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CONTENTS

INDEX.

JOURNALS BRIEFED

Agricultural Gazette of New South Wales
Allgemeine Forst- und Jagd Zeitung
L'Alpe
American Forestry
American Lumberman

Barrel and Box
Botanical Gazette
Bulletin of American Geographical Society
Bulletin of American Institute of Mining Engineers
Bulletin of the New York Botanical Garden
Bulletin de la Société Dendrologique de France
Bulletin Société forestière de Franche-Comté et Belfort
Bulletin of the Southern California Academy of Science

Canada Lumberman and Woodworker
Canadian Forestry Journal
Centralblatt f. d. g. Forstwesen
Comptes Rendues Academie des Sciences (Paris)
Cultura

English News
Experiment Station Record

Forest Leaves
Forstwissenschaftliches Centralblatt

Gardeners' Chronicle

Hardwood Record

Indian Forester

Jahresbericht Vereinigung angew. Botanik
Journal of Agricultural Research
Journal of the Board of Agriculture

Lesnoy Journal
Lumber Review
Lumber Trade Journal

Minnesota Forester
Mississippi Valley Lumberman
Mitteilungen der Deutschen Landwirtschaftlichen Gesellschaft
Mitteilungen aus der Kgl. Sächsischen forstlichen Versuchsanstalt zu Tharandt
Mitteilungen der Schweizerischen Centralanstalt für forstliche Versuchswesen
Monthly Bulletin of Agricultural Intelligence and Plant Diseases
Municipal Journal and Engineer
Mycologia

Naturwissenschaftliche Zeitschrift für Forst- und Landwirtschaft
New York Lumber Trade Journal

Ohio Naturalist

Philippine Journal of Science: Botany
Pomona College Journal of Economic Botany
Praktische Blätter für Pflanzenbau und Pflanzenschutz
Proceedings of the Academy of Natural Sciences
Proceedings of the Society of American Foresters
Pulp and Paper Magazine of Canada
Phytopathology

Quarterly Bulletin of the Canadian Mining Institute
Quarterly Journal of Forestry

Revue des Eaux et Forêts
Rhodora
Rod and Gun

Science
Schweizerische Zeitschrift für Forstwesen
Sierra Club Bulletin
Silva
Skogsvardsforeningens Tidskrift
Southern Industrial and Lumber Review
Southwest
St. Louis Lumberman

Tharandter forstliches Jahrbuch
Timber Trades Journal
Timberman
Transactions of the Forest Experiment Stations, St. Petersburg
Transactions of the Royal Scottish Arboricultural Society

West Coast Lumberman
Woodcraft
Wood Worker

Yale Review

Zeitschrift für Forst- und Jagdwesen

FORESTRY QUARTERLY

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A SUGGESTION FOR SECURING BETTER PROFESSIONAL TERMINOLOGY.

BY P. S. LOVEJOY.

Most of our new words and phrases arise either by direct translation from another language in which they are already in use to express the identical idea, or, through the more or less gradual adaptation of words and phrases already in our own language.

The first source is illustrated by our use of "working-plan"; the second by "reconnaissance." Further terms originate by direct manufacture from established roots, as "silviculture" or "dendrology," or by new combinations of old words, as "lookout-station." It is usual for such professional words and terms to differentiate as the profession develops so that their definition is different from time to time.

Any new term is likely to become permanently grafted into our professional language and has rather great possibilities for use or abuse. An unfortunately adopted term may become very mischievous.

If a term is short, easily spelled, self-defining, legitimate in derivation and accurate in significance, it is likely to be a good term.

Our need for new terms and phrases is constant. The introduction and adoption of new terms is too easy: the results are often unhappy.

An illustration of the perversion of terms is found in the current use of "working-section" and "working-circle." The use of the terms in Schlich is constant and consistent. Forest Service Bulletin 61, properly intended to be the official dictionary for professional terms, retains the terms but exactly reverses the definitions. This seems to have been a clerical error, but the recent literature of the Forest Service is apparently in the way of perpetuating the inadvertence. The term "working-section," as used by Schlich, seems to have been dropped entirely. The results are confusing and the situation would seem to be quite unnecessary.

