinnatum	Amuguis	10.69	1,609
Combretaceae:			
Terminalia edulis	Dalinsi		
Terminalia nitens	Sacat	3.13	313
Terminalia pellucida	Calumpit		
All other (estimated)		46.67	4,667
Total		163.03	16,303

As one would naturally suppose, this forest is more open than the lauan type, consequently the jungle growth consists of tangles of rattan and other large vines. However, mature subtypes are comparatively free from jungle growth.

Erect palms are constantly present. The Mondoro portion of it, above described, shows 66.5 palms to the hectare* (not including young ones without stems), composed of six different species. The lowlands near the mouths of rivers at the head of Davao Gulf (Mindanao) will show even a larger stand.

As the lauan-hagachac type occurs on land sought for agricultural purposes, especially for the cultivation of rice, the area oc-

* 1 hectare equals 2.47 acres.

cupied by it is very limited in extent. In thickly settled agricultural regions it has been entirely destroyed.

Yacal-lauan type.—This type finds its best development in regions where the dry season is short, on low coastal hills whose basal rock is volcanic in structure. It occurs on headlands projecting into the sea, especially those at the heads of embayments. These headlands usually have drier soils, lower relative humidity, and less rainfall than the region back of them. It also occurs on the hills bordering large river valleys that have approximately the same physical conditions.

This type, in contrast to the two dipterocarp types above mentioned, has a slight deciduous appearance during the driest portion of the year. As it has a large number of codominant species, it more nearly resembles the lauan-hegachac than the lauan type. Erect palms are scattered throughout the forest, although they are not nearly so numerous as in the previous mentioned dipterocarp type. Climbing palms and other lianas are present, but are not especially abundant except in open places. The following is an illustration of the volume of a fair sample of this type of forest in Mindanao.

VOLUME OF TREES 40 CENTIMETERS AND OVER IN DIAMETER IN THE PORT BANGA REGION, MINDANAO

(Average of 51.17 hectares [126 acres]).

Scientific name	*Common name*	*Volume per hectare (cubic meters)*	*Stand per acre (board feet)*
Dipterocarpaceae:			
Hopea plagata Pentacme contorta	Yacal White lauan	50.37	5,037
Parashorea plicata	Bagtican-lauan	26.02	2,602
Dipterocarpus sp.	Apitong	12.05	1,205
Shorea guiso	Guijo	16.80	1,680
Vatica sp.	Kalunti-lauan	12.34	1,234
Shorea squamata Shorea furfuracea	Mayapis-lauan Almon-lauan	9.46	946
Vatica sp.	Narig	6.14	614
Hopea sp.	Malayacal	2.83	283
Total Dipterocarpaceae		136.01	13,601

Sterculiaceae:			
Kingiodendron alternifolium	Lumbayao	21.35	2,135
Leguminosae:			
Tarrietia javanica	Batete	7.29	729
All others		124.35	12,435
Total		289.00	28,900

Forests of the same type in Leyte and in various parts of Luzon, especially in the Provinces of Tayabas and Ambos Camarines, show so similar a composition that they may fairly be classed under this type. The actual area that this type occupies is not known at present, but it is not large, as it occurs in narrow belts along the coast, and in many cases has been cleared by caingin makers.

Lauan-apitong type.—So far as altitude and topography are concerned, this corresponds to the lauan type, but differs from it in having a longer dry season, the effect of which is sufficient to justify its separation into a distinct type. During the dry season, this type shows a decided deciduous element. Except in places of favorable soil conditions, the forest cover is quite open, allowing the entrance of jungle undergrowth, lianas, erect bamboos, and the like. The composition of the dominant species is more complex than the lauan type, and resembles markedly in this respect the lauan-hagachac and yacal-lauan types. Here also the dipterocarps furnish the greatest bulk of timber. Many of the species found in the previous mentioned types are here not present, although all the species occurring in the lauan-apitong type are also found in the other dipterocarp types. This indicates that the distinction is a climatic one. While the dipterocarps show a decidedly less leaf surface during the dry season, only one of them, palosapis (*Anisoptera thurifera*), is wholly deciduous, but only for a day or two. This is true of a great majority of the trees belonging to other families, which contain only a few that become bare, even for a short time. On the clearing edge of this forest, there are good stands of almost pure erect bamboo; these extend into the virgin forests where the dipterocarps are mixed with cupang (*Parkia timoriana*) and other species. The bamboo undergrowth in such places, with the rather scattered trees, gives the forest the appearance of a park.

A typical stand of this forest is as follows:

VOLUME OF TREES 40 CENTIMETERS AND OVER IN DIAMETER IN BATAN PROVINCE, LUZON

Average of 50 hectares [124 acres]).

Scientific name	*Common name*	*Volume per hectare (cubic meters)*	*Stand per acre (board feet)*
Dipterocarpaceae:			
Dipterocarpus grandiflorus	Apitong		
Dipterocarpus vernicifluus	Panao	81.6	8,160
Pentacme contorta	White lauan	66.5	6,650
Anisoptera thurifera	Palosapis	28	2,800
Shorea polysperma	Tanguile	16	1,600
Shorea guiso	Guijo	4.1	410
Total Dipterocarpaceae		196.2	19,620
All others		98	8,900
Total		285.2	28,520

Tanguile-oak type.—The forests of this type cover the area extending from the upper limits of the lauan and lauan-apitong types to the lower limits of the mossy-forest type in the higher portion of the mountains. They have not been studied in great detail, and more extended investigations are necessary to determine whether more than one type exists or not. When such studies have been made in many parts of the Islands, it may be found that there are a number of distinctive types instead of the one here considered. In the meantime, the provisional name of tanguile-oak type has been adopted. Its lower limits are from 400 to 500 meters (1312 to 1640 feet) above sea level, and extends upward to a height of between 800 and 900 meters (2624 to 2952 feet). The topography is such as is usually found on mountain sides, gentle to steep ridges and slopes alternating with deep ravines and gorges. The evergreen character of the forests and actual measurements show that rainfall is more evenly distributed throughout the year, and the relative humidity is constantly higher than in the adjacent forests of the lower altitudes.

As its name implies, the principal species represented in this type are tanguile (*Shorea polysperma*) and oak; of these, the former also occurs frequently in dipterocarp types of the lower altitudes. It is found nearer sea level in regions where the dry season is short than in those where the dry season is longer, but in both its numbers increase with the altitude until the mossy-forest type is reached. In the higher portions of the tanguile-oak type, it is the only dipterocarp of numerical importance. In the lower limits of the type occur, of course, scattered specimens of the dipterocarps of the bordering types below. This is especially true of the lauans and the apitongs, although the latter are not nearly so abundant as the former. Some species that usually are found along streams in the types of lower altitudes occur in deeper soils of the tanguile-oak away from the streams. Certain species of oak, which occur as scattered trees in the lower types, here become more abundant, and in some places give a decided tone to the vegetation. Many of the species occurring in this type also occur much dwarfed in the mossy forests higher up. Indeed, the type is the meeting ground of a number of the species which are found in the types both above and below. So far as is known, there are no species of trees that reach large size that are peculiar to this zone, with the exception, perhaps, of certain species of oaks. A number of species, however, reach more successful development, both as regards numbers and size, than in the other types in which they are found. Open places occur in this as in other types, giving rise to many subtypes. The undergrowth trees are numerous, but the composition is not so complex as the types below. The closed portions of the type are comparatively free from large lianas other than rattans, so that the only difficulty in penetrating the forest in any direction is encountered in the tangled growth of the open places.

In the high plateau regions, between 500 and 800 meters (1640 to 2624 feet) of altitude, this type attains heavy stands, but usually the topography is so rough that tall forests, covering large areas without a break, are wanting. Large epiphytic plants, like birds'-nest ferns, are more abundant here than lower down. In the upper limits, the trees gradually become more dwarfed, and the trunks are covered with mosses and liverworts, until the type gradually merges into the mossy forests above.

Molave Type.

Throughout this type, molave *(Vitex parviflora)* is fairly well distributed. The type occupies a topography similar to that on which the yacal-lauan type is found, except that in a great majority of cases the underlying rock is usually limestone rather than volcanic in nature. The low limestone hills, either coastal or bordering large uplifted river valleys, are usually composed of crystalline coral limestone with a honeycombed structure. These rocks are generally covered by shallow or very scanty soil, and this, together with their honeycombed nature, makes the habitat a very dry one. It is roughly estimated that the area covered by this type comprises some 4,000 square miles (1,036,000 hectares—2,558,920 acres). The trees are the most valuable in the Philippines, and are easily accessible for exploitation. This has brought about the more or less complete destruction of the original forest, and so it is very difficult to analyze the true nature of the vegetation. From the study of virgin and nearly virgin areas, however, the following characteristics seem to be most general. The forest is open. Its large trees are few and far apart, with the intervening spaces filled with small trees, or by a jungle growth usually of sprawling, climbing, or small erect bamboos. With a few exceptions, the dominant trees are short boled, irregular to very irregular in form, and with wide-spreading crowns. The forest has a decidedly deciduous foliage, almost entirely so on rough topography in regions where the dry season is pronounced. The composition of the type varies in different parts of the Islands.

In some expressions of the type, the following are among the dominant trees present: molave, dungon, tindalo, supa, batete, ipil, acle, banuyo, alupag, bansalaguin, calantas, lanete, mancono, batitinan, spiny narra, narra, and liusin. Of the smaller species, the following may occur: ebony, camagon, kuyus-kuyus and canafistula. It must not be supposed, however, that all these species occur in any one locality. Indeed, the reverse is the case. Mancono, for instance, in merchantable quantities, is restricted to northeastern Mindanao and adjacent islands. Supa, likewise, is found in Tayabas and Ambos Camarines; narra, calantas, and acle are usually scattered along the hill streams. Distinct forms of this type are sometimes present on dry hills of hard volcanic rock—hills too dry to support any forest but members of this type. Often, such species as molave, batete, ebony, liusin, batitinan, and others, are found scattered throughout the open places of the yacal-lauan type. This is especially true of batete. So far as observations go, with the single exception of supa, all the trees mentioned above are found growing scattered in the various types of dipterocarps, and occupy positions either along the streams or in the drier portions. Some of them reach better individual development in such situations than when growing on limestone hills. It will thus be seen that many of these species occupy limestone soils, not because they prefer them to any other, but because they are shaded out of the moister soils by the more successful development of the shade-enduring dipterocarps. The dipterocarps, on the other hand, have soil-moisture requirements that will not permit them to exist in the drier soils of the limestone regions. In a word, the limestone habitat is one that contains a mixture of certain species of the various types of dipterocarp forest.

As one would suppose, the volume of the molave type is much lower than that of any of the dipterocarp types. This is due both to the thin sand and to the short boles of the trees. It is estimated that the type will average not more than 30 cubic meters per hectare of timber of merchantable size (3,000 board feet to the acre). However, the type is a valuable one, because it contains hard, durable timbers, many of which are very valuable cabinet and furniture woods.

Mangrove Type.

The mangrove type is in many respects the most peculiar one in existence. It is literally a forest of the sea. Where conditions are favorable, it occupies the beach washed by the tides. It is especially well developed on the mud flats at the mouths of rivers entering the sea at the heads of protected bays. Wherever wave action allows a fairly stable shore line, trees of the type are present. They occur on the quieter portions of the coral reefs, and are thinly scattered on many wave-made terraces that are exposed at low tide. A majority of the stand is composed of the members of one family, the Rhizophoraceæ, or bacauan family, comprising the following principal species: Bacauan (*Rhizophora mucronata*), bacauan-lalaki (*Rhizophora conjugata*), busain

(*Bruguiera gymnorrhiza*), pototan (*Bruguiera eriopetala*), pototan-lalaki (*Bruguiera caryophylloides*), langarai (*Bruguiera parviflora*), and tangal (*Ceriops tagal*). The following principal species of other families are pagatpat (*Sonneratia pagatpat*), pedoda pedada (*Sonneratia sp.*), api-api (*Avicennia officinalis*), tabao (*Lumnitzera littorea*), tabigi (*Xylocarpus obovatus*), piagao (*Xylocarpus granatum*), *Excoecaria agallocha*, and dungon-late (*Heritiera littoralis*).

On the muddy flats at the mouths of large rivers in protected bays, the pioneer plant is bacauan. Back of this come the bacauans mixed with pototan and other species of *Bruguiera*, and then, usually covering large areas, is langarai, mixed in varying proportions with bacauan, pototan, busain, tangal, and pedada. In more open bays, where the soil is mixed with considerable sand or coral limestone, occurs a distinct frontal zone of pagatpat, with more or less api-api. Wave-cut coral terraces often contain nearly pure stands of pagatat. The inner margins of the swamps usually have scattered specimens of dungon-late, tangal, piagao, tabigi, and tabao. In many instances, a distinct zone of the nipa palm (*Nipa fruticans*) is present near the upper limits of this type. This palm also forms thickets along the streams where the water is less brackish. Where the type is less distinct, all sorts of mixtures of the above species are present.

The capacity of this type to produce firewood and timber varies according to the degree in which it has been exploited. In thickly populated districts, the forest has been reduced to such an extent as to render it valueless for anything except firewood. Virgin areas show surprisingly large stands of poles and trees, some of which are sufficiently large to produce lumber. In Mindanao, valuation surveys made on a very good stand show 149 trees per hectare of more than 25 centimeters (10 inches) in diameter, yielding 130 cubic meters of timber per hectare, or 13,000 board feet per acre. Pagatpat has been measured with a height of 31 meters (101 feet), a diameter, breasthigh, of 137 centimeters (54 inches), and a merchantable length of 17.5 meters (57 feet); bacauan, a height of 28 meters (92 feet), a diameter above the stilt roots of 70 centimeters (28 inches), and a merchantable length of 16.5 meters (54 feet); pototan, a height of 28.8 meters (94 feet), a diameter, breast-high, of 80 centimeters (32 inches), and a merchantable length of 18.3 meters (60 feet). It is estimated that the swamps of the Islands will show an average volume of 20 cubic meters per hectare (2000 board feet per acre) of trees over 20 centimeters (8 inches) in diameter, and if, as is usually the case, the branches and large twigs are used, this amount will be exceeded.

The forest itself has rather an even top profile. The canopy is fairly well closed, and the forest is practically clear of undergrowth, except at its inner edge. The presence of a complex system of stilt roots, as high as 3 meters (10 feet) and wide spreading, of the two species of *Rhizophora* presents a tangle through which one can make his way with difficulty. A number of the species, such as pagatpat and api-api, show characteristic aerial roots. The leaves of all are hard and leathery in texture. The seeds of the Rhizophoraceæ begin to germinate on the trees, finally drop, and are distributed by the tides until they find a favorable lodging place, where they continue their development.

Beach Type.

Sandy beaches above high-tide limits are found throughout the Philippines. They are favorite places for settlements and so the original vegetation has been greatly modified. In those places where it has kept its original form, it presents a distinct type. Usually the frontal zone has a tangle of vegetation in which pandans (species of *Pandanus*) form a conspicuous part. The principal trees are as follows: Talisay (*Terminalia catappa*), dapdap, (*Erythrina indica*), botong (*Barringtonia speciosa*), mulbago (*Hibiscus tiliaceus*), bani (*Pongamia glabra*), banalo (*Thespesia populnea*), dongon-late, palo maria (*Calophyllum inophyllum*), agoho (*Casuarina equisetifolia*), tawalis (*Osbornia octodonta*), and Dantigi (*Pemphis a idula*). In some places ipil, narra, bansalaguin, and other valuable trees are encountered. Talisay often occurs in patches of pure stands in rich river bottoms. On sandy flood plains of large rivers, in various parts of the Islands, agoho often forms small pure forests.

Behind the frontal line, the vegetation partakes more of the nature of other types. Series of old beaches sometimes cover quite extensive areas, on which the lauan-hagachac type usually is found. This type is especially well developed on old beaches where the dry season is wanting. In the Davao Gulf, for instance, are encountered heavy stands of very large trees of hagachac, guijo, and bagtican lauan that will scale as high as 100,000 board feet to the acre. It must be remembered that in such places the ground water level is not far below the surface, and the atmospheric moisture conditions are constantly humid. The humus accumulations of previous generations of vegetation enriches the well-drained soil. Altogether, these conditions make the habitat an exceedingly favorable one.

Pine Type.

This type reaches its best development in the high plateau region of northern and central Luzon. The greater part of it, although at an altitude ranging from 900 to 1,500 meters (2950 to 3280 feet), is in a region with a distinct dry season. The rain-bearing winds of the dry season deposit most of their moisture before they reach this rough plateau region. The pines are scattered as single individuals, or in open to nearly closed patches throughout a large grass area. In many ravines and along water courses are stands of broad-leaved trees. There is much evidence to show that formerly this area was covered with forest growth consisting principally of broad-leaved trees, and although pines were undoubtedly present, they were of little relative importance, being confined to the steeper and drier situations where the broad-leaved trees could not grow. Through the activities of man, however, in the centuries of occupation, the broad-leaved trees have been cleared off, and repeated fires have prevented their reproduction. The pine, however, is less sensitive to fires, and consequently at present there are broad areas of grass lands with many groves of pines. There is little doubt that if fires were kept off, the pine, in the absence of broad-leaved competition, would quickly seed up the entire area, for its reproduction is abundant and rapid; and gradually the pines themselves would be replaced by the original broad-leaved vegetation. This struggle between the pines and the groad-leaved trees is often shown in caingins bordering situations where both types occur. The pines, because of their numerous winged seeds, will make their appearance first; the other vegetation comes more slowly, but will gradually prevent the starting of a new generation of the light-demanding pines. This last movement of vegetation is a much slower one. Not only are the pines found in regions where the dry season is pronounced, but at higher altitudes in the mossy-forest belt, where the humidity is greater and more evenly distributed throughout the year. Thus, pines occur in abandoned caingins at an altitude above 1,500 meters (4920 feet), and even as high as 2,500 meters (8200 feet). Here they alternate with patches of grass or mossy forest. The rainfall of this region, as in many other portions of the Islands, is exceedingly heavy from June to October. Especially in the deforested regions, landslides occur frequently on the mountain slopes, making the natural reforestation of such places difficult. In the more level places, where fire lines have been established, grass patches become quickly covered with pine seedlings.

Benguet pine (*Pinus insularis*) is the only species in the highlands of central and northern Luzon. In some places, scattered pines are found in the grass lands, as low as 500 meters (1640 feet) altitude, bordering on the upper limits of the lauan-apitong type. Pines are also found in Zambales and Mindoro. In Zambales, two species occur: *Pinus insularis* and *Pinus merkusii* Their altitudinal range is usually from 500 to 1,500 meters (1640 to 4920 feet, although scattered trees of *Pinus merkusii* are found at as low an altitude as 60 meters (200 feet). In Mondoro, *Pinus merkusii* occurs in pure stands and in open groves scattered throughout the grass lands, southwest of a high mountain mass. It is found as low as 60 meters (200 feet) above sea level in one situation, although usually it is not found below 900 meters (2950 feet).

Measured groves of Benguet pine show a volume of 74 cubic meters per hectare (7,400 board feet per acre) of trees 25 centimeters (10 inches) and over in diameter. The trees reach a height of 40 meters (131 feet) and a diameter of from 90 to 100 centimeters (36 to 40 inches).

In general appearance forests of Benguet pine are not unlike some of the poorer stands of Western yellow pine in the Pacific northwest.

The Mossy-Forest Type.

Some 3,200 square miles (828,800 hectares), or 8 per cent. of the land area of the Philippines, is the estimated amount of the high and very rough mountain region covered by virgin forests. They are essentially protective forests. Many such mountainous regions have already been cleared of their forests by caingin makers and are now covered with grass. These regions show such a complex set of conditions, both as regards habitat and vegetation that as yet our knowledge is too incomplete to carefully distinguish the types. Perhaps, in a broad sense only, one type exists, with certain variations or subtypes. Because of the presence of moss and liverworts in great abundance, it has been designated as the mossy-forest type.

The topography is rough and constantly changing. It consists of steep main ridges, rising to exposed peaks, and whose sides are in turn cut into smaller ridges by the deep canons. Land slips are frequent, and these in all stages of being reclothed with vegetation add to the difficulty of analysis. The soil is shallow or nearly absent. Rock exposures occur, often covering large areas; but except on very steep slopes or on fresh slides they are covered with vegetation. Some mountains have more rounded dome-shaped tops, and on these the topography is much more stable.

As a rule, the climatic conditions are exceedingly moist, both as regards rainfall and relative humidity. Opposed to this favorable climate is the very great exposure to winds. The former is the cause of the mossy condition; the latter, of the dwarfed habit of the trees. The temperature conditions are much lower than those of the coastal region.

The tree vegetation is complex, yet not so much so as the forests lower down. Especially on the highest mountains, owing to these very unstable conditions, or where volcanic action has not been long extinct, trees are absent or nearly so. On mountains above 1,200 meters (3930 feet), the mossy-forest appears at its best. *Dacrydium* and *Podocarpus* spp., *Eugenia* spp., *Tristania decorticata, Leptospermum amboinense, Decaspermum* spp., *Quercus* spp., *Myrica* spp., *Englehardtia spicata, Acronychia* *laurifolia, Symplocos* sp., *Ternstroemia toquain,* are some of the principal trees, only a few of which are found lower down. All of these trees are usually dwarfed in appearance, seldom reaching a height of more than 20 meters (65 feet), and usually not over 5 meters (15 feet). The trunks and branches are generally covered with mosses, liverworts, filmy ferns, and epiphytic orchids. The open places are usually occupied with ferns, and sometimes with grass. Tree ferns occur on the slopes within the forests, and on some steep slopes give a decided character to the vegetation. Rattans and other climbers, especially Pandanaceæ, are common, as are also small erect palms. Few mountains in the Philippine Islands attain a height of more than 2,000 meters (6560 feet). In general, the vegetation at such altitudes is much more dwarfed; in some cases, good-sized trees are found, even at high elevations; on others, no tree vegetation occurs at all.

Summary

The following tabular summary will serve to picture relative conditions of the different forest types as regards habitat and character of vegetation.

Types.	Lauan.	Lauan-hagachac.	Yacal-lauan.	Lauan-apitong.
Rainfall	Fairly well distributed throughout year; short or no dry season.	Fairly well distributed throughout year; short or no dry season.	Fairly well distributed throughout year; short or no dry season.	Pronounced dry season.
Relative humidity.	High and fairly well distributed throughout the year.	Medium during short dry season; high during rainy season.	Fairly low for short dry season; high during rainy season.	Fairly low throughout long dry season.
Altitudinal range.	From near sea level to 300 or 400 meters.*	Near sea level .	Near sea level.	From near sea level to 300 or 400 meters.
Soil and underlying rock.	Medium shallow to fairly deep; rock volcanic; moist; sometimes fairly dry.	Usually alluvial; deep; alternatingly very moist and quite dry; underground water level near surface.	Shallow and fairly dry or very dry; volcanic rock.	Shallow to fairly deep; part of year very dry; volcanic rock.
Topography	Slight to steep slopes.	Level or nearly level.	Slight to steep slopes.	Slight to steep slopes.
Merchantable timber per hectare.	50 to 450 cubic meters.**	25 to 200 cubic meters.	50 to 300 cubic meters.	50 to 300 cubic meters.
Composition of dominant species.	Nearly pure stands of dipterocarps to complex.	Complex	Complex	Complex .....
Canopy of dominant species.	Closed or nearly closed; evergreen.	Open to closed; nearly evergreen.	Medium open; slightly deciduous.	Medium open; decidedly deciduous.
Profile of forest	Fairly regular to regular	Very irregular ..	Irregular	Irregular .....
Erect palms	Abundant	Abundant	Fairly abundant	Almost absent.
Erect bamboo ...	None or very few	None or very few	None or very few	Usually abundant.
Large lianas	Not abundant ...	Abundant	Fairly abundant	Fairly abundant
Composition of smaller trees.	Very complex ...	Very complex ..	Very complex..	Very complex..

Tanguile-oak.	Molave.	Pine.	Mangrove.	Beech.	Mossy forest.
Fairly well distributed throughout the year; short or no dry season.	Fairly well distributed throughout the year to a distinct dry season.	Usually a distinct dry season.	Long, short, or no dry season.	Long, short, or no dry season.	Usually well distributed throughout the year.
Hige to very high, except in dry season.	Fairly low during dry season; higd during rainy season.	Low to high.. Usually above 900 meters.	Fairly high, or low during dry season.	Usually low during dry season.	Daily range great, but high at night.
From 400 to 900 meters.	Usually near sea level to 150 meters.		Between low and high tide.	Near sea level	Above 900 meters.
Very shallow to fairly deep; some times fairly dry; volcanic rock.	Usually on limestone rock; shallow soil; dry.	On shallow soil above limestone, or in deep soils not limestone; dry to moist	Usually a muddy, deep, delta soil; also coral limestone and sandy soil; wet.	Sandy or pebbly soil; very dry during dry season.	Rock exposure near surface; soil shallow; volcanic rock.
Usually rough; some gentle slopes.	Usually steep slopes; some gentle.	Steep slope to level ground.	Gently shelving.	Gently shelving.	Very rough.
20 to 150 cubic meters.	50 cubic meters and under.	100 cubic meters and under.	130 cubic meters and under.	Under 25 cubic meters.	No estimate.
Medium complex.	Fairly complex.	1 or 2 species of pines.	About 10 species.	Simple	Simple to medium complex.
Open to closed; evergreen.	Open; decidedly deciduous.	Open; evergreen.	Open to closed; evergreen.	Open; decidedly deciduous.	Open to closed; evergreen.
Very irregular.	Very irregular.	Regular to irregular.	Fairly regular.	Irregular ...	Irregular.
Fairly abundant but small.	None	None	Almost stemless nipa palm.	Very few ...	Many small ones.
None	Abundant or none.	....do	None	Very few, if any.	Practically none.
Fairly abundant.	Abundant climbing bamboo.	....do	do	Very few ...	Fairly abundant.
Complex	Complex	Very few ...	Very few	Complex	Complex.

Uses of Philippine Woods

Although it is estimated that the Philippine Islands contain more than 2,500 tree species, it is probable that not over 300 different kinds find their way into Manila or other Philippine markets, and that, of these, less than 100 are commonly encountered.*

Dipterocarps. As stated previously, the dipterocarp family furnishes the main bulk of standing timber. These woods can be roughly divided into three groups, viz., the lauans, the apitongs, and the yacals.

Lauans. Among the lauan group are white lauan, kalunti-lauan, almon-lauan, bagtican-lauan, malaanonang-lauan, mangasinoro-lauan, tiaong-lauan, mayapi-lauan, red lauan, and tanguile. Many shades of brown and red are comprised in the different species. White lauan and mangasinono-lauan are a light creamy brown color; bagtican-lauan and almon-lauan show shades of pink, which becomes a clear red in the case of mayapis-lauan, tiong-lauan and some grades of tanguile, and even a dark red color in the case of red lauan. In hardness they grade from soft to moderately hard in the approximate order outlined above. Their weight is light to moderately heavy. They are all coarse but straight-grained, free from knots, easily worked, and in general mechanical properties are not greatly dissimilar to the pines. When quartere-sawn or slash-sawn with a figure, they show a beautiful grain. The lauans, without exception, come from tall trees, 100 to 150 or more feet in height, 6 feet or less in diameter, and with straight, regular trunk up to 100 feet to the first limb.

The lauans are readily attacked by fungi and white ants, but not more so than Oregon pine, *(Pseudotsuga taxifolia)* their chief competitor. They can be divided into three groups, the white lauans, the red lauans and tanguile, which are the usual trade names.

*A few of the commoner species are: Molave, *Vitex, pubescens* Vahl and *V. littoralis.* Decne Ipil, *Intsea acuminata* Merr, *I. bijuga* O Kuntz. Yacal, *Hopea plagata* Vid. Acle, *Pithecolobium acle* Vid. Narra, *Pterocarpus indicus* Willd. *P. echinatus* Pers. Tindalo, *Pahudia rhomboidea* Prain. Ebano (Ebony), *Maba buxifolia* Pers. Mancono, *Xanthostemon verdugonionus* Nares. Lanete, *Wrightia laniti* (Blco.) Merr. Camagon, *Diospyros discolor* Willd. Apitong, *Dipterocarpus grandiflorus* Bl. *D. verniciflluus* Bl. *D. affinis* Brandis. D. spp.

Locally, they are used for a great variety of purposes. They are especially adapted for light and medium construction work, in which they will find their greatest usefulness. In this respect they are to the Tropics what the lighter grades of pines and their allies are to the temperate regions. Nevertheless, for many classes of construction, because of their color and beautiful grain, they are superior to the pines. This is especially true for interior finish of all classes. The better grades of lauan and tanguile are now being shipped to the United States under the trade name of "Philippine mahogany."

Apitongs. The trees that furnish timbers of this group are apitong, hagachac, panao, and guigo. They grade in color from a dirty brownish red to red. In hardness they are moderately hard to hard; in weight they are moderately heavy. The first three appear in the market under the trade name of apitong, the last as guijo. The former are coarse but generally straight-grained; the latter has a somewhat finer grain.

They are used for many purposes, but are especially adapted for heavier construction where contact with the ground is not necessary. Guijo is considered more valuable than apitong. They are not durable timbers, being susceptible to the attacks of white ants and fungi. Of the two, guijo is somewhat the more resistant. The apitongs have general construction qualities comparable to the hard pines of the temperate regions. In abundance, they are next in importance to the lauans.

Yacals. The trees that produce timber of this group are yacal, guisoc, guisoc-guisoc, malayacal, narig, karig, mangachapuy, and dalingdinganisac. The woods as a whole are yellowish brown, becoming darker with old age. They are all considered very durable timbers. This is especially true of yacal, guisoc, and malayacal, which invariably appear under the market name of yacal. Narig is often mixed with and sold as yacal. Mangachapuy and dalingdingan-isac are sold as mangachapuy.[1]

The yacals are usually hard and heavy. They are as free from the attacks of white ants and fungi as any so-called durable wood

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*Other trees, closely related botanically to these, yielding woods somewhat softer and less durable, are also found under the name of mangachapuy.

used for construction purpose. Yacal is a general all-round construction timber where contact with the ground is necessary, and because of this is much sought for railroad ties, paving blocks, and house posts. It is also used as bridge timber, in various parts of ships, and for construction of houses. It is estimated that there is more standing timber of the yacals in the Islands than all the other so-called standard durable timbers put together.

Substitutes for Mahogany

The term "mahogany" is here used in its broadest sense. The true mahogany, the product of *Swietenia mahagoni,* does not occur in the Philippines. However, the narra family contains a group of woods of more or less brilliant color and beautiful grain which are capable of taking a high polish, and which cannot be excelled as substitutes for mahogany. These are narra, tindalo, ipil, acle, and banuyo. Narra varies in color from a light yellow to a brilliant red. It is moderately heavy, moderately hard to hard, has a rather coarse more or less twisted grain, and is very durable. It is practically the same as the padouk of India, and is sometimes sold as Philippine mahogany. It is used principally for fine furniture, interior finish, doors, flooring, and windows. Large one-piece table tops come from the buttressed roots. Tindalo has a saffron red color, which becomes darker with age. It has a fine, more or less straight grain, and is heavy, hard and durable. It is used in fine furniture and cabinetmaking, and is one of the best timbers for hardwood floors, stairways, and interior finishings, where beautiful expensive woods are required. Ipil, while used principally in the Philippines for construction work in contact with the ground, is nevertheless a wood of the mahogany grade. It is very durable, heavy and very hard, has a fine, sometimes twisted, grain, and is one of the most satisfactory woods for fine furniture and cabinetmaking. Banuyo is moderately heavy and moderately hard, is golden brown in color, with a fine grain. It is used for fine furniture, cabinetmaking, carriage bodies, and carving. While none of the above are found in large quantities, there is a sufficient supply to meet a small steady demand. All could probably be worked into veneers.

Besides the above, there are a number of other woods that are good substitutes for mahogany. Palo maria, sometimes called

Borneo mahogany, is hard and moderately heavy, reddish brown wood, with a fine twisted grain, that is capable of taking a good polish. Calantas is the only one of the true mahogany family that is sometimes sold under the name of Philippine mahogany. It is light and soft, reddish in color, and has a distinct odor resembling that of cedar. It is closely related to the West Indian cedar, and while making admirable furniture, piano cases, etc., it is much sought after for cigar boxes. It, however, like other fine woods, is not plentiful.

Because of their abundance, and therefore their ability to supply the demands for a steady product, the finer grades of red lauan and tanguile will no doubt be known to the outside world as Philippine mahogany. These woods have a beautiful grain and color, and are susceptible of a good polish. They have already found a place in the United States as a substitute for mahogany. Such a market can be steadily supplied with large quantities of these woods.

Durable Timbers

Next to fine furniture and cabinetmaking woods, the Tropics are noted for their hard durable timbers. Because of the warm climate and continuous moisture conditions, fungous growths and white ants rapidly destroy those timbers that are not able to withstand their attacks. No timber is able to do so indefinitely, but some are much more durable than others. Teak is perhaps the best known of this class of woods. This timber, while not indigenous to the Philippines, occurs in plantations in Mindanao and the Sulu Islands, and it has been demonstrated that the tree can be grown here successfully. It will no doubt become one of the planted tree crops of the Philippines, and the Islands will thus be enabled to furnish their share of the world's supply of this timber.

Because of their excellent qualities and comparative abundance, three Philippine timbers may be classed with teak, or at least may be regarded as substitutes for it. These are molave, ipil, and yacal.

Molave is perhaps the best known hardwood in the Philippines, and more of it is extracted than of any other one kind of wood in proportion to the amount of standing timber. It is a member of the teak family. The wood is hard and heavy, pale yellow in color, and has a fine but usually twisted grain. It is especially valuable for house posts, hardwood floors, window sills, railway ties, bridge timbers, paving blocks, salt-water piling, carvings, and many parts of shipbuilding. Trees of molave occur scattered usually on the limestone coastal hills throughout the Philippines. They generally have short, irregular boles, and this renders the timber less valuable than it would otherwise be. It is in such demand locally that little is now exported.

Attention has already been called to ipil as a valuable wood of the mahogany grade. Nevertheless, the demand for hard durable timbers is so great that it is usually considered as one of the best construction timbers, exposed to soil and weather. Like molave, its principal uses are for house posts hardwood floors, railway ties, paving blocks, and telegraph poles.

Yacal has also been discussed elsewhere. Because of its abundance, it is probably the only one of the hard durable timbers that will find much of a place in the markets outside of the Philippines. Prominence is given to the above-mentioned woods, not because they are the only hard durable timbers the Islands contain, but for the reason that they are the only ones in anything like sufficient quantity to supply the demands of the trade. Other principal timbers that resist well the attacks of fungi and white ants are narra, tindalo, alce, banuyo, calantas, polo maria, mancono, dungon, aranga, banaba, anubing, bansalaguin, batitinan, betis, the macaasims, pagatpat, supa, and agoho.

Salt-water Piling

There is a strong demand for woods that will resist even fairly well the attacks of the shipworm (teredo), and few species are able to meet the necessary requirements. The woods most commonly sought for such purposes are molave, dungon, aranga, betis, liusin, and piagao.

Molave is one of the best woods for this purpose. The chief objection to it, however, is its irregular form, and the fact that it is difficult to find piles of sufficient length to meet the demands. Dungon has long been considered a valuable pile for salt water. The wood is very hard and heavy, tough, chocolate-brown in color, fine and cross grained, and difficult to saw. Besides piling, it is used for a large number of purposes, the principal ones being various kinds of naval construction, railway ties, and paving blocks. The amount that can be obtained is very limited. Aranga, formerly more plentiful but now very scarce, has long had the reputation of being one of the best woods for salt-water piling. It is very hard and heavy, ranging in color from yellow to chocolate brown. Betis, like the others, is a very hard and heavy wood, dark reddish brown in color. Liusin is one of the woods which has only recently come into use for this purpose. It is very hard and heavy, and pale red to red in color. Luisin piles, placed beside dungon, seem to last better than the latter. The part above water is more readily subject to fungous attacks. Piagao is said to resist the teredo well, but there is as yet no direct evidence to confirm this statement. None of the above woods are plentiful, especially in sizes suitable for piling.

THE PHILIPPINE BUREAU OF FORESTRY,—ITS ORGANIZATION AND WORK.

By W. D. Sterrett.

The total area of the archipelago is about 75,000,000 acres. Of this area at least 60,000,000 is public land covered with grass, brush, second-growth, and merchantable forest, and an inconsiderable portion under cultivation of a shifting character.

A conservative estimate places the area of merchantable forest at 20,000,000 acres, with an average of 10,000 feet of timber per acre, or a total of 200,000,000,000 feet of standing saw timber in the Islands. All of this timber is included in the area of public land. Much of it occurs on land suitable for agriculture, while there is much waste mountainous land, unsuitable for agriculture which is covered with grass or brush. Over one-fourth of the area of the Philippines is so steep and mountainous that it should be permanently held as public forest for timber and water purposes.

Control of Insular Forests

Practically all of the timber in the Philippines is on public land. The Philippine Public Land Laws place the control of all public forests, and public land most suitable for forest and water conservation purposes, in the hands of the Bureau of Forestry. These laws provide that no public land can be acquired by private parties without the approval of the Bureau of Forestry, certifying that such land is more valuable for agriculture, or for purposes other than growing timber and conserving water. The Bureau of Forestry thus has the decision as to what public land shall be retained for forest and water purposes.

The laws provide that no timber or other forest products can be collected and sold from public lands without a license from the Bureau of Forestry.

In 1905 a law was passed allowing people for a term of five years to take what timber and forest products they needed for their personal use without license. Previous to this a license was required to collect and remove any forest product for any purpose from public lands. The public land laws also provide that anybody before making a "caingin," or temporary cultivation on public land, must first procure a permit from the Bureau of Forestry. The land laws further provide for the regulation and management of public forests by the Bureau of Forestry, including sale of forest products, and the reproduction and protection of the forest to secure a continuous timber supply and for water conservation.

There are fixed forest charges for products collected for sale from public forests established by law. On forest products for personal use of the collector there are no forest charges. The Government stumpage charges on saw timber amount to about as follows:

First	group	of timber—	$5	per	1000	board	feet.
Second	"	"	3	"	"	"	"
Third	"	"	2	"	"	"	"
Fourth	"	"	1	"	"	"	"

Considerably more than half the timber produced is of the third and fourth group.

It can readily be seen that these laws secure to the Bureau of Forestry the absolute control of the forest and water situation in the Philippines.

Work of the Bureau of Forestry

From its organization in 1900 until December, 1905, the chief work of the Bureau of Forestry was in connection with the collection of revenue on forest products, and very little was done in the way of silviculture and investigation. Although an elaborate set of forest regulations and restrictions for licensees cutting timber was prepared and adopted, yet practically nothing was done in the way of inspection of cutting areas to enforce such regulations. By an act dated October 26, 1905, reorganizing the Bureaus of the Philippine Government this revenue work was transferred entirely to the Bureau of Internal Revenue. It was at this time that the Commission came very nearly abolishing the Bureau of Forestry entirely or making it a section in the Bureau of Agriculture. The day was saved by Major Ahern's securing the aid of Mr. Pinchot. The appropriation, however, for the work of the Bureau was cut down from $150,000 to $50,000 per annum; the field force was reduced from 138 to 43; and the office personnel from 33 to 12. The American foresters were retained but at reduced salaries, so that several of them resigned.

Real forest work commenced with the dropping of the revenue work in November, 1905. The archipelago was now divided into ten forest districts with a forester sent out in charge of each district. This enabled the Bureau, for the first time, to supervise the work of important licensees to see whether they were violating forest regulations and conditions on which their licenses were granted. There was a force of about 25 native rangers located at forest stations throughout the Islands and under the district foresters. Each forester was given a set of instructions which provided for the inauguration of the following work: location and inspection of cutting areas and fines for violations of forest regulations; inspection and recommendations on applications for license to cut and remove forest products; inspection of agricultural character of land desired to be taken as homesteads, and for purchase or lease; and permits for making caingins, or clearings with temporary cultivation, on public land; forest map of the district, and study of forest resources and future fields for new lumber concerns, including data on cost of producing forest products.

It was soon discovered that most of the time of the district foresters was occupied in purely administrative work, especially in the inspection of cutting areas, inspection of areas applied for by prospective licensees and in homestead examinations; that little time was found for systematic investigation work; and that the mapping went very slowly. For this reason in July, 1906, the Division of Products was created, later called Investigation, to investigate the amount, character, value, and uses of the Philippine forest products, and to bring this information to the notice of Philippine and foreign markets. The work of the Division consisted in: classification and cataloging of data on hand, and preparation of reports for the printer; collections for the museum and timber tests; and forest investigation and mapping. The special examinations of tracts suitable for exploitation by large lumber companies, with reports and working plans for the same, were to be made by the Division of Investigation in cooperation with the forester in whose district the particular area examined was located.

At the close of 1908 there were only four foresters in charge of the ten districts—now reduced to three, with two foresters in one of the three. The administrative work in control of public forests was found to be unsatisfactory, due to insufficient force, and to the privilege of free use of timber granted October, 1905, for a period of five years. It was impossible with the limited administrative force to control the abuse of the free use privilege, and trespass of all kinds, especially the making of caingins or clearings in public forests without permit. The need for more intensive management and protection of public forests became very evident.

In the meantime the Division of Investigation, with a force of three American foresters and some native rangers, had completed, by the close of 1908, a land classification map, so essential as a basis for properly organizing the public forests for administration, of nearly half the archipelago. These maps showed the location and distribution of the following four broad vegetative types: commercial forest; non-commercial and second growth; grass lands; agricultural lands. By this time there had also been collected an immense amount of botanical material and wood specimens, and a knowledge obtained of the relative amount and commercial value of the different species of timber. Several working plans had also been made, and special examinations of tracts for concessions to large lumber companies. The possibilities for lumbering were more extensively advertised.

The work of the Division of Investigation, especially in the way of mapping, formed a basis for more intensive organization and administration of Philippine forests, and in 1909 this work was commenced. Two provinces (Bataan and Negros) were taken in hand that year for the organization of more intensive forest control, with an American forester in charge of each.

In the future several provinces are to be taken in hand each year and organized along similar intensive lines. The area in charge of a single forester is about 500,000 acres in one province and 300,000 acres in the other. Under the forester are five to ten rangers and ten to twenty guards. The work of organizing the different forests is under the Division of Investigation and each forest to be subsequently transferred to the Division of Administration after having been thoroughly organized and put in good running shape.

The work on the newly organized forests includes all of the general administrative work formerly carried on, when part of a larger district, and some additional lines of work. The program includes:

1. Inspection of cutting areas and fines for violations of regulations.

2. Inspection of land for homesteads, sale, and lease, and action thereon.

3. Granting of caingin permits on public land.

4. Action on applications for licenses to collect and remove forest products.

5. Patrol against trespass and fire.

6. Control of free use privilege, and the establishment of communal forests.

7. Silviculture—regulations of logging operations and tree planting.

8. Co-operation with the Bureau of Internal Revenue in the collection of revenue on forest products.

9. Investigations tending towards the building up of forest industries.

10. Land status work such as will aid people with valid claims in establishing title to public land; and investigation of public agricultural land unjustly held or claimed to the exclusion of bona fide homesteaders, and throwing the same open for settlement. The Bureau will encourage and aid the natives in taking out permanent homesteads and in acquiring title to the same rather than to practice the shifting caingin method of agriculture by which so much valuable public forest has been destroyed.

11. Establishing and maintaining patrol trails to guard against fire and trespass, and to facilitate caingin, homestead, and status work, is perhaps the chief feature in the organization of the different forests. Forest officers will be provided with horses, and with the patrol trails they can quickly and with ease pass to any part of their district. In general, the main patrol trail will form the boundary between land suitable for settlement and public forest to be retained as such.

12. Each forest, in charge of a forester, is divided into ranger

districts with 100,000 to 200,000 acres in each. The ranger has an assistant ranger and several guards under him.

Needs of the Bureau of Forestry.

The chief need of the Bureau of Forestry is to complete as soon as possible the organization of intensive administration for all Philippine forests along the lines inaugurated in 1909 for the Bataan and Negros forests. To do this will require a greatly increased force of trained foresters and trained native rangers. The foresters for a number of years will be almost exclusively American, but it is planned to educate and train Filipinos of the better class, in the course of time, to be foresters capable of taking charge of forest districts. To properly administer the forests of the islands will require at least 50 trained foresters, 500 or more trained rangers, and 2,000 or more guards.

The present force is ten American foresters and about 40 native rangers and student assistants. In order to increase the present inadequate force to what it should be it will be necessary to increase the appropriations from $70,000 per annum, the present amount, to about $500,000 per annum. The increase in force and appropriations will take place gradually.

There is being established, in connection with the Philippine College of Agriculture, a school of forestry for the education and training of native rangers and foresters. Up to the present the native rangers were trained in the field by the different American foresters while engaged in field work. There are three Filipino assistant foresters, two graduates of Nebraska and one of the Michigan Agricultural College, who have had some forest training in the United States. But as a rule it will be much better to give the native all his forest education and training in the Philippines, as sending him to the States is very expensive and is liable to give him too much of a swell head, and he is then not of as much use for actual field work as rangers with only a rough and ready training in the field.

The education and training of a large corps of native rangers and foresters is the most important work which the Bureau of Forestry has at present. It is part of the policy of the United States to educate the Filipinos to take care of themselves, and most of the higher as well as lower offices in the Government will eventually be held by Filipinos when they have had sufficient education and training and show themselves sufficiently capable and trustworthy to fill them. And so it will be in the future Philippine Forest Service. The cost of well-educated native employees will naturally be a great deal less than for Americans, so it is advisable to use them, wherever satisfactory in more responsible positions, to cut down expenses.

The course in forestry at the Agricultural College will be six years for Filipinos who have completed the eighth grade and are ready for the high school, and four years for those who have completed two years' high school work. There is to be a forest reserve of some 10,000 to 15,000 acres in connection with the school for forest demonstration and field work.

The Philippines as a Field for American Foresters.

The following are advantages the American forester, much preferably single, can reap by two or more years' work in the Philippine Bureau of Forestry: Invaluable broadening experience in living in the tropics and the Orient for a period of years, extremely interesting forest work, knowledge obtained of tropics, especially of the forests. It is predicted by some that the tropics will in time become the world's principal source of timber and food supply. The tropics are the future "Go west, young man" country—the least developed part of the globe in proportion to their almost limitless natural resources. All that is needed is to solve the problem of healthy living in the tropics and they will become the richest part of the globe.

Better pay at the outset than in the U. S. Forest Service, and at the end of two years' service seventy days leave with pay is given, which more than pays the expenses of coming home.

Outlook is good for future big developments in the Bureau of Forestry and increases in pay to American foresters who remain any length of time. Chances to tour foreign countries enroute to and from the Islands is alone worth, to some persons, two years' service in the Philippines.

The principal objections to work in the Philippines are: Too far away from the United States and social connections here.

Climate. Reputed to be very unhealthy. However, with a little extra care of oneself and the taking of a few precautions the forester can easily maintain his health in the Philippines, while the living practically outdoors (houses so open) all the year round makes it healthier, in many respects, than in the States.

It is no white man's country. To my mind this is the greatest objection to work in the Philippines,—that the population is almost entirely Malaysian and white people are few. Under the American principle of "the Philippines for the Filipinos," all work is done for the benefit of the little brown brother, which up to the present seems to have had the effect of making him a spoilt "pampered pup," with much less respect for the American than the Spaniard and an exaggerated idea of his own importance and superiority.

The work of the American forester in the Philippines will consist usually in the administration of an insular forest or district comprising probably a million acres, over half forested and seventy-five per cent. public land. He will have a force of about ten rangers and thirty guards under him. He will be even more independent in carrying on his work than the Supervisor in the U. S. Forest Service. He will be responsible for all work done in his district. His most important work will be in training native rangers to take charge of the different ranger districts into which his forest is divided, as it is through his rangers that the forester administers his forest and carries on all his work. Every forester has more or less work in the training of native student assistants in forest work in the field and in the office, and it is a source of satisfaction to him when he leaves the Islands to look back on the number of successful rangers who have received their training under him, whom he leaves, perhaps, to carry on his pet schemes and ideas.

LUMBERING IN THE PHILIPPINES.

By Donald M. Matthews, *Forester, Bureau of Forestry.*

The lumber industry in the Philippines from the American standpoint is still in its infancy, although actually it stands next to agriculture in point of age and importance. Up to the time of the American occupation the most primitive methods of both logging and milling obtained everywhere throughout the Islands, and even to-day, 90% of the people engaged in the industry are following the time honored methods of two centuries ago. The average Filipino in any part of the Islands who desires to go into the lumber business does not spend a year or two land-looking, interesting capital and studying the state of the market. He has a market that is all that can be desired in the nearest town; the timber, from his point of view, is to be found in abundance right at his back door and a few axes, a carabao or two and a few laborers constitute his capital. He applies for, and obtains a license from the Government to cut 100 (sometimes less) to 5,000 cubic meters (25,000 to 1,250,000 bd. ft.) of timber. Then, with his outfit, which normally consists of 20 to 30 axmen, 10 to 12 carabaos and the same number of laborers, he proceeds to the area for which he has obtained a license. The labor is generally employed on the piece work system and after the employer has given his men general instructions as to what timber to cut and how to cut it, so as to conform to governmental regulations, he returns to his home and calmly goes about such other business as he may have on hand. After a month or two the logs begin to come down to the seacoast, either being hauled the whole distance on crude sleds or floated down the streams. The licensee then takes a few days off to arrange for the whip-sawing of the logs into lumber for local sale or has the logs rafted for sea transportation to the nearest large town, where they are usually disposed of to Chinamen or others who make a business of whip-sawing the logs into lumber.

The whole operation is usually characterized by the greatest deliberation. The licensee is usually so fixed that he can hold his logs for sale under the most advantageous conditions. He will often take a contract to deliver logs at a certain place and time, but as he does not concern himself with the rate at which the logging is carried on in the woods he rarely finds himself in a position to complete his contract. The loggers themselves take time to select the most desirable trees and never make an attempt at clear cutting. Using animal power entirely for hauling, and that unassisted by any mechanical device other than the logging sled, they cannot cut the largest trees and usually limit themselves to straight sound timber under 36″ in diameter.

Naturally the effect of this system of logging on the forest is to remove the most active part of the forest capital leaving the old timber, which is the natural crop, to go back and become a drag on the productive capacity. However, it has one advantage, as the old trees counteract the effect of the highly selective cutting and insure natural reproduction of the desirable species. In general it may be said that the native method of logging, while not an economical one, is not one to endanger the existence of the forest or even of the most desirable species. In the more inaccessible regions of the Islands and where the timber does not occur in large uninterrupted tracts it is practically the only possible method and the one naturally suited to conditions.

However, as American capital became interested in logging, there developed an abrupt change wherever it took hold, from the primitive methods which heretofore obtained, to the most up-to-date western methods. This change took place with hardly any transition stage other than that necessary to the establishment of an industry among a people acquainted with only the rudiments of the new method. Considering the difficulties which the first American logging enterprise encountered in the Islands, steam milling and logging has been astonishingly successful and has even greater success in store for it.

There are at present some 60 or more steam sawmills operating in the Islands, the equipment of which varies from the single crude circular saw to full equipped band mills cutting 50,000 or more feet a day. At least four of these mills do their logging by steam, following the system in vogue in the northwestern part of the United States, namely the "slack rope" with yarding and hauling donkeys. Native labor under high grade American supervision is used throughout and while employers complain of the grade of labor attainable it is probably more effective dollar for dollar than the labor used for the same purpose in the United States. The first companies to install steam logging methods in the Islands naturally worked under great disadvantages while training their woods crew. This was in part due to the ignorance and habits of the Filipinos they were compelled to employ, but also equally due to the incompetent and inadequate American supervision. Furthermore many of the American loggers placed in direct supervision of Filipino labor either failed or refused to understand the Filipino and did not work in harmony with their crews. This was to be expected considering the type of men often employed as logging bosses. However, the employers soon realized that competent Americans in charge of the logging were indispensable and offered salaries that attracted the high grade men. These men being anxious to make good, studied the problem from both the logger's standpoint and that of the laborer and by patient work have developed extremely efficient Filipino crews. As the average Filipino is not nearly as strong as the average American "lumber jack" it was found necessary to employ more men for each operation, such as skidding, swamping, yarding, train hall, etc., than would be employed in the States. Also each of these operations should be supervised by a competent American if the best results are desired and if the general operation is large enough to admit of the expense. This will become less and less true as higher grade Filipinos enter the field, as they are bound to do, and the employer has already found that a good Filipino is many times better than a poor American. The school system of the Islands is rapidly turning out men of all grades who speak English and if some of these who like outdoor work can be picked up by the lumbermen to fill minor supervisory positions they would be invaluable, not only in the capacity of crew bosses, but as interpreters for the American employees. These men would understand both the American and the Filipino, and would do much to smooth out difficulties arising from imperfectly understood orders and would aid the American to hold his crew together.

The millman in the Islands has met with practically the same difficulties as the logger and they are traceable to the same causes.

Too many Americans have attempted to run a lumbering enterprise without knowing more than the rudiments of the business themselves and have attempted to log cheaply with the minimum of American supervision, a practice in every instance disastrous. In bandmill practice the minimum amount of high grade American labor to insure success may be obtained at an annual cost of about $9,600.00. This should employ a saw filer, sawyer, mill foreman and millwright at $2,440.00 for each man. The right man cannot be obtained for less, and with Filipino labor a mill cannot be run as it should be unless thoroughly competent Americans are in charge of the most important operations. Furthermore, experience shows that in the larger mills it pays to put in an American as edgerman, as careless or unskilled edging, especially in defective timber, reduces the output of the better grades of lumber as much as 50%. The writer has seen Filipino edgermen fail to shift saws after cutting out a defect in an 18″ flitch and allow a sound flitch 18″ or more go through and be sawn into 4″ strips. Of course this is exceptional and in mill practice as well as in logging, as the better grades of Filipinos enter the trade, higher and higher grades of work can be entrusted to them.

At present Filipino engineers and setters receive from $1.50 to $2.00 per day, these wages attracting the highest grade of men that are willing to go into the work. Trimmer men, edgermen and setters receive from $1.00 to $1.50 per day and the rest of the mill and yard crew, being classed for the most part as common laborers, receive from $0.25 to $0.75 per day. As higher grades of labor enter the field and as the present crews become more skilled they will of course demand higher wages. Nevertheless, the cost of each operation should lessen, for it is probable that the capacity of the workmen both as to quantity and quality of work will increase at a much more rapid rate than will wages. No good figures can be given as yet for cost of logging and milling for the Islands as a whole because each mill is operating under its own particular conditions which differ from those in any other mill to as great an extent as would the conditions in New England differ from those in Oregon. In most large operations, however, the logs can be delivered at the mill over a five mile railway and at a cost of less than $3.50. The transportation charge is a large item in getting the lumber to the market, but will be largely overcome as the lumbermen get far enough ahead to own their own lumber fleet.

As has been indicated we can expect a considerable decrease in the cost of production all along the line, but it is not certain that a corresponding increase in profits will follow. The market to-day is practically at the mercy of the lumbermen, the demand being far greater than the supply of native lumber and the only competition being that of Oregon Pine. As more lumbermen enter the field competition will lower prices somewhat, but with the immense China market awaiting development and the market for higher grades of lumber for interior finish in the United States, it is reasonably certain that there will be a margin of profit far exceeding that in the United States for 30 or 40 years to come.

In speaking of logging as carried on in the Philippines it has been said that the "slack rope system" is the only steam method in use. This does not mean that it is the only practicable method but simply that the men who have entered the field so far are from the northwest portion of the United States and they naturally installed the method with which they were familiar. As lumbermen of wider experience and backed by more capital enter the field, we may expect to see many of the specialized systems of logging which have proved successful in the United States put in operation here. Steep slopes, heavily forested to the water line, if not too exposed to heavy surf, can be cheaply logged by a modification of the pull boat system of the cypress swamps. A large, strongly built scow with one or two donkey engines mounted on it should be very successful in such a situation and will also probably find a place in logging mangrove swamps for both piling and timber. Steep slopes everywhere can probably be handled by cableways of one kind or another, such as are produced by the Lidgerwood Co. Timber slides of various kinds would be very effective in many parts of the Islands, although none are in use as yet; and driving by water, which is practised to-day on only a very small scale, will probably become an important means of transportation where drivable streams exist.

The development of the timber business as a whole is well started, although as said above it is still in its infancy from the American standpoint. The next few years should be marked by a rapid advance leading to the exclusion of all foreign timber from the Philippine market. Exportation, now only just beginning, will form an important part of the trade and as Philippine lumber gains its place in foreign markets the advertisement it will get, will bring more and more capital into the business in the Islands. The day of the small operator in the Islands is passing just as it has passed in the United States and although he will never be crowded out, as he has been in the United States, the larger operator will in the future be the more prominent of the two.

MUSEUM OF PHILIPPINE FOREST PRODUCTS

By E. E. Schneider, *Wood Expert, Bureau of Forestry.*

Early in 1909 the Bureau of Forestry established a museum of forest products, located on the ground floor of a large building not far from the Bureau offices. Comparatively small as were the beginnings, the museum now contains collections that will compare favorably in some respects with those of any similar museum in the world. The chief motive of establishing the museum was to acquaint the public with the fact that the Philippines contain not only an immense variety of strong, durable and beautiful hardwoods, but also enormous quantities of construction timbers that take the place of the pine family of the temperate zone. During the Spanish regime, and even in the early days of the American occupation, it was scarcely suspected that the chief wealth of the Philippine forests consists, not of the fancy hardwoods, but of the cheaper woods which, on account of their abundance, can be extracted by modern methods in great quantities and therefore yield a much greater profit than the scattered trees of the high priced species.

A nucleus for the museum was already present. Years before, collections had been made of logs of the well known species for the purpose of identifying by means of botanical material the commoner commercial species. Also, many of the common timbers were already represented by planks either acquired by purchase or donated by lumbermen, not to mention a great number of miscellaneous specimens of manufactures of wood and of minor products. As soon as the museum was opened, accessions of all kinds came rapidly. During the latter part of 1909 a special fund was obtained with which a collection of logs was made that added some fifty or sixty species to the number already represented, besides replacing with large specimens, containing typical heartwood, many of the old ones that had been cut from immature trees. Similarly, to the few planks of the well known commercial species have been added many that were formerly little or not at all known. Occasional logs are constantly being added from collections made incidentally, as in investigating tracts for proposed concessions, donations from licensees, etc. Of the planks a large proportion have been presented. To acquire a specially fine plank the Bureau of Forestry is occasionally obliged to buy a whole log, have it sawn to order and after selecting the choicest planks dispose of the remainder to private purchasers.

The logs shown in the museum are sections three feet high sawn down midway to half their height and having a four inch bevel on the upper edge, so that each one shows bark, sapwood and heartwood, and tranverse, longitudinal and diagonal sections. With perhaps half a dozen exceptions they have all been collected with botanical material, which is deposited in the herbarium of the Bureau of Science, each species being thus positively determined. There are now over four hundred logs in the museum, representing about 225 species. The planks, the standard length of which is ten feet, are arranged so as completely to cover the walls. They range from six or eight inches to nearly four feet in width, the average being between two and three feet. They are all polished so as to preserve their natural color as nearly as possible, except that an unpolished plank is sometimes shown beside a polished one of the same species, the pair being generally cut from the same log. The planks now number nearly a hundred, representing about 65 species. Besides these, there are twenty pillars, each sheathed in a different wood, among which are several species not represented among the planks. Both the planks and the pillars have labels which contain, besides the common and scientific names, a series of notes on the durability, mechanical properties, distribution and supply, sizes and prices of the various species. Further information regarding the forest area of the Islands, the bulk and value of the standing timber, etc., is furnished by a series of colored maps and by framed signs conspicuously displayed on the walls, so that even the casual visitor can obtain a great deal of information without the necessity of a guide. Of the entire space occupied by the log specimens about one-fifth is filled with logs belonging to the Dipterocarp or Lauan family and the same is true of the wall space covered by the planks. This family is the only one in the Islands that furnishes timber in great bulk. There is no species belonging to any other tree family that can be classified as abundant in comparison with the 15 or 20 most important species of the Lauan family. Some idea of the size of the trees of this family may be obtained when it is noted that the planks in this section average nearly three feet in width, the widest one being 46 inches wide.

To attempt a description of the immense number of manufactured articles, both of wood and of the minor products, to say nothing of the specimens of minor products in the crude state, would be to convert this article into a catalogue. Most notable among the manufactured articles are a round one-piece table top of Lauan, 9 ft. 7 in. in diameter, and a rectangular one of Ipil 4 ft. by 9 ft. Of the minor products, there is an endless variety of resins, gutta-percha, rattans, bamboos, dye-barks, etc., the most conspicuous exhibit being probably a stand of almaciga or copal resin. Here are shown a variety of grades ranging from small specimens as clear as the purest amber to great brown masses excavated from the ground and weighing nearly a hundred pounds. Not less interesting, though not so conspicuous, are many of the manufactured articles, which, besides showing the forest wealth of the Islands, throw many side lights on native industries and methods.

THE NORTHERN NEGROS FOREST.

By Heber G. Stout, *Forester, Philippine Bureau of Forestry.*

The district known as the Northern Negros Forest was put under intensive administration in July, 1909. It includes the northern third of the Island of Negros, one of the central islands of the Philippine Archipelago. The total area of the district is about one million acres, about one-half of which is in forest containing approximately one billion board feet of standing timber. In dividing off the Northern Negros Forest as a separate administrative unit, two objects were kept in view. First, to test the advisability of creating similar intensive administrative units in various parts of the Archipelago, and second, to serve as a training ground for Filipino rangers. The first object has been well fulfilled, and the establishment of a forest school for rangers has since rendered it unnecessary to use the Northern Negros Forest for purposes of education other than as providing a place for the students to do field work. An unusual importance also attaches to the Northern Negros Forest, as it supplies the timber for the mills for two of the largest lumber companies in the islands. The Insular Lumber Company was established in 1904 at Fabrica, Negros Occidental; and the Negros-Philippine Lumber Company, with mills at Cadiz, has only recently begun operations.

The Insular Lumber Company was the first in the Islands to install modern methods of lumbering. The plant is situated up the Himugaan River about seven miles from its mouth, and is equipped with a 9-foot band saw, large edger, trimmer, surfacer, and tongue and groove machine, and is easily capable of handling the large logs which are brought in from the forest. The company has constructed several miles of logging railroad, and possesses two Shay-geared locomotives and five donkey engines for yarding and loading. They are operating under a twenty-year license agreement with the Government, which gives them the exclusive right to cut from a tract of forest of sixty-nine square miles, the greater portion of which is fairly level country. The forest itself is of the Dipterocarp type which furnishes the commercial species known as the red and white lauans, tanguile, and apitong; and in non-commercial quantities, scattered through the forest are molave, camagon, narra, and a few others of the more valuable hard woods. The annual cut is between seven and eight million feet, board measure, but the company is planning to increase its output materially by the installation of additional machinery. A recent advice from the mill states that the maximum cut for one day amounted to 72,000 board feet.

The mill of the Negros-Philippine Company is located on the coast of Cadiz, and is somewhat similar. It has a circular mill with a top and bottom saw, an edger, trimmer and sizer. The logging methods used are about the same as those of the Insular Company, but with a smaller equipment. There is a railroad haul of about five miles from the woods to the mill. The company owns one Shay-geared locomotive, and two donkey engines. Their concession adjoins that of the Insular Lumber Company to the west, and comprises about 50 square miles of the same type of forest. They have been operating only since May, and are cutting about 20,000 board feet of lumber daily.

Before discussing the plan of administration which was put in practice, it may be well to describe briefly the physical characteristics of the district. All around the coast, varying from half a mile to fifteen miles inland, is a fertile plain. This is partly cultivated and partly cogon land. Large sugar cane haciendas occupy the greater part of the cultivated area; small holdings on which are grown tobacco, cocoanuts, corn and rice, cover the remainder. The cogon area lies between the cultivated land and the forest, and derives its name from the high, coarse grass with which it is covered. This area was originally covered with timber, which was cut and burned in order that the land might be cultivated for a few years, and afterwards abandoned. Back of this coastal plain rise the steep, volcanic mountains, covered with forests of the Dipterocarp type similar to those in which the lumber companies are working.

Until August 1, 1911, an American forester was stationed in the Northern Negros Forest, with headquarters at the mill of one of the lumber companies. It has since been found possible to entrust the details of local work to a Filipino head ranger of long experience, as an assistant to the American in charge. He reports to the forester in charge of the district of the Visayan Islands and Palawan at his headquarters in Iloilo, who is easily available should any emergency arise which the head ranger is unable to meet.

Under the head ranger are rangers and assistant rangers, who are stationed at various points along the coast. They are young Filipinos of ordinary school education, who have passed the required Civil Service examination. Their duties are to map all trails and rivers in their district, inspect the cutting areas of timber licensees, inspect homesteads, and to see that the products taken from the forests are properly invoiced and paid for. They are also to be on the watch for caiñgin-makers, who, if left undisturbed, would destroy vast quantities of timber.

Each ranger has under him a limited number of forest guards, uneducated men of the native laboring class, who patrol all trails leading into the forest and along its edge, on the lookout for caiñgin-makers and for forest products taken without license. They also serve as cargadores for the forest officers.

The chief and the most important work to be done on such a forest and with such an organization is that of conservation, and this problem in the Philippines is entirely different from what it is in America. Fire does practically no damage in the dense, ever-moist forests of the Philippines, and destructive lumbering methods are of relatively less importance than in the States. The caiñgin-maker, however, is a destructive factor unknown to the American forester, and if unchecked, would destroy more good timber than is cut for commercial purposes. Of the lowest class, sometimes working for himself, but more often for some influential person residing in a neighboring town, and in some cases even for municipal officials, he makes a clearing in the heavy forest which is afterwards burnt over, thus preparing the rich forest floor for the planting of crops. No plowing is necessary. Holes are made in the ground with a pointed stock, the seed dropped in and covered up, and all labor is completed until the crop is ready to be harvested, for in most cases no attempt is made to keep out the weeds. Two crops, or at the most three, are obtained from such a caiñgin, and then the weeds and cogon become too thick and the caiñgineros move to another place and repeat the operation.

As a result of careful inspection and activity on the part of the forest officers, caiñgin-making has been checked in the Northern Negros Forest, and there is now but little loss from this cause. All forest officers are empowered to arrest without warrant for violations of the forest law, and it is now the policy to use this power more freely than in the past. The stopping of this form of forest destruction is one of the best arguments for the more intensive management of other forests throughout the Islands.

Some trail building has been carried on for patrol purposes, and it is planned to lay out a trail completely around the forest that will separate the agricultural from the forest land, and will make possible greater vigilance in protection work. Attempts are being made to induce the Filipinos who wish to have their caiñgins in the woods to take up homesteads in the cogon areas, and to turn non-producing land into farms that will furnish a good living to their owners. This object is somewhat difficult of attainment, however, because of the indolence of the average Filipino of that class, the lack of work animals, and because most of the cogon areas are claimed as private land by the more influential men of the region. Although the claim is usually illegal, the ignorant Filipino has too great a fear of the rich man to contest the matter. Land titles are very indefinite, and the boundaries are hard to determine.

As an experiment the organization of the Northern Negros Forest has given sufficiently good results to justify its establishment and the time and money expended during the two years and more that have elapsed since the project was started. If money can be secured for similar reserves on other islands which contain valuable forests, there is little doubt that the present abuses and the destruction of public property can be successfully combated.

THE USEFULNESS OF THE NON-CHRISTIAN TRIBES FOR FOREST WORK.

By Domingo L. Diaz, *Head Ranger, Philippine Bureau of Forestry.*

In our mountains and wild lands are found not only heavy forests and luxuriant vegetation, but their intricate labyrinths and steep hillsides provide a shelter for a strange race of beings, utterly lacking in all that we prize, but very happy and contented in the face of all the vicissitudes and accidents of an unfortunate existence. These are the Negritos, members of one of the so-called non-Christian tribes of the Philippine Islands and commonly known among the Filipinos as "aetas," "itas" or "balugas."

It is the popular belief that these Negritos were the first inhabitants of the Philippine Archipelago and the theory is supported by modern historians, who argue that as the Negritos have doubtless always lived much as they do at present they were forced to retreat to the more inaccessible portions of the Islands before the advance of the stronger and relatively more civilized inhabitants of the plains who also greatly exceed the Negritos in numbers. The Negritos must have been here before the Malay invasions, for, say the historians, it is not logical to suppose that a weaker race could have invaded the territory already held by a stronger people.

The pressure of other work and the limited space which the Editor of the Forest Quarterly has so kindly allotted do not permit a detailed discussion of other important ethnological data on these tribes, and I will confine myself to their usefulness and importance in forest work in one part of the territory they occupy, the forests of the Province of Bataan.

According to a census taken by the writer with the assistance of the "Comisarios de Aetas," there are scattered throughout the forests of Bataan Province, situated some thirty miles north-west of Manila, about 1,200 Negritos of both sexes and of all ages. For the most part they live apart in groups or families on the edge of their caiñgins or forest clearings and remain in a fixed abode during the cultivation and harvesting of the crops on a few little parcels of badly cleared land.

The inhabitants of a pueblo generally hold an election once in two years to nominate and elect a captain, a Justice of the Peace, a senior lieutenant, and one councilman and "teniente" for each district within the jurisdiction of the pueblo. In addition there are police and a "Comisario Mayor" as well as a "Comisario Segundo," the two latter of whom are Christians in most cases.

As the Negritos have been born and have spent their entire life in the forests their practical knowledge and the experience they have gained are of incalculable value, for nowhere else can we find rational beings so intimately allied to the plant world and its reproduction and so thoroughly conversant with the geographical features of the mountains and the names of trees and places. To the Negritos the name of every spot, of every tree and forest not only has some distinctive meaning but also brings up the memory of some notable incident in his life. Even the younger generation know most of the different kinds of trees, their characteristics and their practical uses, and when the name of this or that tree is mentioned it is common to hear such remarks as, "The fruit of this tree is edible," or "The bark of such and such a plant has certain medicinal properties"—and they can guide you to a spot with the exactness of a magnetic compass. As each Negrito has a certain patch of forest which he considers peculiarly his own, it is easy to understand his great familiarity with the mountains and the vegetation which they support.

The most distinguishing characteristics of the Negritos as a tribe have always been obedience and docility. As they are a simple people in one sense and of a nervous, excitable temperament they have always shown a fidelity which borders upon timidity. Imagine for a moment a machine in action, and compare it to a group of Negritos working under the direction of a foreman in whom they have confidence because they feel sure of receiving fair treatment at his hands, and the comparison will be marvelously exact. A primitive people of few wants and basing all their pride in being able to please their friends or fulfill the wishes of their rulers, they are well adapted to employment in any sort of forest work.

We should not consider laziness the cause of the poverty of a class of men who spend night and day in search of food to satisfy the veriest necessities of life for themselves and their families, men who in all kinds of weather clear and cultivate parcels of land far away from their own dwellings—men, in fact, who sell what they have produced at a third or a fourth of the customary prices —it would be ridiculous to characterize such men as lazy. The Negritos are hard workers, workers from necessity and from habit, and their faults are due to lack of method, of ambition, of proper initiative, of insufficient food; and so with a little effort it would be possible not only to better their own condition, but that of the entire community and of the forests which shelter them. Thoroughly inured to the climate, always seeking the verdure of the forest and its cool breezes and feeling agile and happy where all is solitude, it would be difficult to find a substitute for the Negrito for forest work.

Like all other humanity, the Negritos have their shortcomings. Proud of the official authority with which some of them are invested, they wish proper respect to be shown to their rank and they generally seek an employment which is on a friendly basis rather than paternal. They wish to smoke cigars and chew betel nuts while they are working and prefer to go a whole day without food rather than be deprived of them. They are very fond of music and dancing and on a day of "undas," or the solemnities attendant upon a funeral, most of them will lavish all the products of the chase and of their work for an entire year. Such disagreements as arise among themselves are generally the result of amorous intrigues or jealousy, for questions of the ownership of property, much less of thefts, are unknown: their property is owned in common and robbery is considered the most degrading of crimes.

By making a superficial study of their customs, tastes and vices, learning how to avoid the difficulties and to work in harmony with them, one can be assured of finding in these tribes a body of men that are intelligent, docile, faithful, agile and industrious for any class of unskilled forest work which they may be called upon to perform.

IMPRESSIONS OF FOREST ADMINISTRATION IN BRITISH INDIA.

By Theodore S. Woolsey, Jr.

In the fall of 1904, the writer made a three months' trip to study the methods of forest management in British India. The trip included a visit to the sal forests around Dehra Dun; to the spruce, fir, chir pine and oak forests of the Himalaya Mountains at elevations of from 5,000 to 10,000 feet; also a visit to the plantations around Lahore. During this trip the writer had the opportunity of discussing administrative problems with a number of officers. This much is given by way of introduction to point out why the writer has used the title "Impressions of Forest Administration in British India." On the other hand, the Indian Forester has been studiously read in the last five years and perhaps a correct idea of some of the main points in Indian forest administration has been gained.

The climatic conditions in India make forest administration very difficult for a white man. He must live in out-of-the-way places; he must wage a continual warfare with the climate, and in less favorable localities—as in certain parts of Burmah—forest officers are in danger of fever or other tropical diseases. Consequently, the success of the administration is all the more remarkable. Starting as it did in a small way, under the leadership of the late Sir Dietrich Brandis, it has reached its present efficiency in a period of less than 50 years. The success is largely due to the personnel. The pay is excellent, ranging roughly from $1400 for the green Assistant Conservator of Forests to $6400 for the experienced Conservator (District Forester), and at the end of 25 years' service, an average pension of $2500 per annum may be expected. In the early days the officers were ordinarily trained in France or Germany, but now there is a well-established school at Oxford where officers receive the major part of their training, supplemented by tours and assignments in Continental Forests. Of course the subordinate force is paid far less than the average laborer in this country—a fire watcher receiving perhaps $2.50 a month, *without expenses*—but one must make allowances for the unreliability of the native laborer and the necessity for close supervision in considering the net cost of labor. The ranger force is well trained at Dehra Dun, and allowing for the native temperament, they may be said to be an excellent body of men.

A practical business administration stands forth as the foremost achievement. A substantial net revenue can always be assured. In the business success of the forest administration, economy, as well as the development and exploitation of the natural resources, have played important parts. Possibly in some parts of India there has been serious over-cutting due to the keen desire to secure financial results. For instance, it has been stated that the sandalwood forests have been depleted in order to enrich the exchequer.

Perhaps the most delicate problem which the forest administration has had to face is how to deal with the natives. An amicable settlement of the grazing and forage problems has often required great diplomacy. Even in fire protection the native must be carefully handled, since in case of a large fire the untrained coolie must often be relied upon. Even the effect of the restriction of wanton timber cutting on local sentiment must be weighed; in almost every forest there is the so called "village forest" which apparently is mutilated and grazed at will.

Fire protection in British India it seems to me has been successful. In the "protected forest" there are carefully planned fire lines, supplemented by a corps of fire watchers and fire fighters. Especially dangerous meadows are periodically burned over and natural water courses are often improved to make broad fire breaks. In the chir pine forests in the mountains the fire lines usually run along ridges and there are many arguments presented locally in favor of not entirely clearing the line, but maintaining a scattered pine forest upon it in order to reduce the cost of clearance. The lines are burned periodically; first guide lines (their width equals height of grass plus or minus) are cut on each border of the main fire break, then when the grass is sufficiently dry, the whole break is burned under close control. There are numerous instances, however, where fires have escaped while these lines are burned, owing to the blaze unexpectedly getting out of control.

The grazing problem is logically handled. It is felt that the stock must be provided for, and that properly regulated it can be made to assist reproduction. For instance, before a reproduction cutting, heavy grazing may be allowed. Afterwards it may be totally excluded until the second crop is sufficiently established.

Natural reproduction has been and is being carefully studied, but there is room for the application of scientific experimental station methods and if these had been applied years ago, many of the perplexing problems would now be solved instead of being a matter of controversy. For example, does burning in a teak forest improve reproduction? If so, is this improvement sufficient to warrant burning the humus? What is the total net gain or loss? What methods of cutting promote the reproduction of deodar, chir pine, or sal? These are some of the problems which have been solved but in regard to which there is still some doubt. Reviews of the annual administrative reports bring out the lack of artificial reforestation. It is believed that a larger area should be annually artifically reforested than is now being done. At present there is practically but little planting or sowing done in India, considering the total acreage under forests.

Working plans have been prepared for a comparatively small area. The main objection to these plans has been that they have not been made by the men most capable of making them, and they have not always been entirely practicable and workable. In regulating the yield the natural loss through suppression or other causes has never been studied with sufficient care; this is an uncertain factor which I believe some day may lead to local overcutting. Judging by our standards the growth figures upon which many of the cutting plans are based have been insufficient to warrant the inferences drawn. Nor have the volume tables been sufficiently accurate, although the yield has ordinarily been based on area and number of trees rather than the cubic foot—a detail which has made the working plans more practicable.

While the education of the ranger force at Dehra Dun, for example, has been greatly perfected, yet there is need for an increase in the number of forest schools in order to secure a locally educated ranger force familiar with the problems with which it must deal. As compared with the United States the publicity movement which is, of course, of great educational value, has not been pushed with the same vigor. Exceedingly interesting and valuable reports are often limited to small issues, so that the general public cannot be supplied. Possibly this has been necessitated by the spirit of economy, and yet this seems to me to be a short-coming.

Prior to 1906 the experimental work was carried on by a few enthusiasts who were subject to transfer at any time; consequently, much of the value of these experiments was lost. In 1906 a Research Bureau was established which is now turning out excellent scientific work. Possibly this Bureau will be strengthened if it tackles the more practical every-day management problems that the officers in charge must meet, instead of conducting its work along such purely scientific lines.

It is well to emphasize, in conclusion, that the fore-going notes are merely impressions and are not based upon a complete study of Indian forest literature, such as is available; nor upon an extensive tour in India. Yet one can say with a fair degree of accuracy that the Indian administration is to be praised for its net receipts, for its splended supervisory personnel, for its efficient fire protection, and for its understanding of the native problem. On the other hand, it is equally true that in future years there is room for more aggressive artificial reforestation, for working plans over a larger percentage of the area under merchantable forests, for accumulating a more extensive Indian forest literature of a high technical value, and for wider scientific research along practical administrative lines.

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*Since reading an account of the proposed change from the selection to the shelter-wood system in the Teak forests of Burma on the recommendation of a member of the Research Staff it appears to me the investigative officers are already tackiing practical problems of management.—T. S. W., Jr.

A PHASE OF FIRE PROTECTION.

By Theodore S. Woolsey, Jr.

The chir pine (*Pinus longifolia*) at the head waters of the Ganges in northeastern India is managed under the shelterwood system, with a reproduction period of some ten to twelve years. The results of the application of this system seemed satisfactory when the Jaunsar forest was visited in 1904. There was but one objection. As it happened, quite a considerable area of regenerated stands had been practically burnt clear prior to my visit. There were no seed trees scattered over the burnt area and the trees in the higher regions could only restock the area after a serious delay. It was thought at that time too expensive to plant or sow. A rather difficult and undesirable situation!

As a result of this object lesson, all the more striking because of the progress of fire protection in India on so called "protected forests," it has always been my practice to leave at least a few seed trees—say one or two per acre—even if pine reproduction is already complete on the area to be logged. Perhaps the first direct application of this principle in America may be found in section 22 T23 N. R. 4E. G. & I. R. M. Tusayam Forest, Arizona, a Western yellow pine stand. So much by way of introduction.

When the Republic of Genoa ceded the island of Corsica to France, it was the engineer branch and not the forest branch which first took control. But when they did assume the responsibility, they found that fires and excessive grazing had reduced most of the forest to mere brush, (locally known as "maquis"). But high up in the mountains, usually above three thousand feet altitude, there were still fine forests of Corsican pine (*"pin laricio"*) They found large areas of fully stocked, even aged stands, and consequently decided that the shelterwood system should be applied. After the seed fellings, the regeneration was fairly successful, although it is judged that where the grazing of goats was especially severe, the young growth did not come in as uniformly as was desired. During the early administration, the severity of the control incited the local grazers to armed opposition and to reprisal by incendiarism. To-day one sees goats and hogs in federal forests where they are formally forbidden entry under the existing forest code. But, as an old ranger put it—"If one must take poison, it's better, if you have the choice to take the poison, which, altho it does make you sick, does not actually kill you." In other words, they have found that if grazing is strictly prohibited, the local herders, whose very existence is at stake would set fire and burn the forest. With grazing winked at, there are still fires, but many less than when incendiarism was rife.

But to continue—after the final fellings—a series of disastrous fires during especially dry seasons swept over many of the important pine forests, as for example—Vizzanova, Marmano, Bavella and Marghére. These fires destroyed not only the young growth but also even aged saplings and pole stands since many of the more open stands have a heavy understory of bruyiere. For the most part, veterans escaped destruction. To-day the shelterwood system has been abandoned and both with Corsican and Maritime pine (which grows in mixture with Corsican pine up to three thousand feet elevation!) they have adopted the selective system with what is probably the longest official rotation for a coniferous species to be found any where in the world—namely three hundred and sixty years and, in my opinion, at least a century or a century and a half too long. With the selection system, they felt that after fires the standards would remain to seed up the burnt areas—Perhaps the German would call the system in all a grange system, because in theory at least, small changes of trees are cut so as to admit plenty of light for an intolerant species. In the working inspected, however, mostly single mature trees had been cut and only 20 per cent. to 40 per cent. (roughly estimated) of the total stand was removed. When the openings are stocked, the working plans call for thinning, although it must be admitted they have been sadly neglected because there was no demand for small size wood.

While it cannot be claimed the method has been tried out and found successful, yet it must be admitted that the principal of bearing in mind fire dangers in choosing a system of cutting, is an important one where dangerous fire conditions prevail or successful protection is doubtful.

FORESTS AND FORESTRY IN THE GERMAN COLONIES.

By B. E. Fernow.

During the last few years a great deal has been written on forest conditions and the beginnings of forestry in the various German colonies. In the following pages an attempt has been made to briefly sketch conditions as they appear from this multifarious literature, mostly the result of personal visits and expeditions.

Germany entered upon her colonial policy about 1884, and acquired most of the territory by treaties and amicable arrangements. She possesses the following colonies, over one million square miles of colonial territory, namely,

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Das Forstwesen in den deutschen Schutzgebieten. By Baderman. Zeitschrift für Forst—und Jagdwesen. November, December, 1909. Pp. 719-746; 796-808.

Deutsche Holzerzeugung und Forstwirtschaft in den deutschen Kolonien. Von Dr. Jentsch in Gewerbliche Material Kunde. 1910. Pp. 16.

Was lehren uns die Anfänge unserer Kolonialen Forstwirtschaft. Geiseler. Zeitschrift für Forst—und Jagdwesen. April, 1912. Pp. 222-233.

Forstwirtschaftliche und forstbotanische Expedition nach Kamerun und Togo. Von Dr. Jentsch und Dr. Büsgen. 1909.

Der Kameruner Küstenwald. Zeitschrift für Forst—und Jagdwesen. May, 1910. P. 264.

Beiträge zur Kenntniss der Pflanzenwelt und der Hölzer des Kameruner Waldlandes. By Büsgen. Review in Zeitschrift für Forst und Jagdwesen. April, 1911. Pp. 380-386.

Die Forstwirtschaft im Schutzgebiet Togo. By Metzger. 1911.

Nutzholzbäume Deutsch-Suedwest-Afrikas. By Pagge. Zeitschrift für Forst—und Jagdwesen. July, 1910. Pp. 400-426.

Aufforstungs arbeiten am Haho (Togo.) Deutsches Colonialblatt; berichtet in Zeitschrift für Forst—und Jagdwesen. August, 1910. Pp. 510-512.

Die Forstschritte in Kiautschou. Allgemeine Forst—und Jagd Zeitung. January, 1911. Pp. 35-37.

In Africa	
German East Africa (1885)	366,000 square miles
German Southwest Africa	324,000
Cameroons (1884)	192,500
Togoland (1884)	34,000
In the South Sea	
Kaiser-Wilhelmland (New Guinea)	70,000
Bismarck Archipelago (New Guinea)	23,800
Samoa	925
In Asia	
Kiautschou	195
	1,011,420 square miles

Of all these possessions only East Africa, Kamerun and the South Sea Islands have available supplies of timber, and the Kamerun is perhaps the only one that has enough for export.

So far, the exports of forest products from all the colonies combined have hardly amounted to $500,000 in any one year.

The extent and value of the forest area in the timbered colonies is still uncertain; it is only certain that they exist. In Togo, only remnants of once extensive forests remain, and Southwest Africa exhibits only a sparse brushforest. Samoa and the Salomons Islands have luxuriant forest growth in the Interior, while the Carolinas, Marianas and Marshall Islands contain only cocoa palms and camphor trees. The rented territory of Kiautschou is forestless, but successful plantations have been begun here.

Kamerun (or the Cameroons, as it is called in English) is the most densely forested of the African colonies. It is as yet impossible to state with precision the extent of the forest area, especially as it is still doubtful what to call forest and what is simply woodland. Estimates vary between 15 and 25 million acres. Some 15 million acres is tropical, evergreen rainforest, with trees of enormous size; some 250,000 acres are mangrove and bog forest; and in the higher altitudes "fog" forests are found along the west and south coast in a belt of 60 to 100 miles; the northeast and middle of the colony being plains country.

The description of the Kamerun forest, as given by Dr. Jentsch, resembles very much the conditions known to us in Cuba, Porto Rico, or Jamaica. Here, as there, the *Rhizophora mangle* and *Avicennia nitida* form the mangrove forest, and other familiar names occur, like the parasitic Ficus and Ceiba, and Dipterocarpaceae with various species. This forest knows only broadleaf trees, mostly of hard, heavy wood, several hundred species and mostly even botanically undetermined. Dr. Jentsch collected 600 woody plants. He enumerates by common names some 150, and describes in more detail some 40 species, only half of which could be botanically placed; and as technically recognized and used, only 14 species are named. As to the value of most of these species there is as yet no certainty.

So far, only two species are being exploited for export, namely *Kickxia elastica*, for rubber, and *Diospyros dendo* (together with other Diospyros species, of which 12 are cited) for ebony. For home consumption some 10 to 15 species are utilized. Several mahogany woods (*Mimusops djave*, the magnificent *Terminalia superba* and the botanically undetermined *Bope ba mbale*, and the teak-like *Chlorophora excelsa*, several cedar woods, yellow woods and other dyewoods promise to come into the market.

The most widely represented family in the dominant stand are Leguminosae with 43, Apocynaceae with 25, Euphorbiaceae with 22, Moraceae with 20, and Annonaceae with 10 species. In the underwood, Rubiaceae and Acanthaceae are most frequent.

Büsgen gives a very complete list and description of this flora with illustrations of wood sections. Four groups of woods are distinguished which make it easier to classify for technical purposes, namely

a. wood parenchyma not distinguishable with magnifying glass, but vessels and pithrays visible.

b. parenchymatous tissues very fine, lines crossing pithrays prominent;

c. wood parenchyma forming striking figures, namely *c. 1.* more or less coherent lines, or *c. 2.* more or less isolated fields surrounding vessels;

d. grain figures not visible to naked eye, and only very fine structures differentiated under magnifying glass.

The important woods are mahogany-like, rosewood-like, ebony-like, cedar-like, oak-like, pitch pine-like, a number of species as a rule furnishing wood of the same description. The most promising, Jentsch thinks, are the oak-like or teak-like, and pitch pine-like, Chlorophora, Milletia, Bongongi, *Irwingia Barteri*. If these could be laid down in Hamburg in large dimensions for 40 to 50 cents, which is not impossible, they would successfully compete with American oak, which brings now 40 to 60 cents, and in large dimensions up to $2 and more, or with teak worth 65 cents to $2 per cubic foot.

In mahogany woods, the African, although lower for common run, is for the best, now higher than the American of the genuine Swietenia. While common African brings only 28 cents and American around $1, the maximum prices are near $2 for African as against $1.30 for American.

Several cedar-like species also are promising. Here Dr. Jentsch makes the curious mistake of mixing up pencil-cedar (Juniperus) and the cigar box cedar (*Cedrela odorata*), which is not a conifer.

In the original woods, the average height is around 150 feet, and diameters run from 3 to 10 feet. On one sample area of 1 1-4 acres not less than 93 species over 3 inch diameter were found. The largest volume out of 12 sample areas showed 14,270 cubic feet, of which a little over 5,000 feet were sawtimber; in another case, the total volume was 12,700 cubic feet with 6,000 feet available. One of the largest trees had a diameter of 7 feet and a height of nearly 200 feet with a timberwood content of 2,577 cubic feet. Lack of knowledge of technical and commercial values precludes an estimate of merchantable quantities, which is, however, estimated at 50 per cent.

The forest of the coastbelt which so far alone is needful to consider can be divided into three types: the mangrove forest, the primary and the secondary forest.

The primary or virgin forest is particularly rich in species.