Another illustration of an unhappy term is "reconnaissance." When the word first came into use in the Forest Service it was legitimate and accurate even though clumsy, foreign, long and miserably easy to mis-spell. It signifies "preliminary survey" and had been used in this sense for many years. But the character of our forest surveys changed rapidly; the use of the word was continued. It now signifies "the linear and topographic survey and mapping, estimating and reporting upon of forest lands." It often involves all sorts of further details of logging, grazing, alienations, soils, tree diseases and ecology. Much of this work is to-day of the most intensive and accurate kind and involves a very large degree of permanence. The inadequacy of the word early became evident and we have "jack-rabbit surveys" for the original "reconnaissance" and "intensive reconnaissance" for the rest. But why "reconnaissance" at all? By the word we mean "finding out what we have and where it is." That is "taking stock." Taking stock is "inventory." Why not say inventory when we mean just that?

An objection against the use of "inventory" in this sense has been urged, to the effect that "it smacks too much of common business." To some foresters this might not be an insuperable objection. This might also be said of the objection that "it would require the re-filing of pounds of correspondence and another circular letter."

The phrase "germinative force" has recently been introduced to express a new measure of the rate of seed germination. The need of some such phrase would seem to be evident; but is the phrase wholly satisfactory? Certainly it is far from self-explanatory and the use of the word "force" is actually misleading. In order to use the new conception conveniently we need some form of abbreviation or numerical expression. We have to express a per cent. of a per cent. What shall we call that?

If the whole matter is not to be left to work itself out by individual preference, accident and whim, there should be some representative professional body to pass upon all new terms and phrases. In the absence of such a body is it not likely that foresters in America will soon find themselves in a hopeless tangle of terminology? Ample precedence for such an experience can be found in many sciences and professions.

Let us have a standing committee in the Society of American Foresters, the duties of which shall be somewhat as follow:

(1) to consider and revise current terminology
(2) to note or receive all new professional terms and phrases and to pass upon their suitability, recommending their adoption or rejection.
(3) to recommend new or other terms for all terms rejected, if deemed desirable.
(4) upon application, to consider and recommend terms for any conception deemed worthy of fixation in our professional language.

EDITOR'S NOTE TO THE ABOVE ARTICLE.

The Editor, having to handle the manuscripts of his contributors, desires to express his full sympathy with the above proposition. He is often filled with sadness at the lack of uniformity not only, but of linguistic sense in the choice of terms. There are any number of clumsy, misinterpreted, misunderstood terms which recur in the contributions to the Quarterly. He desires to recall his longer article in Vol. III, p. 255, written more than eight years ago, when reviewing the U. S. Forest Service Bulletin 61, which tried to establish a terminology. He there laid down some principles which may bear repetition in this connection.

We hold that technical terms are merely conveniences for quick and precise speech and should be first of all tested by that object. To attain it, they should conform as much as practicable to at least the following four requirements, important in order of their sequence:

(a) A term should be necessary. As long as common language is sufficient to precisely state the idea, special terminology is superfluous, except, perhaps, for special cases or special writings. A corollary is that, as long as an accepted term employed in other sciences or arts expresses precisely the conditions or ideas to be expressed, there is no gain in coining a new word.

(b) Words which are current with well established meanings should not be employed as terms in another sense, especially where it is likely that ambiguity would be introduced by the simultaneous use of the ordinary sense and the term meaning.

(c) Age is a virtue: a long-established, sufficiently well defined and understood term should not be lightly discarded or supplanted unless very considerable improvement were gained. Convenience, we repeat, is the object of language, and it is more convenient to use established language than to fish for new words.