After the virgin woods have been exploited and, as usual, burned, a secondary forest growth comes in, as with us. The secondary forest which results from the practice of burning and agricultural use is entirely different from the virgin: rapid, light-needing species, with soft wood predominate here, with a luxuriant undergrowth of climbers and lianas and weedgrowth forming impenetrable thickets. The most common species which, like our aspen and birch, takes possession of these openings is *Musanga Smithii,* Umbrella tree. This is shady enough to keep weeds out and at the same time light enough to permit some better species to thrive in its shade, like our species, hence it is a good nurse tree. Its proposed use for wood pulp completes the resemblance. *Ceiba pentandra* also belongs to this class of nursetrees of little technical value.

As everywhere in the tropics, the lack of gregariousness of species makes logging expensive, unless the many species can be marketed together. The really (at present) marketable woods occur only sparingly scattered through the forest. Thus a sample plot containing 369 trees belonging to 41 species had only 4 merchantable trees of one and 6 of another species, and this was rather an exceptionally good proportion. Other difficulties in the exploitation are the form of trees; the boles are often strongly buttressed with salient root-ridges which adds to the labor of felling and working up. A stem 30 inches in diameter at 65 feet had a basal diameter of 50 feet. Felled trees frequently prove worthless and the logging waste runs up 60 and 75 per cent. Labor conditions add to the difficulties. Woodswork is heavy and unhealthy and must be interrupted during the wet season.

Transportation is rendered difficult by the rough or swampy country and hand power alone is commonly used. Horses or oxen cannot be kept (Tsetse fly!). Built roads are few, and but very few light railways have been run into the country. The nature of the streams and the density of the woods to be floated alike conspire to render river driving almost out of the question.

Present prices of wood are very low and the margin of profit in the industry is very small. Attempts have been made to acquaint German wood-using industries with the possibilities of the woods from Kamerun, but so far with poor success.

We may quote here at once the verdict of a forester, who has studied the situation on the ground officially. Gieseler writes: "The experiences gained in exploiting tropical woods, where large capital is required for securing means of transportation, are by no means encouraging. The English in British Africa and Americans in Central and South America have experienced this—it is a jump in the dark!"

This colony is to a considerable extent settled, and railroad construction to open it up has progressed so that presently the forest wealth will become available. Climate, labor conditions, political uncertainties, besides the causes mentioned before, which make forest exploitation in the tropics dubious, and limited means of transportation contribute to the difficulties. Only large enterprises hold out hopes for success.

So far, only two operators were at work, the government leasing large territories to them; but instead of charging by measure, the government participates in the profits of the operation, if any. One of the enterprises is *prima facie* a railroad construction with the timber exploitation as a side show; the other one has already abandoned the undertaking.

Rubber seems to be the most profitable product, and regulation in regard to its conservative exploitation is needful. Experimental plantings of rubber producing plants have been inaugurated. Other so-called by-products, tannin, quinine, perfumeries, resins and oil may also become important forest products for export.

Besides the rubber plantations, the various experimental stations have started a number of cinchona, teak, oil palm and other plantations, details of which are given in Baderman's article.

Dr. Jentsch's monograph discusses in great detail not only the conditions but the requirements for a sane forest policy and management. He cites the propositions of the late Prof. Mayr, who wants, before any exploitation begins, a thorough investigation, a land classification and segregation of agricultural and pure forestsoils, a scientific investigation of the value of woods, etc., then reserving what is necessary for protective purposes and beginning at once a real forestmanagement on strict forestry principles. To this program Jentsch objects on practical grounds:—it would take too much time to secure all the information, and only by trials on a large scale can most of the knowledge be secured. All that can and should be done in the present stage of development is to utilize the utilizable values in such a manner as not to destroy the future, avoiding rapine, and giving up soil for settlement wherever the need appears; private enterprises to be encouraged in such exploitation without inducing wild speculation.

Above all, the forest must remain State property and all reservations for special reasons can then be made from time to time.

In silvicultural direction there is also difference of opinion. The tropical forest, according to Mayr, if only the most valuable species are exploited continuously deteriorates in composition and value (so does the mixed forest everywhere!), while the pure forest is easily reproduced, hence Mayr recommends this form, but, according to his well-known theory, in small areas of not over 25 acres for the single stand, to avoid the dangers of pure stands generally (mixture by stands). Jentsch pleads for the retention of the natural mixed forest in selection form.

The difficulty in the absence of annual rings to determine the admissible felling budget, based on increment, Jentsch proposes to overcome by confining (as Brandis did originally in India) the exploitation to a diameter limit. This, tentatively upon the basis of a few sample areas, merely to illustrate the calculation, he places at 24 inches, when, finding that about two thirds of the total volume is formed by trees above that size, he formulates the volume increment per cent. for n years (In):

$$2/3V : V = In : 100; In = \frac{V.67}{V} 100$$

The question of the length of n, the period of return, needed to replace the $2/3\ V$, or the I for a given n, can be found only by experience after the first n has passed. If n were placed at 10 years the annual increment per cent. would have to be 6.7%, which the author does not think out of the way, corresponding to a production of 540 to 960, average 758 cubic feet per acre. By lengthening the period of return, say to 20 years the increment needs to be only 370 cubic feet, a very reasonable expectation. Applying to the sample areas the proposition to remove two thirds of the volume, it is found that in the virgin timber of the 361 to 668 trees present (per hectare) only 29 to 48 or 4.6 to 9.2% are removed, hence from 90.8 to 95.4% remain. In the secondary forest areas similar results appear. It would, therefore, be safe, even to cut into the second size class.

The author advocates the exploitation by private enterprise under concessions. The time for which such concessions are to run must be determined not by silvicultural considerations alone, which would make 10 to 20 years sufficient, but by business considerations, especially the size of the capital required for the enterprise, for which an amortization of at least 10% must be calculated. After pointing to the experiences in Bosnia, and bringing in various arguments, the author concludes that 10 years would be the lowest and 30 years the highest time limit, for which to grant timber licenses.

In Java, where since 1864 such licenses have been in vogue, the time limit varies between 10 and 75 years, the latter, however, only for concessions which contemplate change into agricultural use and colonization.

To impose any cultural work on the timber limit holders the author considers impractical, since all personal interest is excluded in such work, and therefore it will be poorly done. Such work, if necessary, should be done by the forest administration. Such cultural work may become necessary to check the tendency of the natural regeneration in increasing the number of species and especially the less desirable ones. As to what can be expected from planting is exemplified by citing the dimensions of 3-year planted Kola trees, namely 25 feet in height and 6 to 8 inch in diameter.

From other parts of the very interesting and throughout sane discussion by Jentsch we can afford to note only here and there points of interest: Fire does not seem to be troublesome; no forest destroyed by fire was seen. Elephants are destructive; apes pull out plants; but these are only annoying, hardly noticeable damages. Insects, especially borers, are not infrequent.

River transportation is not promising without much outlay; only the natives bringing one or a few logs tied together with lianas at a time can do it cheaply. Most of the valuable species do not float. Land logging is impracticable so far in the absence of roads and animals, (Tsetse fly danger!), and the difficult topography. Railroads are, therefore, the main reliance, permanent and moveable in combination.

Whether a railroad could develop as much as 6 miles on each side, as first supposed by the author, has become doubtful on account of the cut up topography, and half that distance seems more likely the limit.

The waste per cent. in logging with which the operator will have to figure, the author places at 66 to 75, even 80%, based on various calculations. This should be reduced by turning it into charcoal, and possibly its by-products, alcohol and acetate of lime, of which Germany imports, mostly from the United States, in the average over 1.5 million dollars. A calculation based on a $50,000 investment for plant figures out 22% profits.

As regards labor conditions Dr. Jentsch is more hopeful than other writers, although he does not expect it to be cheap, and he gives data to show that the negros may do satisfactory work, 50 men for a season to produce 350,000 cubic feet.

For power at mills, water with electrical installation is advocated, but only on a large scale, since small installations are shown not to be profitable.

All statements on this and other discussions of cost are based on statistical detail and practical calculations.

Finally, the question of ocean freight is touched upon. At present, the freight rate per ton from Kamerun to Hamburg by regular liner is $6 to $11, making 28 to 35 cents per cubic foot, which is prohibitive for many or most woods. The use of sailing boats is warned against, as the wood suffers from rot and insects in the long voyage. But lower freights by steamer are possible, as from East Africa and Australia they are now more moderate.

A plea for reduction in import tariffs of the mother country is based on the argument that the woods are not in competition with those of the home country, which imports anyhow around 525 million cubic feet, and the Kamerun is the only colony from which importations of this nature can be expected.

The small colony of *Togo,* to the west of Kamerun, the most prosperous of the German colonies, is a fertile country which does not any more require expenditures from home. Formerly probably heavily wooded, it exhibits at present only remnants of forest on the mountain range running north and south, and river forest, about 1% of the land area. The larger part of the territory is occupied by pampas. Here plantings have been begun, in a rather ineffective manner, largely with native species. All the wood is used for home consumption. The most important species are *Chlorophora excelsa,* the African Teak, *Diospyros mespiliformis, Khaya Kleinii* and *senegalensis* (African mahogany), *Erythrophloeum guineense* (furniture wood), *Borassus flabel-*

liformis (building timber), as well as a large number of Leguminosae.

Not until 20 years after the occupation by Germany was a systematic beginning made with forestry, the troubles with the natives preventing any kind of management. In 1906, the systematic exploration of the forest conditions was begun by Metzger and the first attempt at organizing a service made. In his book Metzger describes the vegetation, the origin of the savannahs, the forest influences in the tropics, especially in Togo, the necessity of forest preservation and the measures needful for it, with plan for the future exploitations. The more important tree species are discussed and propositions for the re-forestation of the savannahs made. He himself started systematic re-forestation of the watershed of the Haho river, with a view of improving water flow, some 75,000 acres having been set aside for the purpose on a territory bounded at one end by a 7,500 acres river forest, at the other end by savannah. By 1910 some 50 acres had been sowed and some 95 acres planted, and nurseries established. The cost has been excessive owing to lack of skill of the black labor, namely about $45 per acre; results are not yet quite satisfactory; drouthy conditions seem to prevail. The detail of the plantation is given by Metzger in the articles on the re-forestation work at the Haho.

German Southwest Africa, lying 20° south of Kamerun, with a dry continental climate and dry, sandy soil, is practically forestless, except for clumps of Acacia brushforest, and riverforest. Only in the North are found some remnants of forest with Adansonia, Cassia, Eugenia, Combretum, and other tropical forms.

The forest administration here is engaged in trying to find suitable species for planting in the plains, the species used being mainly exotics: *Pinus halepensis, canariensis, pinea, pinaster,* Eucalypts, Casuarina, Prosopis, Cupressineae, Morus, Schinus, Ailantus, Robinia, Cork oak, Camphor tree and Bamboo. In the six or eight experiment gardens Casuarina thrives especially well. In a forest plantation, in two and one half years it attained a height of nearly 30 feet and circumferences of 12 inches at 3 feet height. Eucalyptus, Prosopis, Cupressus, Schinus and Ash appear promising, but the pines seem a total failure. Lack of water and frosts are the enemies. Even in the best situated location (Okahandja) irrigation for at least the first two or three years is necessary.

In *German East Africa* conditions are only slightly better. The forest area is estimated as covering 4% of the territory, say 15,000 square miles, most of which is brushforest of xerophytic character composed of small deciduous trees. This condition prevails over the entire south coast from Kilwa Kiwindje south to Niassa Lake, and on the central high plateau from New Langenburg and Bismarckburg north to Victoria Lake. The species are mostly Leguminosae without commercial value.

The country may be divided into five zones: namely, (1) the treeless strip along seashore, rising from the shore 700 *m,* about 80 *km* wide, with rarely more than 15*mm* rainfall; (2) the bushforest of Hereroland, rising to 1,500 *m* with 100-600 *mm* rainfall, in which only rarely trees of size occur; (3) another low brushforest, Namaland, rising to the same altitude, but with less rain, 60-230 *mm;* (4) the park-like forest of the eastern portion, Kalahari and Omaheke, with higher tree growth in the river bottoms, up to 1,200-1,400 *m* elevation, with unknown rainfall condition; and (5) the northern region, north of 20° lat., which bears almost dense forest growth without thorn trees in contrast to the other four zones, up to 1,000-1,400 *m* and with up to 1,000 *mm* rainfall.

Pagge describes with more or less detail, giving characteristics and use value, only species of the dry forest, namely six Acacias, two Combretaceae, a Ficus, a Zizyphus, a Rhus, a Euclea and a Tamarix. Only one and that a botanically unnamed species, Tambuti, from the true forest country, possibly *Ximenia americana,* is cited.

The rainforest is, as stated, found on the east slopes of mountains at 1500 to 5000 feet elevation, and is described by Baderman. The forest here is composed of many evergreen broadleaf species in two tiers, the upper story reaching up to 150 feet and more, with diameters to 6 feet, the lower story 60 feet, with a dense undergrowth of lianas, epiphytes, etc. Most of this forest has been turned into farms or has been burned over, and has reproduced mostly in xerophytic forms. Only small remnants remain in Usambara, Kilimandscharo and Meru, in the Uguru mountains, and Uluguru, and west of Victoria Lake.

Another type of hygrophytic forest is found under the influence of the fogs, in the alpine locations at 3500 to 10,000 feet, also evergreen but of different species and smaller sizes.

The river forests, following the rivers in the plains as with us, and the mangrove forests at the seashore add little of value. Only the rain—and fogforest furnishes the basis for a wood-trade.

The mountain forests of Usambara and Pare are estimated to contain, besides 85,000 acres Alpine forest, 50,000 acres of cedar (*Juniperus procera*), 75,000 acres of *Podocarpus usambarensis,* 1000 acres of mixed broadleaf forest, in which only *Chlorophora excelsa* (Morac of Meoule, the African "oak") furnishes at present commercial timber, in addition to the two mentioned conifers, and *Khaya senegalensis,* a mahogany.

Other giant trees are *Piptadenia buchananii,* (Legum.) and *P. hildebrandtii, Albizzia fastigiata* (Legum.) *Parinarium goetzenianum* (Rosac.) *Chrysophyllum msolo* (Sapot.), *Sizygium guineense* (Myrt.)

In the Uluguru mountains the valleys are filled with rainforests up to 7000 feet elevation. Here, besides Podocarpus, Stearodendron, Ocotea (*usambarensis*), Serindeia (*obtusifoliata*), Chrysophyllum (*ulugurense*) are the leading species.

In the district of Kilimandscharo and Meru, some 300,000 acres of such rainforest is found, with Juniperus, Podocarpus and Chlorophora the leading species, besides an unknown, Ash-like tree (Ljondo).

The forest department of East Africa was, after several expert reports, organized in 1904, under a German forester, Eckert, who had gained experience in Java. The country was districted into 6, later 7 districts; a protective service was organized. Systematic reforestation, especially at sources of streams; control of utilization; a real forest management on some of the crownlands—this was the program.

All forests, not yet in private hands (about 50,000 acres), were declared fiscal forests (about 3.5 million acres) and placed under control of the forest department (1 million acres organized), while private owners were obliged to submit felling plans to be approved. (These acreage figures do not coincide with other figures in the various reports!)

A service consisting of three administrators and twelve foresters, with a number of native guards was organized, and a beginning made at least in regulating exploitation and securing protection against fire.

The annual burnings for grass are being stopped; and even private forest property is already under restriction, in so far as not more than three quarters of forest property may be cleared, and in brushforests clearing and burning-over is altogether forbidden; indeed, cutting and peeling of bark may only be done by permit, and the permit may require reforestation. Penalties, money and imprisonment, are threatened for transgressions and especially for incendiarism.

The forest administration itself exploits only for small home consumption except the mangrove forests at Rufidgi (35,000 acres), in which some eight mangrove species are enumerated, some fit for small sawtimber (*Rhizophora mucronata,* and *Bruguiera gymnorhiza*), with very hard, brown to red wood, teredo proof; some for wagonstock (*Carapa mollucensis* and *obavatus*); some for other small uses and fuel. The bark (up to 45 per cent. tannin) promises to become an object of trade. Otherwise the exploitation for export mainly is carried on by private operators under a timberlicense system or under special contracts, several such licenses and contracts having been entered upon.

This exploitation has so far failed to be lucrative; the expectations of a large income from the start were not realized (as could have been foretold), and a reduction in the operations has been the result. Only one larger operation in cedar forest and two small ones in mangrove bark, besides one large one on private territory, have maintained themselves. Large investments in costly railroad construction have been made, and it cannot yet be foreseen whether these will secure adequate returns. Besides, a number of small sawmills are at work for home consumption.

The greatest activity seems to have been developed in the direction of plantations, in the mountains at headwaters as well as in the dry plains. These plantations are in part experimental, in part horticultural (cocoa palms, rubber trees), and only in small part for forest purposes.

The species most frequently used and successfully, are, besides Teak, *Chlorophora excelsa, Caya senegalensis, Cassia florida* in the valleys, and Eucalypts, Acacia, Cedar, *Grevillea robusta,* Camphor trees, Olives, etc., in the mountains.

The *South Sea Islands,* are in part well wooded, and perhaps the best wooded possessions of Germany, with mangroves at the shore and dense rainforest in the interior mountains. Giant Eucalypts, like Jarrah, Karri, and mahogany-like woods of Barringtonia and Cordia abound in Kaiser-Wilhelmland, and especially the highprized *Cedrela australis* (which Jentsch curiously and mistakenly calls a needle tree!) appears in real stands. *Afzelia bijuga, Inophyllum,* and *Calophyllum* are other promising woods, but occur only sparingly. All these islands are still largely unexplored and unexploited.

There are some 35,000 acres planted with cocoa palms, some 2,800 acres of *Ficus elastica,* 1300 acres of *Castilloa alba* and several hundred acres of *Hevea brasiliensis, Prosopis juliflora, Casuarina muricata.* Plants are given away to private would-be planters from the government nurseries. A personnel of four German forest guards and 74 natives, 9 gardeners with 61 colored assistants to carry on the work.

In the small colony of *Kiautschou* (China), a persistent policy of planting has been pursued from the start and effective work has been done in changing an inhospitable sandwaste, hills and slopes, into a green oasis, pleasant to look upon.

These hills around Tsingtau had been absolutely denuded by the Chinese and turned into desert, furrowed, eroded, without vegetable cover.

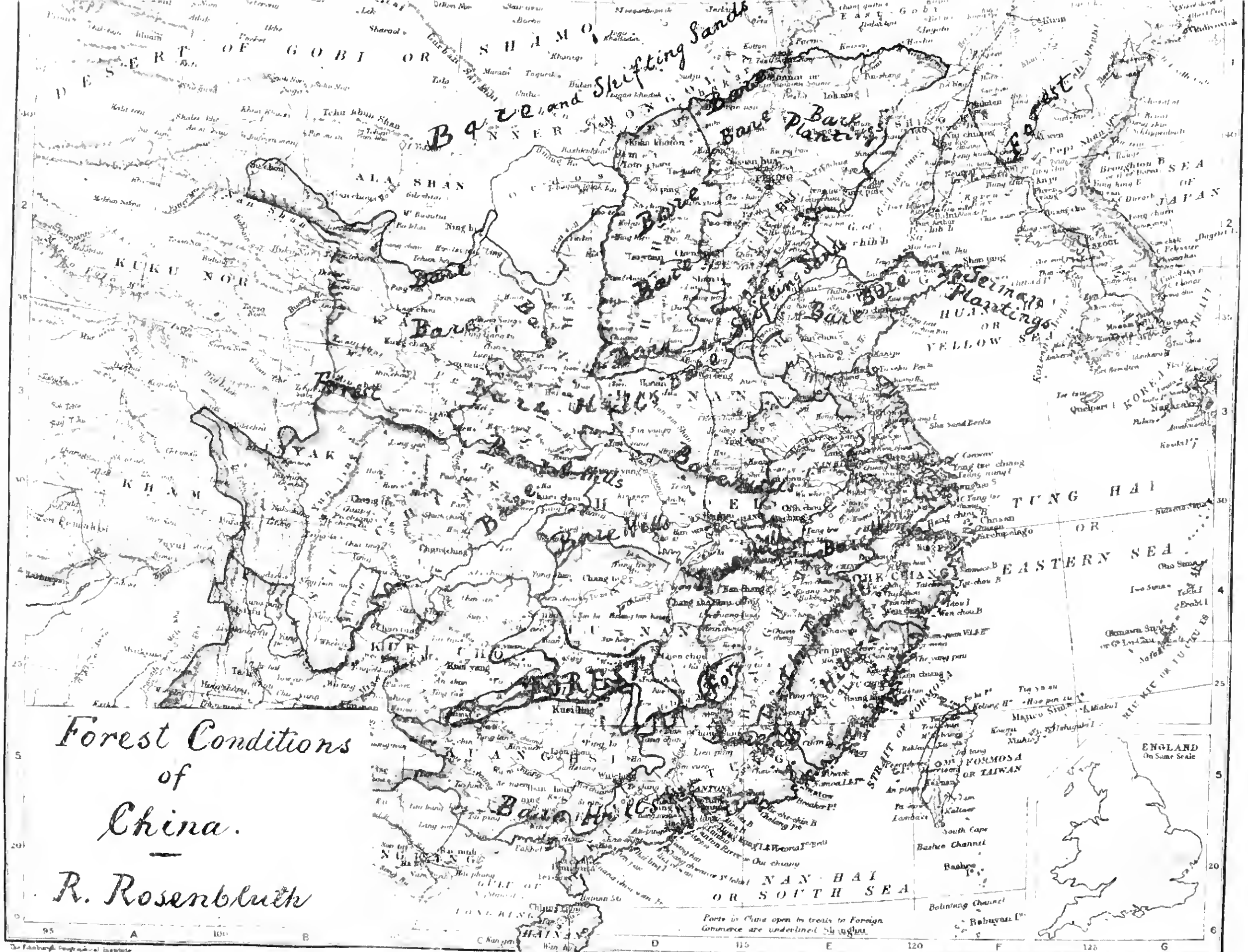
Immediately upon taking possession under a 99-year lease, in 1898, a nursery was established and plantations were begun mostly with European species. Some 250 acres have been planted, after many failures due to climate, insects, and Chinese depredations. Such depredations sometimes assumed wholesale dimensions, 36 thieves being captured in one raid, in which specially trained police dogs do good service. Fires have been reduced by building of roads and forcing the Chinese to use them instead of wandering through the plantations and also by the removal of graves, excluding thereby the religious rites accompanied by fireworks—a frequent source of forest fires. Next to man, insects of a great variety did the greatest damage but are now successfully combated.

The first thinnings can already be sold at good prices, the dearth of wood making the small brush and poles desirable material.

The success through persistent effort and repair planting eventually has been such that the Chinese themselves, as well as Chinese and English companies, have undertaken similar work, securing their plant material, and, in part, superintendence from the German forest department; and the influence has extended to the forest policy of the village corporations in placing their remnants of forest property under surveillance of the department. Land values have risen in consequence to two and three times their former value.

The Chinese cement works, the Ching-Ching mines, the Dutch Heiho conservancy, the government of Schantung and many Chinese villages, corporations and private land owners are among the beneficiaries. Many European and Japanese species have been used in the plantations, among them Robinia, Larch, Scotch and Maritime Pine, Alder, Poplar. Some 4 million plants have been distributed.

Altogether, it cannot be said that colonial forestry has so far developed much to the advantage of Germany, at least not as much as has sometimes been expected. There is, however, a rational effort made to prevent deterioration of the forest resources, to ascertain their value and marketability, and to prepare for a sane management and exploitation when the time comes, not forgetting the needs of reforestation.



Forest Conditions of China.
R. Rosenbluth
Bare and Shifting Sands
Bare
Bare Plantings
Bark
Forest
Bare German Plantings
Shifting Sands
Bare Hills
Bare Hills
FOREST
Forest
Bare Hills
DESERT OF GOBI OR SHAMO
ALA SHAN
KUKU NOR
YELLOW SEA
TUNG HAI OR EASTERN SEA
NAN HAI OR SOUTH SEA
SEA OF JAPAN
FORMOSA OR TAIWAN
HAINAN
ENGLAND On Same Scale
Ports in China open by treaty to Foreign Commerce are underlined Shanghai

FORESTS AND TIMBER TRADE OF THE CHINESE EMPIRE.

By R. Rosenbluth, M. F.,

Director or Forest Investigations, New York State Conservation Commission.

[This report was written in the winter of 1909-10, based on extensive studies made for the Philippine Government, with the purpose of ascertaining conditions in China, and of developing there a market for Philippine timbers. In some respects, especially market prices, it may be behind the times.]

"It is the duty of the sovereign to protect the forests!"

Mencius, the great Chinese lawgiver and philosopher, 300 years before Christ, wrote this; and perhaps, therefore, the Chinese may have been the first people to recognize the duty of the State in junction has been observed mainly in the breach. Just when the connection with its forests. But for some centuries past the in- wholesale destruction of forests in China began is hard to say. Marco Polo, in his wonderful, and truthful description of his travels about the year 1300 A. D., notes great forests on mountains now barren and deeply eroded. There is some evidence to show that the most serious and widely spread destruction and annihilation of the mountain forests took place in the troubled times of the 17th century, when finally the Manchu conquerors seized control of the government. This, however, I have in no way verified.

At the present the destruction of forests is for the most part completed and the effects have been most disastrous. There is no other country which teaches so thoroughly the lesson of the influence of forests on soil and waterflow; for here, for thousands of years the many extensive mountain ranges in the South, and plains and mountains in the North have been deforested; desert conditions and appalling floods in the rivers are the result.*

The rivers run always muddy with the yellow "loess" soil, carrying enormous masses of fertile earth to the sea, assisted by

*For a brief but graphic description of these conditions, see H. Mayr, "Fremdländische Wald- und Parkbäume," 1906.

the notorious sandstorms in the northern plain. The Yellow River, Hwang Ho, "China's Sorrow," once, records show, flowing through a rich fertile valley, its tributary hills well wooded, is to-day a broad moving quicksand with a small amount of water for most of the year, but when the floodtide comes the whole face of the landscape may be changed. In 1886, some 20,000 square miles of the most densely populated, most intensively cultivated lands were flooded, thousands of villages and towns were wiped out and not less than two million (according to other seven million) people were drowned. Moisture conditions are so uncertain that seven years out of ten are said to be more or less famine years.

While the needs of a protective soil cover impress themselves most forcibly, the lack of wood is a no less serious trouble, and one wonders why with a population so dense, with labor so cheap and efficient (15 to 30 cents a day), with a market for everything in the wood line at the door (to-day roots of grass and bushes serve for fuel), and prices for all forest products higher than with us, the wastelands are not being re-forested.

General Conditions.

In dealing with such a vast empire as China, the study of any one phase of her economic conditions cannot but be fragmentary unless years can be devoted to such study; and even then, owing to lack of facilities of communication and the impossibility of travel in many districts, the results could hardly be considered accurate. Most of the data in the following pages, especially those on the timber trade of China was obtained in a three months' tour through the principal commercial centers of China, made from September to December, 1909, by personal observations amplified by interviews with men who were thoroughly acquainted with conditions in various parts of the empire—such men being mostly missionaries resident in the district, engineers, and so on.

The Chinese Empire stretches from 10° to 53° north latitude, and from 74° to 134° longitude east of Greenwich. It is bounded on the north and northwest by Siberia, on the west by Russian Turkestan, on the southwest by Hindustan, on the south and east by Tongking and the Pacific Ocean, and on the northeast by

Korea. Within these boundaries lies an area of 4,278,352 square miles of the most varied country in the world; mountain, plateau, valley, and plain giving place to each other in rapid succession, and on this area lives and thrives a population officially estimated at around 430,000,000 souls, namely:

	Population.	*Area in square miles.*
China proper (the 18 provinces),	400,000,000	1,532,800
Manchuria,	8,500,000	363,700
Mongolia,	2,580,000	1,367,953
Chinese Turkestan,	1,200,000	550,579
Thibet,	6,430,000	463,320

There can be little question that this is an overestimate, and in 1904, Mr. Rockhill, U. S. Minister to China, came to the conclusion that the population might be only 270,000,000.

A very casual glance at these figures will show that the density of population varies greatly. Thus in China proper there are roughly 400 people to the square mile, whilst in Mongolia there are only 2 people to the same area, and in Thibet 14.

The provinces which will figure most largely in foreign trade will be those commonly known as The Eighteen Provinces, or as the Chinese themselves have it "The Middle Kingdom," as follows:

	Area in square miles	*Population*	*People per square mile*
Anhwei	54,286	23,672,300	432
Chekiang	36,680	11,580,000	310
Chihli	115,830	20,930,000	180
Fokien	46,332	22,870,000	492
Honan	67,954	25,317,820	373
Hunan	83,398	22,169,000	265
Hupeh	71,428	35,280,000	495
Kansu	125,483	10,386,000	82
Kiangsi	69,498	26,532,000	382
Kiangsu	38,610	23,980,230	620
Kwangsi	77,220	5,142,000	66
Kwangtung	100,000	31,865,200	318
Kweichow	67,182	7,650,000	114
Shansi	81,853	12,200,000	149
Shantung	55,984	38,247,900	683
Shensi	75,290	8,450,000	112
Szechw'an	218,533	68,724,800	314
Yunnan	146,718	12,721,500	86

Mongolia will probably play no part whatsoever in the timber trade either in importing foreign material, except possibly from across the Siberian border, or as a source of supply for China Proper. The same will be true of Thibet and Chinese Turkestan. Manchuria is reputed to contain large amounts of timber, but so far has supplied its timber needs by importing from Japan, the United States, and Siberia; and it is quite likely that the timber is confined to the eastern portion—in the Yalu River drainage basin, and in the far north in the Upper Amur basin—and that it will probably not be a very large factor in supplying anything but its own needs, as even if that timber becomes open to lumbering the development within the province itself will probably be more rapid and will consume all the timber produced. If timber is to be imported from foreign countries into Manchuria, it will be Japanese and Korean timber, so that it will have but little interest to any other countries.

Coming down then to The Eighteen Provinces proper, a brief survey of the conditions is found below. This description, as also the above, is taken from a book entitled *"The Provinces of China,"* by Polikon.

China proper stretches from Nainan and Canton in the torrid south to Peking and the Great Wall in the frigid north. Longitudinally China proper stretches from the high western borders of Thibet to the delta of the mighty Yangtse Kiang. This area of over a million and a third square miles is most conveniently divided up for us by nature into three parts, each the basin of a river. The northern portion consists of all the country in the basin of the Huang Ho (Ho River), with an estimated area of 390,000 square miles and a population of ninety-five million souls. This region is one of loess and alluvial lands, and therefore very fertile when there is abundant rain, but liable to famine in case of drought. The region is dominated by the "Yellow River," or "China's Sorrow." The provinces in this basin are Kansu, Shensi, Shansi, Honan, Chihli and Shantung. The second region is that of the basin of the Yangtse, the great central waterway of China. In this region lie the provinces of Szechw'an, Hunan, Hupeh, Kiangsi, Anhwei, and Kiangsu. This basin is the richest, the largest, the most populous, the most favored, of the three great divisions of China; and the great central artery of communication, the Yangtse, has attached to it a vast network of navigable streams. The loess of the north is much less in evidence here, the chief formations being alluvium, limestone and sandstone. The great lakes of China are found in this valley, which is also the region of the Great Treaty Ports. The third region is the basin of the Sikiang, with which are included the coast provinces south of the Yangtse delta. This region is highly diversified in character, abounding in mineral wealth and in semi-tropical productions; stocked with a variety of races, amongst whom the Chinese race is poorly represented—except in the two northerly coastal provinces. The provinces included in this basin are Yunnan, Kweichow, Kwangsi, Kwantung, Fokien, and Chekiang, and of these six three are maritime.

It is thus seen that the Eighteen Provinces divide themselves naturally into three groups of six. The Dependencies, commonly so called, are four in number—Manchuria, Mongolia, Chinese Turkestan, and Thibet. These four Dependencies lie, in the order named, on the northern and western boundaries of China Proper, and are all that remain to China of a peripheral chain of such Dependencies forming the complete landward boundary of the Middle Kingdom. The other four, Korea, Burma, Siam, and Annam, have fallen out of China's grasp and will in all probability never again be hers.

The internal communications of China present a remarkable contrast. On the one hand China is traversed by numberless roads (from our standpoint, they are more nearly paths or tracks than roads) and, though few are paved or metalled and all are badly kept, a vast amount of domestic traffic passes over them. At the same time an enormous volume of trade passes along the great waterways of China. There is probably no country in the world so well supplied with water communication—certainly none other in which the waterways are so fully used. The center of the whole system is the Yangtse Kiang, with its many tributaries, and numerous canals or canalized streams, the greatest artery of this kind being the Grand Canal itself. Contrasted with these ancient lines of communication and tedious means of travel are the rapid and rapidly extending railways in the extension of There are over 5,000 miles of the line opened or under construction; and there are projected some 2,000 more miles—Chinese, British, Japanese, Belgian, German, French and Russian enterprises. Undoubtedly development in railroad building will take place as soon as political affairs become more settled.

Character of Forest.

It is difficult to reconstruct from the remnants of forest and from the single specimens of trees that are still to be found the forest types and zones as they must have been originally. It is tolerably certain, however, as Mayr infers, that at one time forest types largely similar to those of eastern North America covered the land area from the shore into the interior of Mongolia and to the rocky mountains of Thibet, although at present this county is partly prairie, partly devoid of all vegetation.

According to Mayr,* the Chinese forest represents both horizontally and vertically all zones of vegetation from the tropical forest to the last representatives of spruce and larch in their short alpine form.

The tropical zone, to be sure, occupies only a small area. Along the Coast it is represented by the Mangrove *(Rhizophora Mangle)*, in the equatorial region a mighty tree, gradually reduced in size, until at Swatow, precisely on the Tropic of Cancer, it is only an evergreen shrub. The rest of the flora belongs to the Indo-Malayan type; Diospyros and Pterocarpus, with the cocoa palm and banana, find here their northern limit.

North from the Tropic of Cancer to the Kuen-Luen mountain range, with its east extension of the Tsinglingshan and Funiushan mountains—the most remarkable continuous mountain range in the world—a sub-tropic forest type, the richest in species, occupies three-quarters of the most densely populated and most intensely cultivated portion of the empire, running in the south to altitudes of 10,000 feet, in the north on the south slopes of the mountains to between 500 and 1,000 feet. Many of the species are still unnamed. The large number of Laurineae is striking, among which Machilus, Litzaea, and the much prized camphor tree, *Dryobalanus camphora*. Evergreen oaks are characteristic of the cooler portions of the sub-tropic forest, with species of Indian,

See "Fremdländische Wald- u. Parkbäume für Europa," H. Mayr, 1906.

Malayan, Japanese and indigenous sources, among them *Quercus seme—carpifolia, glauca, thessalica,* as well as *Pasania cuspidata, formosana,* and the truly Chinese *brevicaudata.* Besides these, *buxus, magnolia, ilex, ternströmia, largerströmia, Olea, Camellia* species are found. Two valuable conifers of paleontological times have survived: *Cryptomeria japonica* is found in the middle provinces; *Cunninghamia sinensis,* resembling Araucaria, is found frequently in the south-east. *Keteleeria Fortunei,* the genus indigenous only in China, resembling fir, and Torreya are also frequently found. *Glyptostrobus heterophylla* is the cypress in the river swamps. One pine, *Pinus sinensis,* which occurs on poor mountain slopes and reaches into the sub-tropic zone, is treated in a kind of coppice management. North of the Kuen-Luen and along the coast from Shantung north to the frontier of Mangolia and into Mandschuria the deciduous forest flora prevails with chestnut (2 or 3 species) characteristic of the southern, and beech *(Fagus longipes* and *chinensis)* characteristic of the northern portion. Some 58 species of oaks are enumerated by Hemsley, the most important *Quercus variabilis* or *Bungeana,* a cork oak. *Quercus dentata,* a magnificent tree and another cork oak *Q. serrata* are quite frequent.

With these associated are Zelkowa, specifically Chinese besides the Japanese species, three species of Celtis, several Juglans, and Paulownia, besides the familiar genera of Carpinus, Tilia, Acer, Ulmus, Gleditsia, Catalpa, Magnolia, Ailanthus, Sophora, Rhus, Alnus, Bethula, Populus, Sorbus. A Liriodendron so close to the American as to be hardly distinguishable is also found. A host of shrubs and halftrees occupies the understory. Of conifers, there are *Pinus Bungeana* and *Henryi,* on the poor sands, *Pinus Armandia* and *Koreensis* on better soils, with *Libocedrus macrolepis, Juniperus chinensis, Biota orientalis,* and Cupressus. *Abies firma* (?) and *Pseudolarix Fortunei* with several Piceas lead into the northern coniferous forest type. Of the spruces, *Picea Ajaneusis, bicolor, Mastersii, Schrenkiana,* besides four others unnamed, occupy the spruce zone on the mountain slopes, while *Tsuga, dumosa* and *Sieboldii,* descend into the broadleaf forest; several other Tsugas are doubtfully identified. Abies are doubtful as to their occurrence, except possibly *Abies Veitchii;* but a number of larches reach into Mandschuria and Mongolia, like *Larix dahurica, Griffithii, Sibirica* and several others.

In the Alpine creeping forest type a specific pine, *Pinus pumila* is found.

Among the trees most frequently planted in northern China we find the Mulberry as food for silkworms. Further south the bamboo is the principal cultivated "forest crop." Other trees which might be mentioned are *Dryandra cordata* a favorite for ornamental use and prized for its hardwood and the oil from its seed; *Stillingia sebifera* (Tallow tree); *Rhus vernicifera* (Varnish tree), the important wood-oil tree, *Aleurites cordata*; and the Vegetable Wax tree, *Fraxinus chinensis.*

Forest Areas and Forestry.

Of actual forest areas very little is known. An attempt has been made to indicate on the accompanying map in merely rough approximation the location of existing forests, of which there is, indeed, a very small proportion. In many parts there is such a dearth of fuel that even grass roots are dug, and the fruit trees and roadside trees are not safe from depredations for their wood.

The forest still existing is far up on the headwaters of rivers and in quite out-of-the-way places; and the forest districts are inhabited by a different people from the Chinese proper. The largest is probably that in southern Hunan, where the people are called "Miaotze," and the Chinese call them "wild people" although the testimony of missionaries who have traveled through the district is to the effect that they are a rather peaceful and pleasant people. However, the Chinese still have great tales to tell of the wildness of this people, and it may be on account of that that this forest is still preserved. For these wild people have a crude system of forestry. It is largely based on religious superstition,* as they think that the wood gods become greatly angered by the cutting down of trees, and the way to appease them is to replant. Although this basis may be doubtful, it is a fact that a more or less clear cutting by groups and aiding natural reproduction by planting is practiced; this being about the only case of forestry development in a country where on all sides forest destruction has been absolute.

In a patch of forest in Kansu Province there is also a rough

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*Mayr reports, that the small remnants of forests, now and then found in the distant mountains are as a rule of the nature of cloister groves preserved by the Buddhist hermits.

system of forestry practised by the Thibetans, under which they sell stumpage to the Chinese contractors, marking the trees to be cut by the contractor; in other words, a rough selection system. Another forest region is on the steep headwaters of the streams running to the coast in Fukien Province. Here, too, there is some attempt at forest culture, practising clear cutting and planting. I am reliably informed that this forest area is also decreasing—that is, planting is not keeping pace with cutting. The rotation used is a short one—generally 15 years and spruce is the most common tree planted, according to my information.

Outside of these sporadic attempts to keep the native woods in producing condition, there are here and there plantations found on waste lands. Especially the successful example of the Germans at Kiautschou has found imitators in the neighborhood, several mining and other companies and municipalities having begun the work of reclamation. Near Mukden, where also a forest school exists, the government has set aside some 25,000 acres for forest planting and some 600 acres had been planted by 1910. The Shantung Railway Company plants along its right of way, etc.

The general government some years ago instituted a Commission of three to investigate the cause of river floods and this Commission recommended forest planting as one of the needs to reduce the floods; but nothing resulted.

Forestry courses—mostly very poor in charge of poorly adapted Japanese—have been started in some of the agricultural colleges. For the awakening of general interest in the subject of forestry a Mr. Howard L. Richardson, Jr., deserves special mention for giving illustrated lectures, free of charge, under the auspices of the Young Men's Christian Association in many parts of China. The first trained Chinese forester, Ngan Han, secured his education in Cornell and Michigan, and has lately published the first elementary book on forestry.

Considered from every point of view, the requirements of wood and the cultural influence, including the profitable employment of the unemployed—a serious problem in China,—a rational forest policy will be of ever-increasing importance in the new China, and, since the title to the wastelands is said to be vested in the government, energetic efforts for their reclamation may be readily begun.

Wood Consumption.

The following tables will give a fair idea of the timber trade of the Empire.

Native Timbers.

Hunan Province	$10,000,000	gold	
Kiangsi "	1,000,000	"	
Fulkien "	2,000,00	"	
Kwangsi "	5,000,000	"	
All others	10,000,000	"	
			$28,000,000

Foreign Timbers

United States of America			
Softwood (Oregon pine),	71,575,000 bd. ft.		1,330,000
Canada (Oregon pine)			
Softwood	3,392,000 bd. ft.		77,000
Japan (and Formosa)			
Softwood (mainly pines and spruces)	142,218,000 bd. ft.,	$2,255,500	
Hardwood (mainly oak, chestnut and ash)	737,000 cu. ft.	209,000	2,464,500
Russia (Pacific Ports)			
Softwood (mainly pines, spruces, etc.)	2,592,000 bd. ft.		39,500
Hongkong			
Softwood (probably American)	697,000 bd. ft.,	14,000	
Hardwood (undoubtedly Malayan)	1,092,000 cu. ft.	504,000	
			518,000
Singapore			
Hardwood	1,219,000 cu. ft.		368,000
Miscellaneous Malay Ports			
Hardwood	95,000 cu. ft.		30,000
Australia, etc.			
Hardwood	10,000 cu. ft.		3,100
			$32,830,100

Grouped a little differently, these would result, approximately, as in the following figures:

Softwoods

Native (Mostly pines, firs, and cedars)	2,000,000,000	bd. ft.	$21,000,000
Japan (and Formosa) and Siberian Ports	144,810,000	" "	2,295,000
U. S. A. and Canada (nearly all Oregon pine)	75,800,000	" "	1,420,000
	2,220,610,000	" "	$24,715,000

Hardwoods

Native (very varied)	14,000,000	cu. ft.	$7,000,000
Indo-Malay Region (mainly Dipterocarp woods of the most common kinds, and Teak)	2,400,000	" "	916,000
Japan (and Formosa)	737,000	" "	209,000
	17,137,000		$8,125,000

Naturally, the figures for native timber are more or less guesses, as no information worthy of the name could be had. For the foreign timbers, the reports of the Imperial Maritime Customs, while accurate, are not so grouped as to make one sure of the species, etc., but are quite valuable in connection with a study on the ground. The results of their table elaborated a little by such local studies are given above.

Roughly, this would correspond to an annual consumption of about 2,400,000,000 board feet of lumber, worth $32,800,000 gold. For a population of 400,000,000, based on the industrial organization of such an economical wood using country as Germany, there would be needed at least 30,000,000,000 board feet of lumber a year. Assuming that by extra economies and a development of substitutes, China, after developing along modern industrial lines, could get along with half that amount, or 15,000,000,000 board feet, even this, at an average value of $17 per thousand, would amount to $265,000,000; and of this, about 13,000,000,000 board feet, worth $221,000,000, would have to be imported.

Without any extraordinary development, it may be figured conservatively that by 1915 China will require imports in forest products of not less than $10,000,000 gold per year, and that by 1925 the demand will be for $25 to $50,000,000 (gold) worth of forest products imported each year.

In connection with the growth in demand for wood in China the most important feature is entirely new development in railroads, mines, and modern industrial establishments; and another factor is the change from the old-type one-story building, the prevailing type all over China in the past, to the building of modern three-story and higher buildings. The building of houses of more than one story conflicted with the old religious belief, and so very few many-storied houses were built. In the one-story house the floor was of tile, walls of brick, and roofs of mud or tile, hence very little wood was used. This type of building is now very commonly displaced by large and many-storied buildings requiring very considerable amounts of wood for flooring, window-sashes, etc.—at least this is true for all the principal ports, and undoubtedly will spread rapidly elsewhere. Just how much difference it will make is hard to estimate.

In figuring, however, on the needs of the Chinese Empire for wood supplies there are two limiting factors which must not be lost sight of. *First* the bamboo cultivation. Bamboo grows naturally, and is cultivated all over China south of the Yangtse basin; and the bamboo supplies many needs for which we use wood. The *second* limiting factor is the poverty of the nation. Although we might think that wood would be almost indispensable in many cases and would be the wise thing to use, the lack of money often compels the Chinese to do without it; and cheap labor, which must get work in some way or another, often makes substitutes like bricks, tiles, etc., cheap enough. But even with these limiting factors there is hardly any question as to the enormous growth in the demand for wood which will take place in China with the new development along modern industrial lines which is now everywhere taking place.

Sources of Supply.

As will have apeared from previous statements, the home supply, although still furnishing two-thirds of the present consumption is becoming more and more limited and difficult to secure.

From the forest in southern Hunan Province it takes from fourteen months to three years to float down the rafts of logs to the markets on the Yangtse River; and it takes but slightly less time from the forest of southwest Kiangsi to the main markets on the Yangtse River. From the forests on the south slope of these mountains to the markets at Canton and in Kwang-tung and Kiangsi Provinces it takes from five months to fifteen months to bring down the rafts. These rafts are made up nearly altogether of long timbers or poles, very few being over 18 inches at the butt and 6 inches at the top; they are generally from 20 to 40 feet long, thus being very tapering—and to our notion rather ill-suited to building purposes. The most common kinds of wood are Sahmung ("mung" or "mo," meaning *wood,* is always appended to the Chinese name for the wood itself), and Sung-mung. The first is probably a cedar, and the latter a pine; and these two are by far the most generally used for building purposes in the Yangtse basin. For furniture woods the most common are Buhmung and Tsao-mung.

The largest source of supply in the past has been the United States and Canada, and the wood from these places has been nearly altogether the Douglas Fir—or "Oregon pine" as it is generally called in China. The Oregon pine shipped to China has been called "China quality," and includes much that is not merchantable at home and is sold very cheaply in the principal ports of China, at present (1909) selling for from \$16 to \$18.50 gold per thousand board feet on board ship at the principal ports of China for large square logs. This price, however, is largely due to the financial depression which has existed for the past two years, forcing the Pacific coast lumbermen to sell almost regardless of price, and as the stuff included much of poor quality which was encumbering the yards they were still further pleased to dispose of it. This price then is a rather temporary one, and it is said that within three months the price would advance \$1.00 gold per thousand board feet. Looking forward for about five years —when the Panama Canal will be opened—it can be safely predicted that the much higher-priced markets of eastern United States, eastern South America, and even Europe, which will then be thrown open to the Pacific Coast timber, will cause a very rapid rise in the price of Oregon pine.

So with an increase in price, and considering the fact that Oregon pine rots rather badly in China south of the Yangtse basin, it will probably be less used after five years than it has been in past. One reason that Oregon pine has been sold even in North China in competition with the much cheaper Japanese woods is because of the long lengths and large sizes of that wood which can be supplied, as there is considerable demand all over for large timbers and the Japanese and local woods can be supplied only in short lengths and rather small sizes.

The second great source of imported woods is Japan. The importation of Japanese woods has been increasing. Japanese wood —mainly oak, chestnut, ash, etc.— is used more largely than any others for railroad ties, and the Japanese pines and cedars are entering largely into building purposes.

The present price (1909) on board ship at Shanghai for the various kinds of Japanese woods is about as follows:

Pine, ...	\$11.00 gold per thousand board feet.
Oak, ...	15.00 gold per thousand board feet.
Sen, ...	12.50 gold per thousand board feet.
Tamo, ...	12.00 gold per thousand board feet.
Katsura, ...	14.50 gold per thousand board feet.

Japanese woods come as rough square-hewn logs. These woods have a very bad reputation because of the common practice of the Japanese of working in as much poor stuff in a shipment as they possibly can; it being stated that they often resort to "fixing" the inspector so that very poor stuff will be accepted. Also in the Yangtse valley itself and in the whole of China south of that, the Japanese wood is practically worthless on account of the rapidity with which it decays; and in the southern parts also because of the partiality which the white ants show for a diet of Japanese wood. Thus in Hong-Kong, Japanese wood is practically not found on the market, although within the past few years Mitsui Bussan Kaisha has started to sell small quantities of japanese oaks at about 22 cents gold per cubic foot to introduce them into the market. In the Yangtse valley, Japanese oaks used as railroad ties, treated with copper sulphate at a cost of about 16 cents gold per tie, have not proved satisfactory, rotting in from three to five years in the valley land. Experiments will be made after this year with Japanese oaks treated with creosote. Considerable amounts of Japanese oak and ash are now being used for furniture, and there is a great demand for them in the vehicle trade.

With more strict inspection and a very largely increased demand taken in connection with more strict ruling and higher stumpage charges for timber by the Japanese Bureau of Forestry, the price of Japanese woods in the Chinese Empire will also largely increase.

Woods of very much the same quality, sizes, etc., as the woods from Japan are now being supplied from the Yalu River district along the Chinese-Korean frontier, although the lumbering is carried on by Japanese almost entirely.

What has been said concerning Japanese wood will apply largely to the Yalu River timbers, although there is a rather good grade of white and red pine coming from there which is not supplied from Japan. The present prices in Tientsin are, for white pine, about 23 cents gold per cubic foot; for red pine about 25 cents per cubic foot.

The next largest source of supply is from the Indo-Malayan district, and nearly altogether in that district in the portion from Siam, Burma, and the Malay Archipelago. The most commonly used of these woods fall in the following trade names; Redwoods and Hardwoods, generally distinguished by some place-name such as Singapore redwood, Borneo hardwood, Manila hardwood, etc. At present, under these crude names, a very great variety of wood is supplied, there being apparently no standard. Thus under the name of Singapore hardwood, woods varying in quality from rather soft and not durable to very hard and extremely durable woods may be furnished. So that in one wood, if wanted for some special purpose, the consumer is very apt to get a wood entirely unfitted for that purpose unless he is personally acquainted with the timbers and personally selects them. As a result of many cases where these woods were stipulated in contracts because of the belief in their special qualities and the fact that woods of other qualities were supplied in their stead, these woods do not have a very high reputation. The average price on board ship at Shanghai for Singapore redwood is $17.00 gold per thousand; for Singapore hardwood, $21.00 gold per thousand. This comes commonly in sizes sawn 16′ in length and 1″ to 4″ by 4″ to 8″. Borneo hardwood comes commonly as rough square-hewn logs 12″ to 30″ square, averaging 16′ long, and sells for $20.00 gold per thousand feet on board ship at Shanghai. Teak, which is most commonly used for ship-building, for fine foreign furniture, fine interior finishing, etc., comes ordinarily in logs 10″ to 24″ square with an average length of 18′, and sells at an average price of $60.00 to $70.00 gold per thousand feet on board ship at Shanghai. This teak is also called "China quality," and is much inferior to the qualities used in Europe and America.

For the fanciest native furniture, called blackwood furniture, the wood most commonly used is called Bangkok redwood. This is sold by the picul (133 1/3 pounds), first quality selling for about $2.10 gold per picul, and common quality for about $1.30 gold per picul.

As there are vast stores of forests eminently suited for lumbering in the Malay Archipelago, and as the woods found in those forests are adapted for every kind of purpose, and as the forests are so much closer to China than the United States or Canada, it must be evident that it will be these places on which China will have to depend for her great supply of wood. Especially will this be true in the region south of the Yangtse River, where the

Japanese woods are unsatisfactory. There is no reason why these woods, properly graded, should not prove eminently satisfactory for all purposes and that manufacturers located throughout the various islands should not be able to undersell Oregon pine in any sizes and still make a good profit. Very likely the Philippine Islands will prove another large factor in supplying the Chinese markets, as they are the closest to China of any islands in the district. At present, however, there are practically no large sawmilling enterprises in this whole district, the largest being one in the Philippines with a capacity of about 30,000 board feet per day. There is promise of a considerable development in modern lumbering enterprise in the Philippines, but at present almost none throughout the rest of the district. This is probably due to the fact that the forests of the district can be economically handled only by using the modern logging machinery, such as is used in northwestern United States and Canada, and to the fact that the Americans who are more familiar with such work are the only ones who have developed the use of modern logging machinery in the forests of the district. But it is only a question of a very short time until modern logging will be found widely in practice over this entire district.

The fourth source of supply for imported woods at present is Australia and New Zealand. The amounts from there are rather small and are made up nearly altogether of railroad ties, etc., where the durability of the Australian eucalypts gave them an advantage over most other woods. It is not likely that the Australian source of supply will ever be a very prominent factor in the Chinese markets. The Australian ties (Jarrah wood) have sold for as high as $1.75 gold each; but that was an extraordinarily high price—about $1.30 being a more representative value. The Tasmanian woods, said to be very good for ties, have sold for about $1.15 gold each.

Trade Notes.

For most of my information concerning Chinese woods and wood trade, I am indebted to Mr. Sun Hwah Ting, the largest dealer in these woods at Hang Kow. He was very kind in explaining the elaborate system of measurements and prices which governs the selling of the raft timber; and as he has been a dealer in these woods for over thirty years he is very well acquainted with the whole trade. He says that there is a much greater demand for wood now than ever before, but he believes that the supply is sufficient (this, however, is probably contrary to the true facts of the case). As to prices, it is very difficult to get a true comparison in China on account of the enormous fluctuation in value of the currency and the difficulty of making due allowance for the amount of change which the variation in value of the coin based on the gold standard would make in the selling value of a product produced wholly in China by Chinese labor; for certainly it would not make so much difference as in the trade in articles imported from abroad. The present price (1909) is only about 80% of the price six years before, but this is largely due to the great depression in trade which existed in the year when this was written not only in China but apparently all over the world now. The present price is about double what it was twenty years ago.

As will be shown later, the price for larger sizes of native woods mounts up very rapidly, and since with the growth in demand for all kinds of native woods for building purposes it is likely that the supply of native wood will fall far short of the demand and the price soon will probably be too high to compete with imported woods.

The sale of wood, like practically all other business in China, is controlled by a guild. Members of the Wood Merchants' Guild act really as commission agents for the raft merchants who buy from the Miaotze cutters. The raft merchants make as close a bargain as possible—generally getting the wood very cheap from the "wild people," and bring it down to the market but do not sell direct; the members of the Wood Merchants' Guild do the selling, and charge about a 3% commission. Like everything else in China, there is no fixed price, the price always being settled by bargaining; and to prevent people outside of the guild from learning the trade the system of measurements is very complicated. Thus, for each different kind of wood the circumference is measured at different points and for a given measure of circumference a certain length is guaranteed; then for each kind of wood a pole of a given circumference is considered as being so many taels of wood, and for each tael of wood there is a different price quoted in taels of money; for example; if Sah-mung is involved, the circumference is taken 5′ from the butt, and one of 1′ 5″ in circumference is considered as being 9/10 of a tael of wood, and a member of the guild would know that it would be guaranteed at least 30′ long. One tael of the best Sah wood is worth about thirteen taels in money, so that its value would be 9/10 x 13 or 11.7 taels in money. (The present value of the Hangkow tael is about 58 cents gold, making this piece worth $6.78 gold). In the case of Sung-mung, the circumference in the middle would be measured, then 15″ deducted from that, and the remainder multiplied by the length. Thus if the wood is 3′ in circumference in the middle, deduct 15″ and the remainder will be 15″ (there are ten Chinese inches to the foot). If the length is 40′, multiplying 40 x 15 makes 600. They call this 6 fangs, and it is worth at present 1 tael 2 mace of money per fang; so in this case the piece of wood quoted would be worth 7.2 taels of money ($4.18 gold).

From the above it can be seen how complicated is the system of measurements. The Chinese Import and Export Lumber Company, which buys large quantities of these poles, has given me the following figures for the ordinary native poles:

	Length.	*Top Measure.*	*Price (gold.)*
F. O. B. at Hankow,	23′	4″	$0.78
		5″	1.01
		6″	1.40
	30′	4″	1.29
		5″	1.90
		6″	2.63
	40′	4″	3.86
		5″	4.59
		6″	5.32

With freight and insurance, they cost at Shanghai each about 22 cents gold more.

These poles are mainly pine and cedar; pine used for interior work, and cedar for posts, telegraph poles, etc., etc.

In the south—Canton, etc.—the guilds are even stronger. Prices quoted there for ordinary "China Fir" poles, according to information given me by Kwong Fong Yuen, a very large dealer, average as follows: 14′ long and 4″ top, average cost about 40 cents gold. For one about 20′ long and 4″ top, about $1.12 gold.

There is also some forest furnishing raft timber in the hills of Fukien Province at the headwaters of the short mountain streams which run down to the coast. These Foo-chow poles, as they are called—from the name of the principal seaport of that province—generally come in much shorter lengths than the others and are also of smaller diameters; they are mainly pine, fir, etc., and sell for a lower price than the Hankow poles, their principal market being in the coast provinces from Swatow to Shanghai.

Prices are.... 4½″ diameter, 16′ long..............$0.61 gold
5½″ diameter, 16′ long.............. 1.00
These two comprise the great bulk of the timbers.
6½″ diameter, 16′ long.............. 1.28
8½″ diameter, 16′ long.............. 2.44

It is of special interest to note the rapid increase in price, with size, of these native poles; and that there are practically no large sized native woods.

As to the handling of the import business, one again encounters the complex organization of Chinese business methods. In the past, manufacturers abroad almost never sold direct to native merchants. There would be some large European business house in China to whom they would sell. This house would very seldom sell direct to the user in China, but generally to other native merchants, the foreign house figuring more as a commission house or merchant, depending for his business on his knowledge of the native merchant and the distrust of native merchants by the foreign manufacturers, who did not know them. In dealing with the native merchant, the foreign house generally depended on its compradore, who is always a Chinese of good standing and who would make all the deals for the house. It was really quite surprising to see how completely these compradores were trusted by their employers, and it is a surprising tribute to the honesty of the Chinese that the houses are not cheated more by the compradores than is the case. Many seem to think that this is the only satisfactory way to deal with the Chinese, even to-day; but that, I think, is hardly correct. There are now arising in every line of business in China Chinese merchants whose credit is good, whose name is well established for honesty, and who are importing directly from abroad. So that undoubtedly as time goes on more and more of the foreign house commission will be eliminated and about the only representative a manufacturer would need in China would be simply an agent to look after his general interests—much as our commercial travelers at home.

In general, no very large stocks are kept in the yards, as the dealers try to keep just as little ahead of the orders as possible. The only large yards are at Shanghai, Tientsin, Hankow, and Hongkong; and even these are hardly to be called large yards. Most of the wood is imported in the form of square or round logs, and sawn up according to order, by hand. There is some importing of manufactured stuff, especially tongue-and-groove Oregon pine, flooring, and Japanese railroad ties; but compared to the total amount of wood, the amount sawn in advance is very limited.

The sawmills which are at all worthy of the name are but two in number—the Kow kee Timber and Sawmill Company, of Shanghai, and the China-Borneo Company of Hongkong—and both of these are small and are used only for rush orders, as the Chinese claim that they can saw the logs by hand cheaper than can be done by machinery and that there is less waste. The cost of sawing by hand is small due to the very low wages paid. The sawyers are paid at a rate per superficial foot sawed. It would seem that there would be quite an advantage in shipping stuff at least a little more fully manufactured than at present, that is instead of shipping 12"x12" pieces, that inch boards might be shipped in large quantities. Especially would this be true in cases where freight rates are high. On the other hand, the consensus of present opinion among dealers in China seems to be to the contrary, namely, that for the bulk of the stuff it is better to depend on local sawing.

A lumber company would do well to keep on hand about the following amounts and sizes of lumber: 2,000,000 bd. ft. in sizes 12"x12" square, 20' to 40' long; 1,000,000 bd. ft. in sizes over 40'; and small amounts of tongue-and-groove flooring, inch boards, dimension stuff, lath, etc. (The use of lath is a rather new thing in China but is seemingly growing in favor.)

For a yard in North China, should it be decided to have one there, Tientsin would be the most available point, as that is the metropolis of North China. The Manchurian ports New Chwang and especially Dairen (Dalny), have been growing rapidly; but as mentioned above, the trade here will be dominated entirely by Japanese and there is very little opportunity for any other nations. For trade in North China, for any but the Japanese, one yard in Tientsin should be ample; and it would be better to confine the stock largely to lengths over 24', in order to avoid competition with the much cheaper Japanese woods. The Japanese woods are not only cheaper here, but serve about as well; as the climate is very dry, and rot is not a very serious menace to wood.

In the Yangtse basin, Shanghai, of course, would be the main depot. In fact, it might be made a central supply depot for the whole of China, as it is so centrally located. A stock of the amounts previously indicated would have to be kept on hand here, based on its taking about one month to six weeks to replenish the same from the mills upon receipt of orders. Should the mills be closer—such as would be the case in the Philippine Islands—the stock might be considerably reduced. And in the case of a yard at Manila, the main depot might even be made in Manila with very little stock at all in any place in China. However, a yard such as indicated would not be very large, in consideration of the territory which is subject to the city of Shanghai, embracing a population of 100,000,000 and at least half a dozen large and flourishing ports, all of which are putting up a great many new buildings, etc.

Hankow might also be made a depot for lumber for the upper Yangtse and interior points. Hankow, with its sister cities of Wuchang and Houyang, is undoubtedly destined to become the greatest industrial center in China. Situated as it is at the head of navigation for large ocean-going vessels, with three rivers for small boat traffic opening a vast interior country—the cross-road of the great transcontinental lines from north to south and from west to east—with immense agricultural and mineral territories back of it, and a vast tributary population, its future is assured. Already one finds there large iron works, engineering works, and so on; and it was one of the few places in China which went ahead even during these last two years of great financial depression. So that here, too, the desirability of establishing a yard appears good.

For South China, apparently, at present, it would be better to establish a lumber yard in Kow-loon, in the British concession opposite Hongkong, as land itself in Hongkong is a little too expensive for a lumber yard. This, however, is very apt to be subject to change, as, if the Chinese government does, as is expected, make some provision whereby goods imported into one Chinese port and paying tariff there will not have to pay tariff again upon entering another Chinese port, as is now the case, Canton would be an ever so much more desirable place for a supply depot for South China. It is rather strange that the Chinese thus discriminate at present against their own ports; and so long as that is the case one would perhaps be forced to keep the yard in Hongkong and ship lumber as ordered to various points in the delta of the West river and to interior and coast points.

The new railroad development in South China will open a large amount of country and will prove a big stimulus to the lumber trade. It is rather curious that South China and especially Canton, which has always been considered the most progressive city in China, should be about the furthest behind in the development of railroads and modern industrial works, mining, etc. This is probably due to the stronger opposition to foreigners' participation in industrial activities there and the incapacity, so far, of the Chinese themselves to successfully manage them. This incapacity, however, is rapidly being overcome by experience, so that now even railroads are being successfully built entirely under the direction of Chinese engineers with Chinese capital. However, political disturbances and the extraordinary power of the old guilds in this district will probably result in this district falling behind, relatively, in its development along modern industrial lines as compared to the other districts (the Yangtse basin and North China). Thus for example, railroad building and mining is much further developed in the other two districts than in the South, although the opportunities are reputed to be as good in the South.

From a lumber standpoint, this district, it must be remembered, has a semi-tropical to tropical climate, at least in the lower elevations. It has therefore many great menaces to woods, especially rots and the white ant; and therefore wood to be satisfactory here must be fairly resistant to these destructive agencies to be successfully used. That precludes practically all the Japanese woods and American woods; and especially, when it is considered that the Malay district is closer than any other source of supply, it can readily be predicted that South China will be supplied almost entirely from the Malay district. At present the native woods are used far more commonly than any other, with an exception, possibly, in the case of Hongkong itself.

Wood-Using Industries.

Turning now to the many classes of wood-using industries in China we note the following kinds of material used:

General Building Purposes.

For the ordinary Chinese houses, etc., native woods still lead, but in the ports the growth in the use of imported woods for flooring, interior finish, etc., is rapid, and the use of imported woods for such purposes is bound to spread even more rapidly with the change from the old-type one-story building to modern structures. For North China the great bulk of such imported woods will be supplied by Japan, followed in turn by the Yalu River district and Siberian points, and there will be only a limited use for other woods, such, for example, as long lengths and sizes which cannot be supplied by the Japanese. For the Yangtse basin there will be more competition. In the near future probably the proportion of Japanese wood will increase, but in about five years —or after the Panama Canal is open—very likely the Oregon pine will be very little used there, Malay woods taking its place. And in a comparatively short time these Malay woods will become the most commonly used woods in the district. As mentioned before, this is bound to come, as they are ever so much more satisfactory than the Japanese woods for the climatic conditions there; and there will not be a great difference in price such as now exists between the two.

For South China, for general building purposes, the Malay district will probably supply practically all of the imported wood used.

For Railroads.

At present and probably for a long time to come, the entire supply of railroad ties, etc., will have to be imported into China. For North China, Japan will undoubtedly continue to have, as at present, a practical monopoly in supplying railroad ties—as Japan is closer than any other source of supply and their oaks, chestnuts, and some other woods, last very well in the climate there.

For the Yangtse basin in the valley land itself, Japanese oaks, so far, even when treated with copper sulphate, have not proved very satisfactory. Experiments will now be made with Japanese woods creosoted, and much will depend upon the success of these in proportion to their cost as to whether or not they will be the best and most satisfactory railroad tie there. Experiments are also being made in creosoted Oregon pine at $1.15 gold per tie; but at best I do not believe the future of this supply to be very great. Australian woods have been used, and undoubtedly will last very well; but it is a question whether the cost—from $1.15 up per tie—will not operate against their common use.

The Malay district woods of the grade of the Philippine Yacal (Hopea and Shorea species) most certainly would prove satisfactory, and ought to be sold there at a price sufficiently low to control the market for railroad ties, at least in the more unfavorable situations. There would also be a likelihood that the soft Malay woods, such as the grades of the Philippine White Lauaan (Pentacame species), treated with creosote, should prove very satisfactory and might compete in cost with the Japanese woods. In this connection, the presence of city gas supply works in Shanghai and other points might prove of great value. At present, to the best of my knowledge, the creosote is not saved in the process of manufacture of gas. There are also large coke works near Hankow, which might supply creosote cheaply. So far as I know, however, all creosote used at present has been imported, and nothing done towards creating a local source of supply. There would be a chance for someone to make quite a profitable contract by inducing these coal dealers to produce creosote for local use.

In South China the railroad ties will probably have to be of more durable woods such as Australian woods or woods of the grade of the Philippine Yacal unless the softer Malay woods, when treated with creosote, would prove satisfactory. Japanese woods have been used in the past, but are not very satisfactory.

For Telegraph and Telephone Poles

For these, native poles are now used practically altogether and probably will continue to be so used as they will be cheaper than others and their size and form are well adapted for that purpose.

For Piling.

For piles for the foundations of houses, etc., where the piles are completely buried, native poles are used entirely, and being quite satisfactory and the cheapest available, will probably continue to be so used. For piling for wharves, etc., imported woods are used nearly altogether. Some Oregon pine has been used in the north and elsewhere, simply because of the ease with which large sizes could be secured, but the Malay woods such as the Borneo billian and Philippine aranga, molave, and yacal are much preferred and are indeed very superior woods for that purpose; and could the supply of the timbers be secured at reasonable prices they would be used exclusively. The prices paid for piling in Hongkong run to about 50 cents a cubic foot for the best grades.

For Mine Timbers.

For these, so far, a rather large share of the timbers used has been Japanese wood, but this is largely because most of the mining development has been in North China away from any local supply of wood. The Japanese timbers will probably continue to control the market for mine timbers in North China, as they are cheap and their sizes adapt them well for that purpose. For Central and South China, probably native poles will be must used.

In connection with the supply of mine timbers, it might be noted that the largest mining company at present—the Chinese Engineering and Mining Company—always stipulates in their contract for the supply of timbers that the timber contractor shall in turn buy so much of their coal.

For Shipbuilding.

At present the woods most commonly used are Oregon pine for decking, and teak for finish, railings, etc., and of course a little lignum vitae for special purposes. These woods are very satisfactory, and whether or not they can be replaced by others is a question. Undoubtedly the Oregon pine decking might be replaced by ordinary Malay woods, such as the grade of the Philippine lauaans, provided these Malay woods were well seasoned. Teak apparently, will be very difficult to replace, as it is so fine in quality that hardly any other wood can equal it. However, when the price rises higher than at present—and there is every indication that the price of teak will rise rapidly—it is quite likely that some of the better Malay woods will be found to replace it; especially when better knowledge is had concerning the methods of seasoning these Malay woods so that they will stand without excessive warping or shrinking and expanding after being put in place. Likely substitutes for teak would be woods of the grade of Philippine yacal, where strength is desired, and of the grade of the Philippine red lauaans or tanguile for finish. For lignum vitae, there is a possibility that a wood similar to the Philippine mancono may partly replace it.

There should be a very large development in the shipbuilding trade in China in the near future when the Chinese produce their own iron and steel, taken in connection with the skill and ability of Chinese mechanics and the wages they receive in comparison with wages elsewhere.

For Furniture.

For the native furniture by far the greatest amount is made of native woods. The finest native furniture, generally called "blackwood furniture," is made from the Malay wood known as Bangkok rosewood, which is a very dark red, growing darker as it ages, and which the Chinese color black in making their furniture. It is a very fine furniture wood. For the foreign style furniture, teak is almost universally used and its fine properties fit it eminently for such use. Of late years, there has been an increasing amount of use of Japanese woods, especially oak and ash, and their use will probably develop more and more. There has been almost no use made of the common Malay woods such as the grade of the red lauaan. As these woods are so well suited for furniture in every way—color, figure, and ease in working—their use will probably develop very considerably, especially as the native woods become poorer and poorer in quality and less able to supply the increasing demand for modern office furniture which will of course accompany the development of modern business houses and methods.

So far, there is practically no use made of veneers. There should be a good opportunity for a development of veneers of the many very fancy Malay woods, using as a base either native woods or some other soft woods, in order to supply attractive furniture at a reasonable price. The use of veneer could also be made in piano manufacturing, and even for fine coffins.

Coffins.

Strange to say, the manufacture of coffins is one of the principal uses of wood in China. The Chinese coffins are not like ours—a rather thin piece of wood—but generally the sides are curving and about 2″ or more in thickness, so that really a rather large-size piece of wood is necessary to make each side of the coffin. Of course the ordinary coffin is of native wood—in fact, practically all the coffins in China are made of native wood because of more or less superstition entering into the question. Very fancy prices have been paid for fine coffins, as it is one of the ambitions of the Chinese, apparently, to be buried in a fine coffin. Very frequently a man invests in a fine coffin long before his death, and keeps it in his home to feast his eyes on during the remainder of his life. Could the superstition of the Chinese be overcome regarding the use of foreign woods for coffins, there ought to be a considerable development in the use of such woods as the western American cedar, on account of its odor, and of the ordinary Malay woods; and for the finest coffins for the fine Malay woods, used either solid or as veneers.

In connection with the coffin industry might be noted the fact that occasionally there is a demand for extraordinarily large single pieces of wood for pillars in temples, as much as $1,000 having been paid for single pieces of very large size of hardwood; so that lumber manufacturers in the Malay districts might take advantage of that also.

For Vehicles.

Chinese woods (mainly scattered trees, fruit trees, etc.) are most used. The native vehicle on the whole is an extremely clumsy one, designed to carry heavy loads over the roughest imaginable roads. In recent years some Japanese wood has been used in vehicle making.

The importation of vehicle woods should increase very rapidly, as in many cities, and even some country districts, roads are being made where before were none worthy the name, and with such roads comes the modern vehicle.

For Minor Wood Industries.

Mulberry wood is burned for the lampblack used in making ink. It is also used in paper making. The wood oil industry is very important in places. Perhaps mose interesting is the bamboo, which is used for almost everything the mind could conceive.

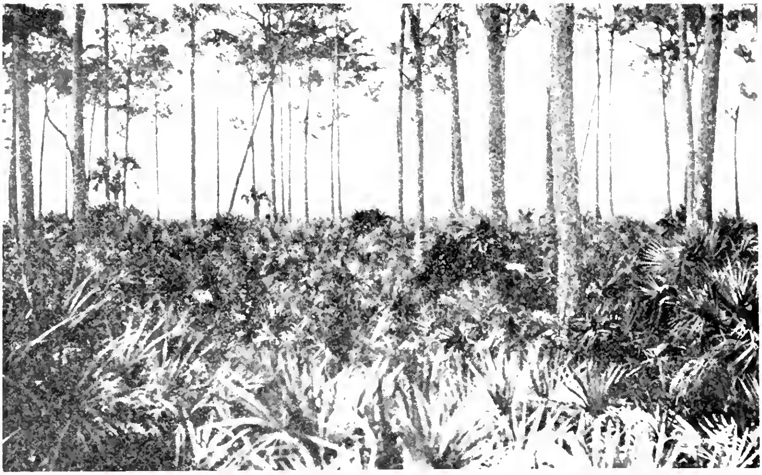
Chinese Timber Tariff.

On practically all soft wood and railroad ties there is a tariff of 69 cents per thousand board feet, except in shipments which have tongue-and-groove flooring in excess of 10 %, and on masts and spars, on which there is a tariff of 5% of the value. Hardwood beams and planks pay about 1 2/10 cents per cubic foot; hard wood masts and spars pay 5% of the value. Teak wood of all sizes pays about 4 9/10 cents per cubic foot. Lath pays at the rate of 12 6/10 cents per thousand.

Some idea of the costs of unloading ships, etc., may be had from the following table showing such costs at Tientsin:

River dues, 1/5 of 1%.
Charge for lighters for wharfage, about $1.80 per lighter holding about 300,000 board feet.
For the French Municipality, about 3½ cents per thousand.
For donkey engines, etc., on lighter to discharge same, about $6.00 per day.
For stevedoring, about 42 cents per thousand.
Or a total of about $2.85 per thousand to get the lumber to the yards.

For delivering lumber in town, the costs vary from about 30 cents to 70 cents a thousand. To load railway cars costs about 20 cents per M feet. In Hong Kong, the cost from ship to yard is a little under 1.8 cents a cubic foot, which would include one month's storage. Generally, sales are made on one month's sight.



Looking out from Cuban Pine lands toward the flat treeless Everglades, southwest of the head of Miami River.

Border Line between Cuban Pine type and tropical Hardwood hammock.

Typical view of open Cuban Pine type. Punta Gorda.

THE TROPICAL OR ANTILLEAN REGION OF FLORIDA.

By Nelson C. Brown.

It has been estimated that 77 per cent. of the total land area of Florida is timbered. This means that Florida probably has a greater percentage under forest cover than any other state in the Union. Besides having such a wealth of forest growth, 47 per cent. of all the tree species found in the United States occur in Florida. A particularly large number of northern species find their southern limit within the borders of the state, including, White, Post, Cow, Live, Spanish, Water, and Yellow oaks, Ash, Hickory, Yellow Poplar, Red Gum, Elm, Persimmon, Willow, Black Gum, Red Maple, Holly and Magnolia. Of the other woods that are not found in any other part of the country, there is an almost numberless variety of tropical or Antillean species, many of which have still to be identified and classified. Between the hardwoods of the temperate zone and the tropical zone occud the transitional forms of tree growth such as Cuban pine, longleaf pine, short leaf pine and cypress. The distinctively tropical region of Florida is found only on the southern end of the peninsula and extends much farther north on the Atlantic coast than on the Gulf Coast. This is undoubtedly caused by the warming influence of the gulf stream which skirts the coast of southern Florida very closely. It is somewhat difficult to locate exactly the definitive line between the tropical zone and the transitional belt just north of it, but the following description will suffice. From Mosquito inlet on the Atlantic Coast in eastern Volusia County, the line skirts the coast in a narrow belt to lower Osceola County about 20 miles north of Lake Okeechobee. From here the line runs across lower DeSoto County and turns northeast across Manatee County to lower Tampa Bay. Approximately one-fourth of the peninsula proper is included within the tropical zone.

Up to the present date comparatively little has been known of this region. It has been traversed occasionally by botanists and explorers but little has been known of the swampy interior before the extension of the Florida East Coast Railroad to Key

West. The more accessible portions have been exploited for mahogany and lignum vitae. Besides these two trees there is a considerable number of species of commercial size and importance. Many of these are exceedingly valuable for their hard, heavy, and highly colored wood. Others are not of sufficient size or amount to be of any considerable commercial importance. The species that are most abundant and highly prized for their lumber are as follows:

Mahogany, *Swietenia mahagoni*—Jacq., Lignum vitae or ironwood, *Guaiacum sanctum*—Linn., Red Mangrove, *Rhizophora mangle,*—Linn., Buttonwood, *Conocarpus erecta,*—Linn., White Mangrove, *Leguncularia racemosa,*—Linn., Black Mangrove, *Avicennia nitida,*—Jacq., Seagrape, *Coccolobis uvifera,*—Jacq., Jamaica Dogwood, *Ichthyomethia piscipula,*—Linn., Mastic, *Sideroxylon mastichodendron,*—Jacq., Satinwood, *Xanthoxylum fagara,*—Linn.

As far as possible these have been listed in the order of their importance. All are found on the keys and hammocks of the southern peninsula where they grow in dense tropical thickets. The mangroves only grow in the salt water swamps and along stream courses where their chief use is of protective value to the shores. Their bark contains a high percentage of tannin and the wood is now being used for flooring and cabinet manufacture. Trees up to 23 inches in diameter and 50 feet in height are very common. Mahogany and lignum vitae have been largely cut but there are still considerable quantities in the remote sections of the keys and hammock lands. Buttonwood, Mastic, Jamaica Dogwood, and Satinwood produce heavy, durable, highly colored woods which are particularly esteemed for high grade cabinet work and furniture. Besides the presence of a large number of tropical varieties, the Antillean region is characterized by extensive pure stands of Cuban Pine. The topography is almost universally flat and this species is commonly found growing directly from the limestone formation which outcrops at the surface of the ground throughout this region.

The following types of forest may be distinguished in the tropical region of Florida:

1. Cuban Pine; 2. Mangrove swamps; 3. Hardwood hammocks; 4. Fresh water swamps.

In the first type, Cuban Pine grows usually in pure stands on the dry flat stretches along the Gulf and Atlantic Coasts. On the sandy border of the latter coast there is a narrow strip of Sand Pine *(Pinus clausa)* and the palmetto is occasionally associated with it. Trees up to 2½ feet in diameter and 80 feet in height are common but the average is not over 16 to 20 inches in diameter and 50 to 70 feet in total height. Along the Gulf Coast flats the pine is inclined to be short, scrubby, and open grown. Here trees frequently do not average over 10 inches in diameter and 50 feet in height and occur usually about 45 to the acre. Frequent overflowing is the chief cause of the stunted growth. Cuban Pine includes about 40 per cent. of the forest area of this region.

The chief trees found in the mangrove swamp type are the following: Red Mangrove, White Mangrove, Black Mangrove, Buttonwood, and Seagrape. The mangroves often attain a size of 24 inches in diameter and from 40 to 50 feet in height. Their principal economic value lies in their ability to build up the shores and hold the mud together by their long, complex, root systems. The type is only found along the tidal shores where there is an abundance of salt water. Evidences are commonly present to show how this type has pushed its way into the water by its remarkable soil forming qualities. North of Cape Romano it forms immense bodies of thousands of acres, in dense, crowded stands. The cocoanut and royal palm are distinctive trees of this type and are usually found fringing the shores on the border of the dense forest.

The hardwood hammocks consist of isolated groups of tropical hardwoods, shrubs, vines, and herbaceous plants scattered about in the pine lands and on the keys. This type is also found on the higher lands just above the mangrove shore type which probably built up many of these areas by its remarkable soil forming qualities. The stands are dense and frequently almost impenetrable. This type represents the climax forest of this region. That is, if the fires were excluded on the pine lands, it would occupy all the dry flats eventually. Evidences of this are everywhere apparent on the borders of these hammocks where reproduction is continually reaching out and securing a foothold in the adjacent pine timber. The principal trees of this type are

Jamaica dogwood and mahogany. Other common trees are the Ironwood, Satinwood, Paradise tree, Torchwood, Gumbo limbo, Ficus and Manchineel. All are exceedingly valuable for furniture, and cabinet work on account of their highly colored, heavy, close grained wood. The well known fertility of these hammock lands is due to the accumulation of humus from the forest. In decomposing it yields acids which cause the surface limestone rocks to crumble and render available whatever plant foods it contains.

. The fourth type of this region is the fresh-water swamp. The characteristic tree is Bald Cypress, *(Taxodium distichum)* which occurs chiefly on the banks of streams, along the borders of the Everglades and in a single large body of unknown extent in Lee County. Other trees of this type are the Live Oak, Magnolia, and Red Bay. The wooded islands of the Everglades are included in this type, but tree growth on them is usually very scrubby and poor. The chief species are Cocoa-palm, Custard Apple, Sweet Bay, Wild Lemon, Lime and Live Oak. On account of their small sizes they have no commercial importance.

Throughout the southern end of the peninsula, the State, Government and the railroads are the largest owners of timber lands. The region is very sparsely settled as yet and with the exception of the Cuban Pine and Cypress in Lee County and the mangrove swamps along the shores, there are no large lumber companies interested in this region. A few small mills have been operated on the Gulf and east coasts to supply the local demands, but the pine is of such a hard and brittle character that it cannot be used in building or construction work after it has seasoned, on account of its extreme hardness. Two companies have purchased State lands in the mangrove swamps and are now engaged in cutting them for tannin, which they extract from the bark and for a high grade flooring.

As regards the silvicultural phases of this region, reproduction of the pine is excellent wherever fires are not too severe, especially on the east soast. There is always a luxuriant undergrowth in the hardwood hammocks and the reproduction is constantly encroaching on the adjacent pine lands. The forest conditions in these hammocks are ideal for tree growth. The floor is always kept so damp and moist by vegetable accumulation and a dense crown cover, that fires seldom burn over them. The growth of Cuban Pine is exceedingly slow. It is found on drier situations than in the northern part of its range and repeated annual fires slow down its growth to a great extent. Some of the tropical hardwoods grow very raipdly but their form is usually so crooked and gnarled that but little lumber can be cut from the individual trees. None of these Antillean species are found in pure stands.

Cuban Pine is remarkably free from any tree disease or injury besides fire damage. The cypress is badly affected by peckiness, certainly much more so than in northern Florida, and the trees are usually short and scrubby. On account of the dense dark forest cover on the tropical hammocks, their moist atmosphere is very conducive to a great variety of fungous growths, but otherwise they are entirely free from windthrow, ground fires and insect attacks.

A special feature of this region is the vast tract of 3,404,000 acres in Dane, Monroe and Lee Counties, known as the Everglades. They consist of a flat, practically treeless expanse of fresh-water marsh stretching from the narrow low sandy ridge along the East coast to Lake Okechobee and the western part of Lee County, and extending in an irregular form from Northern Dade County, to the mangrove swamps of the southern capes. The surface is covered by saw-grass and several species of marsh grasses. Isolated patches of hardwood and occasionally Cuban Pine hammocks are found scattered over it. They vary in area from one-eighth acre up to several acres. A thick muck of decayed vegetable matter from a few inches to 15 feet in depth supports the grasses which grow usually in a foot or two of water. Underneath the muck is found a limestone of indefinite depth. On the eastern and part of the southern boundaries of the Everglades the water is retained by a limestone core or rim. The State now has in progress an extensive scheme of dredging deep canals through this core and into the heart of the Everglades from both Fort Lauderdale and Miami on the East Coast. This will open up an immense tract of agricultural land. The hammocks are usually composed of a dense stand of cocoa plum, red bay, sweet bay, custard apple, wild plum, wild orange, lime, live oak and a great variety of tropical shrubs and herbaceous plants.

With the exception of some of the pine land which will be cleared for fruit and farm crops, the present wooded area of the Antillean region will remain almost indefinitely under forest cover. There is an excellent opportunity to cultivate the tropical hardwoods for furniture wood on account of their comparatively rapid growth, ease of reproduction, and the exceedingly valuable quality of their wood. Much can also be done along the line of introducing foreign species in this region particularly such trees as eucalyptus which are adapted to this soil and climate. Most of the Cuban Pine is still in virgin forest and as soon as it is cut, there will be a good opportunity to renew it on these lands which would otherwise grow up to brush, weeds and inferior species.

THE DISTRIBUTION OF COSTS AND VALUES IN A LOGGING OPERATION

By R. Clifford Hall and Dean W. Martin.

An important element that enters into the determination of stumpage value in a region which includes many species of merchantable timber varying widely in value, is the distribution of costs and values between the different species and products so as to secure equitable results. This problem appears especially important in reference to apportioning the construction cost of a logging railroad which must be built to operate a tract in an undeveloped region.

It is customary to estimate the total cost of building the railroad and then to divide this figure by the number of thousand board feet of timber that will be taken out in the entire operation. The quotent obtained is the cost of railroad construction per thousand board feet and this figure is added to the other operating costs per thousand. This method is very satisfactory when only one species is involved in the operation, or when there are several species or products of nearly the same value. It is not satisfactory when there is a great variation in the value of the species and products under consideration. In the latter case it may often happen that the cost of railroad construction per thousand plus the other operating costs per thousand may equal or exceed the f. o. b. mill value of an inferior species. Calculated on this basis, the stumpage value of the species would appear to be zero or negative, indicating that there would be no profit in handling it. Such is the situation in the case of black oak in the illustration given later (See table 1,) Although no stumpage value is given for this species, the net returns on the entire operation are $20,000 greater if black oak is cut than if it is left in the woods. If it is cut, the operating cost is increased by $220,000 (20,000M. feet at $11 per M), but the total receipts of the operation are increased by $240,000 (20,000 M. feet at $12 per M), while the cost of the railroad remains the same whether black oak is handled or not. It can be readily seen that any low grade product can be profitably handled as long as the other operating costs, exclusive of railroad construction cost, are less than the f. o. b. mill value, and in an actual operation will certainly not be left in the woods. The railroad construction cost or, in fact, any absolutely fixed charge is in reality disregarded in determining the merchantability of a single species, because if there is enough valuable timber on the tract under consideration to more than cover the railroad and other fixed costs, any species that will yield a profit over other operating costs will be taken out even if it cannot bear an equal share per M. of the entire cost. Moreover, every additional carload of timber that is handled at a profit in reality helps to pay for the railroad. It is evident, then, that the distribution of construction cost on a per thousand basis is not logical and does not fit actual conditions where there is a considerable variation in the value of the species to be handled. It does not, moreover, give equitable stumpage values, as it unduly reduces the stumpage values of inferior species in favor of the more valuable, and may even indicate that a certain species has no stumpage value at all when as a matter of fact it can be handled at a profit.

These features are illustrated in an ideal example. The assumptions in this example follow closely, but in a simplified form, the conditions of a case met with in actual practice by the writers. The stumpage values are worked out by two different formulae, which will be briefly explained.

(1) What we may call the direct percentage formula is based on the principle of crediting to the stumpage an assumed percentage (P) of the gross profit (the difference between the f. o. b. mill value of the final product (v) and the total operating cost (c+r) and allowing the remainder to cover the operator's profit and risk. Calling the stumpage value, x,

$$x = P\ (v - c - r)$$

In this case P is assumed at 25 per cent. for lumber and 30 per cent. for other products, as there is less risk in handling the latter.

(2) The Forest Service formula, so called because it is given in the National Forest Manual, is based on the principle of allowing as operator's profit an assumed percentage of the operating costs plus the stumpage value (c+r+x), adding this to the

operating costs, and subtracting the total from the f. o. b. mill price to get the stumpage value. Thus::

$$x=v-p\ (c+r+x)$$

$$x=\frac{v}{1+p}-(c+r)$$

When the value for $(v-c-r)$ has already been obtained for use in the direct percentage formula, the Forest Service formula can be used most easily in the following form, obtained by adding the expression $v\,\frac{P}{1+P}$ to $\frac{v}{1+P}$ and then subtracting, thus:

$$x=(v-c-r)-v\,\frac{P}{1+P}$$

In this case P is assumed to be 25 per cent., and the two formulae become:

$$x=4/5v-(c+r)$$

$$x=(v-c-r)-1/5v$$

The following are the conditions of the illustration:

It is assumed that the area to be logged is 50,000 acres requiring railroad construction amounting to $150,000 or $3 per acre. The average stand per acre is 2,000 board feet while the products (extract wood, tanbark, and ties,) are equivalent to 1,000 board feet. Although the location is in the southern Appalachians only a few species are used in the illustration to avoid confusion. The capacity of the mill is 50,000 board feet a day. The costs of the operation are as follows:

Cutting and skidding,	$4.50	per	M.
Loading and R. R. haul to mill	1.00	"	"
Sawing, handling, and loading lumber	3.50	"	"
Overhead charges	2.00	"	"
Total	$11.00	"	"
R. R. construction per A, $3, per M	1.00	"	"
Total	$12.00	"	"

Cost of products, f. o. b., excluding railroad construction:

Extract wood	$3.00	per	cord
Tanbark	5.00	"	"
Ties	.20	per	piece

Table 1.—Distribution of construction costs per M. bd. ft. and stumpage values

Species and products	Value f. o. b. mill	Total costs	*Direct percentage formula* Gross profit	Stumpage	*Forest Service formula* Stumpage $\frac{4}{5}v-(c+r)$	
	v	c+r	v—(c+r)	x	$\frac{4}{5}v$	x
Poplar lumber	$27.00	$12.00	$15.00	$3.75	$21.60	$9.60
Chestnut lumber	17.00	12.00	5.00	1.25	13.60	1.60
Chestnut oak lumber	16.00	12.00	4.00	1.00	12.80	.80
Black oak lumber	12.00	12.00	.00	.00	9.60	—2.40
Extract wood (cords)	4.00	3.60	.40	.12	3.20	— .40
Tanbark (cords)	8.50	5.60	2.90	.87	6.80	1.20
Ties (pieces)	.45	.24	.21	.06	.36	.12

If railroad construction cost is not to be distributed per thousand board feet, what, then, is the proper method? If not quantity, then value must be the basis. Value is an important element in rate making by common carrier railroad, as indicated by the higher freight rates on manufactured articles of high value in comparison to those on coal and ores of relatively low value in proportion to weight. It is believed that both the elements of value and quantity should be given a place in rate making on the books of a logging railroad, apportioning the construction costs according to value and the operating costs by the thousand board feet. The same principle could be applied in operations where a railroad is not used, by distributing the expense of building a wagon road, flume, or other improvement of fixed cost, no matter how much material is taken out, on the basis of value. The following plan for the distribution of fixed construction charges on a value basis is suggested.