(d) Terms should be as short and as nearly as possible self-explanatory. It is, of course, well nigh impossible, nor is it necessary, that a term explain all that is implied in it: it is the very impossibility of doing so that leads to the use of special terms which to the initiated at once convey the full explanation. But, if the term suggests its own explanation, it will be the more acceptable.

(e) Finally, the word or word combination should have a *term-quality*. This is, perhaps, the most difficult requirement to define or to discover: it is like taste in art, it requires a language sense which by instinct or intuitively rejects the unsuitable. A word infrequently used in common language has thereby more term-quality, than one in common use; a Roman word more than a Saxon; a brief combination more than a long one; a compound more than a phrase; an unusual compound more than a common one.

If the term fulfills all these conditions, it is perfect; by so much as it fails, it is deficient and open to criticism, calling for improvement.

We may add, that there is a movement on foot to have a Committee of the Society of American Foresters revise the terminology—a most excellent proposition! Such committee may then be made permanent or self-perpetuating.

GRADED VOLUME TABLES FOR VERMONT HARDWOODS.

By Irving W. Bailey, Harvard University,

and

Philip C. Heald, Harvard University.

Approximately one half of the data upon which the following volume tables are based was secured by senior students of the Harvard Forest School in April and May, 1913. During this period the members of the class were engaged in mapping and estimating the timber upon the township of Somerset in southern Vermont. The primary object in collecting material for graded tables was to focus the attention of the students upon local methods of logging, milling, and grading hardwoods, and to afford essential experience in studying the effects of such fluctuating factors as forest type, tree form, defect, method of utilization, etc., upon the graded yield of logs and trees. Although each student spent but three out of eight weeks in this type of preliminary training before undertaking the final task of estimating standing timber, much instructive and reliable information was obtained. The facility with which material for graded volume tables could be collected made it seem advisable to secure sufficient additional data to justify the construction of tables for beech, hard maple, and yellow birch. With this plan in view one of the writers and Mr. George W. Kimball, M. F., spent the month of June, 1913, in the locality previously visited.

Before passing to a detailed description of the results of this investigation it will be well perhaps to discuss briefly certain points that are significant in the construction and use of hardwood log scales and volume tables.

An elementary principle but one which is not always sufficiently emphasized is the theorem that no greater degree of refinement should be used in any detail of a problem than is justified by the homogeneity of the material and the accuracy of methods used in other phases of the problem. Of course the accuracy of these details should be properly correlated with the accuracy desired in the results. For example, in the determination of the 'Modulus of Rupture' and 'Crushing Strength' of timber, values are read not infrequently to units or decimals. These figures are the averages of a large number of individual tests. Unfortunately, wood, like most organic matter, is an extremely variable material and differs to a marked degree in different representatives of the same species and in different portions of the same tree. Furthermore the same piece of timber will vary greatly with changes in its environment. Thus the 'Modulus of Rupture' or 'Crushing Strength' of a given kind of wood represents an average of many widely fluctuating values. As yet no satisfactory method has been discovered for determining, *a priori*, the variation of a given piece of timber from the normal or average strength values of its class or grade. Since a structure is in most cases dependent upon the strength of its weakest member the engineer and architect must allow for these fluctuations by the use of the so-called 'factor of safety,' an approximate and arbitrary figure. Therefore, elaborate methods of testing timbers, and values which record units or decimals are refinements that are not justified except perhaps in theoretical researches when the investigator endeavors by means of carefully selected small specimens to analyze certain factors that produce variation in the strength of wood.

In a similar manner the contents of logs and trees fluctuate greatly with variations in certain natural and economic factors of which the most significant are form, defect, and methods of logging, milling and utilization. Thus, log scales and volume tables, compilations of averages, are inherently inaccurate except when applied to more than a limited number of logs or trees. Furthermore, they are untrustworthy unless the natural and economic factors to which they are standardized are homologous with those which prevail in regions where they are applied, or unless accurate converting factors are available. The problem of successfully standardizing tables to given conditions and of using in each step of the process a justifiable degree of accuracy is a difficult undertaking. For, even in the case of homogeneous bodies of coniferous timber, volume is subject to considerable variation due to differences in method of logging, milling, and utilization; a point that has not always been sufficiently emphasized in the construction and use of volume tables.