The data required is as follows:

The f. o. b. mill value of the species involved=v

The total operating and manufacturing costs including interest and depreciation per M=c

The average stand per acre for each species and product=s

Then for each species the index value (=i) (or value to be used in apportioning the construction cost) is the f. o. b. mill value minus the other costs.

$$i = v - c$$

The index value per acre (I) is the sum of the average stand per acre of each species multiplied by the index value of that species.

$$I = s \times i \text{ (chestnut)} + s \times i \text{ (poplar)} + s \times i \text{ (oak)} + \text{etc.}$$

The total railroad construction cost divided by the number of acres is the railroad construction cost per acre=R

The railroad construction cost per acre should be distributed among the different species and products in order to obtain the railroad construction cost per unit quantity (thousand feet, cord, or piece) of each product (=r)

The first step is to divide the construction cost per acre by the index value per acre thus obtaining the construction cost per dollar of index value $= \frac{R}{I}$ Then the construction cost per unit of quantity for each product (r) is the index value of that product multiplied by the construction cost per dollar of index value

$$r = i \frac{R}{I}$$

Having obtained the construction cost per unit quantity (thousand feet, cord, or piece) of each product, this can be added to the other costs in order to obtain the total costs of operation. Then the stumpage value can be obtained by any of the usual methods.

The following table shows the application of this plan to the same set of conditions assumed for the first example, using both the direct percentage formula and the Forest Service formula. By using the first formula, the operator's profit is distributed on a value basis, since it is taken as a direct percentage of the gross value. In the Forest Service formula it is a percentage of logging cost plus stumpage, and is affected by the value of the product only to the extent that the construction cost is apportioned on this basis.

Table 2.—(a) Distribution of construction costs on a value basis

Species and products		Stand per acre s	Value f. o. b. v	Costs c	v—c i	i x s	Constr'n costs per M $i \times \frac{R}{I}$ r
Poplar lumber	(bd. ft.)	400	$27.00	$11.00	$16.00	$6.40	$2.80
Chestnut lumber	" "	900	17.00	11.00	6.00	5.40	1.05
Chestnut oak lumber	" "	300	16.00	11.00	5.00	1.50	.87
Black oak lumber	" "	400	12.00	11.00	1.00	.40	.17
Extract wood	(cords)	1	4.00	3.00	1.00	1.00	.17
Tanbark	"	.2	8.50	5.00	3.50	.70	.61
Ties	(pieces)	7	.45	.20	.25	1.75	.04
						I=$17.15	
					$\frac{R}{I}$=	.175	

(b) Stumpage values based on distribution of costs shown in (a)

Species and products	*Direct percentage formula* Gross profits per M v—c—r (i—r)	Stumpage x	*Forest Service formula* $\frac{1}{5}$ v	Stumpage $(v—c—r)—\frac{1}{5}v$ x
Poplar lumber	$13.20	$3.30	$5.40	$7.80
Chestnut lumber	4.95	1.24	3.40	1.55
Chestnut oak lumber	4.13	1.03	3.20	1.93
Black oak lumber	.83	.21	2.40	—1.57
Extract wood (cords)	.83	.25	.80	.03
Tanbark "	2.89	.87	1.70	1.19
Ties (pieces)	.21	.06	.09	.12

While the foregoing discussion has referred especially to the distribution of the cost of railroad or other construction charges, it applies equally well to any fixed charge which must be incurred in developing a given tract, whether all of the timber or only the best of it is cut. Many of the overhead charges, such as depreciation on sawmill equipment, rolling stock, and other machinery are of this nature. On the other hand, the charges for maintenance and cost of supervision seem to depend on the length of the operation, which is in turn conditioned by the amount of timber cut, and apparently should be apportioned on a quantity basis. The smaller items may be distributed one way or the other without affecting the results very much, but it is important that a charge which constitutes a high proportion of the cost of logging, such as the cost of constructing a railroad, be apportioned between the species on a proper basis.

The same idea of apportionment on a value basis may be applied in the use of the Forest Service formula for obtaining stumpage values. It seems that this formula applied directly to each species and product exaggerates the differences in value between the low grade and high grade products by assuming that the operator must make an equal percentage of profit on each. What the operator is primarily interested in is the profit on the entire operation. If there is enough high grade products to yield a profit sufficient to warrant the operation, in all probability the operator will be willing to increase his total profit by handling at the same time low grade products, even if he cannot make nearly as large a percentage of profit on these as on those of greater value. Therefore it is easy to see that the unmodified Forest Service formula may show a negative stumpage value for a product which would actually be handled with profit both to the operator and to the stumpage owner.

This difficulty has in some cases been corrected by assigning arbitrary stumpage values to the low grade products and reducing the stumpage values on high grade products so as to give the operator the same profit on the operation. A similar result can be obtained by a logical mathematical process as long as the products can really be handled without loss, that is, as long as the f. o. b. mill value of the lowest grade product included is more than the operating costs exclusive of railroad construction (or other equally fixed charges) and of operator's profit. Of course there must be enough high grade products to make the operation profitable as a whole. The method is to distribute the railroad construction costs on the value basis as already explained, and then to apportion the stumpage value of the average acre as a whole between the different products in proportion to the gross profit on each. This has the effect of distributing the operator's profit in the same proportion, since the gross profit is divided between the operator and the stumpage owner. The stumpage value for the average acre, X, may be obtained by the following formula, in which V is the f. o. b. mill value per acre (the sum of the f. o. b. mill values of each product multiplied by the average stand) and C is the operating cost per acre, exclusive of railroad construction (the product of the stand per acre in board feet and the operating cost per thousand)

$$X = (V—C—R) —1/5V$$

Since $V—C=I=$index value per acre

$$X = (I—R) —1/5\ V$$

Then the stumpage value per dollar of gross profit can be obtained by dividing the stumpage value per acre by the gross profit per acre, and the stumpage value per unit quantity by each product can be obtained by multiplying the gross profit on that species by the stumpage value per dollar of gross profit. The formula is:

$$x = \frac{X}{I—R}\ (v—c—r)$$

Using the same set of conditions as in the previous computations, table 3 shows the application of this modified form of the Forest Service formula.

It should be mentioned in this connection that another method of distributing the stumpage values as given by the Forest Service formula between species of different value has already been worked out on the same principle and arriving at the same results, but by a different arithmetical process. However, this method seems preferable to the authors, and is especially applicable when the fixed charges have been apportioned by the similar method already described.

Table 3.—Stumpage value by modified Forest Service formula Construction cost, operator's profit, and stumpage distribution on value basis.

Species and products	Stand per acre	Value f. o. b.		Gross profit v—c—r	Stumpage $\frac{X}{I—R}(v—c—r)$
	s	v	v x s	(Table 2)	x
Poplar lumber (bd. ft.)	400	$27.00	$10.80	$13.20	$4.88
Chestnut lumber " "	900	17.00	15.30	4.95	1.83
Chestnut oak lumber	300	16.00	4.80	4.13	1.53
Black oak lumber	400	12.00	4.80	.83	.31
Extract wood (cords)	1	4.00	4.00	.83	.31
Tanbark "	.2	8.50	1.70	2.89	1.07
Ties (pieces)	7	.45	3.15	.21	.08
			$44.55 (=V)		

$$1/5V = \$8.91$$

$$I-R \text{ (Table 2 (a))} = \$17.15 - \$3 = \$14.15$$

$$X = (I-R) - 1/5V = \$5.24 \text{ (Stumpage value per acre)}$$

$$\frac{X}{I-R} = \$0.370$$

The same plan of apportioning costs and operator's profit may be applied to the method for arriving at stumpage values worked out by Wm. B. Hunter of the Bureau of Corporations. This method is based on the principle of allowing as the operator's profit a fixed percentage of the capital at risk in the operation and charging this against the returns each year. Since this capital is diminished annually by the amount allowed for depreciation, the amount of profit also diminishes, but the total amount available each year for profit and depreciation is the same. Therefore the amount available for depreciation increases, as the sum of the annual depreciation and annual operator's profit is a constant. This constant, K, which is charged against each year's returns, is obtained by the following formula:

$$K = pA + \frac{B}{d}$$

in which:

A = original cost of plant plus working capital
B = A—wrecking value of the plant
P = rate of profit

$$d = \frac{(1+p)\ n-1}{p}$$

n = number of years of operation

The stumpage value is then found by subtracting from the selling price the other operating costs including maintenance, plus the constant allowed for depreciation and profit. This constant can either be reduced to the basis of thousand board feet, disregarding the value of the different species, or the distribution between depreciation and profit and the stumpage can be made in proportion to the difference in value between the f. o. b. price of the species and the operating costs. This latter plan can be effected by several methods, but the one illustrated in table 4, in which selling price, costs, and stumpage are figured on an acre basis and the stumpage then pro-rated, seems most satisfactory. The assumptions of the problem are here modified as follows:

The overhead charge in the cost of saw timber (see page 5) is assumed to be $1 instead of $2, since in this case it covers only maintenance and cost of supervision and selling. This makes the operating cost $10 per M.

The sum of the working capital and the original investment in cost of the plant including the railroad is taken as $350,000. The plant is assumed to have a wrecking value at the end of a ten-year operation of $50,000, making the amount to be written off $300,000.

The profit to be allowed the operator is 15 per cent. of the capital at risk.

Table 4.—Stumpage values by Hunter's formula. Construction cost, depreciation on equipment and operator's profit distributed on a value basis.

Species and products,	Stand per acre.	Value f. o. b.	Operating costs.			Stumpage Value.
	s	v	c	v-c	s (v-c)	.297 (v-c)
Poplar lumber,	400	$27.00	$10.00	$17.00	$6.80	$4.06
Chestnut lumber,	900	17.00	10.00	7.00	6.30	2.08
Chestnut oak lumber,	300	16.00	10.00	6.00	1.80	1.78
Black Oak lumber,	400	12.00	10.00	2.00	.80	.59
Extract wood (cords),	1	4.00	3.00	1.00	1.00	.30
Tanbark (cords),	.2	8.50	5.00	3.50	.70	1.04
Ties (pieces),	7	.45	.20	.25	1.75	.07
					$19.15	

Operating cost per acre

2 M feet lumber @ $10.00,	$20.00
1 cord extract wood @ $3.00,	3.00
.2 cord tanbark @ $5.00,	1.00
7 ties @ $0.20,	1.40
Total,	$25.40

Depreciation and operator's profit

$pA = \$350{,}000 \times .15 = 52{,}500.00$

$\frac{B}{d} = 300{,}000 \div 20.304 = 14{,}775.41$

Total per year, ...67,275.41
Total per acre (÷ 5,000),..........$13.45

Total cost and operator's profit per acre, ...$38.85
F. O. B. value per acre, (Table 3), ... 44.55
-38.85

Stumpage value per acre, ... $5.70
5.70 ÷ 19.50= .297

Summary.

Table 5 shows a comparison of the stumpage values obtained by the different methods outlined, the conditions in each case being the same with the exception of the modifications noted in the last case. For the details of computation, see Tables 1, 2, 3, and 4.

Table 5—Comparison of stumpage values obtained in Tables 1, 2, 3, and 4.

Species and products,	A	B	C	D	E	F
Poplar, per M,	$3.75	$9.60	$3.30	$7.80	$4.88	$4.06
Chestnut, per M,	1.25	1.60	1.24	1.55	1.83	2.08
Chestnut oak, per M,	1.00	.80	1.03	1.93	1.53	1.78
Black oak, per M,	....	—2.40	.21	—1.57	.31	.59
Extract wood, per cord,	.12	—.40	.25	.03	.31	.30
Tanbark, per cord,	.87	1.20	.87	1.19	1.07	1.04
Ties per piece,	.06	.12	.06	.12	.08	.07

A—Direct percentage formula; construction cost distributed per M bd. ft.

B—Forest Service formula; construction cost distributed per M bd. ft.

C—Direct percentage formula; construction cost (and, incidentally, operator's profit) distributed on value basis.

D—Forest Service formula; construction cost distributed on value basis.

E—Forest Service formula; construction cost, operator's profit, and stumpage distributed on value basis.

F—Hunter's formula, construction cost, depreciation on equipment, operator's profit, and stumpage on value basis.

It is seen that although in the case of black oak lumber there is a difference of $1 per M between f. o. b. mill value and operating costs to be divided between railroad construction, operator's profit, and stumpage, this product is given a zero or negative stumpage value in columns A, B, and D. This is because A gives too large a share to railroad construction; D, too large a share to the operator's profit; and B too large a share to both. In column B the extract wood is also given a negative value although there is a margin of $1 per cord to be divided between railroad construction, operator's profit, and stumpage. It is seen that the difference between the value of low and high grade products is exaggerated in A, B, and D. It is believed that columns C. E. and F show the most logical stumpage values, and the most equitable distribution between the different species and products. Column E, based on the modified Forest Service formula, gives more to stumpage and less to operator's profit than column C, which is based on the direct percentage formula. By changing the percentages used, columns C and E could be made almost identical. The fact that all fixed charges are pro-rated on a value basis in arriving at the values in column F accounts for the decreased difference between species.

The question of the proper formula for the determination of stumpage values is a very broad one, and involves many considerations that have not been touched upon. It is the purpose of this article merely to call attention to the plan of distributing fixed costs and operator's profit between the different species and products involved in a logging operation on a value basis.

CURRENT LITERATURE.

Indo-Malayan Woods. By Fred W. Foxworthy, Ph. D. Philippine Journal of Science, Section of Botany. Vol IV, No. 4, October, 1909 Pp. 184, plates 9. Price, 50 cents.

Dr. Foxworthy, in this paper, has given us by far the best work ever published on the woods of the Indo-Malayan region.

The objects aimed at by the Philippine Government in having the study made were to correlate the Philippine woods with the related or identical forms in other sections; and then to call attention to the structure, uses, and distribution of the eastern woods.

Very little is really known about the forests and woods of this district except by a very few; and as there was no one work which described accurately the woods of the region and their uses, together with the local names by which they are known in different parts of the district, the great importance and value of the work can be seen.

Even the extent of the area is but faintly realised by most. Dr. Foxworthy defines the region to take in all of Ceylon, British India, Burma, Andamans, Siam, Cochin China, Malay Peninsula, Sumatra, Java, Borneo, Philippines, and all of the Malay and Indian Archipelago down to New Guinea—in other words, nearly all of the tropical east. As so few are acquainted with the district, a table showing areas and population is given.

English Territory.

	Area Sq. mi.	Population	Density per sq. mi.
	Area Sq. mi.	Population	Density per sq. mi.
Ceylon,	25,000	3,600,000	141
Indian Empire,	1,767,000	294,400,000	167
Federated Malay States of Malay Peninsula,	37,000	1,500,000	41
British Borneo,	84,000	493,000	6

	Dutch Territory.		
Dutch Borneo,	212,700	1,180,000	5
Java and Madura,	50,500	25,700,000	509
Sumatra and Islands,	184,000	3,450,000	19
Celebes,	71,400	1,998,000	28
Moluccas,	43,800	400,000	9
Lesser Sundas,	65,600	1,164,000	17
	French Territory.		
French Indo-China,	256,000	18,200,000	71
Siam,	200,000	9,000,000	46
	American Territory.		
Philippine Islands,	115,000	7,500,000	65
	Independent.		
Siam,	200,000	9,000,000	46

The region is a distinct geographic district. The connection of the islands of the Malay archipelago with southeast Asia and India was first pointed out by Wallace, who showed also that New Guinea, although so close, was a distinct mass not connected biologically with the rest, but rather with Australia. So that the Indo-Malayan region, an old continent, might well be presumed to have forests more or less similar, and the close similarity of the forest over the whole region is indeed remarkable.

The most surprising thing with regard to the forests of this region to the new comer is its comparative simplicity, that there are heavy stands rather free from undergrowth, that softwoods are not uncommon, and that so much of the timber is of medium or light weight. The common notion seems to be that the forests are composed mainly of very heavy and hard ornamental woods, growing very scattered—due to the fact that only those woods in the past have reached the European and American markets.

Very little is known abroad of the great family of *Dipterocarpaceae,* which furnishes by far the largest share of the timber of the district. This family is to this region what *Pinaceae* is to the temperate regions. Dr. Foxworthy says, of the *Dipterocarpaceae,* "So wide is its distribution and so general the uses of its woods that I believe that all other woods could be spared from many eastern markets without seriously hampering work or affecting prices." Probably over 75 per cent. of the bulk of the merchantable wood of the area is composed of members of this family. The most important woods of this family are those falling under the following groups: Rassak, Chengal, Yacal, Peniow, Mangachapuy, which may be called the *Yacal* group, and all being heavy, hard, durable woods, suited especially for railroad ties and uses where durability and strength are essential. The *Guijo* group comprises mainly Kapor, Guijo or Sal, and Apitong, being fairly heavy, fairly hard strong woods suitable for planking, beams, etc.; and the *Lauan* group comprising Tanguile, red and white Lauans, Almon, Merante, Seriah—being light woods, easily worked and well suited for all general purposes for which wood is used, and also being well suited for furniture, etc.

Thus it is seen that woods suitable for practically every purpose are furnished by members of this family—from the hard, very durable woods to light, soft woods; and from woods for almost any special purpose to woods for general construction; and as nearly all grow to great size and clear length and occur in heavy stands, the importance of the family can be seen. The lighter woods form the most common members of the family.

Next to the family *Dipterocarpaceae,* Dr. Foxworthy places the *Leguminosae.* This family supplies the greatest number of woods for fancy furniture and ornamental work. The most important woods of this family are the Cutch tree, East Indian Walnut, Ipil or Mirabow, Pyingadu, Indian Rosewood, Blackwood, Padauk, and Red Sanders or East Indian Sandalwood.

The members of these two families are very well grouped, and the excellent description and analytical keys given enable one readily to distinguish the most important groups.

Of what certainly must be considered not less than of third rank in the families of this region (even considered first in importance by some), i. e., the *Rhizophoraceae,* there is not so much as might be desirable, although a useful key to the genera is given. This family embraces practically all of the species found in the great Mangrove swamps of the tropics and might supply vast quantities of the best fuel-wood, charcoal, tanbarks and tanning extracts, dye materials, and even wood for piling, poles, railroad ties, etc.;

and being situated in the most accessible places, responding easily to forest management, and being on absolute forest land (swamp lands overflowed by tide water) is bound always to be of great importance. Most important are Tangal *(Ceriops* sp.), and Bacao or Bacauan *(Rhizophora* sp.).

Easily next in importance would come *Verbenaceae,* supplying the best wood for general utility known in the world. This, of course, is Teak—the only wood placed in the first line in the classification of woods in Lloyd's register, and one which has become the standard for estimating the value of all other woods. It is now being extensively cultivated, and thriving on poor soil, its future is assured. Another valuable member of this family is the Molave of the Philippines.

Next in importance would probably come the family *Lauraceae,* supplying Billian, the best wood for wharf piles in the world, and Camphor wood. Then would come the *Sterculiaceae* and *Myrtaceae,* among which are found many very hard, durable, tough woods. In the *Myrtaceae* is found Mancono which the Philippine Bureau of Forestry believes will prove a satisfactory substitute for lignum vitae in ship building. The *Myrtaceae* of this district are not nearly so important as in the Australasian region, where members of the family comprise the great forest wealth—Eucalyptus, etc.

The *Ebenaceae* is important as producing the ebonies of commerce. The *Meliaceae* yield many valuable furniture woods, etc., but are very limited in amount. The West Indian mahogany (*Swietenia* sp.), members of this family, have been planted here. The *Combretaceae* yield several very valuable, fairly hard and durable woods.

All told, there are described 661 species in 379 genera in 81 families. A list of not over a hundred genera could be made to include probably 95 per cent. of the bulk and value of the forests of this extensive region. This, compared to the 52 genera which Dr. Sudworth says comprise the great bulk of American forest trees, gives a fair comparison, although it is true that nowhere are there such extensive stands of only one or two species such as occur in the United States.

Scientific name, common name, distribution, uses, and characteristics of important woods are given, so that the notes are particularly valuable. Besides this valuable work of description of species, etc., a most valuable table is given showing commercially equivalent woods of the district by the generally accepted common name in each division rendering the work of prime importance from a commercial standpoint, and one of great value to lumbermen in new districts and to architects and wood-users generally. Of equal importance to wood-users will be the very excellent lists of wood of the region known to be suitable for special purposes enumerated as follows: exposed to salt water; for ship and boat building, for woods in contact with the ground, paving blocks, furniture and ornamental woods, tool handles, boxes or packing cases, etc.

Other useful tables are those showing weight and hardness of the most important woods. Although a considerable number are found to be heavy and hard, still there is noted a surprising number of light and soft woods or moderately light and soft woods, and when it comes to bulk and total weight in the district the proportion of these is very large.

The work is illustrated by nine plates showing cross-sections of 108 of the most typical and important woods. These are on a uniform magnification of five diameters that require only an ordinary hand lens—so these, too, will prove valuable aids in recognizing the woods. A complete bibliography and an accurate index add to the value of the work.

Dr. Foxworthy gives a short summary as to the source of the supply of the woods and the possibilities of future production. In this, he was too conservative, and by refraining from any definite statement, other than stating that large amounts will be available for export, does not give as adequate conception as he might of the possibilities.

Dr. Foxworthy in this work has not only made a valuable contribution to the scientific and economic knowledge of the world's timbers, bound to be of immense use in the immediate future, but has presented a work which for its standard of excellence and thoroughness will serve as a model for others to copy.

R. ROSENBLUTH.

A Research on the Pines of Australia. By Richard T. Baker, F. L. S., and Henry G. Smith, F. C. S. Technological Museum, New South Wales. Technical Education Series No. 16, 1910.

A large volume of some 458 pages, profusely illustrated, dealing with the eleven genera of Australian Coniferae, *Callitris, Actinostrobus, Diselma, Athrotaxis, Phyllocladus, Dacrydium, Pherosphaera, Microcachrys, Podocarpus, Agathis,* and *Araucaria.* The use of the term "Pines of Australia" appears to be somewhat unfortunate and confusing since the genus *Pinus* which is numerously represented in Europe, Asia, and America does not occur in the flora of Australia.

The authors ambitiously undertake to consider the numerous species of Australian Conifers from the point of view of taxonomy, morphology, anatomy, phylogeny, chemistry, ecology, forestry, and economic botany, an undertaking which might well occupy the entire time of a botanist and chemist during a life time. Owing to the magnitude of the undertaking and the limited time at the disposal of the authors, information in regard to many subjects considered is extremely fragmentary. This is particularly true of forestry, geographical and economic distribution of species, silvics of species, properties and uses of economic products, and methods of silvicultural management.

The morphology and anatomy of the leaf and cone, particularly of the genus *Callitris,* are considered at length with numerous interesting photographs of external and internal structure. Certain phylogenetic conclusions of the authors, especially the theory that *Callitris* may be "the oldest living representative of the order" are not based upon sufficient evidence to stem the rising tide of evidence in favor of the comparatively recent origin of the *Cupressineae.* The internal structure of the bark and wood are also abundantly illustrated. The chemistry of leaf oils, of Guaiol in the wood of *Callitris,* tanning and Sandarac resins in the same genus, later in *Araucaria Cunninghamii,* oleo-resin in *Agathis robusta,* and crude oil in *Dacrydium Franklini* are considered at length and form a large portion of the text.

The authors grade the various genera of Australian Coniferae upon the basis of their importance in forestry as follows:

Callitris, timber, bark, and Sandarac (resin).
Araucaria, timber and oleo-gum-resin.
Agathis, timber, oil of turpentine and resin.
Athrotaxis, timber and oil.
Dacrydium, timber and oil.
Phyllocladus, timber and bark.

I. W. B.

The Economic Possibilities of the Mangrove Swamps of the Philippines. By Raymond F. Bacon and Vicente Q. Gana, (From the Chemical Laboratory, Bureau of Science, Manila, P. I.) The Philippine Journal of Science, Vol. IV, No. 3, 1909.

In an interesting scientific article the writers call attention to the fact that the supply of native tanning materials in leather producing countries is so far exhausted that they are looking elsewhere for a supply. Such a supply the writers state, is at present available in the Philippines.

Although, up to the present time, no mangrove bark has been exported from the Philippines, there are large areas of mangrove forests containing a sufficient quantity of bark to supply several cutch factories. It is as cutch, the authors believe, that the material can most profitably be handled.

Several tables are given showing the composition of tan barks of different species from different localities and comparing these with analyses from other regions. The Philippine tan barks of the best species contain from 20 to 25 per cent. of tannin which compares favorably with Borneo barks of the same species in which commercial cutch factories are now in operation. These tan barks are secured from several species of *Rhizophora, Bruguiera,* and *Ceriops.*

M. L. M.

The Forests of the Philippines. Part I. *Forest Types and Products.* Part II. *The Principal Forest Trees.* By H. N. Whitford, Ph. D., Forester, Chief of Division of Investigation, Department of the Interior, Bureau of Forestry. Bulletin No. 10. Manila, Bureau of Printing, 1911. Part I, 94 pp. illust., map. Part II. 113 pp. illust.

"The object of this bulletin is to bring together the most important facts concerning the forests of the Philippines and the exploitation of their products." The chief idea in Part I appears to be to furnish information that will be of interest to prospective forest exploiters.

A detailed description of the character of the vegetation on each of these areas is followed by a discussion of the climate; topography and soil; types of forest; wood uses; lumbering; minor forest products, and relation of the Government to the forests and their products. An appendix contains a list of 34 Philippine woods with a table showing the results of mechanical tests.

The forest resources of the Islands are conservatively estimated to be 203,264,000 M. ft. B. M.

The requirement of the local markets for the fiscal year 1909-1910 was 89,000 M. feet B. M. of which 20 million feet were imported from the United States. In addition 246,776 cubic meters of firewood cut from public lands was measured by the Bureau of Forestry and a large additional quantity of wood was extracted for which no record was kept.

The local markets are rather unstable; the lumber poorly seasoned and graded and it is generally handled in an inefficient manner. Conditions are rapidly improving and these evils will probably be eliminated largely in a few years because storage yards are becoming more common and some of the large manufacturers are beginning to grade their lumber.

The average retail price (U. S. currency) of the dipterocarp lumber ranges between $25 to $45 per M.; Yacal $60 to $75; Molave $75 to $100 per M.; Ipil $75 to $100 per M. Douglas Fir from the Pacific Coast, the chief foreign competitor of the dipterocarps sells for $25 to $35 per M.

The greater part of the logging is carried on in a very primitive way, carabao, or water buffalo, usually providing the power for dragging the logs from the stump to tide water.

Three American firms employ steam logging railroads and yarding engines of the type used on the Pacific Coast.

Although there is a continued increase in the number of steam sawmills in the Islands, the manufacture of lumber by the whip saw is very common in the rural districts. In the larger towns the business of lumber manufacture has been usurped largely by the steam mills.

The main text closes with a discussion of the methods by which the Government disposes of its raw forest products, prices charged, cutting regulations and the character of assistance offered to lumbermen by the Bureau of Forestry.

The map accompanying Part I shows the extent of merchantable forests in the Islands and the areas explored by the Bureau during the period of 1908-1910.

In Part II popular descriptions are given of 106 of the different merchantable trees of the Philippine Islands. Brief mention is also made of about 277 other trees common in the forests and fields.

The descriptions were made largely in the forest from living trees, checked in the laboratory with herbarium material. The idea has been to furnish a description by means of which the trees in the forest could be readily distinguished without reference to the flowers and fruiting bodies. No key is given.

The author states that the tallest tree yet measured in the forests of the Islands had a height of 200 feet. It is probable however that some trees may reach a height of 230 feet. Very few species reach a diameter in excess of six feet.

A list of the principal forest trees, giving the family name, species, official common names and the usual trade names accompanies the report.

Both parts will be of great value to lumbermen, foresters and others interested in the forest resources of the Islands.

R. C. B.

Die Grundlagen der räumlichen Ordnung im Walde. By Professor Christoph Wagner. 1907. 320 pp.

Although Wagner's book has already been reviewed in the Forestry Quarterly, a further discussion of the silvicultural principles advanced by the author is desirable in view of their possible application to our own conditions.

Professor Wagner's book has created a sensation in Europe, as he touches upon silvicultural practices which vitally affect every forester. The author points out clearly the defects of the European silvicultural practice of to-day, and advocates a return to nature and to natural reproduction. He advances a silvicultural system of cutting entirely his own which secures natural reproduction and which makes forest management possible on small areas.

Wagner points out that in forestry there are two opposing principles: the natural and the economic. The natural principle tends to retain the forest in its natural conditions; this is obtained by many aged stands and by a selection method of cutting. The economic principle demands the greatest possible revenue from the forest. This end is obtained by even-aged stands resulting from clear cutting systems. The great trouble of the prevailing silvicultural practice of Europe is that it is guided almost entirely by the economic principle; it seeks to increase the revenue from the forest and entirely neglects the natural principle which preserves the productive powers of the forest. Wagner places silviculture in the front and relegates the requirements of forest regulation to the second place. Such defense of the silvicultural practice by Wagner sounds especially interesting as he is a Professor of Forest Regulation at the University of Tübingen and is more concerned with the economic questions of forestry than with silvicultural ones. Accordingly, Wagner devotes practically all of his book to silviculture, and forest organization and regulation are discussed only in the last few chapters. In pointing out the defects of artificial reproduction he dwells especially on the spruce plantations and calls them an insult to nature. Horizontal spreading of the roots inherent to spruce under natural conditions, in artificial plantations become vertical, which in his opinion, is the source of many evils in the further development of the tree. Natural reproduction alone is the nature's way and has many advantages, as it produces the best seed and tends to develop climatic races most suitable to each site.

The present German forest management with its prevalent artificial reproduction the author considers not intensive, in spite of the great application of labor and capital. The virgin forests of Russia, Sweden, America, and Austria furnishes to the world market products, the cost of production of which includes only the expense involved in their harvesting and transportation. Germany which receives part of its timber supply from abroad, must compete with the products of the world and sell the timber from its own forests at a price lower than their cost of production. For this reason Wagner thinks German forest management must increase its intensiveness at the expense of natural factors; must resort to the free forces of nature as productive factors and eliminate the application of labor as much as possible. Only means of transportation, in his opinion, deserve expenditures of large amounts of capital and labor. He recognizes the value of artificial reproduction only as means of filling in fail places under natural reproduction. The method which he advises in such cases is ball planting of spruce.

Being an ardent advocate of natural reproduction, he discusses in detail the conditions under which natural reproduction is possible. The silvicultural systems are dictated by the size of the cuttings. Cuttings over large areas require reproduction at the same time over the entire area, and this can be attained only by clear cutting or shelterwood systems of cutting. Cuttings over small areas require a gradual but constant reproduction over small areas, and this can be secured only by the selection cutting in its various forms. All silvicultural systems of cutting the author analyzes from the point of view of their effectiveness in securing natural reproduction. He entirely rejects simultaneous cuttings over large areas for the reason that they do not correspond to the nature of the forest. As opposed to cuttings over large areas at one time he considers cuttings over small areas under which natural reproduction gradually extends to the entire cut-over area as the form of forest management which corresponds most closely to the nature of the forest. The selection cuttings of Schwartzwald and of the Vosges, and the selection cuttings in groups of Bavaria have many advantages, but require favorable conditions for success and therefore are not applicable everywhere. It is a well known fact that the appearance and the development of natural reproduction depend almost entirely upon humidity, and therefore the author discusses the silvicultural systems of cutting with reference to this factor. Under the shelter of a uniformly thinned-out stand, the humidity of the soil is not in the optimum condition, because the crowns of the trees intercept a part of the atmospheric precipitation and the roots of the trees drain and dessicate the soil. In selection cuttings in groups the moistening of the soil is in a better condition, and for this reason natural reproduction appears more readily in such groups and develops well. When, however, these groups are widened, too much light is allowed at once and the soil becomes dry. In his opinion, a narrow strip protected by the shade of the adjoining forest is in the optimum condition as far as the humidity of soil is concerned.

The essential features to be considered in securing natural reproduction are therefore the control of the relation of crown density to the amount of precipitation which is allowed to reach the ground, as this relation determines the humidity of the soil and consequently the appearance and development of natural reproduction. This relation, however, is not the same for the appearance of natural reproduction and for its further development. Wagner proposes, therefore, a silvicultural method of cutting under which natural reproduction appears under the shelter of unevenly thinned stands and its further development proceeds on a narrow strip entirely clear of trees but shaded on one side. The central idea in Wagner's method is to locate the cuttings in optimum conditions of humidity by giving them a definite direction and form. This method of cutting he calls "Blendersaumschlag," that is, selection cutting in narrow strips, and to the discussion of this method of cutting, he devotes the greater part of his book.

Wagner's method of cutting is extremely simple. On the edge of a forest which is to be cut over and reproduced a narrow strip of timber is cut out. Adjoining this narrow strip another strip is laid out on which the timber is thinned out not uniformly over the entire strip. Gradually, as natural reproduction appears on the clear cut and thinned strips, the timber remaining on the thinned strip is cut off and another strip adjoining the last one is laid out on which the timber is again unevenly thinned out. In this manner the cuttings are moved gradually more and more into the interior of the untouched stand. The strips on which natural reproduction has taken place are gradually freed of all timber. The timber is being felled in the direction of uncut area and not toward the area that has been naturally reproduced. The width of each strip is narrow and the cuttings are done at very short intervals. The author pays a great deal of attention to the direction of the cutting areas and considers the compass as one of the most necessary instruments in laying out the cutting areas. By means of a whole series of very ingenious schemes the author analyzes all possible directions of cutting under which the optimum conditions of the soil humidity may be secured. He believes that the commonly accepted direction of the cuttings from east to west has many disadvantages. The easterly and westerly orientation of the cuttings does not protect natural reproduction against frosts; the upper layers of the soil dry out considerably, and the rains which are brought by westerly and southwesterly winds, are intercepted and so reach the ground only in small quantities. A cutting area is in optimum condition when it is fully open to the rains, and at the same time shaded. In central Europe where the prevailing westerly and southwesterly winds are the ones which bring rains, natural reproduction springs up most readily on the edge of a forest exposed to the northwest and north. Here the dessicating effect of the midday sun is absent. Here the danger from frost is not great, and here also the snow accumulates in greatest quantities and, as it thaws gradually in the spring, helps to conserve the winter moisture in the ground. Furthermore, the formation of dew on these situations is greater and remains for a longer time of the day. In a word, the northwesterly and northerly walls or edges of the forest present the optimum conditions of soil moisture. The cuttings on east and south sides or edges of the forest are, on the other hand, exposed to the strongest light and for the longest time and therefore suffer from drought and frost and for this reason are not favorable to natural reproduction. An ideal direction in which cuttings should proceed is from the northwest to southeast. Because of the danger from wind he gives his cuttings an orientation from north to south. As the cuttings are scattered and only small, narrow strips are exposed to the wind, the damage from this source cannot be very great in one place.

The selection cutting in the form of narrow strips advocated by Wagner has the advantage of providing conditions for natural reproduction such as exist in a virgin forest. It affords an opportunity of making use not of one but of several good seed years; it can be practiced on very small areas and therefore adjusts itself to different requirements of forest management. It makes possible to raise mixed stands in any desirable combinations. If it is desired to have a predominance of tolerant species, the timber on the strips is thinned very lightly and gradually; if, however, intolerant species are preferred the crowns are thinned out more fully. As a result of this system of cutting pure, even-aged stands over large areas which are the necessary consequence of the present day methods of forest regulation in the European forests must disappear. In the last chapters of his book the author briefly criticises the methods of forest regulation and dwells especially on the regulation by the area-period allotment. All these methods lead to even-aged stands over large areas. They dictate the time and the progress of reproduction. They cannot make use of natural reproduction and depend entirely on artificial reproduction.

Such, in brief, are the contents of Wagner's interesting book. The conclusions to which the author came are based on his personal observations in the forest, and from applying the selection cuttings in the form of narrow strips on a forest near Heildorf. The results of this method of cutting are splendid. Two or three years after the strips are thinned, there may be seen natural reproduction especially of spruce, more rarely of silver fir, and still less of Scotch pine. The conditions at Heildorf, however, are very favorable, and what is possible at Heildorf may not be applicable in other places. The region in which Wagner is conducting his new method of cutting is characterized by abundance of atmospheric precipitation, by depth and freshness of the soil, by an advantageous silvicultural mixture of species, and simple topography; the felling and exportation of the timber is done by experienced laborers permanently in the employ of the forest administration; and by a high intensiveness of forest management. There is no doubt that the present methods of cutting as they are practiced in central Germany lead to even-aged stands over large areas. The return to more natural forms of stands is a very urgent necessity. Wagner offers a new method which, under favorable climatic and economic conditions, judging by the results obtained at Heildorf, will accomplish the end sought; under less favorable conditions, however, it may result in failure. The conclusions of the author apply chiefly to Norway spruce stands. To what extent this method is applicable also to pure stands of intolerant species, such as our western yellow pine, is very doubtful. Wagner's analysis of the conditions under which natural reproduction is possible, is so comprehensive and is in such accord with the new tendencies in forest ecology (Silvics), and since natural reproduction with us must, for the present, as a matter of necessity, remain the prevalent method of reproduction, his conclusions are of the utmost interest to us. It is very desirable that the forest experiment stations should take up this interesting question and test its suitability to some of our conditions.

R. Z.

The Specific Heat of Wood. By Frederick Dunlap. Bulletin 110, U. S. Forest Service. Washington, D. C. 1912. Pp. 28.

The specific heat of wood is its heat capacity compared with that of an equal volume of water. This bulletin deals with the specific heat of so-called "ovendry" wood, determined by measuring in a slightly modified form of Bunsen's ice calorimeter the quantity of heat given off by small cylinders of wood in falling from a temperature slightly above that of boiling water to that of melting ice. The standard "oven dry" condition was produced by drying the green or air dry wood for two days at above 105° C. and then weighing the cylinders at intervals until their weight became constant to within 1 milligram for eight hours. Material for the experiments was received from 16 important indigenous economic species which varied greatly in density and structure. This included material from different parts of the same plant and, in the case of species, from trees grown under varying factors of locality.

The conclusions to be drawn from these experiments are:

1. The average specific heat of "oven dry" wood is approximately 0.3249.
2. The specific heat of "oven dry" wood varies but slightly with change of species. Lowest recorded mean specific heat Chestnut .317, highest .337 Longleaf Pine.
3. The variation in specific heat within a species due to variation in locality is so small and inconsistent as to furnish no reliable basis for concluding that locality influences the specific heat of wood.
4. The transformation of sapwood into heartwood does not appreciably affect its specific heat.

In addition to the numerous experiments upon the specific heat of "oven dry" wood obtained by cooling cylinders from 106°—0° C, preliminary experiments with cooling from temperature of 60°+ and 23° C indicate a great variation of specific heat with temperature. Also an increase of specific heat was encountered which was apparently due to the effect of drying moist wood at 110° C in saturated steam.

The problem of artificial seasoning and preserving wood are so complicated, involving so many variable structural, chemical, physical and economic factors that investigations to unravel the tangle must be conducted with great care and thoroughness to avoid illogical and unwarranted conclusions. Scientific investigations and theories should be analyzed and tested accurately before heralding a solution of the difficulties which confront the business man.

Mr. Dunlap describes in detail the construction of apparatus, and outlines with much care the exact conditions of his experiments and the methods by which his results were secured and errors eliminated. Logical and scientific methods, a spirit of thoroughness and accuracy, and a bibliography of *previous investigations* make the bulletin a more valuable scientific contribution to our knowledge of wood than many previously published by the Forest Service. A continuation of these experiments, particularly in studying the effect of temperature and steam and the effect of moisture which occurs in wood as used in the dry kiln and preserving cylinder, should yield results of scientific and practical value.

I. W. B.

Report on Timber Conditions around Lesser Slave Lake. By D. R. Cameron. Bulletin 29, Forestry Branch. Ottawa, Canada. 1912. Pp. 54.

This report deals with a reconnaissance of country adjacent to Lesser Slave Lake made with the object of segregating non-agricultural land into forest reserves ahead of settlement. The general conditions of topography, soil, climate, forest growth, fire damage and reproduction, of some 6,700 square miles are discussed.

The forest areas are placed in nine classes.

The muskeg type, developed as marginal areas to river systems, undrained height-of-land areas, or plateau summits, predominates, aggregating some 30 per cent. of the area examined. The forest is largely dwarf black spruce, in some regions stunted tamarack.

The lodgepole pine type, occupying an equal area, is confined largely to the valley slopes of Swan Hills; on the benches a large admixture of black spruce occurs. The quality is indicated by the statement "on over 95 per cent. of the area the pine will never make tie size."

The poplar type aggregates some 21 per cent. of the total area, occupying the ground of a fire-destroyed original spruce forest. Eighty per cent. of the stand is aspen and 15 per cent. balsam poplar. One-half of the trees, at least, are useless, owing to the attacks of *Polyporus igniarius,* so that only seven cords of sound pulpwood per acre are estimated.

The plateau summits (20 per cent. of the area) carry a varying mixture of lodgepole pine, balsam fir and black spruce, of a stunted type valuable only as a protective covering.

The other types occupy but small areas. On alluvial benches are to be found stands of balsam poplar of large size. Stands of scrubby northern white birch, and pure stands of young jack pine averaging fifty years and eight inches diameter, occur locally. The heights of land are largely muskeg, with stunted tamarack and spruce, dotted with islands of boulder clay carrying open stands of poor jack pine or lodgepole. The commercial white spruce exists in small scattered patches which have escaped the fires.

The writer estimates for the whole area a stand of 33 million cords of pulpwood, 4 million ties, and 350 million feet of timber. One-seventh of the total land area has been burned over within the last twenty-five years, and being largely muskeg country there is little sign of good reproduction as yet.

The report closes with recommendations for a proposed reserve, outlines the fire ranger districts, and suggests needed trail improvements and extensions. The area is worthy of reservation, if for no other reason than to prevent unguided settlement.

J. H. W.

Forest Products of Canada, 1911: Tight and Slack Cooperage. By R. G. Lewis and W. G. H. Boyce. Bulletin 31, Forestry Branch. Ottawa, Canada. 1912. Pp. 13.

Slack Cooperage.—In 1911 there were manufactured in Canada 102,787 thousand staves, valued at $710,717; 8,808 thousand sets of heading, valued at $482,370; and 35,779 thousand hoops valued at $272,615; a total of $1,465,702 for the industry. It is estimated that this industry uses over 60 million feet, board measure, of logs.

Of the staves 50 per cent. were of elm, 30 per cent. of spruce, and 6 per cent. of poplar. The use of elm is decreasing (exhaustion in Ontario), that of spruce increasing. Elm staves averaged $7.60, and spruce $5.66, per thousand.

Of the heading manufactured, one-third was of poplar, one-quarter of spruce, and one-eighth of elm. The average price, per thousand sets, was $56.73, $53.04, and $51.26, respectively.

For hoops, elm formed over 75 per cent., spruce 12 per cent., and birch 9 per cent., with average prices of $7.99, $6.76, and $6.00, per thousand.

The slack cooperage industry is largely carried on in Ontario and Nova Scotia, the former using about two-thirds and the latter about one-quarter of the total quantity. New Brunswick ranks third, while the industry is practically undeveloped in British Columbia and Quebec.

The above figures do not include those of the nail-keg industry, for which a separate table is given. In this industry a total of 13,883 thousand staves, 577 thousand sets of heading and 989 thousand hoops was used, with a total value of $61,029. Spruce was most largely used for staves and heading, while all the hoops were of elm.

Tight Cooperage.—This industry necessarily amounts to very little in Canada owing to the scarcity of white oak. Most of the oak staves are manufactured from imported logs. Less than 5 million staves were reported, and 828 thousand heading sets.

J. H. W.

Turtle Mountain Forest Reserve. By R. L. Campbell. Bulletin 32, Forestry Branch. Ottawa, Canada. 1912. Pp. 20.

The Turtle Mountain Reserve, established in 1895, comprises nearly 70,000 acres situated along the international boundary in southwestern Manitoba. This bulletin contains an account of its natural features and resources. The reserve has been devastated by fire, over ninety per cent. having been burned over within the last twenty-five years. The burned-over area, however, bears a promising reproduction of poplar and birch.

Despite the small stand of timber the reserve is a specially important one locally. Its supply of fuel, posts, poles, etc., in the midst of a prairie region is valuable; hay is cut on a permit system, and arrangements have been made for restricted grazing use. Besides this direct value to the settler, and its importance in conserving water supply, the reserve is becoming more popular each summer as a recreation ground. Thus it fulfills all the beneficial functions of a public forest.

J. H. W.

What is the Matter with the Elms in Illinois? Bulletin 154, Illinois Agricultural Experiment Station. 1912.

A timely bulletin appeared from the Illinois Agricultural Experiment Station in February. Many complaints have been received from that section regarding the unhealthy condition of the American elm. The trouble is distributed over nearly the entire state and is, for the most part, confined to cities and towns. It manifests itself by the leaves ceasing growth, turning brown and finally falling, first on the terminal twigs and later on the larger branches, between early summer and autumn. This is followed by the progressive death of the branches, and in a year or two of the entire tree. However, the tree may often survive five or six years, or, in mild cases, may recover.

The cause seems to be chiefly a physiological one, as an examination of the roots indicates. The elm in its natural habitat grows in loose, shaded fertile soil. In cities the environment is wholly unnatural, resulting in a weakened condition of the tree, particularly when the climatic factors are unfavorable. The bark insects which soon appear seem to be a secondary factor which hastens the death of the trees.

If the weather of the next few years is normally moist it is quite probable that many of the injured trees will recover and the general condition of the elms throughout the region may improve. The remedial measures suggested are proper care in watering, fertilizing and pruning, which should always be followed by a suitable wound dressing. To keep borers away from the trunks and large limbs painting with a mixture of 1 gallon soft soap and 1 pint crude carbolic acid in 8½ gallons of water is recommended.

An emphatic protest is entered against the practice of topping or pollarding trees like the elm.

OTHER CURRENT LITERATURE.

Mechanical Properties of Redwood. By A. L. Heim. Circular 193, U. S. Forest Service. Washington, D. C. 1912. Pp. 32.

Condition of Experimental Chestnut Poles in the Warren-Buffalo and Poughkeepsie-Newton Square Lines after Five and Eight Years' Service. By C. P. Winslow. Circular 198, U. S. Forest Service. Washington, D. C. 1912. Pp. 13.

The Absorption of Creosote by the Cell Walls of Wood. By C. H. Teesdale. Circular 200, U. S. Forest Service. Washington, D. C. 1912. Pp. 7.

Emory Oak in Southern Arizona. By F. J. Phillips. Circular 201, U. S. Forest Service. Washington, D. C. 1912. Pp. 15.

The Profession of Forestry. By H. S. Graves. Circular 207, U. S. Forest Service. Washington, D. C. 1912. Pp. 17.

Extracting and Cleaning Seed. Compiled by the Branch of Silviculture. Circular 208, U. S. Forest Service. Washington, D. C. 1912. Pp. 23.

Tests of Structural Timbers. By McGarvey Cline and A. L. Heim. Bulletin 108, U. S. Forest Service. Washington, D. C. 1912. Pp. 123.

Distillation of Resinous Wood by Saturated Steam. By L. F. Hawley and R. C. Palmer. Bulletin 109, U. S. Forest Service. Washington, D. C. 1912. Pp. 31.

Lightning in Relation to Forest Fires. By F. G. Plummer. Bulletin 111, U. S. Forest Service. Washington, D. C. 1912. Pp. 39.

Fire-killed Douglas Fir: A Study of its Rate of Deterioration, Usability, and Strength. By J. B. Knapp. Bulletin 112, U. S. Forest Service. Washington, D. C. 1912. Pp. 18.

Forest Conditions in Louisiana. By J. H. Foster. Bulletin 114, U. S. Forest Service. Washington, D. C. 1912. Pp. 39.

Possibilities of Western Pines as a Source of Naval Stores. By H. S. Betts. Bulletin 116, U. S. Forest Service. Washington, D. C. 1912. Pp. 23.

Forest Fires: Their Causes, Extent and Effects, with a Summary of Recorded Destruction and Loss. By F. G. Plummer. Bulletin 117, U. S. Forest Service. Washington, D. C. 1912. Pp. 39.

Western Hemlock. Silvical leaflet 45, U. S. Forest Service. Washington, D. C. 1912. Pp. 6.

Broadleaf Maple. Silvical leaflet 51, U. S. Forest Service. Washington, D. C. 1912. Pp. 4.

Oregon Oak. Silvical leaflet 52, U. S. Forest Service. Washington, D. C. 1912. Pp. 4.

Red Alder. Silvical leaflet 53, U. S. Forest Service. Washington, D. C. 1912. Pp. 4.

Record of Wholesale Prices of Lumber. Based on actual sales made F. O. B. mill, for April, May, and June, 1912. U. S. Forest Service. Washington, D. C. 1912. Pp. 15.

A Working Erosion Model for Schools. By D. C. Ellis. Circular 117, Office of Experiment Stations. Washington, D. C. 1912. Pp. 11.

Damage to the Wood of Fire-killed Douglas Fir, and Methods of Preventing Losses, in Western Washington and Oregon. By A. D. Hopkins. Circular 159, Bureau of Entomology. Washington, D. C. 1912. Pp. 4.

General Information Regarding the Yosemite National Park. Department of the Interior. Washington, D. C. 1912. Pp. 22.

Contains a general statement regarding the location and creation of the Park; transportation, hotels and camps; and distances to the principal points of interest. A bibliography of books and articles pertaining to the Park is attached.

Similar publications are issued for the Crater Lake, Mt. Rainier, Mesa Verde, Sequoia and Grant, and Glacier National Parks.

Water Resources of the Penobscot River Basin, Maine. By H. K. Barrows and C. C. Babb. Water-supply Paper 279, U. S. Geological Survey. Washington, D. C. 1912. Pp. 285.

Contains an interesting chapter on log driving and lumbering on this stream.

National Reservation for the Protection of Wild Life. By T. S. Palmer. Circular 87, Bureau of Biological Survey. Washington, D. C. 1912. Pp. 32.

The Planting and Care of Shade Trees, by A. Gaskill; including papers on *Insects Injurious to Shade Trees,* by J. B. Smith, and *Diseases of Shade and Forest Trees,* by M. T. Cook. Forest Park Reservation Commission. Trenton, New Jersey. 1912. Pp. 128.

Largely a reprint, with revisions.

Forestry and Forest Resources in New York. By F. A. Gaylord. Bulletin 1, Division of Lands and Forests, Conservation Commission. Albany, New York. 1912. Pp. 58.

Discusses existing conditions and future possibilities.

The Conservation Law of the State of New York. Chapter 647, Laws of 1911, as amended by Chapters 318 and 444, Laws of

1912. Compiled by the Conservation Commission. Albany, N. Y. 1912. Pp. 167.

The Determination of Woods. By C. A. Darling. Reprint from Torreya, Vol. 12, No. 9, September, 1912, pp. 201-208.

This is a key for the identification of certain North American woods.

Outline of the Smoke Investigation. Bulletin 1, Department of Industrial Research, University of Pittsburg. 1912. Pp. 16.

The Pennsylvania Chestnut Blight Conference. House of Representatives, Harrisburg, Pa. 1912. Pp. 253.

A Forester's Notes from Europe. By J. S. Holmes. Press Bulletins 63, 85, and 87. North Carolina Geological and Economic Survey. Chapel Hill, N. C. 1912.

Joint Conference of those interested in the Conservation and Development of the Natural Resources of Michigan held under the Auspices of the Public Domain Commission. Lansing, Mich. 1912. Pp. 121.

First Annual Report of the State Forester, Minnesota Forestry Board. Duluth, Minn. 1912. Pp. 116.

Deals very largely with the work of fire protection.

Forest Protection Law, to Preserve Forests and Prevent and Suppress Forest Fires. By J. R. Welty. Olympia, Washington. Pp. 25.

Wood-using Industries of California. By A. K. Armstrong. Bulletin No. 3, State Board of Forestry, in coöperation with U. S. Forest Service. Sacramento, Cal. 1912. Pp. 114.

Forest Products of Canada, 1910. (Being Bulletins 21 to 27.) By H. R. MacMillan. Bulletin 28, Forestry Branch. Ottawa, Canada. 1912.

Report of the Thirteenth Annual Convention and Meeting of the Canadian Forestry Association held at Ottawa, February, 1912. Ottawa, Canada. 1912. Pp. 123.

Commission of Conservation: Report of Third Annual Meeting. Ottawa, Canada. 1912. Pp. 154.

Thirty-seventh Annual Report of the Ontario Agricultural College and Experimental Farm, 1911. Legislative Assembly, Toronto, Canada. 1912. Pp. 278.

Contains the annual report of the department of forestry, pp. 261-265.

A Critical Revision of the Genus Eucalyptus: Volume II, parts 4, 5, and 6, (parts 14, 15, 16 of the complete work). By J. H. Maiden. Sydney, New South Wales. 1912. Pp. 134-163, plates 61-64; pp. 164-184, plates 65-68; pp. 185-216, plates 69-72.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forestry in Mexico.

The United States of Mexico comprise 27 sovereign States and three unorganized territories, besides the Federal District—the City of Mexico and its surroundings (about 600 square miles). The latter contains about 75,000 acres of wooded area, but only 3,700 belong to the government. Outside of the federal district the government property consists of vacant or ownerless lands, but it is not known where exactly these are situated or what extent they have.

The whole forest area is estimated at about 20 million acres, or 25% of the whole country. Exploitation of the crudest kind is the rule even in the valley around the city. Wherever accessible in the neighborhood of settlements and along railroads, no real forest is to be seen, but away from means of transportation there are large untouched forest areas, awaiting development. More than 300 species are found to compose the forest, (among these, some excellent yellow pine over large areas and equally excellent oaks on the Sierra Madre).

The first beginnings at regulating forest use of the national forests date back to a decree in 1881 and a law of 1894 with regulations for its execution, prescribing the manner of their exploitation. These prescriptions seem to have remained a dead letter. They referred only to the small federal holdings, while in the States the control of forests is entirely in the hands of the governors and there is no restriction in their use, as this would offend the conceptions of private rights.

In 1904 a "Junta central de Bosques" was formed by private initiative—a forest council or forestry association, which received official recognition by the government and was subventioned through the Minister of Agriculture (Fomento) with a view of improving matters.

This council, however, confined itself mainly to the growing of seedlings for free distribution, from nurseries established near

Mexico City and, since ornamental and fruit trees were more popular than forest trees, the distribution gradually took shape in that direction. In 1907, at the instance of the council, four French foresters were imported to take charge of the nurseries and planting and possibly of the management of the federal forest area. But the Department of Public Works was not disposed to cede jurisdiction over the latter. The only result, therefore, besides the nurseries was a successful plantation to bind the sand dunes or shifting sands near Vera Cruz after creating a litoral dune. Even this work was done under bickerings by the local members of the association itself.

Since in the dry climate of Mexico without rain for seven months it is hardly possible without irrigation to make trees grow, the results of the planting efforts compared with the expense have, indeed, remained disappointing.

A re-organization took place in 1909 which placed the forest service specially on a new footing under the Department of Public Works (Fomento) in the Direction of Agriculture. This Direction is divided into five sections 1. Agricultural teaching and experimenting, pathology of plants and animals; 2. Agricultural propaganda; 3. Rural economy and statistics; 4. Forestry; 5. Biological exploitation of the national domain.

The Central Council becomes then also a part of the Direction of Agriculture in section 4, which has in charge "the conservation, exploration, exploitation and police of the national and municipal woodlands in the Federal District and the Territories." The Section is to make a reconnaissance of the public timber and determine which areas are ready for immediate exploitation and which are to be "reserved for reforestation." The exploitation is done under timber licenses running for not more than 10 years under conditions prescribed by the Minister, among which a bond in proportion to the value of the limit. For special woods, dye woods, ebony and other extraordinary forest products an annual ground rent equal to 6% of the value of the territory according to a variable valuation is imposed.

Provision is made for reservations to protect water courses or for other reasons, and for this purpose expropriations may be made, especially if replanting is necessary, or else arrangements with the owners for conservation or reforestation of their lands may be made. For this purpose subventions may be made. Regulations for the control of hunting and protection of animals form part of the decree.

For 1910-11 a budget of $55,000 was granted, out of over one and a half million for the entire Department of Public Works.

Notes Forestières d' Amèrique Mexique. Revue des Eaux et Forêts, Oct. 15, 1912, pp. 619-624.

Forests of Australia.

As is well known, the interior of Australia as well as the west, northwest and south coast are mainly occupied by savannah and scrub growth, besides the treeless sand and salt deserts. Only the interior mountains show denser tree growth. The savannah forest—grassy plain studded with trees consists of Eucalypts, Casuarinas and small Acacia species. Real forest is found only in the North and East. Where, as in Queensland, precipitation is plentiful a true tropical rain forest of many species and luxuriant undergrowth, lianas, palms, pisang, etc., is found. In drier portions "gallery" forests —belts following the rivers— are typical.

According to official estimates, the Commonwealth of the six States has only 159,375 square miles or 102 million acres, or 5.35% of forest area. Queensland leads with 40 million acres, West Australia is next with 20 million, New South Wales has 15 million, Victoria 11.8 million, Tasmania 11 million and South Australia 3.8 million acres. These estimates are, however, believed to be very conservative. This may be true as far as forest land is concerned, but as exploitation has undoubtedly destroyed much, these figures probably represent the productive portion.

So far only 16.7 million acres have been placed in forest reservation.

New South Wales leads in this direction with over half its forest area in reserve; Victoria next with one-third; Queensland following with nearly 25 per cent.

Each of the States has a forest department, most of them of recent origin. The first was inaugurated in New South Wales in 1877, but a re-organization and more far-reaching though still crude legislation was enacted in 1910. In the main, exploitation is still the rule, and most of the States have a surplus, although small ones, from the forest administration. New South Wales, for instance, until 1896 worked with a deficit, but during the years 1905-1910 cleared about $800,000; Victoria $200,000, while West and South Australia worked with deficits (the latter largely through planting). For the whole Commonwealth, the balance of the five-year period leaves $367,000 to the good. The importations of wood, largely from the United States, during the five-year period averaged about 300 million feet B. M., valued at around 8 million dollars. The imports from the United States represent 40 percent of the total, New Zealand coming next with nearly 26 percent and Norway third with nearly 20 percent. As against this import, the export amounts to around 150 million feet and 3.8 million dollars, so that Australia imports nearly half her wood consumption.

Die Wälder Australiens. Zeitschrift für Forst-und Jagdwesen. October, 1912. Pp. 637-641.

Australian Timber

Australia furnishes a number of highly valuable woods among which the following: Black Bean, *Castanospermum australe,* from the northeastern part of the island rivals the Italian walnut in beauty of wood but is not considered so durable. White Beech is soft, easy to cut, and well suited for carvings that are broad in treatment. It is almost immune from worm attack and is used largely for veranda floors, decks of coast vessels and for other purposes demanding a clean, light, easily worked wood. Silky Oak, *Grevillea robusta,* much resembles East Indian satin wood. It has a very even grain and is comparatively soft. Locally it is used for butter kegs, churns, butter baskets, veneers, light cabinet work and was originally used for boomerangs.

Tulip Tree, *Harpullia pendula,* is best suited for lithographers scrapers and engraving. It is prized for ornamental cabinet work because of its alternate bands of black and yellow. Jarrah, *Eucalyptus marginata,* is the pre-eminent tree of Western Australia. It is estimated to cover 14,000 square miles where the best timber grows on ironstone ridges. This species is valued in ship building, paving, furniture and joinery. Karri, *Eucalyptus gomphocephala,* occurs in the southwesten part of the Island. Locally it is used for building, wheels, piles, and bridges.

Red Cedar, *Cedrela toona,* yields beautifully figured wood near the root and the branches making it very valuable for veneers. It is fragrant, moderately hard, easily worked, and termite proof which allows its use for cabinets, wardrobes, doors, paneling and other interior fittings. Rosewood, Coachwood, and Blackwood are three other species of considerable importance especially for cabinet purposes.

Forestry in Indo-China

As is well known, the part of Indo-China, embracing Cochin-China, Cambodia, Annam, Tonquin, and Laos, is a colony of France since 1883 and in part earlier in the sixties. One would have expected that the well-organized forest department of the home country would have had an influence which would have early led to some attempt at forest control, but it was not until 1894 that in Cochin-China some kind of a control was attempted and not until 1901 that a real forest service under the Department of Agriculture with a director and four assistants and agents placed in charge of allotted territories was inaugurated.

Professor Guyot, in a short note reveals now a most curious condition of affairs in regard to this service. The organization was on January 1, 1912 broken up by the governor-general, and instead five independent services, one in each of the five provinces were instituted, apparently without any authorization from the President of the Republic or the Minister of Colonies. The former bureau, however, remains as a board of control and to unify the work of the five local bureaus. It is not quite clear, what the powers of the bureau of control is and whether the arrangement approaches the excellent idea of the district offices of the U. S. Forest Service, or indeed whether it is administratively wrong or merely the act of the governor ethically reprehensible.

Another conflict or doubt seems to exist in the handling of the revenue derived from forest exploitation and as to the ownership of the forest areas. In Paris it is supposed that the colonial forests are property of the State of France, and hence the State has the independent disposal of the revenues, even though it may as a rule leave them to the colonies for their development. At present, Guyot admits, the question is not pressing for the revenue so far does not exceed $80,000, but in a few years it may be ten times as much. Since the home country will be called upon to help in the development of the colony, it should be definitely settled that the home government will not abandon this source of revenue.

It appears that the new governor—governors are always changing and anxious to introduce new ways—in his budget makes no allowance for the interests of the home country, but with a free hand distributes directly as a subvention the revenue to the different provinces in the Union, contrary to the orders of the home government.

Le Service Forestier en Indo-Chine. Revue des Eaux et Forêts. July 1, 1912. Pp. 395-397.

Forestry in Argentine

It is astonishing to read in a volume of laws published in 1901 at Buenos Ayres, that as early as 1827 a decree for the reservation of all public timberlands was issued and a project was to be elaborated by the Topographic Survey for the utilization of the woods. Nothing more is noted until 1880, when an edict to stop irresponsible cutting of timber on unlicensed lands was issued, this and other subsequent edicts showing that it was difficult to cope with this abuse of the public domain. In 1892, in the financial budget, forest inspectors are mentioned attached to the Bureau of Lands and Colonization, and since 1900 several decrees constitute forest reservations. In 1903, the "law on lands" prescribes that areas stocked with building timber shall not be sold or rented but are to be reserved for forest purposes. Every purchaser of government lands is to plant 100 trees for every 6 acres but a payment of 50 cents per tree releases from this obligation.

In the same year a forest service was organized, and in 1905 measures against forestfires were inaugurated and every limit holder in the forests was obliged to replant two trees of the same species for every one cut, the plants being furnished by the forest service, and to care for and replace lost trees under the superintendence of the Inspector General of Forests.

The final comprehensive law of 1906 places under the forest law all wooded areas belonging to the State, those of the provinces who desire to profit from the arrangement and those of the municipalities, corporations and private owners who desire it.

The State is divided into four forest zones, and each of these into districts and sections as needed for administrative purposes. All government timberlands of commercial value are provisionally reserved until they can be mapped and finally reserved. The final reservation is to include the mountain forests, those needed for protection of soil, dunes, torrents, rivers, watersources.

The exploitation is carried on under timber licenses secured by sealed bids, a concession covering not more than 25 acres and for not longer than 10 years at a ground rent which is to be not less than 10% of the value of the wood cut at the place of shipment.

The Forest Service is placed under the Direction of Lands and Colonization, the Minister of Agriculture with the assistance of a Forest Commission being in charge of this Direction. The Forest Service comprises also a section of fisheries, and of chase and of fish culture. It is under a Director, under whom a chief forester and seven inspectors are placed, altogether 30 employes form the main office with a salary list of $4370 per month, the head being paid $850 (silver) per month. The section of sea fisheries and chase is placed under a chief with a zoologist, two naturalists and a number of minor assistants, altogether 16 employes. The section of fish culture is separately organized under the same chief, however, and has charge of the river fisheries.

The total budget of the Department of Agriculture in 1906 amounted to nearly 5 million dollars, one fifth of which sum was for the forest service.

An arborday—the 9th of July—is also legalized.

Revue des Eaux et Forêts. Sep. 15, 1912. Pp. 545-550.

Aspects of South African Forestry

Mr. D. E. Hutchins, in his report, states that the total area of indigenous forests in Cape Colony, from Cape Town to Natal, is estimated at 500,000 acres or 810 square miles, or $\frac{1}{2}$ percent of the total area of the Colony. All except about 30,000 acres of this is Government forest worked systematically by the Forest Department. These forests are estimated to yield from 6 to 10 cubic feet per acre annually. Contrasted with this small yield he gives a number of results obtained from Eucalypts and pine plantations. The pines range from 170 to 341 and the Eucalypts from 332 to 533 cubic feet per acre per year.

At that time the value of timber imported into Cape Colony amounted to from $1,250,000 to $2,500,000 annually. A large percent of this amount was spent for the purchase of railway ties, most of which were Eucalypts from Australia. To avoid this latter outlay the government is laying out tie plantations of Eucalypts, which, it is expected, will ultimately supply the need. Various species of pines as well as of other sorts are also being tried in plantations. In 1903 it was estimated that there were 20,000 acres of plantations established, the thinnings from which already bring in sufficient revenue to cover expenditures—before a stick of the main crop is cut.

The South African Railways Company has also set aside 30,000 acres for tree planting and has so far planted 8,000 acres.

M. L. M.

From the Report of the South African Association for the Advancement of Science, Vol. I., April, 1903.

Forestry in South Africa

Consul Edwin N. Gunsaulus of Johannesburg, South Africa, reports that "Outside of the operations of the Forest Department there are practically no forestry operations in South Africa. The Government holds nearly all the lands of forest value, and the Forest Department purchases seeds from abroad and both sells seeds and raises large quantities of trees for transplanting, which it sells at low rates to the public. The officer in charge of the Forest Department of the Union of South Africa is Mr. J. Storr Lister, Chief Conservator of Forests, Pretoria, Transvaal.

"Elementary forestry, enabling students to enter the subordinate grade of the Government forest department, is taught at the Government forest school at Tokai, near Cape Town, Cape Colony, and a course in forestry suitable for farmers is given at the Government agricultural school of Cedara, in Natal Province. Vacancies in the higher grades of the forest service are filled from the South African Rhodes scholars who successfully pass through the Oxford School of Forestry, with its attendant courses on the Continent of Europe."—American Forestry, May 1912, p. 319.

Forests of Tunis

In the North African country which has been absorbed by France, the forests are State property. They cover about 5,000 square kilometers (1,930 square miles) and are divided by the Medjerdah Valley into two districts or sections. The northern of these, covering the Kroumerie Range and the Nefza and Mogod districts, are zee oaks and cork oaks; the latter on the eastern and southern slopes, the zee oaks on the northern.

At the foot of the mountains are wild olive trees, elm, willow, white poplar, ash and Thuya. The forests south of the Medjerdah (mostly spruce and pine) have been well cleared by unscrupulous and uncontrolled feeling. Since 1884, the Kroumerie forests have been regularly operated on scientific and business principles; the output being cork, tan bark and railway ties.

The cork oaks cover about 90,000 hectares (206,000 acres). In the vicinity of the Kroumerie they are found in number, and their nearness to the coast and the railway render their exploitation easy. The cork bark has a thickness of about 25 to 27 centimeters (9.35 to 10.6 inches) and is skinned off every 8 to 12 years. The wood is hard and difficult to split, but is good for fuel, and yields fine charcoal. From 1900 to 1907 over 3,600,000 francs (says $720,000) worth of cork was sold from these forests, which was mostly exported to France and Algeria, where it is made into corks.

The tan bark is sold each April in Tunis and mostly to Tunesian and Italian merchants, and sent to Italy, Portugal and Egypt.

The zee oak wood, which dries slowly, is prime for railway ties; the other sorts there found—except the thuya—are of little value.

In 1910 Tunis imported 2,525,146 francs, (say $500,000) worth of lumber, including 48 tons of American pitch pine worth 7,423 francs ($1,480). Of walnut, Tunis received about 290 tons from America.

It will be seen that there is here is a field for American enterprise.—American Lumberman, September 28, 1912.

Forests of Chile

The Chilean Congress is seriously discussing a revision of the forestry laws of the country with a view of preserving a large area of forests now in existence near Valparaiso, according to United States Consul Alfred A. Winslow at Valparaiso. During the last few years large areas of forests have been cleared for agricultural purposes and the work is still going on.

The forests of Chile contain several classes of useful timber, among them being roble, known as Chilean oak and very useful where strength is required; rauli, valuable for furniture, giving a good polish and grain; lingue, noted for its excellent tanning bark, said to equal the tree known for this property; quillay or soap tree, valuable for its bark for cleaning purposes (it yields also fair tar); elmo or elm, that grows very large and makes about the best light lumber produced in the country.

Most of the timber in Chile is very heavy and it is almost impossible to raft it down the rivers, which makes it difficult to get to market unless near a railway. The lumbering business has not increased in Chile as in most other parts of the world because of the reasons mentioned, and there does not seem to be any immediate future for it unless more capital is employed and additional railroads are built. The imports of lumber for 1911 amounted to 35,461,000 feet, of which 33,920,000 feet came from the United States.—American Lumberman, November 2, 1912.

Teak in Burmah.

The teak forests in Burmah are under supervision of the British Government which uses about one-half of the out-put in the construction of battle-ships for the exposed parts. The average commercial log from these forests is about 20 feet long and squares 18 inches. The trees are girdled a year before cutting so that they will be dry enough to float. The logs are brought to the landings and docked by elephants. One elephant can carry a log weighing as much as 1,200 pounds. The average animal weighs about 6½ tons and is valued at $5,000. On account of the excessive heat they are worked only 3 hours a day.—Lumber Review.

Forests of Turkey.

On the basis of a report of the Turkish Ministry of Mines and Forests respecting the forests of Turkey, the condition may be briefly described as follows:

The total wooded area of the whole Turkish empire is estimated at 21,745,300 acres. Of these, 88.03% belong to the State, 1.23% are in mortmain, 1.66% belong to the Communes, 6.13% to private individuals and the ownership of 2.96% is uncertain.

Of the area under forest, the following percentages are covered by these species.

	Per cent.		Per cent.		Per cent.
Spruce,	13.72	Poplar,	1.30	Alder,	0.73
Beech,	11.19	Olive,	1.21	Lime,	0.73
Silver fir,	9.64	Chestnut,	1.14	Box,	0.58
Hornbeam,	5.06	Elm,	1.14	Birch,	0.38
Ilex,	3.67	Ash,	0.97	Gall-Oak,	0.18
Cistus,	3.04	Velani-Oak,	0.83	Elecampane	0.12
Laurel,	1.53	Plane,	0.79	Cypress,	0.12
Pine,	1.44				

As is shown, nearly nine-tenths of the forest belong to the State, which, however, turns it to little account, and even allows the herdsmen to burn it down, while the peasants and woodcutters destroy the trees in a ruthless manner. A State Forestry Department is practically non-existent. There is only a department of the Ministry, and scarcely any foresters or rangers are to be found in the woods. There is also no sign of any improvement in the matter.

According to the *Annuaire Oriental* 32e *Annee,* 1912, pp. 79-81, there are: Ministry of Commerce and Agriculture (Tidjaret vé Ziraat Nezaréti), General Direction of Forests (I General Director, 3 General Controllers); Ministry of Finances (Malié Nezaréti), General Direction of Domains; Ministry of

Charitable Funds (Evkaf Houmaizoum Nezaréti), Forests and Vakoufs-Lands Section.

The Turkish Government has given permission to the mitred Abbot of the Mirdites to exploit, for 15 years, the magnificent oak forests in the territory of the Mirdites, and Prince Bib Doda sold, two years ago, a large forest near Lake Scutari, to some Italians, who have organized the exploitation of its resources.

Waldbestände und der Holzhandel in der Türkei. Continentale Holz-Zeitung. June, 1912. Pp. 221-222.

Forests of Greece.

Of the total area of Greece 12.67% or about 2 million acres are woodland, including shrubby pastures. Of this area 80% belong to the State, the balance is private property. The mountains in northern Greece (Pindos, Ossa, Helion) and the middle provinces are the best wooded parts. The coast and the islands are forestless. Maresch believes that Greece in olden times was much better forested, due to holy groves which were destroyed in the Christian era. The decimation continues through herding of sheep and goats (3 million of the latter), and through fire to secure grass. Statistics place the annual decrease of forest at 1.2% or 25,000 acres. Among the conifers firs prevail (35%), especially *A. apollinis, panachaica, cephalonica;* spruce is common and *Pinus halepensis* (20%). Among broadleafed trees oak is most common, chestnut and beech come next, besides about 60 other species.

No forest management seems to exist, exploitation is the rule. The State secures annually about $225,000, the cut being about 28,000,000 cubic feet. A large importation from Austria, Turkey and Roumania is necessary.

Ueber Griechenlands Wälder. Centralblatt für das gesammte Forstwesen. April, 1912. Pp. 195-6.

Forests of Santo Domingo.

The forests of Santo Domingo were studied by Mr. Karl W. Woodward in 1909. The republic contains nine and a half million acres of forest or 85 per cent. of the total area. More than half of the area is unfitted for farm use. Three types are distinguished: the humid hardwood, the dry hardwood and the pine types. Typical trees of the humid hardwood forests are mahogany, cigarbox cedar, silk cotton tree, royal palm, walnut, *Pinus occidentalis, Xanthroxyluem* and "oak" (*Tecoma*). Bayahonda, campeche, mahogany, dividivi, and lignum vitae are characteristic of the dry hardwood type while the pineries consists of pines and a juniper (*J. barbadensis* Lam.). These types contain eleven billion feet of hardwoods and three billion feet of pine with a total value of nearly twelve million dollars. Lack of roads renders it impossible to realize this value at the present time.

Wood exports amounted to $150,000 in 1910 of which lignum vitae contributed more than half and mahogany about nine per cent. England was the largest customer while the United States bought a little less. Ten per cent. went to Germany.

Nutzholzbestände in der Dominikanischen Republik. Silva. January, 1912. Pp. 21-2.

Plant Associations of North Central New Mexico.

Watson has reported upon several years of study in the region where the 35th parallel crosses New Mexico. The altitude of the region extends from approximately 5,000 feet in the valley of the Rio Grande to 11,000 feet on the Sandia Mountains. The topographic forms include: a river vallev composed of beds of adobe clay, sand and gravel; a gradually sloping plain of stream origin consisting of ancient gravels and clays intermixed with sand fans and other detritus resulting from the weathering of the mountains; mesas, sometimes covered by a lava flow so recent that it has suffered almost no weathering, the shallow soil covering them to the depth of a few inches having been deposited by wind; other mesas composed of archean granites and gneisses capped by carboniferous limestone; mountain slopes; dry stream valleys and canyons.

With the exception of the cottonwood association in the river valley, no tree associations are encountered until the slopes of mountains, or sometimes the higher mesas (6,500 ft. or over) are reached. The first of these is the cedar formation *(Juniperus monosperma)*. Contrary to most of authors, the writer seperates this from that next above, the piñon formation. The piñon *(Pinus edulis)* never extends as far down the mountain side as does the juniper, the differences being on the average at least 500 feet.

The yellow pine association descends in some places to 7,000 feet, and extends upwards to 10,000 feet, and its distribution coincides very closely with that of the deep winter snow. In the drier situations the pine arises scatteringly from a chaparral of dwarf oaks and dwarf locust. The associated herbaceous vegetation on the east slope with its greater precipitation is strikingly similar in genus and often in species to that of the hard pine forests of the eastern States. The association represents a tension line between the flora of the arid southwest, as for example, on the adjacent mesas, and that of the more humid north and east. The higher points of the mountains are covered with *Abies concolor* and in some places with Englemann's spruce.

In ascending the canyons, the first trees met are the hackberry *(Celtis reticulata)*. Next comes a society dominated by box-elder. Higher up in the narrow and more mesophytic portions of the canyon one finds a society dominated by *Populus angustifolia*. If the valley is wide and open, yellow pine may occupy the floor with poplar along the stream. If narrow or higher up where the valley is V-shaped, the Douglas fir association controls. At the head of the canyon, above the permanent stream, there usually occurs an association of quaking aspen.

Among the conclusions of the author the following may be noted: The chief factor determining the abrupt changes of vegetation is moisture, the supply of which is largely determined by precipitation, the ability of the soil to hold it and the protection from drying winds and sun. This conclusion is based upon the fact that the same plants occur throughout a great range of altitude and temperature, but in a soil of about the same relative degree of humidity. Spruces and piñons (separated into distinct temperature zones by Merriam) will grow with their branches almost touching if the roots of the former have access to an unfailing water supply.

The tendency of the higher zones to creep down canyons and the lower zones to creep up the ridges receives a much more plausible explanation in connection with the supply of moisture in the two situations than through the cooling effects of descending and warming effects of ascending currents.

The Plant Geography of North Central New Mexico. Botanical Gazette. September, 1912. Pp. 194-217.

BOTANY AND ZOOLOGY.

Anatomy of Plants from Different Sites.

To our small amount of knowledge in regard to the actual differences in structure of the same species growing in different habitats, Miss Starr has made an important contribution. The material of the study was taken from the sand dunes of Lake Michigan in Indiana and from the flood plains of the Des Plaines river. The leaves were compared with respect to thickness, and the relative proportion which each of the tissues bears to the entire thickness; the stems with respect to number of vessels in an octant, the average diameter of the larger vessels, the thickness of the walls of the vessels, the thickness of the walls of the fibers, the number of growth rings and the thickness of the cork. Tables of the various species show these points in actual measurement and in percentages.

The summary of the observations is given below, where X and M refer respectively to the xerophytic and the mesophytic habitat, the numbers preceding the number of species in which the character occurred.

Hairs more abundant,	12 X— 0 M (3 same)
Surface of epidermal cells greater,	9 X— 5 M (2 same)
Depth of epidermal cells greater,	5 X—12 M (4 same)
Outer wall of epidermis heavier,	18 X— 0 M (2 same)
Cuticle ridged,	10 X— 6 M
Palisade more completely organized,	17 X— 0 M (1 same)
Better development of conductive elements,	15 X— 2 M (1 same)
Heavier sclerenchyma,	14 X— 1 M (1 same)
Heavier collenchyma,	17 X— 0 M

A summary of the stem characteristics is as follows:

Vessels more numerous,	14 X— 7 M (1 same)
Vessels larger,	9 X—11 M (2 same)
Total area larger,	17 X— 5 M
Walls of vessels heavier,	16 X— 4 M (2 same)
Walls of fibers heavier,	14 X— 6 M (1 same)
Lumen of fibers smaller,	16 X— 2 M (2 same)
More growth rings,	10 X— 6 M (3 same)
More sclerenchyma and collenchyma,	15 X— 6 M (1 same)
Cork thicker,	9 X— 8 M (1 same)

Comparative Anatomy of Dune Plants. Botanical Gazette. October, 1912. Pp. 265-305.

Light and Heat in Germination.

Dr. Pittauer reports in a voluminous article on the results of experiments in influencing germination by different degrees of light and extreme temperatures. The experiments were made on a variety of conifers besides Beech and Black Locust. The germination was carried on in a modification of Jacobsen's apparatus which is illustrated. In testing the effect of various stimuli, hot water, frost, heat, light are utilized.

Jacobsen's experience with *P. strobus* is cited, showing that in a cold porch germination proceeded better than in a room temperature, the data being:

	30	60	70	100	130 days
Room,	2	9	14	18	22 per cent.
Porch,	0	3	39	69	73 per cent.

Similar results were obtained by exposing the seed placed on snow in a zink case in a north window to frost for several days. It was found with this species that the highest germination in the shortest time was secured, when the seed was first allowed to freeze dry for four weeks, then for 24 hours soaked in room temperature; or was allowed to freeze on snow for 5 or 6 weeks; or was for 60 seconds scalded with boiling water, all in diffuse light.

Beech is most stimulated to germination by freezing on snow for 5 weeks and germinating in diffuse light.

For Black Locust the scalding with boiling water was found best.

Germination proceeds more rapidly in light than in shade and is most satisfactorily accelerated in diffuse light.

Soaking for 24 hours in room temperature proved favorable in case of spruce, larch and Austrian Pine, but Scotch Pine germinated better without such soaking.

Dry freezing invariably improved the germination per cent, White Pine increasing after 26 days freezing by 46% and after five weeks on snow by 52%.

Ueber den Einfluss verschiedener Belichtung und extremer Temperaturen auf den Verlauf der Keimung forstlichen Saatgutes. Centralblatt für das gesammte Forstwesen. April, May, 1912. Pp. 157-172; 213-224.

Plant Experiment House.

Those engaged in scientific research of plant development will be interested in Dr. Möller's account of his "vegetation house," which he has tested for two years at the experiment station at Eberswalde.

The requirements for such a house are stated. The detail of its construction given and illustrated. The character of the work done in this plant house is elucidated by a few examples.

Ein neues Vegetationshaus und seine praktische Erprobung. Zeitschrift für Forst-und Jagdwesen. September, 1912. Pp. 528-538.

SILVICULTURE, PROTECTION AND EXTENSION.

Selection vs. Uniform System for Teak.

H. C. Walker criticizes Troup's plan of adopting the uniform system of managing teak in Burma; Walker advocates a continuance of the selection system because a change would be "an elaborate and complicated matter," the transport difficulties would be increased, the yield would be irregular particularly at the fifth period on a 150 year rotation, natural regeneration and cleanings would be more difficult, artificial regeneration difficult and expensive because of the bamboo growth, an even aged stand of a mixed forest such as teak is impossible, and the export trade would be ruined owing to the irregular yield during the first rotation the uniform system was being started. In the same number Mr. Troup replies to the criticism, and quotes from the draft adopted at a Forest Conference held at Maymyo, Burma, in June, 1910, which gives fully the reasons for the change:

"This change of system is justified from the fact that under the selection system:—

(1) The natural reproduction of teak is not as plentiful as it should be, even in areas where improvement fellings have been carried out. It is often absent, and under the present method of treatment the teak will disappear over large areas.

(2) Improvement fellings can be carried out only over a small fraction of the area over which they should be carried out.

(3) Species other than teak cannot be exploited to the extent desirable, owing to the scattered nature of the fellings and consequent high cost of working.

(4) For the same reason road construction is not as remunerative as it should be.

(5) Adequate supervision of the fellings is difficult owing to their scattered nature.

It is believed the proposed change of system will tend towards a better state of affairs."

The counter argument goes on to prove that the teak forests will be benefited by a change to the uniform system, and explains that it is entirely practical. It is interesting to note that Mr. Troup, who is a member of the Research Bureau, advocates "light burning" in teak forests to favor teak reproduction prior to regeneration; then a rigid fire protection. "It is tentatively suggested that fire protection should be introduced in areas of the first period the year following extraction, and should be continued for eight years."

Silviculture in Burma. The Indian Forester. December, 191.. Pp. 646-659; 682-690.

Value of Eucalypts.

Professor Müller points out that *Eucalyptus globulus* which, owing to widespread propaganda, has been largely planted in the tropics and especially in Uruguay, is, on account of its incurable twisted grain, fit only for fuel, besides, it exhausts the soil, leaving it unshaded and bare; while the other Eucalypts are more difficult to grow.

To change the Eucalyptus firewood plantations into timber plantations he suggests thinning out and underplanting with *Acacia melanoxylon* (Australian Blackwood), which is a half tolerant, deep-rooting tree, easily sprouting and easily propagated tree, furnishing a large amount of litter.

The underplanting is to be done in 20 to 30 year stands, adding some of the finer Eucalypts *(rostrata, robusta, marginata)*.

Wirtschaftliche Behandlung und Umwandlung der Bestände von Eucalyptus globulus. Revista de la Seccion Agronomia, Montevideo. Zeitschrift für Forst-und Jagdwesen. March, 1910. Pp. 189-90.

Seed Tree Selection.

The first proof of the need of seed selection is credited by Zederbauer to A. Cieslar, whose experiments at the end of the 19th century proved the existence of geographical races of the same species, which differ in rate of growth, resistance to disease and in other features. Zederbauer now reports on a series of experiments to find out whether the progeny of different individuals in the same stand or of the same region shows differences in behaviour corresponding to the differences of the individuals themselves. The experiments have been conducted for only six years so far, but already give interesting results. Scotch and Austrian Pine and Spruce were used. The seed trees were classified by appearance into loose—broad—crowned, and compact—small—crowned; the former being the superior, vigorous specimens. Besides these there are deformed specimens. The small-crowned pines simulating spruce, occur especially in mountain regions, those of the plain, where the danger from snow pressure is less to be feared, are usually more frequently broad-crowned. A tabulation describes in detail the site and character of the seed trees; and another the growth of the seedlings giving the length of annual leaders and height of largest, smallest and medium plants, as well as curves of height growth. In these latter, if the curves of plants from different individuals are compared the difference is striking, but if the progeny of several seed trees is mixed, their average curve, of course, produces the usual height curve, but the results from various geographical regions (Scotland, Norway, Finland, Bohemia) are characteristically different those of the more rigorous climate showing slower development.

The author draws the following conclusions:

The difference in individuals of a stand is not only dependent on the site but on inherent disposition. The site can influence the latter ("Anlagen") favorably or impede their development but cannot entirely obliterate them. The progeny of broad-crowned individuals are more rapid in growth than that of small-crowned (with weak branches and short leaders!) The average height of six-year plants was 109 *cm* for broad-crowned, and 61 *cm* for small-crowned, a difference of 75%! The difference in height is the same as between seeds from Norway and Middle Europe.

The age of seed trees has no great yet a noticeable influence on the progeny, that of young broad-crowned seed trees being 14 *cm* higher than that of old broad-crowned trees.

The resistance to the "Schutte" *(Lophodermium Pinastri)* is noticeable. The progeny from dominant trees remains immune, that from suppressed trees suffers badly (disposition!). The progeny of some seed trees were all attacked by the disease excepting one single or a few individuals, which in the midst of sick, yellow-brown ones remained completely green. A colored plate shows the condition in this respect of 25 plots.

Versuche über individuelle Auslese bei Waldbäumen. I Pinus silvestris. Centralblatt für das gesammte Forstwesen. May, 1912. Pp. 201-212.

Seed Crop in Sweden.

The article by Gunnar Schotte is a compilation of the data which the Forest Supervisors of Sweden are required to furnish to the District Office with regard to the abundance of seed of different species. These data must be submitted not later than the 15th of October of each year. The District Forester brings together all the data received from the Forest Supervisors and sends a report to the Central Office of the Forest Department. The information thus secured is later turned over to the Royal Forest Experiment Station which works up the data in great detail and makes general deductions of the production of seed throughout the entire country. This report is printed in the series of publications issued regularly by the Forest Experiment Station since 1905. The method of collecting statistics about seed crops in Sweden is about the same as in Germany, namely ocular-statistical. The abundance of the cones, seed, and acorns is designated as follows:

0=Failure, i. e. no cones, seed, fruit, or acorns of any kind were observed.

1=Insignificant crop, when cones, seed, and acorns are found only on a few trees which grow by themselves.

2=Fair crop when cones, seed, etc., were found in small quantities on trees growing in the open and on trees on the edge of the forest.

3=Good seed crop, when cones, seed, etc., were found in considerable quantities on trees growing in the open as well as in stands.

4=Full seed year, when cones, etc., were found in large quantities on the majority of trees in medium and old-aged stands.

On the basis of data gathered in this way, Schotte prepared diagrams of seed production of Scotch pine, Norway spruce, birch, oak, and beech which give a graphic picture of the seed crops of these species in Sweden in 1909. For Scotch pine, there is given besides a diagram of the crop of 2-year cones, also the crop of 1-year cones of the preceding year from which it is possible to make very interesting deductions.

A comparison of the abundance of seed of the different species with the climatic conditions during the vegetation season shows that the warm weather of the summer of 1908 was the cause of abundant blooming in the spring of 1909. Thus from the reports submitted by the Forest Supervisors regarding the flowering of pine and Norway spruce, the following results were obtained:

Blooming	Average number of reports in per cent.	
	Pine.	*Spruce.*
Without flowers,	....	5 per cent.
Poor blooming,	43 per cent.	44 per cent.
Medium blooming,	38 per cent.	37 per cent.
Vigorous blooming,	19 per cent.	14 per cent.

On account of unfavorable climate during the vegetative period of 1909, the production of seed and cones was extremely un-uniform and on the whole poor.

The cold and wet spring of 1909 probably made fertilization difficult. During the cold summer of the same year the development of the cones and seed has been retarded so that many trees did not produce normally developed seed. This was especially true of the oak and also of spruce and birch, and to some extent also of beech. How poorly developed the seed and cones were may be inferred from the size of the pine and spruce cones:

Size of Cones.	Average number of reports in per cent. *Pine.*	*Spruce.*
Large cones,	4 per cent.	3 per cent.
Cones of medium size,	65 per cent.	62 per cent.
Small,	31 per cent.	35 per cent.
Cones affected by worms,	....	20 per cent.

The crop of beech acorns in Southern Sweden as well as in the most of Europe in 1909 was good, but in northern Sweden the beech nut did not mature. The early snow further prevented the gathering of beech nuts.

The data about seed production in 1910 has been furnished by the Forest officers on a uniform blank prepared by the Royal Swedish Forest Experiment Station. The forest officers were required to furnish separately information about the production of cones, seed, and acorns for trees standing by themselves, trees on the edge of the forest, as well as for trees in stands. In order to make this data of practical importance to the Forest, the Forest Supervisors were required to note to what extent each Forest is provided with its own seed for the different species as a result of the seed crop. The following figures were accepted for indicating the extent of seed production and the extent of sufficiency for the needs of each Forest:

Extent of Seed Production.	*Extent of Sufficiency.*
0-failure,	=No seed at all-0.
1-poor,	=Not enough seed-1.
2-fair,	=Sufficient-2.
3-good,	=More than needed-3.

The indications for trees standing by themselves and for stands in the same locality were combined in the following manner:

Amount of Seed Crop.

Trees in the open.		*In stands.*	Average seed production of the locality.
0	+	0 -	Failure - 0
1 - 2	+	0 - 0 -	Poor - 1
1 - 2	+	1 - 1 -	Fair - 2
2 - 3	+	2 - 2 -	Average - 3
3	+	3 -	Full - 4

In accordance with the plan prepared for gathering data on seed production, the weather conditions for the vegetative year have been recorded. The severe cold and drought during the first part of the summer have to some extent affected the development of spruce and pine cones. Thus from the answers received it appeared that on an average, 78 per cent. of pine cones were well developed and 22 per cent. of the cones have not developed at all. In spruce, 74 per cent. of the cones have developed and 26 per cent. have not developed.

Nine per cent. of all the answers showed that the pine cones were injured by *Pissodes validirostris* and 42 per cent. of all the answers mentioned an injury to spruce cones by *Tortrix strobiliana*, *Pucciniastrum padi,* and other insects.

The fall in most places was extremely warm and favorable so that spruce cones have matured in some places much earlier and began to scatter its seed. On the basis of the replies received, the abundance of blooming in spruce and pine in 1910 was as follows:

	Average number of replies in per cent.			
Blooming.	*Pine.*		*Spruce.*	
	In the Open.	*In Stands.*	*In the Open.*	*In Stands.*
Small number of flowers,	5%	30%	13%	28%
Few flowers,	48%	51%	29%	38%
Average number of flowers,	37%	18%	41%	26%
Abundant flowering,	10%	1%	17%	8%

On the whole the blooming of pine was fair in the northern and central portions of Sweden and poor in the southern part of the country. Spruce bloomed equally well in the northern and in the central part, but less in southern Sweden. The figures show also that blooming of pine and spruce is less vigorous in trees which grow in stands than in trees grown in the open. Birch and beech developed few seed and acorns. Beech, Carpinus and Fraxinus did not flower and did not produce fruit. Of all other broadleaf species only elm gave a good crop of seed in places. Siberian larch, Japanese larch, and silver fir flowered and bore cones in a few places, and the silver fir which is an imported species in Sweden gave a fair crop of well developed cones.

The extent to which the Forests were provided with seed from their own trees was as follows:

Extent to which the Forests were provided with their own seed.	*Number of Forests, per cent.*	
	Pine	*Spruce*
No seed at all	3 per cent.	12 per cent.
Very little seed on hand	38 " "	39 " "
Fairly well provided	56 " "	42 " "
Very well provided	3 " "	7 " "

Although the statistical data regarding the production of seed in 1909-10 collected by Schotte are well worked up, his deductions must be taken with considerable caution. They must be considered merely as giving the relative, qualitative seed production as ocular statistical method for determining the seed production has proved to be not very reliable.

R. Z.

Skogsträdens Frösattning Hosten 1099, 1910. Un meddelanden fran statens skögsforsoksanstalt H. 7.

Influence of Removal of Litter.

Dr. Schwappach reports the result of experiments carried on at Eberswalde during 50 years (!), more carefully during the last 12 to 15 years. Similar investigations, carried on at the Australian station, are briefed in F. Q. vol. IX., pp. 126.

The results are given in detail, tabulated and discussed. Former reports on these investigations are cited, and confirmed or modified. The experiments were made in stands of Scotch Pine, Spruce, and Beech. For each species, the influence on increment and on soil and condition of stand is described. The removal of the litter was done in various ways in different plots, leaving some untouched, some robbed annually, more or less thoroughly, some every two, four and six years.

In pine, the conclusion is reached that the annual thorough robbing of the litter influences increment greatly, especially on III and IV siteclass, even on good soil and in old timber a loss of from 5 to 12.5 percent being noted; in stands on good to medium soil, partially robbed, no influence was noted, nor in stands robbed every six years.

As regards the influence on the soil (in pine) a beneficial influence was noted in the absence of raw humus formation on the slightly raked soils. On the four-and six-year areas a vigorous regeneration takes place, due to the destruction of the raw humus. Intensive robbing, however, leads to compacting of soil and heather growth.

In spruce, on good sites no influence on increment, but on poor soils, especially shallow ones and in younger ageclasses (40-60 years) a very rapid and considerable decline in increment is experienced, a loss of about 35 per cent. in cross-section area increment compared with that on unraked areas. The raking uncovers the shallow roots; the raking gives rise to moss formation, which vanishes when left unraked under the needle litter.

For beech, in all cases, even on better soils a detrimental influence on increment results, but the six-year areas seem to stand at the limit of the dangerline, for while on the areas, robbed yearly, the loss is 25 to 50 per cent; on two-year areas, 15 to 40 per cent; on four-year areas 10 to 30 per cent; on six-year areas, on good sites no loss, on poor sites up to 10 per cent loss is found.

The influence on soil is very noticeable, especially on the poorer sites, where a dense moss cover and even grass growth is the result; stagheadedness is the further consequence and the opening up of the stand by individuals.

But the volunteer reproduction is here also favored by the removal of the soilcover, as is to be expected.

Ueber den Einfluss der Streuentnahme. Zeitschrift für Forst-und Jagdwesen. September, 1912. Pp. 538-558.

Fire Protection in the Tropics.

C. E. C. Fischer reviews in detail the pros and cons as regards fire protection in the tropics. This includes a discussion of light burning. Mr. Fischer first quotes B. Ribbentrop, formerly Inspector General of Forests, who argues for extended fire protection. "My parting advice is to extend fire protection wherever feasible." Then follow the usual arguments against fires. The arguments opposed to fire protection (chiefly as applied to teak in Burma): it retards teak reproduction, kills out bamboos by letting trees suppress it, fire affects other species more than teak, so burning is beneficial to this valuable species; fire gives the teak much needed light; accumulated leaves, etc., unfavorable to teak regeneration; no impoverishment of soil; burn undergrowth to favor soil; protection retards chir pine reproduction. After a thorough review of the problem the writer concludes that fire is harmful; in certain forests fire protection must be accompanied by improvement fellings; "fire protection to be really effective must be continuous."

Those who favor "light burning" in the southern pineries or elsewhere will do well to read this article.

The Indian Forester. May, 1912. Pp. 191-221.

Utilization of Fire Lines.

H. H. Haines, while admitting that cleared fire lines (or "pucca"="sure" lines) are the best, shows the cost in area if a forest is cut up by lines. "It does not seem to be realized that every area of four square miles isolated by fire lines 100 feet wide means a loss of close on 100 acres (96.7 acres). There are other objections besides cost; streams when denuded are apt to dry up; cleared roads are during the wet season much harder on transport stock. Mr. Haines proposes therefore to plant the opened lines with trees that are in leaf during the hot months; the shade would keep out grass; the trees would be valuable for fuel and the value of the fire line would be increased rather than diminished. Six trees are listed which are considered practicable for fire line plantation. If practicable, the scheme seems quite logically and certainly theoretically correct.

The Indian Forester. July, 1912. Pp. 314-319.

Flood Injury to Forests. Prolonged inundation of the forests along the Rhine flood-plains in the summer of 1910 led to serious injury to many of the trees, not only young plants, but old ones as well. Ashes, beeches, maples, cherry and, occasionally, black alder were diseased or dead at the base up to a height of about half a meter, while such trees as oak, elm, pine, aspen, willow and birch were practically uninjured. Trees on higher ground adjacent to the depressions to which the injury was confined were still sound, indicating that it was the duration of the flooding which caused the damage.

At the diseased bases the bark was brown and dead, often leaving strips, or "bridges," of living tissue. Only the surface roots were killed and the larger ones only on the exposed upper side. It is seen that the injured species are all relatively smooth-barked. Tubeuf explains this selective action on the hypothesis that the injury is due to asphyxiation of the inner bark tissues, these inner tissues often being dead while the outer cortex was still green. The water closely invests the smooth bark and closes the lenticels, thus reducing respiratory activities to a minimum. In the case of rough bark sufficient air is perhaps imprisoned in the crevices, or air-channels may even extend to the surface of the water. The fact that stagnant water is much more injurious than running water is strikingly confirmed.

As to the disposition of the injured trees, Tubeuf suggests felling immediately all which have the roots killed, while those with the bark dead entirely around the base can be left a year or more, if necessary, before cutting. In case there is some living tissue left it was thought the trees would survive. If the injury was too severe, however, the bark would loosen and saprophytic fungi enter, hence, it would be best to remove such trees, preferably in fall or winter to avoid discoloration of the wood. Where the injured area was small, say one-eighth to one-quarter of the circumference, stripping away the dead bark and painting the wound with carbolineum or "raupenleim" should hasten the recovery. Young trees, such as ash, will often send out sprouts below the injury and may be cut back.

Following the original discussion, the author reviews in some detail earlier literature on the question of flood-injury.

Weinkauff, while substantiating the observations of Tubeuf and others as to the susceptibility of thin-barked species and the greater harmfulness of standing water, summarily dismisses the asphyxiation hypothesis and ascribes the injury to the high temperature of the water, particularly during hot humid weather when evaporation was greatly reduced. This, he thinks, explains why the roots were so little injured. He suggests that the "bridges" are only areas where the bark is thicker.

Tubeuf takes up these arguments in a second article and shows they are not as plausible as the hypothesis, stating that it appears from experiments conducted during the hot summer of 1911 that temperatures under 48°C are not fatal, and these can only be reached by direct insolation and low evaporation.

Hochwasserschäden in den Auwaldungen des Rheins nach der Uberschwemmung im Sommer 1910. Naturw. Zeitschr. f. Forst u Landw. 10, 1912. Pp. 1-21.
Sommerhochwasser am Rhein im Jahre 1910. Ibid. Pp. 294-296.
Waldschaden durch Sommerhochwasser. Ibid. Pp. 296-298.

Chestnut Blight.

The Moore bill appropriating $80,000 for the study and control of the chestnut blight disease passed Congress in August toward the end of the session. $10,000 of this fund is set aside for the study of insects associated with the disease. The remainder of the funds are to be administered by the Laboratory of Forest Pathology, Bureau of Plant Industry, of which Dr. Haven Metcalf is in charge. The force of pathologists and assistants has been greatly increased and active investigation is under way.

The Pennsylvania Chestnut Tree Blight Commission, operating under a State appropriation of $275,000, has also recently reorganized its technical staff with Dr. F. D. Heald, pathologist (with 6 assistant pathologists), A. G. Ruggles, entomologist, J. P. Wentling, forester, Caroline Rumbold, physiologist (tree medication), F. P. Gulliver, geographer, Roy G. Pierce, tree surgeon, Jos. Schrawder, chemist.

The Commission's report of the conference held at Harrisburg the latter part of February was issued in August. The volume is illustrated and contains 253 pages of matter consisting largely of original papers and discussion. Some sixteen papers covering various aspects of the disease and setting forth the different opinions of American pathologists are presented. It is but natural that the delegates should differ radically regarding the advisability of attempting to control the disease and in outlining the methods to be employed. Those interested in the question of this very destructive fungus should consult the original document

In studying the distribution of the chestnut blight in Pennsylvania the Andersons found a saprophytic fungus closely resembling *Diaporthe parasitica* externally, but with larger asci and larger and differently shaped ascospores. The differences in cultural characters are quite marked and readily distinguish the two organisms. The new fungus apparently never kills chestnut trees nor will it grow actively on the living portions, although it is very common on dead stumps and logs. It appears to be distributed over, southwestern Pennsylvania, West Virginia, Virginia and eastern Tennessee, and will probably be found throughout the eastern states and southward, occurring on oak as well as chestnut.

In an attempt to clear up the systematic position of the new organism the authors have compared it with all its known American relatives, with the result that they consider it a new species for which the name *Endothia virginiana* is proposed. As regards the identity of the chestnut blight fungus, *Diaporthe parasitica* Murr. with *Endothia radicalis* (Schw.) Fr. the authors hold them as distinct, while *Endothia gyrosa* is apparently an entirely different thing from any of them.

In *F. Q.* X., No. 2, a short review of Shear's work on the identity of the blight fungus was given. Since publishing his former article Dr. Shear has returned from his European trip. While abroad he collected abundant material of *Endothia radicalis* of European authors on chestnut in Italy and Switzerland. He considers this morphologically identical with *Diaporthe parasitica,* but inoculation experiments are not far enough along to say whether they behave the same physiologically. The European fungus is not parasitic on chestnut in Italy and Switzerland, although common on stumps.

As yet no European specimens of typical *Endothia radicalis, sensu* Schweinitz, have been seen and, likewise, no intergrading forms between this and *D. parasitica*, which fact bears out the work of Anderson. Authentic material of *Endothia gyrosa* in

European and American herbaria is so immature that the identity of this species with *E. radicalis* remains doubtful.

The author thinks the chestnut blight fungus was introduced from Europe and has spread from a central point, largely through the agency of borers or other animals which injure the trees.

The Chestnut Blight Fungus and a Related Saprophyte. Phytopathology. 2, 1912. Pp. 204-210.
The Chestnut Blight Fungus. Ibid. Pp. 211-212.

MENSURATION, FINANCE AND MANAGEMENT

Yield Formula in Selection Forest

Mr. R. S. Troup cites a number of fomulae for variations from the standard method where in a selection forest the yield is calculated by the formula $\frac{I+\frac{1}{2}II}{p}$ where I=No. of 1st class (i. e. exploitable) trees counted.

II=No. of 2nd class trees counted.
p=period of years for which the fellings are prescribed.

The examples given are for the information of officers who have in the past made errors in calculating the yield.

The Calculation of the Yield by Number of Trees under the Selection System. The Indian Forester. February, 1912. Pp. 75-84.

Forest Loans

An unsigned article advocates running the Indian Forest Service on a different financial footing because middlemen's profits are eating into the legitimate revenue. When a corporation needs money it borrows so why shouldn't the Forest Service, when it comes to developing new resources. "Such loans might take the form of short term borrowings for a particular object or they might extend over considerable periods, as the case might be." The writer estimates in Burma with departmental exploitation the net revenue would increase from $2,200,000 to $2,700,000. The arguments presented are by no means conclusive.

The Indian Forester. July, 1912. Pp. 299-305.

Economic Forestry for India

In an interesting discussion Mr. Blascheck argues for more of a financial review. He feels that generally the present rotations are too conservative and have been established without proper regard for financial and silvicultural considerations; mere regularity is too often a proper objective. If the timber is mature why hold it over for a period of years merely to insure a sustained yield. He cites some interesting gross revenue figures for India:

1873-1877	$2,241,064.00
1903-1907	8,351,717.00

This is an amazing advance for 30 years development!

The Indian Forester. March, 1912. Pp. 116-125.

Financial Results of Small Forests

A most interesting, because rare, account of the financial results of a small private forest under management is given in greatest detail by Forstrat Reich. The account refers to the 7500 acres of forest belonging to Count Isenburg in Hesse. The soil, although variable, is in general very favorable and so are the means of transportation to market, so that a cut of 77.5 cubic feet per acre (36% workwood) under sustained yield management and a gross yield of $6.02 results. A full accounting from year to year is given, tabulated for 10 years. The average for this decade shows the expenditures to be 30.5% of the gross yield or $1.84 per acre, leaving therefore a net income of $4.18 per acre (an annual income of over $30,000 from 7500 acres, which at 3% would make the property worth $1,000,000!).

The gross yield per cubic foot of wood was 6.5 cents, the net result 4.3 cents. Logs of spruce (6-12 inch average diameter) run at from 13 to 16 cents per cubic foot, and in beech (12 to 20 inch top diameter) at from 9 to 14 cents. In the expenditures are spent $2000 for roadbuilding and $2230 for planting, $10,000 for personnel, $5800 for woodchoppers. In addition, 10% of the income goes for taxes, against which a small income from the chase may be figured, 700 to 800 hares, 200 pheasants, and the surplus of 350 roebuck.

The forest is to the extent of 71% beech, the least profitable crop, sometimes mixed with ash, maple and oak; the balance is spruce. That the sustained yield is amply provided for appears from the age class distribution, which for beech in 100-year rotation runs from the youngest to the oldest 18, 12, 11, 22, 37, and for the spruce in 80-year rotation 45, 28, 18, 9. It is intended to increase the spruce area by planting; the cost of planting in 4-foot spacing has varied between $16 and $19 per acre. A regular thinning practice begins in the 30th year. Other silvicultural practice is also described.

Die fürstlich Isenburgischen Waldungen bei Birstein. Allegemeine Forst- und Jagdwesen Zeitung. June, 1912. Pp. 181-196.

UTILIZATION, MARKET AND TECHNOLOGY

Status of Impregnation Practice

Engineer Petritsch remarks on the very general interest lately extended to the use of preservatives) of wood, which is not any more confined to railroads but has found its way into all kinds of wood consumption; telegraph and telephone poles, posts, mine timber, pavements, even vineyard stakes are more or less generally treated. The constant increase in wood consumption together with the rise in prices explains this.

A table brings the results of mycological investigations into quantities of impregnation fluids in percent which must be used in order to prevent the growth of fungi on gelatine—which are an indication (and only such) of the amounts needed in practical treatment and their relative poison value.

	After Malenkovic	After other authorities
	Per cent.	
Copper sulfate (Cu S O4)	4 —4.5	3 —3.5
Zinc chloride (Zn Cl2)	3.5	3.5 —4.5
Chloride of Mercury (Hg		
Chloride of Mercury (Hg Cl2)	.15— .25	
Creosote oil without acids	5 —10	.15
" with 10% acids	2 —4	.15

Tarry Acids (Phenol, Kresol etc.)	.2 — .4	.10
Calcium-Cresol		.05— .15
Dinitrophenole and Dinitrobenzole	.05	
Hydrofluoric acid (H Fl)	.1 — .25	
Fluorzinc acid (Zn Fl2 2H Fe)	1 —1.1	
Neutral fluorzinc (Fn Fl2)	.75	
Neutral fluor sodium (Na Fl)	.75	.5 — .1
Acid fluor sodium (Na Fl H Fl)	1.25	

Every rot fungus species reacts characteristically to the different poisons; one species may be readily killed by a given poison, while another may be not at all or little affected in its growth by the same.

So far too little positively is known as to the durability attainable by use of different poisons. All careful investigations have shown that the much praised copper sulphate is a weak antiseptic; and so the Boucherie process, the author states, is well nigh forgotten, although a few establishments still use it and the German Post Administration still employs it for about 50 percent of its needs for telegraph poles, and in France and Netherlands it remains still in vogue with assistance, however, of creosote oil painting and tin covers at the ends, or by immersing ends in hot solutions of thin creosote oil—an expensive process.

Zinc chloride (see table) has proved itself not much better as an antiseptic, while the effectiveness of chloride of mercury is bringing the old Kyanizing process (patented in 1832) again to honor, this poison having been found 15 to 20 times as effective as copper sulphate. The experience of the German Post Administration has verified this theoretical result practically: telegraph posts treated with the Boucherie process lasted in the average 11.7 years, Kyanized ones 13.7 years or 17% longer, while the cost of the latter were only 5% higher. In the last few years this process has therefore been more widely used, 25% of the Imperial Post administration's requirements, say 100,000 poles, and as many for other electric companies being treated by it, as well as in other parts of Germany and in Australia.

The author proposes an improvement in this process by treating different species separately and in different times, namely, 7 days for pine, 10—14 days for spruce and fir. Also for different species, liquors of different strength should be used, and that under vacuum and pressure which could be done by employing concrete tanks or cylinders (since the poison corrodes metal) and rubber tubing, etc, by which larger quantities could be forced in.

The cost of the process in spite of the high price of mercury ($60 to $85 per 100 lbs.) is relatively small, for the quantity required in a 2/3% solution is not more than ½ to 1 ounce per cubic foot and therefore the total cost per cubic foot 4—5 cents (about 12 to 15 cents per tie) for the material.

Caution in handling the poison is necessary, but many of the objections raised, the author thinks, are exaggerated.

Creosote oil, which, as a waste product of the coal tar industry, Bethell recommended in 1838, has constantly increased in use, so that at present it is difficult to supply it and the price has risen accordingly, and hence substitutes are sought for—phenols, cresols—which may be artificially prepared. Creosote was objectionable because originally such large quantities were apparently needed per cubic foot and the smeary condition of the treated wood was objectionable. Newer processes have in part overcome these objections, Ruping's process (1902) being among the best. It consists in admitting the liquor only after the wood has been under pressure of two to four atmospheres for a quarter hour when the heated (75°C) oil is put in under pressure of 7 to 8 atmospheres; the surplus of oil runs off when the pressure is removed. The control is indicated on a card like a steam pressure card. A series of such cards illustrating the progress of the process and cuts of treated ties to show the penetration accompany the text. This process is superior to the chlor-zinc-tar oil process, being simpler and easier to handle.

Another patented process designed to save oil and distribute the oil well is known as Rutger's patent, which treats the charge with hot steam or hot air under pressure to prepare it for impregnation.

This process used by the firm of Guido Rutgers is mainly used for telegraph poles, the Austrian Telegraph Administration having from 1904 to 1911 placed some 300,000 poles treated in this way, only .007% of the poles having been lost in the first five years. One trouble is that the poles must lie for a year to lose their stickiness. The detail of the process is described and illustrated by diagrams and cuts. The process is as rapid as the Ruping process; the costs are practically the same although the Ruping process puts only 4 lbs., the Rutgers process 6 lbs., per cubic foot in; the former being a rather scanty allowance.

It is open to question whether either quantity is really the economically most suitable. The main objection to both processes is that they are applied only for pine and possibly larch (and supposedly other species of similar structure like Douglar Fir?); they do not work with spruce and fir, since they are too slow in taking up the liquor, requiring too much pressure and time, and the distribution remaining astonishingly uneven. Only when at least 12 to 15 lbs. of oil have been infiltered is partial satisfaction attained.

The author then describes an economic procedure in preserving telegraph poles practiced in Hungary. Only the lower end is thoroughly impregnated, the top end only superficially. This is accomplished by driving small pointed nails of one-half to one inch length by special machinery into the butt end for the first six feet. This opens the paths for the oil to the interior. Since the conducting of liquids takes place most readily in the direction of the length fibres the nails are so arranged that in length direction nails are placed only every 8 inches, but peripherically every one-quarter to one-half inch; each hole, therefore opens the path lengthwise for four inches, sidewise for only a quarter inch or less. The penetration is usually a little deeper than the length of the nails. The process used is the Bethel process with one hour heating of the wood and one hour vacuum, and one hour creosoting under 15 atmospheres. According to the nail length the amount of creosote used varies from 5½ to 7 to at most 8 lbs. per cubic foot, mostly concentrated in the butt end. No loss of strength is experienced. Two years' experience are satisfactory. The cost comes to 9 cents per cubic foot, one-half the cost of the former full impregnation. This process was applied to spruce; whether it would be economical for pine, so much more easily penetrated, is an open question.

The Austrian Telegraph administration employs another process for spruce and fir by first saturating the poles in a solution of a metal salt, say sodium fluorid (Na Fe) and then pressing in creosote oil until the sapwood is filled. The metal solution evaporating the creosote oil penetrates more deeply, and about 5 lbs. are taken up. The process is, however, somewhat more expensive than the Ruping or Rutger process.

Another, Italian process, employing alternating hot and cold baths, is briefly described.

In North America, the author states, "*the technique of wood preservation is still in its infancy;* but as in so many directions the Americans understand by systematic trials to secure the experiences of the old world." A brief review of what has been done in the United States follows.

The author then discusses a number of new preserving fluids, which are to obviate the expense and other undesirable features of those described. These have been found by systematic experiments. There are two groups of such fluids, namely phenols and their homologues, and fluorsalts or silico-fluoric salts.

Among the first a *B*—naphtalin zinc sulfate [Zn (C_{10} H_7 SO_3) 2], known as Wiesesalz has been used by Rutgers with mine timbers, which in 5½ years showed no sign of decay while untreated rotted in 1 to 2 years.

Dinitro salts of phenol and its variants show good antiseptic properties and form the ingredients of a number of new fluids like Antinonin, Antigermin, Mikrosol, etc., but they are all too expensive. Hence the attempt is made to secure their good properties by admixture of the same to cheaper preservatives, for instance with the cheap sodium fluoride (Bellit or Bellit double fluor) or with gas oils. A more promising antiseptic is the so-called calcium cresol which is secured by mixing slaked lime with crude cresol and water at a temperature of 40°C. This costs about 5 cents per lb. and has remarkable antiseptic effect (see table above) 20 times that of copper sulfate and zinc chloride.

This has been used experimentally in Sweden for railroad ties and in Austria for telegraph poles, the latter coming 10% cheaper than creosoting by Rutgers process. Per 1 cubic meter, 300 liter of 2% solution, spec. gr. 1.0082 at 15°C, or 6 Kg (13.2 lbs.) of the salt had been used. This salt was also used with creosote oil.

More widely used are some of the fluoric and silico-fluoric acid salts, the active ingredients of a number of preservatives in the market, like Kronol, Hylinit, Murolineum, Montanin, Montanin fluat, Keramit, Keramyl and others. Many of these are sold much higher than their antiseptic value, or contain the antiseptics in an ineffective form; and this fact has damaged the introduction of the fluorides. The sodium silico-fluoride, however, has been extensively used by Rutgers, the 2% solution being made in hot water (90°C). This makes wood also non-inflammable and can advantageously be used for building timber. It is cheap. Curiously enough, while weak solutions are antiseptic, fungi will grow on concentrated solutions. This accounts for differences of opinion as to its preservative use.

Lastly, the author reports the experiments made in Austria with fluoric acid itself. A zinc solution in hydro-fluoric acid (5%) was first used in 1905 for telegraph poles, and in 1907, after satisfactory experience, other fluorides were experimented with. The process was similar to Kyanizing with 7 or 8 days immersion. The salt cost about 10 cents a pound; a 3.7% solution of 5.5°Bé being used; the absorption being about 4 lbs. in pine, and less than 2 lbs. in spruce. The cost is lower than for Kyanizing.

An experiment to use the Boucherie process with this fluid showed a much more rapid absorption than that of zinc chloride or copper sulfate. A cubic foot required 16 lbs. of liquid leaving about 4 to 5 oz. of the effective zinc salt in the wood or 2½ lbs. for a 24 foot pole. This is about the same as it would be with copper sulfate, but the antiseptic effect is as 1 : 5 in favor of the fluor salt. The one objection is that the fluro salt attacks iron vessels. To overcome this Malenkovic has invented a neutral Chlor zinc-fluor-sodium process, which also prevents the leeching out of the antiseptic. The interesting reactions of sodium fluoride on zinc chloride in the dry wood body are explained. This process has been considerably used in Austria. A few other experiments with flurosalts are explained.

Altogether a final judgment on the value and applicability of the fluorides cannot yet be given, although they have been widely used. Not less than a decade of experience suffices to give a verdict. Systematic trials alone will lead to final judgment.

Neuere Bestrebungen auf dem Gebiete der Holzkonservirung. Centralblatt für das gesammte Forstwesen. June, July, August, 1912. Pp. 265-282, 321-333, 383-392.

Durability of Railroad Ties

A very exhaustive article on the subject of causes of decay and how to prevent them by Havelik has been running through several numbers of the Centralblatt. In the summary, the author states that narrow-ringed wood is preferable. The materials used for impregnation are divided into two classes: the strong poisons, mercury, tar oil and fluor compounds which can keep out even *Merulius lacrymans*, and the weak poisons, which cannot prevent this but other wood destroyers—chlorzinc and coppersalts. The latter have the advantage of easier penetration. The strong poisons stay more on the surface, excepting tar oil.

The conductivity of the wood for the impregnation fluid varies from individual to individual tie and from the outside to the inside heartwood, with exception of beech, being incapable of impregnation. Hence, if wood of varying quality is put into the cylinders together, the better woods and therefore more difficult to treat take up less or require more time than the poorer woods. Hence the author proposes to charge cylinders only with woods of the same character of same width of ring and sapwood. Two types of rot are recognized, surface rot and interior rot. The latter deteriorates the railroad ties in the sapwood parts. These therefore must be above all fully saturated.

Ueber die Dauer der Eisenbahnschwellen. Centralblatt für das gesammte Forstwesen. March, April, May, 1912. Pp.

Merulius lachrymans on Telegraph Poles

Havelik contributes an important article on the question of the distribution of Merulius in nature. For many years the fungus was considered as domesticated and limited to buildings. Toward the end of the 80's a Telegraph Company in Moravia, Austria, applied to the Forest Management at Mariabrunn for advice regarding the decay of their poles treated with copper sulfate. Dr. Cieslar investigated the question and found that *Merulius lachrymans* was the cause of the rapid decay. After giving valuable recommendations the subject was dropped and forgotten until Balasek establishel the frequent occurrence of the fungus on poles in Tabor, Bohemia, in 1903. During the past decade Havelik has supervised the management of telegraph lines in south-eastern Moravia and has found that, on certain lines at least, 80% of the copper treated poles had to be removed on account of decay induced by the fungus at the base.

Fruiting-bodies were difficult to find at first, and do not occur on rapidly decayed poles. They appear in May and June, develop well in high grass, and wither when this vegetation dries out about June 15. The hymenium is frequently enclosed by an overgrowth of mycelium in the shape of flaps, but the form largely depends on moisture and surrounding conditions, bracket forms being produced when sufficiently moist, and more variable and aborted fruit-bodies when drier. These prefer the south-east side of poles, if sufficiently protected from the light. Development is often accompanied by the production of strands, or rhizomorphs, both in the soil and in checks in the wood. An effective way of calling forth the fruit bodies is to dig a cone of soil away from the base of the pole, thereby allowing a space in which the fungus can develop. Alternation of moisture and dryness, without reference to the chemical nature of the soil, is sufficient for development, and poles set in quartz sand decay most rapidly on account of the more favorable moisture relation. Whether the organism is exactly identical with the true *Merulius lachrymans* the author has not fully decided.

Fir, spruce, pine or larch poles, about 8 inches in diameter and treated with copper sulfate last 2-14 years. Under unfavorable conditions the fungus appears first after about 10 years, and completes the destruction in 4 years more. A poorly creosoted stump of a pole sent from Pressburg, Hungary, was similarly decayed by Merulius.

The trouble seems rather widely distributed in Austro-Hungary but is not reported from Germany. As a result of the investigation thorough creosote treatments are replacing copper sulfate. The preservative action of creosote the author believes due, not to phenols, which almost disappear within two years, but to its water-proofing capacity.

In another article Wehmer calls attention to the fact that oak wood is immune to the attack of *Merulius lachrymans* and cites an observation in a building to support this opinion. The older authors disagree among themselves on this point, some claiming resistance, others susceptibility. *Coniophora cerebella,* a form closely related to Merulius, behaves similarly toward oak, although both produce a destructive decay in conifers and certain other hardwoods. It is very possible that other fungi have been confused with these species in literature. The cause of immunity has not been worked out, but the author suggests that it is less physical than chemical, and promises further work on the question.

C. J. H.

Havelik, Karl *Der Hausschwamm in der Natur.* Zeitschrift für Forst- u. Jagdwesen. September, 1910. Pp. 573-577.
Wehmer, C. *Resistenz des Eichenholzes gegen Hausschwamm.* Bericht deutsche botanische Gesettschaft. 1911. Pp. 704-708. 1 fig.

Tannin on Merulius

In an attempt to throw light on the immunity of oak wood to the attacks of *Merulius lachrymans* Wehmer takes up the relation of various tannins and their cleavage products to the growth of this organism. He calls attention to the loose use of the term "tannin" in literature and to the fact that oak-wood tannin is not identical with that of the bark or the galls. Comparable figures on the tannin content of various parts of the tree are not available, but the writer succeeded in getting only 4% of extract from the heart, only part of which consisted of tannin. Since oak-wood tannin is not in the market Wehmer selected gall-tannin and gallic acid for his tests, using malt-agar, malt-gelatine and starch paste, to which were added certain nutrient salts, as media. The tannin or gallic acid was mixed with these in various proportion, the flasks sterilized and then inoculated with the mycelium of the fungus in question. While the various media gave somewhat different results in general, .5 to 1% of either substance plainly inhibited growth, while 1-2% completely stopped it, tannin proving slightly more toxic than gallic acid. In contrast to *Merulius* it was found that *Penicillium* grew rather quickly on 5-10% concentration. Since tannin tends to liquefy and precipitate the media on heating, particularly gelatin, the tests are only approximate.

Small blocks of oak heartwood were also extracted with hot water for varying periods. This was found to render them suitable for the growth of *Merulius*, while the uncooked blocks only supported a scanty surface growth. After three weeks it was estimated that the development was three times as strong as on the uncooked wood. The water-extract from the wood was found to be toxic when mixed with gelatin media or dextrose solution. By boiling spruce wood in a 2% tannin solution it was practically rendered immune.

The toxic action of tannin and gallic acid toward *Merulius* is specific, depending on the particular kinds of these substances and not upon the acid reaction, the former heing only one-tenth as acid as the latter. As to the relation between the constitution of tannin and its toxicity little can be said until we know more of the specific chemistry of the organisms under consideration. In the present case if we do not wish to explain the immunity of oak as due to an essential difference in fungus enzymes, we can ascribe it to the unfavorable action of tannin. As is well known, inhibiting substances are often disposed of by fungi through cleavage, oxidation or reduction, and it is very possible that the general conditions of temperature, constitution of media, concentration, etc., are of essential importance, so that *Merulius,* under particularly favorable conditions, might do the same with tannin.

The pigment production of *Merulius lachrymans* is considered in a second paper by Wehmer. The earlier investigators attribute it to certain distributing factors, such as poor nutrition, too high temperature, etc. By varying the composition of the nutrient solutions and the consistency of the solid media Wehmer sought to follow up the question, but without arriving at any definite conclusions as to the specific causative factors. Shades of color varying from bright yellow to reds and browns were secured. Although, in general, the kind of nutrient is not the determinant it still seems to play a part. The bright brown spore pigment is soluble in alkaline reagents with a blackish-brown color and can be precipitated from dilute sodium hydroxid.

Der wachstumhemmende Einfluss von Gerbsäuren auf Merulius lachrymans in seiner Beziehung zur Resistenz der Eichenholzes gegen Hausschwamm. Mycol. Centralbl. I:138-148, May, 166-174. July, 1912.

Uber Pigmentbildung bei Merulius lachrymans Schum. Ber deutsch. bot. Gessell. 30:321-329, 1912.

The Decay of Timber

A short popular treatise on this subject has recently appeared in French, compiled by two military engineers. The pamphlet comprises forty-four pages and is divided into two parts: I General ideas concerning the organization and development of fungi. II. Changes in wood due to fungi, and methods of preservation.

After the usual introduction, a brief description of *Merulius lachrymans, Polyporus vaporarius, Stereum hirsutum, St. frustulosum, Polyporus sulfureus, P. igniarius, P. dryadeus, P. borealis, Trametes pini, Tr. radiciperda* (=Fomes annosus), *Armillaria mellea,* and blue-stain is given. This is followed by an outline of chemical tests with Nessler's reagent, Fehling's solution, and silver nitrate, as well as microscopical examination, to detect the diseased condition in wood.

The section on prophylaxis and treatment includes a brief discussion of the common wood preservatives. The paper concludes with a note on the deterioration of wood by insects. A large colored chart embracing thirty figures, for the most part reproduced from Robert Hartig's works, accompanies the pamphlet and adds greatly to its value.

C. J. H.

Campa et Marinot-Lagarde. *Notice sur les altérations des bois dues aux champignons, et les moyens de s'en préserver.* Extract from the Revue du Génie militaire, Oct. & Nov., 1910.

Wood Discoloration

Brick reports a peculiar discoloration of pine window frames in a house at Hamburg, Germany, due to the fungus, *Zythia resinae* (Fr) Karst. The trouble was characterized by violet to dirty-red, or even dark grayish-brown, flecks beneath the oiled surface of the wood. The spots were covered with minute pustules varying from violet, orange, and brown to black. These constitute the spore-producing bodies, of which a careful description is given.

The discolored areas extend within the wood more or less as streaks closely associated with the medullary rays and resin canals, which microscopic examination shows are abundantly provided with brown septate mycelium. Only the central cells of the rays are affected. In the tracheids little mycelium is found. In its method of development, then, the organism is very similar to the blue-stain fungi belonging to the genus Ceratostomella.

The author notes the natural distribution of the fungus on the resin of spruce and pine in Europe, and discusses its systematic position and connection with other fungi of which it is assumed to be the imperfect stage.

C. J. H.

Brick, C. *Zythia resinae (Fre) Karst. als unangenehmer Bauholzpilz,* Jahresber. d. Vereinigung, f. angew. Bot. 8:164-170, 1910.

Wood Preservation

A peculiar method of preserving wood relics from decay is outlined by Pinoy. He soaked the wood to saturation in a mixture of 2% potassium bichromate and 1% sodium fluoride and exposed to the light and dry air. He then covered with a solution containing 5% gelatine, 2% bichromate and .5% fluoride, which gives the articles a brilliant hard polish and a mahogany color, imitating old wood. The author thinks the method could be quite generally used, and would be equally applicable against insects.

Sur la conservation des bois. Compt. Rend. Acad. Sci. 154, February 26, 1912. Pp. 610-611.

New Method of Resin Tapping

R. S. Pearson explains the conservative methods of tapping chir pine used in the Naini Tal division (forest), United Provinces. After tapping 5 years "the tree shall be given a period of rest for ten years." Before tapping commences all trees to be scarred are serially numbered and marked to show the number of pots which can be placed by the contractor. The "heavy tapping" (corresponds to "resinize a mort") is only allowed on trees to be felled within 5 years. The following number of pots is allowed: (a) light tapping, 1 pot on trees 3½′ to 4½′ girth, 2 pots on trees 4½′ to 7′, 3 pots on trees over 7′; (b) heavy tapping, 1 pot for each foot of girth. Cups should be equidistant, chipping is "4″ wide by 1″ deep and about 6″ long at the base." Chipping after the first incision should not be more than "2½″

of the vertical length of the tree." The maximum scar each year is 15". The season is March 15 to November 15.

The Indian Forester. June, 1912. Pp. 271-275.

Tannin from Tropical Timber

The tannin contents of the mangroves (100,000 acres in East Africa) vary greatly not only from species to species but from individual to individual. The red color of the tan is objectionable to its use; it also imparts a soft spongy condition to the leather. Hence the market has so far not been favorable. There has, however, in 1907, a process been inaugurated by the firm Fuerlein in Stuttgart, which removes from the mangrove extract the red color. Those mangroves which contain 35 to 45% of tannin lend themselves to extract manufacture, which is more cheaply done in Germany than at the places of their occurrence.

The native Acacias which contain tannin have so far not appeared profitable for world market. but the cultivation of Black Wattle from Australia is advocated by Semper. Neither do the Combretum and Terminalia species appear promising in this respect.

Die Aussichten der Gerbstoff production in den deutschen Kolonien. Zeitschrift für Forst- und Jagdwesen. January, 1910. Pp. 48-52.

Prices in Germany

From a comprehensive detail discussion of market conditions in Germany during the year 1911 by Laris, we quote a few price data of interest. The market in that year was good. Long coniferous logs moved between 18 and 19.7 cents per cubic foot for II class, 1.5 cents to be added for I class, and as much to be deducted for class III, and 3 cents for class IV. Squared timber rose to 4% over the previous year; and since 1909 by 8 to 10.8%. Oak, sawed, rose 7% over the previous year; first class veneer material, to be sure of extraordinary quality, bringing as high as $3.37, but even second class material brings $1.85 to $3.16 per cubic foot—$262 per M feet!

Coniferous boards also rose generally in values, the better qualities by 3.9%; the lowest prices quoted were 21 cents per cubic foot up to double that price for II quality. The following comparison shows prices for different dimensions during the last three years. The figures are per M ft. B. M. for 6, 8, 10 and 12 inch boards, the first set for II quality, the second for mill run, wholesale, from Black Forest mills, the average price for which figures out $18.97 per M ft.; the third for the same, selected for retail.

Year	6″	8″	10″	12″
I Good Quality				
1909	$26.28	36.00	50.40	63.00
1910	28.80	38.16	49.68	64.80
1911	26.28	36.00	51.84	68.40
II Mill run				
1909	16.11	23.31	30.51	40.32
1910	17.67	24.87	32.20	42.38
1911	17.44	24.67	32.36	42.60
III Selected retail				
1909	22.68	30.96	39.60	48.96
1910	23.40	31.32	41.22	50.58
1911	23.76	32.04	41.22	50.04

The average price for a large order of pine, spruce and fir lumber by the Prussian Railroad Department, to be delivered at various stations, all II quality, varied between $25.75 and $36, the average for pine being $29.12, for spruce $27, and a little less for fir.

A comparison of average prices for 20 years of one-inch boards at the Middle and Lower Rhine, from 1892 to 1911 shows the following changes per 100 boards 16 inch:

	6″	8″	10″	12″
1892	$10.47	14.75	20.70	26.90
1911	15.70	21.18	27.37	33.08
Increase %	50	50	33	29

Pitch Pine and Red Pine boards sold at from $46.50 to $51.50 per M feet.

The wood manufacturing industry in all its branches thrived marvelously during the year, showing as far as exports are concerned an increase over 1910 of 59 per cent in quantities and 150% in values, with nearly $9,000,000.

Das Wirtschaftsjahr 1911 in Deutschland. Centralblatt für das gesammte Forstwesen. July, August-September, 1912. Pp. 347-8; 425-431.

STATISTICS AND HISTORY

Forestry in India

The reviewer of this report handles it without gloves but brings out many interesting features: "It is now the custom in these Provinces to depute an experienced Revenue officer to examine a working plan . . . with the forest officer who is preparing it." By this the wants of the people are considered along with the silviculture of the forest.

The "Southern Circle" is criticised because of a falling off in revenue, due in part to money thrown away on improperly located roads. The overgrazing is said to be deplorable, yet the public interest is so strong that little improvement is looked for; 45% of the cattle were charged but *$2 per head per year*—no wonder it is decided to raise the rates. Yet it is recognized that light grazing is actually favorable to seedling reproduction of teak and other species. Experiments have shown that cutting certain coppice stumps flush with the ground is an unnecessary expense. The net revenue was 24% of the gross revenue and this is said to be extremely disappointing. The principles brought out in reviews of administration reports are nearly always applicable to American conditions in the West.

Report on Forest Administration in the Central Provinces for the Year 1910-11. The Indian Forester. July, 1912. Pp. 332-336.

Indian Forest Service

The regulations for probationary appointment as government paid students in forestry (dated Simla, the 23rd of October, 1911) are given for the information of applicants. Appointments are made by the Secretary of State for India "with the advice of a Selection Committee," which makes it a point to personally interview each candidate. Competitive examinations are held when there are more than five qualified applicants. The following are the more important conditions of entry: Age limit 19 to 23 years on the 1st of July of year appointment is made, but in 1913 and thereafter the limits will be 19 to 22 on the 1st of January; each candidate must be "a natural-born British subject," unmarried, of good physique and character; they must "undergo a strict examination by a medical board," with particular reference to vision and hearing; they must spend two years at Oxford, Cambridge or Edinburgh and obtain the Degree of Forestry. Vacations must be spent in British or Continental forests as directed. Tuition is paid by the government and each candidate receives annually an allowance of $600, but this is contingent on his entering the Indian Forest Service and on making good during the two years at the university. Before going to India, riding must be learned. Upon completion of the probationary period candidates (in the order of seniority and of merit) will be appointed "Assistant Conservator of Forests" at $1520 per annum.

According to extracts from latest revised rules: The pay in India is roughly as follows: Inspector General, $10,500; Chief Conservators (Burma and Central Provinces), $8,600; Conservators (of three grades), $6,000, $6,800 and $7,600. An officer acting as Assistant Inspector General receives the pay of his grade and $800 a year additional. Deputy and Assistant Conservators (Supervisors and Deputy Supervisors or Forest Assistants) receive $1,520 with annual increases of $160 up to $2,800 then annual increases of $200 up to $5,000 per year and research officers are on the same footing as executive officers. There are liberal furlough allowances, special leave of not more than six months with intervals of six years service and privilege leave of three months every 33 months service. After 5 years continuous absence "civil service" standing is forfeited. Pensions are given after voluntary retirement after 20 years service or when "attaining the age of 55 years." An invalid pension after 10 years could reach $333; after 15 to 19 years to $1,000. After 20 to 24 years of completed service $1,333 might be secured. "A General Provident Fund has also been established."

The Indian Forester. February, 1912 Pp. 57-74.

Austrian Budget.

The Austrian budget for 1912, as usual comprises statements of a somewhat mixed character, the State domain being in part agricultural, in part forest, and the "funds forests and domains" being treated as a special property.

For the personell of the general central administration of the Department of Agriculture $393,000 are set out, from which the 12 officials, having the central technical direction of the forests in charge are paid (detail salaries not stated). The forest experiment station has an allowance of $15,000; for educational purposes in agriculture and forestry, $336,000 are allowed; for the furtherance of agriculture and forestry, $1,230,000, of which $220,000 for association work (!), $160,000 for reforestation and cultural measures, $80,000 to assist alps management, and $40,000 to combat the increase in cost of living. Statistics and other information have $375,000; hydrographic work including fixation of torrents secures $243,000, including the salaries of 124 officials specially detailed to this work.

Under the title "Surveillance over land culture," provision is made for that peculiarly Austrian institution of technical forest police attached to the political administrations, an organization which is made up of altogether 186 higher grade and 204 lower grade foresters, for which $280,000 are provided. These items total for the directive department $2,870,000.

The State property in forests and domains consists of 1,767,700 acres forest and 160,000 acres agricultural lands and pasture besides 840,000 unproductive ground. The cut represents a little over 80 million cubic feet, of which 52.5% workwood and 47.5% fuelwood. The cut per acre of forest area then is 45.6 cubic feet. There are still rights of user for wood and pasture estimated at $354,000 in value. Total receipts are placed at a little under five million dollars, the expenditures a little under three million, the balance at $944,000 or only 47 cents per acre. If, however, the expense for the directive office, which has many outside functions, is left out of the calculation and the value of the rights of user is added to the income the per acre revenue rises to 80 cents.

The personnel of the directive offices consists of 106 foresters of various rank and 143 other functionaries; in the executive offices 195 higher grade, 580 lower grade foresters and 501 guards are employed.

The funds forests and domains of about 327,000 acres (18% unproductive) belonging to church and school institutions are administered under the Ministry of Culture and Education, with 27 higher grade and 183 lower grade officials. They leave a net result of around $200,000 or 75 cents per acre productive area.

Centralblatt für das gesammte Forstwesen, July, 1912. Pp. 342-346.

Forestry in Saxony.

The State forests of Saxony are, next to those of Württemberg, the most profitable in the German Empire, and consequently in the world.

The following table gives an analysis of the returns, first the totals, and then the figures for the forests showing respectively the largest and smallest net returns per unit of area:

		Single Forest.	
	Total.	*Largest.*	*Smallest.*
Area under forest, acres,	426,286	46,994	2,915
Wood cut total, cubic feet,	30,546,000	3,690,600	150,400
Timber wood:			
Cubic feet,	25,680,000	3,298,800	132,600
Per cent. of t otal,	84	89	82
Receipts:			
Wood,	$3,744,775.17	$531,184.74	$25,288.42
Secondary products,	28,105.49	550,91	105.61
Total,	3,772,880.66	531,735.65	18,094.27
Expenses:			
Wages of woodcutters,	552,581.77	75,254.00	2,908.56
Forest improvements,	109,101.91	33,618.69	2,949.43
Management and protection,	608,382.71	60,620.80	4,965.46
General working,	299,139.89	6,926.73	1,051.20
Total,	1,564,349.36	143,087.23	11,878.32
Net returns:			
Total,	2,208,531.29	355,315.09	6,218.63
Per acre,	5.17	7.56	2.13
Per 100 cub. ft. of wood,	7.22	7.19	4.12
Forest capital:			
Capital,	101,007,034.00	13,130,358.67	655,905.00
Rate of interest,	2.19%	2.71%	0.95%

The figures for the forest giving the smallest returns per unit of area are from the reserve annexed to the Forestry College of Tharandt, while those for the largest are from the forest district of Schwarzenberg, which has a wooded area slightly above the average.

Under expenses for forest improvements the principal items are for seeding and planting; in 1910 these were carried out on a total area of 6,668¾ acres, of which 287½ were seeded and 6,381¼ planted. The costs per acre were:

	Average.	For largest total cost.	For smallest total cost.
Seeding,	\$8.76	\$12.49	\$6.53
Planting,	10.26	8.09	8.27
Total (without general expenses),	10.19	8.49	8.07
Total (with general expenses),	14.51	11.47	11.03

The highest cost of regeneration (including general expenses) is again from the Tharandt reserve; the highest cost for seeding is, however, from the district of Barenfels, *viz.* \$14.03; and the highest cost of planting is from the forest district of Auerbach, *viz.* \$12.41; this district also had the highest total cost without general expenses, *viz.* \$12.39. It is thus seen that the general expenses are responsible for the high figure from Tharandt. The lowest total cost, including general expenses, is from the district of Dresden, and occurs with the lowest cost of seeding and planting respectively and together.

The highest cost per acre for conifers is \$20.17, occurring with the highest cost per 100 trees in the plantations, *viz.* 73 cents. The lowest cost per acre is \$4.52, occurring with the lowest per 100 trees *viz.* 16 cents.

Die Reinertragsübersichten der Kgl. Sächs. Staatsforsten für das Jahr 1910. Tharandter Forstliches Jahrbuch. February, 1912. Pp. 143-157.

German Forest Studies.

Those who desire to travel in Germany for purposes of study will find much suggestive discussion in the notes by Dr. Heck, an experienced forester, made on his own journeys. Seven years ago he recorded his observations on southern Germany. (See F. Q., vol. III, p. 302.) The present series concerns itself with north-east Germany, and is as rich in suggestiveness as the former series.

Vom Meer zum Fels. Allgemeine Forst- und Jagdwesen Zeitung. July, August, September, etc., 1912.

OTHER PERIODICAL LITERATURE.

American Forestry, XVIII, 1912,—

A Definite State Forest Policy... Pp. 421-430.

Chronological account of New York State's reforestation in the Adirondacks.

The New York State College of Forestry at Syracuse University. Pp. 453-457.

Outline of organization and proposed work.

Forestry in Formosa. Pp. 485-492.

[See also Quarterly Journal of Forestry.]

The Forestry of France. Pp. 493-500.

Silvicultural practice.

Why do Lumbermen not Apply Forestry? Pp. 613-615.

The time element.

Method of Forestry Campaigning. Pp. 635-643.

The technique of the successful educational work carried on by the Western Forestry and Conservation Association.

The Present State of Forest Tax Legislation. Pp. 653-655.

Two Solutions of the Forestry Tax Problem. Pp. 663-666.

Deferring of taxes or a system of State loans.

Forest Leaves, XIII, 1912,—

Cork Industry of Spain. Pp. 135-136.

Rhodora, XIV, 1912,—

The Genus Amelanchier in Eastern North America. Pp. 117-161.

In this treatment of this very valuable genus eight species are recognized, with the interpretation of the numerous transitional forms as hybrids.

Canadian Forestry Journal, VIII, 1912,—

Quebec Province Starts Forest Planting. Pp. 63-65.

An account of the beginning by sturents of Laval forest school of the planting up of waste sand lands at Lachute.

Government Forest in Saxony. Pp. 105-108.
An account of the method of management.

The Victoria, B. C., Forestry Convention. Pp. 113-136.
Brief account of proceedings.

Pulp and Paper Magazine of Canada, X, 1912,—

Experiments on Ground Wood at Government Laboratory, Wausau, Wisconsin. Pp. 149-152.

Qualities of Canadian Pulp Wood. Pp. 153-156.

Quarterly Journal of Forestry VI, 1912,—

State Reafforestation in New Zealand. Pp. 184-187.

The Forests of Formosa. Pp. 267-269.

The Journal of the Board of Agriculture, XIX, 1912,—

Preparation of Willows for Market. Pp. 277-288.

Notes on Kerry Woods, Illustrating Methods of Collecting and Utilizing Information for a Forest Survey. Supplement No. 9, August. Pp. 1-64.

Production of Timber in Great Britain. Pp. 567-569.

Transactions of the Royal Scottish Arboricultural Society, XXVI, 1912,—

The Report of the Departmental Committee on Forestry in Scotland. Pp. 121-146.

On the Relation of Light Intensity to Advance Growth in Oak and Beech Forests. Pp. 147-155.

The Gardeners' Chronicle, LII, 1912,—

The Forests of Provence. Pp. 89-90; 112-113; 131. Ecological.

The Indian Forester, XXXVIII, 1912,—

Turpentining in Florida. Pp. 280-286.

Insect Invasions and Methods of Control in American Coniferous Forests. Pp. 400-403.

Bulletin de la Societe Dendrologique de France, 1912,—

Conifères, Essais de Tableaux Dichotomiques pour la Détermination des Espèces. Pp. 23-27; 47-56.

Deux Genres Nouveaux pour la Chine. Pp. 58-61.

Graines et Plantules des Angiospermes. Pp. 72-141.

NEWS AND NOTES.

The unprincipled promoters of the eucalyptus game are evidently being found out and there is a very striking decline in the number of schemes presented to a gullible public. This is due perhaps to local sentiment in California where most of the ventures have been launched, and to the more enlightened attitude of the press in placing eucalyptus culture in the limited field where it belongs. Trade papers have of late assisted in setting people straight on this question. The Hardwood Record in particular has frequently expressed unqualifiedly its opinion of the unscrupulous eucalyptus promoters. In a recent issue this paper states that, "One of the more recent legends emanating from some of this cult is the statement that the Pullman Company is employing eucalyptus to the exclusion of mahogany, oak and other high-class woods for the interior finishing of its sleeping and passenger cars, and is substituting eucalyptus with a pretense that it is mahogany. The statement is absolutely without foundation in fact."

South American countries are usually looked upon as a possible future source of heavy, hardwood timber, but are not credited with any tendency towards forest conservation. A recent consular report from Chile indicates that this country at least is taking measures to reduce the destruction of timber, and to reforest certain arid regions. The estimated area of Chile's natural forest is given as about 7,000,000 acres, in addition to which there are about 30,000 acres of planted forests. Exploitation is hindered because most of the Chilean timber is very heavy and will not float, and because there are few railroads through the timber regions.

Objection has been made by a large number of the lumbermen and land owners interested in the Adirondacks to the provisions of the State Law of 1909 which requires the lopping of tops of coniferous species in the Adirondack section. The principal objections to the operation of the law may be summarized as follows:

It is claimed that if the top is not lopped the main portion of refuse is supported by the limbs and raised off the ground, therefore if a fire runs through, it will burn only lightly. On the other hand, if the tops are lopped this debris is on the ground and causes a very hot fire, burning more deeply into the soil. It is claimed further that the close lopping of the branches injures the reproduction of the forest, partly by smothering the seedlings and partly by cutting them down in connection with the lopping operations. It is urged further that even if it be shown that some benefit follows, the beneficial results are not commensurate with the additional cost.

In order to secure a complete expression of opinion, public hearings were held at Watertown, Saranac Lake, and Glen Falls, N. Y., on September 30th, October 3rd and October 4th, under the auspices of the State Conservation Commission. A large amount of testimony was taken which, however, was of such a divergent nature that no final conclusions could be reached. It became necessary therefore to make a field investigation which was carried out during the last week in October and the first week in November by State Forester F. A. Gaylord accompanied by the representatives of a number of operators in the Adirondack region.

In order to determine how far the top lopping situation in the Adirondacks might be applied to conditions in Eastern Canada the party was accompanied by T. W. Dwight, representing the Dominion Forestry Branch, and Clyde Leavitt, representing the Canadian Commission of Conservation. When published reports on the investigation are available, the matter will be reviewed in the QUARTERLY.

Notwithstanding the injunction issued by the Court of Chancery last spring restraining the State Forest Commission from enforcing the so-called "Railroad Fire Line Law," the three railroads having the greatest exposure in the State have voluntarily undertaken to extend their lines during the coming winter. The Pennsylvania Railroad Company will make new lines on the Freehold and Jamesburg Branch, on the Long Branch Railroad, and on portions of the West Jersey and Seashore System. The New Jersey Central Railroad Company will make lines along the New Jersey Southern Division south of Lakewood. The Atlantic City Railroad Company will extend its lines in Gloucester, Atlantic and

Cape May counties. All three roads will also do considerable work in cleaning up and making effective the lines that have been constructed heretofore. The length of fire lines now in service on all railroads approximates 250 miles. The increase this year will probably raise the total to at least 300 miles.

It is rather remarkable that this law which has been declared unconstitutional should still be so effectively supported by the very parties against whom it was directed; that is, the railroads which endanger the forests of the State. The Forest Commission expects that the decision of the Court of Chancery will be reversed by the Court of Errors and Appeals. Such a decision is earnestly hoped for as a means of enforcing the provisions of the Act where less liberal minded or less far sighted railroad companies are concerned.

On account of the unusually wet weather which has prevailed during the latter part of the summer, there has been but little strain upon the organization of the Fire Inspection Department of the Canadian Railway Commission. Since June, fires have been largely conspicuous by their absence, and such fires as have occurred have for the most part been attributable to causes other than the railways. The work of the Fire Inspection Department of the Railway Commission has been organized, under Order 16570 of the Board in the Provinces of British Columbia, Alberta, Saskatchewan and Manitoba. The requirements as to special patrols, reporting and extinguishing of fires by railway employees, and the disposal of inflammable material along railway rights of way, are being administered, and the work of the railway companies inspected, through a coöperative arrangement whereby certain officials of the British Columbia Forest Service and of the Dominion Forestry and Parks Branches, are appointed officers of the Railway Commission without additional salary. These officials handle the railway fire work as a part of their regular duties. The plan is working very satisfactorily, and it is hoped that it can be extended to the Provinces of Ontario, Quebec, New Brunswick and Nova Scotia when the work of the Fire Inspection Department is extended to these Provinces for the summer of 1913.

In connection with the prevention and control of railway fires along the Great Northern Railway in Canada and the United States, the following instructions to employees have been issued from the office of the General Superintendent at Seattle, Washington:

Working Instructions in Connection with Order No. 16570 of the Board of Railway Commissioners for Canada, Dated May 22, 1912.

To Engineers:

It will be the duty of engineers on freight and passenger trains, when discovering any fire adjoining the right-of-way of the Railway Company, to stop and extinguish such fire by the use of their branch pipe connections, where such fire is close enough to the track to enable this to be done. Where the fire is too far away from the track to be reached by hose, it will be their duty to stop at the first telegraph station and file a report showing the location of the fire accurately, with the Agent or Operator on duty.

To Conductors:

In all cases where fires along the right-of-way are noticed by conductors, it will be their duty to assist the engine crew in extinguishing such fire, where the fire can be reached by hose carried on the engine. If the fire is so far away from the track that it cannot be reached, the train must proceed at once to the first telegraph station, where a report must be made to the Superintendent, giving the exact location of the fire.

To Agents:

Engineers and Conductors of all trains have received instructions to report fire along the right-of-way and adjacent thereto, and it will be your duty to immediately wire the Superintendent, giving the location of the fire, extent of same, and any other information which might be of value, particularly as to the number of men needed to control the fire and extinguish it. At stations which are within the boundary of the United States, and the Forest Reserve the local Forester or Ranger should be first notified immediately, and notice also sent by wire to the Forest Supervisor in whose territory the fire is located, giving the exact location of same and the extent. Agents will also notify all section crews that can be reached, and also any bridge crews or extra gangs which may be in their territory.

To Roadmasters, Assistant Roadmasters, Master Carpenters, and other officials:

In cases where fires are reported, it will be the duty of any division official to proceed to the scene of the fire as quickly as possible and take charge of the work of fire-fighting until he can be relieved by the Division Roadmaster. The man first on the ground should organize his men to do the best work possible, and, when this is done, he should immediately proceed to investigate the origin of the fire. location, where it started; get statements from all witnesses and make every effort to learn the origin and responsibility. The law as now interpreted practically makes this Company responsible for fires starting within three hundred (300) feet of the track, and it is necessary therefore to positively determine the origin in order to relieve the Railway Company from the responsibility. On the American side and in the Forest Reserve the Government will stand the expense of fire starting two hundred (200) feet outside of the right-of-way, and, in order to re-imburse the Railway Company, for any expense incurred in fighting fires starting outside of this limit, we are obliged to determine positively the exact origin of the fire. On the Canadian side the limit is three hundred (300) feet.

Where the fire originates within the Forest Reserve of the United States, or adjacent thereto, the first officer on the ground should endeavor to hold a joint investigation with the United States forestry men and agree upon the origin of the fire. This will avoid disputes later on.

To Chief Dispatchers:

In all cases where fires are reported, it will be the duty of the Dispatcher to get full information as to the extent of such fire, its location, and the number of men necessary to fight the fire. It will also be the duty of the Dispatcher to furnish whatever train service will be required to move extra gangs, section gangs, or bridge crews, to the fire immediately, giving this movement preference if the emergency requires it.

To Section, Extra Gang, and Bridge Foremen:

In all cases where fire occurs, it will be the duty of all section crews, extra gangs, and bridge crews to immediately proceed to such fire and extinguish same, remaining as long as may be necessary to do this, and it must be understood that this is the most important work that can be done, and the carrying on of your work which may be important must be set aside until the fire is under control, and is completely extinguished. There must be no failure to understand this, and foremen will not be criticised for negligence in doing their other work in cases where they are fighting fires.

The Simmons bill, providing for a *nursery inspection service* and authorizing federal quarantine wherever thought necessary by the board in which the power is vested, has at last become a law. It has long been the desire of pathologists and entomologists to have suitable laws and regulations covering the importation of dangerous fungus and insect pests. The entrance into the United States within comparatively recent years of the destructive brown-tail and gypsy moths, upon whose partial control millions of dollars have been spent, the even more recent importation from Germany and France of the serious white pine blister-rust, against which only the most strenuous eradication methods have prevailed, and the possibility of the introduction of the potato wart disease, which has already reached Canadian territory, has made it highly necessary that federal restrictions be placed on indiscriminate importation of diseased plant material. The recent theory as to the foreign origin of the chestnut blight disease, which will soon have used up a half million of the national and state funds adds still greater weight to the argument.

As to the technical provisions of the inspection law a review will be given in the next issue of the QUARTERLY.

Prior to June 30, 1912, the National Forest Reservation Commission had approved for purchase 287,698 acres in the Southern Appalachian and White Mountains and purchase contracts had been entered into or condemnation proceedings begun on 257,228 acres.

These lands are situated in eight separate purchase areas in the States of New Hampshire, Virginia, Tennessee, North Carolina and Georgia. Eighteen such areas including 6,383,000 acres have been designated, situated in the above named States and in the States of Maryland, West Virginia and South Carolina. All of them lie on the watersheds of important navigable streams and they include a large proportion of the most mountainous areas in the Appalachian region. At the present time purchases are being considered only within these areas, in which lands aggregating 2,102,330 acres had been offered for the consideration of the Government prior to June 30, 1912.

It is not expected to buy all of the lands included in the Purchase Areas in any case, usually not more than from 50 to 75 per cent. is likely to be recommended for purchase. Compact bodies of land containing from 25 to 50 thousand acres or more and from 25 to 100 miles apart are being assembled within the Purchase Areas. They will be located with reference to their strategic importance in controlling the fire problem and in furthering conservative cutting throughout the region.

Under the law, the Geological Survey is required to pass upon the lands considered for purchase and no purchase can be made until a favorable report has been made by the Survey showing that the control of the lands is important for the protection of a navigable stream. The Survey has made rapid progress with its work completing examinations and reports prior to June 30, 1912, on 2,629,800 acres. All the reports rendered thus far are favorable.

The Forest Service has been designated as the Bureau to receive proposals of land and to examine and value lands for purchase. The Commission considers land only on the recommendation of the Forest Service. Prior to June 30, 1912, the Forest Service had examined 840,453 acres. These examinations resulted in recommendations upon which the Commission has approved the acquisition of 287,698 acres. Negotiations are in progress for large areas of other lands which have been examined and further examinations are being made at this time.

All lands on which condemnation proceedings have been instituted or which are brought under purchase contract are surveyed by the Forest Service by horizontal measurement and the acreage thus ascertained is used as the basis of payment. In many cases in the Appalachian region lands have never been accurately surveyed. Such surveys as have been made have usually been by surface measurement, which in a mountainous region is very inaccurate. Frequently the actual acreage is found less than that reported by from 5 to 10 or more per cent.

The lands placed under purchase contract or condemnation proceedings during the year are partly cutover, partly more or less culled of their best timber, and partly virgin timberland. The average price is $5.95 per acre with a range of from $1.16 to $15.00 per acre.

During the last session of Congress action was taken to make available until expended the appropriation for the fiscal years 1912 to 1915. A fund of $8,000,000 is thus made available for the work. An appropriation was also made for the protection and administration of the lands acquired. The appropriation having been made available for these purposes as soon as a purchase contract has been executed or the lands placed under condemnation the areas covered in the work of the last fiscal year are already under the care of the Government. The agents of the Government are now on the ground and plans for the protection and improvement of these lands are being worked out.

For a number of years the Government has owned several tracts of land in western North Carolina. These lands are of the character desired for purchase under the Weeks Law and are in fact in one of the Purchase Areas. Congress at its last session transferred these lands amounting to 32,000 acres from the care of the Treasury Department to the Agricultural Department to form a part of the system of Appalachian National Forests. These lands are now being surveyed and will soon be put under administration.

White Pine Culls. A peculiar feature of current lumber demand in the old white pine sections of the North is the extraordinary requirement for low grade stock, which 20 to 30 years ago would have been considered refuse, thrown into the burner or used to build wharves or roadways, or for firewood. Grading downward has come with the demand for box material, until "three-men boards," as they have been jocosely called, are now graded as No. 5 or anything below that. The call for low-grade stuff has become so general and insistent that such stuff is more saleable than the medium and better qualities. This feature is true, not only of the lumber market of the Northern States, but pertains also to that of Canada. At Toronto the demand for the lower grades of pine is especially active and large, so that there is a veritable shortage of mill culls and what are called "dead" culls, the latter term applying to lumber that has no sort of "pickings" in it. This condition with respect to the lumber market of Ontario shows how closely the lumber trade of that province is connected with that of the United States, the same requirement for cull lumber—namely, for box manufacture—prevailing in that province as in the northern part of the United States. The way in which the cull lumber of the Northern States and Canada is being used up almost to the last carload has more than ordinary significance! It means that anything in the shape of a tree or log is being utilized in the way of sawed product, and that timber that was once considered usable only as firewood is now being converted into lumber that actually sells quicker than good stock.—American Lumberman.

After 1912 all mail in U. S. must be carried in all steel cars, as provided by Post Office Department. There were also six bills introduced in 1912 to supplant all wood passenger equipment. This would on 55,872 cars of 225 companies mean an outlay of $632,746,000.

It has been demonstrated quite conclusively that the full cell creosote treatment of timber when preceded by steaming as a means of artificial seasoning, materially reduces the strength of timber. At some railroad plants, however, bridge timbers are given full cell treatment without preliminary steaming and there has been some question as to whether treatment of this kind results in any reduction in strength. The Santa Fe Railroad in order to demonstrate this point has recently completed a series of tests, under the direction of H. B. McFarland, Engineer of Tests. Thirty-two standard long leaf pine stringers, 7″ x 16″ x 28′ were used, these being picked from the stock in the yard at the creosoting plant at Somerville, Texas, and all had been air seasoned for ten months. Each stick was sawed in half, and half of each creosoted by the full cell process. The average amount of creosote injected was 13.7 lbs. per cubic foot, and in the specimens which were tested one year after treatment there had been an average loss of creosote by weathering of 3.7 lbs. per cubic foot. The tests were made in a 200,000 lb. Olsen testing machine. The tests included transverse breaking, compression parallel to grain and compression perpendicular to grain.

Summarizing the final results of the tests made immediately after the timber was treated it was found that the moduli of rupture in the transverse tests was quite uniform and the average of 4,955 lbs. per square inch was considerably lower than is usually given for long leaf pine. The general results show that there is very little difference in the strength of treated and untreated timber. In a few cases where the untreated sticks were stronger than the treated, an examination of the data shows that knots or defects existed. As was to be expected it was found that the percentage of moisture had considerable influence on the strength of the timber. One stick which contained 55% of moisture in relation to dry weight showed a modulus of rupture of 4,670 lbs. as against 6,160 lbs. for a stick containing only $13\frac{1}{2}$% of moisture. Only 15 out of 64 specimens failed in tension, the remainder failing by horizontal shear. Seasoning checks and heart shakes seemed to influence the horizontal shearing failure, while a number of knots near the neutral axis tended to prevent horizontal shearing.

In the compression parallel to the grain test the strength of the untreated specimens was quite marked. The elastic limit was 10% greater, the modulus of elasticity 9% greater and the maximum load 9% greater in the untreated than in the treated specimens.

Special tests showed that stringers from the butt end of the tree were stronger in all respects than those from the top, in one case the difference reaching 30% in the modulus of rupture.

The detailed results of these tests are given in a bulletin of the American Railway Association, Vol. 14, No. 149, September, 1912. The conclusions stated by Mr. McFarland are that: "The data show conclusively that long-leaf pine timber which has been subjected to the full-cell process of creosoting and allowed to weather for a year is in no way inferior to untreated timber. When tested immediately after treatment, the results show the treated timber to be slightly inferior to the untreated timber."

Ontario is the latest Canadian province to appoint a Provincial Forester in the Department of Lands, Forests and Mines. This position, abolished several years ago, has been once more established with the appointment of Prof. E. J. Zavitz to the post. Professor Zavitz is a graduate of Ann Arbor and since graduation has been in charge of forestry work at Guelph College for the Department of Agriculture. His main energies heretofore have been in connection with the waste land problem. Prof. Zavitz's initial activities will probably be in the fields of lumber slash disposal, fire protection organization, and general reconnaissance.

In order to protect and administer the Dominion Forest Reserves to the best advantage, they are being subdivided into ranger districts and houses are being built at strategic points for the use of the rangers in charge. The first of such houses to be occupied on the Duck Mountain Forest Reserve is located at Madge Lake, a few miles from Kamsack, Sask.

The ranger at this station has direct charge of some two hundred and thirty square miles of highly valuable, young second-growth spruce and poplar forest, and his central object and work will be to safeguard it from fire by every possible means, so that in two or three decades it may yield welcome and abundant supplies of fuel and lumber to the dwellers on the prairies.

The new forestry policy of the State of Kentucky, as outlined by J. E. Barton, State Forester, at a dinner of the Louisville Hardwood Club, gives promise of definite accomplishments and should be of mutual benefit to all timber interests in the State. The essential features of the plans worked out by the State Forestry Board are:

The establishment of nurseries, both for demonstration purposes and as a business proposition, including the sale of seedlings to private concerns which are engaging in forestry work.

The purchase of lands and the acquirement of others by gift where forest reserves may be established and timber raised in commercial quantities.

The studies of the possibilities of preventing waste in timber logging and manufacturing, and the utilization of by-products, involving the establishment of a laboratory for the use of lumbermen and wood users.

The protection of the forests by the enactment of adequate laws looking to proper fire protection and the prevention of grazing on forest lands, which would result in young trees being killed or seeds destroyed.

The study of streams and stream flow, and regulating them by the planting of forest at their headwaters, thus preventing floods. Study of water power possibilities is also to be included in this provision.

Coöperation with individuals in examining timber tracts, laying out a plan of scientific management and aiding in the operation of the property. This work will be begun early in 1913, when the forestry work will have been fully organized.

Changes in the personnel of the Forester's office of the Pennsylvania Railroad during the late summer and fall include the resignation of W. C. Shepard, Willard Springer, S. T. Pollock and C. W. Tiffany, and the appointment of I. T. Worthley, formerly connected with the Forestry Academy at Mont Alto, Pa.

The sale of the timber above fourteen inches on 68,000 acres of the Biltmore estate in North Carolina, for $12 per acre or $816,000 shows the possible profit to timberland investors who bought timber when it was cheap. The Biltmore lands cost about $2.00 per acre, which gives a profit of $10 per acre after holding the land twenty years. An element of forest management is introduced, by the provision that the timber below fourteen inches shall be left and the slash disposed of. It is reasonable that at the end of the cutting period of twenty years another merchantable crop will be available. Even without any thought of forestry or conservative cutting, timber of the character found on the Pisgah forest would yield a handsome profit to any lumberman at the price paid twenty years ago. Mr. Vanderbilt has in several ways set a good example in the forest management of his Biltmore estate, and not the least will be his retention of the land and the timber below a fixed diameter limit with the evident expectation of reaping future profits. A little more care in logging and fire protection and the holding of cut over lands would give many lumbermen an asset of great future value.

At the Fourth National Conservation Congress held in Indianapolis in early October the lumbermen and foresters in attendance held several independent meetings, at which various specific problems of mutual interest, such as forest taxation, fire prevention, legislation, etc., were discussed. Steps were also taken toward a permanent organization which will work along definite lines throughout the year and prevent the lapse of interest which results from confining the work to general papers read at popular gatherings such as the Conservation Congress. A committee, made up of E. T. Allen, Captain J. B. White and H. S. Graves to represent the lumbering, forest fire and government timber interests, was appointed. This committee will work in conjunction with a special committee of the American Forestry Association in arranging a forestry program for the next Conservation Congress, and what is most important, in organizing standing committees in various subjects. The final plans have not been worked out, but it is expected that standing committees will be appointed to cover all of the important subjects relating to lumbering and forestry. These committees will, from time to time, submit reports for consideration by the forestry section of the Conservation Congress or perhaps by other organizations, and such reports as are accepted will become the basis for definite and concerted action.

The American Forestry Association through its magazine and otherwise will give publicity to the work.

Two international meetings held in New York City during September gave considerable space in their programs to questions of interest to lumbermen and foresters.

At the Sixth Congress of the International Association for Testing Materials the following papers relative to timber were presented: McGarvey Kline: Forest Service Investigations of American Woods, with Special Reference to Investigations of Mechanical Properties; W. H. Warren: Australian Timber Tests; J. Janka: Hardness Testing of Wood by the Ball-pressure Method; Danish State Testing Laboratory: Bending Tests on Wood for Scaffolding; P. Labordere and F. Anstett: Means for Increasing the Strength of Wood Paving Blocks; M. Rudeloff: Large vs. Small Testpieces in Testing Wood.

The other meeting was that of the Eighth International Congress of Applied Chemistry, at which the subjects of wood preservation and forestry were covered by papers on: Tests to Determine the Relative Commercial Values of Wood Preservatives, H. F. Weiss; Antiseptic Tests on Wood Preserving Oils, A. L. Dean and C. R. Downs; The Development and Status of the Wood Preserving Industry in America, E. A. Sterling; and papers on Forestry by O. W. Price and Henry S. Graves.

The New York State College of Forestry established at Syracuse University by the State Legislature in 1911, opened the present college year with registration of 110 Freshmen and 47 men from the second year on. These men represent sixteen states and two foreign countries. No special students were entered, as men wishing to enter in this way were urged to take further preparatory work or enter the Ranger School held on the College Forest of 1,800 acres at Wanakena in St. Lawrence county. Several men were added to the Faculty of the College during the late summer, which is now made up of the following men: Hugh P. Baker, M. F., Yale; D. Oec., University of Munich, Professor of Silviculture; Frank F. Moon, A. B., Amherst; M. F. Yale, Professor of Forest Engineering; Philip T. Coolidge, A. B., Harvard; M. F. Yale Forest School, Director, State Ranger School; Edward F. McCarthy, B. S. & M. F., University of Michigan, Assistant Professor of Forest Products; John W. Stephen, B. A. & M. F., University of Michigan, Assistant Professor of Silviculture; Nelson C. Brown, B. A., Yale; M. F., Yale Forest School, Assistant Professor of Forest Utilization; Reuben P. Prichard, A. B., Dartmouth; M. F., Yale Forest School, Instructor in State Ranger School; Russel T. Gheen, B. S. F., Penn State, Student Assistant in Forestry.

The State Ranger School opened in September with sixteen men and two instructors. Two of the men are from Massachusetts, two from New Jersey and the remainder from New York. The only requirements for the Ranger School are that a man be eighteen years old, in good physical condition and come well recommended. All of the men take the same work for the first year and those who wish, continue for a second year, getting during this year more theoretical work in Mathematics, Botany, Geology and Soils, and Surveying, with independent work along practical lines.

The law which established the New York State College of Forestry at Syracuse University, obligates it to carry on both educational and investigative work. To meet the second requirement, the College purchased in the spring of 1912 two small adjacent farms of 90 acres on the south boundary of the city, which is being developed as a State Forest Experiment Station.

During the past spring an Experimental Nursery was started at the Station which is now under the direction of Professor John W. Stephen, who has had five years of practical experience along these lines with the State Conservation Commission. At present there are a million and a half seedlings and transplants growing, following out definite plans as to different methods of planting and upon different soils and situations. Thirty acres of the Station is covered with an excellent second-growth woodlot and here permanent sample areas have been laid out and are being treated according to different methods of management applicable to such woodland. It is very essential in the State of New York that definite data be obtained as to methods to be used in rejuvenating worn-out woodlots, in hastening maturity and improving composition of second-growth timber, and in underplanting and replacing woodlots which are now made up entirely of worthless species.

The contract for the erection of the forestry building at Cornell which has just been let calls for a brick structure 143 feet by 58 feet, with three floors and a finished attic. The building is to cost $100,000. It is to be appropriately located close to a hardwood and hemlock woods on the edge of the Campus, and is to be ready for occupancy sometime during the college year 1913-14.

The trustees of Cornell University have just enlarged the faculty of the Department of Forestry by the appointment of Arthur B. Recknagel as full professor. The faculty now includes three full professors and an assistant professor. Mr. Recknagel will have the work in forest management, forest utilization and wood technology. Mr. Recknagel graduated from the Academic course at Yale University in 1904, and from the Yale Forest

School in 1906. Since graduation he has been in the employ of the U. S. Forest Service, and has had a wide range of experience in many sections of the country. He is at present assistant district forester in District 3, having just returned to his duties in Albuquerque after a year's study in Europe. Mr. Recknagel will begin his work at Cornell on February first.

The professional course at Cornell covers five years. Thirty-six professional students have registered as members of the four upper classes. There is no means of knowing how many freshmen are planning to take the professional forestry course, as in their first year the men take the same work as the agricultural students, and they do not need to register in the Department of Forestry.

The total registration in forestry courses at Cornell this fall is 235. Most of this registration comes from students of general agriculture.

P. S. Lovejoy has been appointed Assistant Professor of Forestry at University of Michigan. He was formerly Supervisor on the Medicine Bow National Forest and later of the Olympic National Forest of Washington. He is a graduate of this school. The faculty now consists of Professor Roth, Junior Professor Sponsler, Assistant Professor Lovejoy, Mr. Young and Mr. Pottinger. A re-arrangement of courses is being made to adapt the work to the enlarged facilities for teaching; additional equipment for laboratory and field is improving this phase of the work.

It is reported that the University of Missouri at Columbia, between St. Louis and Kansas City, has added a School of Forestry to its course. Some 25,000,000 acres in the State of Missouri are still covered with natural forest growth, but at the present rate of cutting the merchantable timber will be exhausted in a comparatively short time. Even now, timber up to the amount of $7,000,000 is purchased outside of the State, but the School of Forestry will aim to stimulate interest in forest production and protection in Missouri, and as a start will have 50,000 acres of State forest land for demonstration purposes.

Professor John A. Ferguson returns from the University of

Missouri to The Pennsylvania State College as head of the Department of Forestry. Before going to Missouri Professor Ferguson was connected with this institution three years and in the absence of the head of the department took charge for nearly two years.

The Association of privately employed foresters in Germany has issued a circular, published through the newspapers, warning young men against entering private employment, and describing the distress in which private foresters find themselves. From 200 to 300 applicants are had for every poorly paid position, and many well-educated men are forced to take inferior postions; the market is greatly overstocked.

On October 1, Mr. J. S. Dawley, General Stage Director of Thomas A. Edison, Inc., and troupe arrived at Northfork, California, and in co-operation with and under the supervision of the officers of the Sierra National Forest, took 65 views of foresters' activities and forest fire work. These views will be combined in a moving picture entitled "A Forest Fire and How it is Fought." This picture will be released, it is expected, by the Edison Company in December and will be shown simultaneously in all the large cities of the United States and Europe. This is the first time that a moving picture, showing in detail the many activities of a Forest Ranger, and the work in connection with a real forest fire has ever been taken, and because of the action in the picture it ought to be received very favorably. The cause and effect and methods of fighting a forest fire ought to be made clear to the thousands of persons who previously have had no conception of this subject.

The July issue of the "Philippine Journal of Science" is a memorial number to Doctor Paul Caspar Freer who died in April at the early age of fifty-one years. Dr. Freer was Director of the Bureau of Science, Dean of the College of Medicine and Surgery, Professor of Chemistry of the University, and Editor-in-Chief of the Journal at Manila.

After a scientific training in United States and Europe Dr. Freer was appointed to the chair of Chemistry in Michigan University in 1889. But in 1901 he was chosen as the man best fitted to undertake the work of centralizing the laboratory work of the Insular Government of the Philippines. On him fell the heavy task of planning the buildings, equipment, and personnel of the Bureau of Government Laboratories. So wisely and efficiently did he develop the Bureau during his eleven years' directorship that he may well be called the father of modern science in the Philippine Islands. The Bureau will be "a lasting monument to his unquestioned scientific and business ability, his clear foresight, his sane judgment, and his unwavering perseverance."

Dr. William A. Buckhout, Professor of Botany and the Senior Professor at the Pennsylvania State College, died of heart disease on Tuesday, December 3, 1912. In 1871 he became Professor of Botany and Horticulture at this College; later, Professor of Botany, and for many years Botanist of the Pennsylvania State Board of Agriculture. In 1888, he was appointed to the Pennsylvania State Forestry Commission and was a prime mover in the State in creating and taking an active interest in forestry. He was author of papers such as "The Chestnut as a Fruit and Food," "The Effect of Smoke and Gas on Vegetation," "A Microscopic Examination of State College Water Supply," "Forest Fires," and, as a contributor to the FORESTRY QUARTERLY (vol. V, p. 259), of a study on the "Formation of the Annual Ring of Wood in European Larch and White Pine."

He determined the relation between the nodules of legumes and bacteria just previous to the same discovery by Hellriegel and Wilfarth, of Germany. Excessive modesty prevented him from becoming one of the foremost investigators. He was a true Professor in the best meaning of the word. No man was ever more faithful to his duty than Dr. Buckhout. He conducted classes to the last, having taught for over forty-one years, a record of which few can boast.

No American student of forestry who may lay claim to a full professional education is unacquainted with the name and work of Karl Gayer. His classic volume on Silviculture which made him the foremost exponent of the school of natural regeneration is, to be sure, accessible only to those acquainted with the German language. But his volume on Forest Utilization has become a standard textbook in translation through Dr. Schlich's efforts.

Prof. Gayer died on March 1, 1907. It is proposed to erect a memorial of the decennial return of his demise, a stone and bronze bust on his grave, commemorating his services to the profession.

A committee of the leading foresters, on which all countries are to be represented, will be in charge of executing this plan. To encompass the plan, subscriptions are invited from all foresters who are proud enough of their profession to honor its masters. The amount is fixed at not less than $1.00 nor more than $5.00.

Prof. E. Ramann, of the University of Munich, is the organizer of this undertaking.

Names of intending subscribers will be accepted by the Editor of the QUARTERLY. Further announcements will follow.

COMMENT.

It will be noticed that this issue is largely devoted to a discussion of matters pertaining to tropical forests and development of forestry in the tropics. The suggestion of such an issue came originally from Mr. M. L. Merritt, whose experience in the Philippines enabled him to condense into practical limits the information contained in Bulletin No. 10 of the Philippine Forestry Bureau, and to editorially pass on other articles in this issue.

Next to India, it would appear that the Philippine Forestry Bureau is the foremost and best developed forest service in the tropics, and Major Ahern may well take credit for having brought it to the standard which it has attained.

The future of the woodtrade will undoubtedly at some time largely depend on the tropics, which can, if properly directed, produce more rapidly valuable woods than any other climate. But we shall have to learn a great many things before this can happen.

In the first place we must learn how to use the tropical woods for our purposes in the civilized world. At present there are too many of them, their value not only is little or not at all known, but their specific gravity is, except for the best ornamental and fancy material, a positive objection not only to their use but to their exploitation. Softwoods are rare in the tropics.

New methods of using wood, however, may be invented, like the pulpboard; new ways of logging may be devised. Eventually, when true forest management has become practicable, the tropical, natural forest may be changed from its present heterogeneity to the homogeneity of the forester's forest. A choice of species on which the management is to be based will have to be made and the balance subdued; the lighter woods may be favored in the reproduction and the enormous productive power of the tropics used to the best advantage.

There are, however, also subjective troubles to be overcome. The tropical climate, after all, is not attractive to white skulls, and the blacks are as a rule poor workers—probably in part a result of the climate. The labor question and not less the question of efficient superintendence are also important in not only exploiting but actually managing these resources. The men who are pioneering in these woods certainly deserve our admiration; they have giants' work before them!

The failure of the enemies of conservation in general and of the Forest Service in particular to bring about the passage, in the last Congress, of an amendment to the Agricultural Appropriation Bill requiring classification of all lands "fit and suitable for agriculture" within the National forests, eliminates, temporarily, a serious menace to National forest administration. The iniquity of the proposed measure requiring the elimination of lands locally considered or alleged to be agricultural, has been pointed out by Mr. Graves and others, and it is entirely clear to those familiar with the situation that the existing laws are quite ample to take care of the classification and elimination of lands which are truly agricultural.

It is to be hoped that the question of agricultural classification will not come up again, but in the meantime another danger threatens the National forests. This new menace is a proposal to turn the National forests over to the individual states, and there seems to be a strong movement to bring this about, fathered by interests which would prefer to have the natural resources of the country open to private control and exploitation rather than under efficient National management. It is unpleasant to anticipate what would happen if the timber, coal, mineral, grazing and other resources of the public lands were placed in the power of the political machines in various states. Aside from the menace which would follow under such a policy it is evident that the States, even if sincerely and honestly desirous of properly managing these lands, do not have the organization nor experience to handle property representing such diversified conditions and of such enormous value. In the first place, many of the administrative problems are national, among these being fire protection, insect control and matters relating to water in the form of storage, flood damage and irrigation. The States also lack the financial resources to properly develop and protect large areas of forest land and do not have the broad viewpoint which reconciles present use and the perpetuation of important resources. Entirely aside from the ability or inability of the States to handle the National forests, Mr. Graves strikes the keynote when he says that "the underlying purpose of the proposed transfer of the National forests to the States is really not a substitution of State for Federal control, but rather to substitute individual for public control."

With a different party in control of Congress next year still greater uncertainty is adding to the situation as regards the National forests, and the developments in Congress and elsewhere cannot be watched too closely, nor vicious legislation fought too vigorously by friends of forest conservation.

Subscribers are requested to note that, with this issue, the office of publication of the Forestry Quarterly is transferred from Cambridge, Mass., to **Ithaca, N. Y.** where all business communications should be addressed. This change of address does not apply to the Editorial department, which remains in the same hands and at the same address as before.

Soon after the final issue of Volume X, a comprehensive index embracing the contents of the ten volumes is to be issued, which will greatly enhance the value of the set as a book of reference. It is expected that the index will contain about 100 pages and that it will cost $1.00 per copy.

As the edition will be limited, subscribers who desire this index are requested to make early application by postal card, addressing Business Manager Forestry Quarterly, Ithaca, N. Y. Full sets of back volumes can still be obtained.

By a peculiar accident, the article on Rainfall, a Factor of Tree Increment, printed on pages 222-228 of the present volume was credited to Francis Davis, when it should have been credited to Chandler Davis. Please correct.

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