Hardwood timber is heterogeneous and extremely sensitive to fluctuations in the economic factors mentioned above. Therefore, it appears to be true that, until our methods of utilization are matured and become less plastic, 'general' volume tables based upon a large amount of data, collected from a wide area, cannot be applied in any given region with sufficient accuracy to justify the cost of their construction. If 'local' volume tables are to be employed it must be demonstrated that they can be compiled rapidly and inexpensively and that their use yields more reliable and accurate estimates than existing rule of thumb methods. For many reasons it is to be hoped that this can be accomplished. At present, however, reliable information in regard to the yield of logs and trees is possessed by a comparatively limited number of individuals. These persons, by long and intimate contact with lumbering operations, both in the woods and the mill, have acquired a more or less accurate knowledge of the yield of certain types of timber when utilized by methods with which they are familiar. Unfortunately this type of information is intangible, and non-accumulative since it is buried with those who possess it. Thus the owner or purchaser of timber is dependent upon the judgment and, what has proved in practice to be even more important, the honesty of one or more individuals. Local volume tables carefully standardized to natural and economic factors would serve not only as guides in given regions, but would furnish data for comparative study, the determination of the effect of variation in form, defect, and method of utilization, and the construction of reliable converting factors.

As has been stated above, if local tables are to be used in estimating hardwoods, rapid, inexpensive and reasonably accurate methods of compiling, tabulating, and standardizing data must be developed. A common practice in collecting material for volume tables is to number the logs in each tree as they are measured in the woods, and subsequently record their contents as they pass through the mill. In the experience of the writers this procedure has been slow and expensive, due to the fact that in most medium sized and large mills a considerable period of time elapses usually between the felling of the trees and their arrival at the mill. Moreover, if the officials of lumber companies or the woods foremen are secretly hostile to the construction of the tables, as several consulting foresters have found to be the case, an effective means of frustrating the work is to delay sending numbered logs to the mill. This difficulty can be avoided if the contents of trees measured in the woods are computed from a log scale or 'tally' made at the mill. Errors inherent in this procedure are in most cases not excessive, particularly if butt logs are separated into a class by themselves. Variations in 'defect' and method of logging, milling, and utilization have so much weight in the case of hardwoods that the usual fluctuation in the taper of the upper logs of a tree are for practical purposes negligible. In other words the process of following numbered logs from the woods to the mill is a refinement that is not justified by the accuracy of other phases of the work and of the final application of the tables.

A second procedure which deserves attention is the elimination from volume table data of all defective and poorly shaped trees. Graves in his 'Forest Mensuration' states,

> 'Care is required in the selection of the trees for measurement. It is the rule to measure only sound trees, because volume tables show the full contents of sound trees. It might appear that the tables would be more practical if based on average trees, including those partially defective. But a table made up in this way would be extremely unreliable, for it is well known that the defects of trees differ greatly in different situations; so that a table based partly on defective trees would be useless in eliminating trees whose defects are different from those of the trees observed in the construction. Again, any such defect as injury by fire, insects, disease, wind, or ice would entirely vitiate a table constructed for trees showing another defect than the particular one in question. Whereas a table based on sound trees may be reduced for unsoundness in logs.'

In most portions of the Northeastern United States a large percentage of the hardwood trees are defective or deformed. To sort out and measure only sound, straight logs and trees is laborious and expensive. Furthermore, if tables are based upon selected trees they must be discounted whenever they are used even if the timber and methods of utilization resemble closely those where the tables were compiled. In addition the construction and use of tables based upon sound trees presupposes an accurate knowledge of the exact effect which different types of abnormalities have upon volume and grade. Unfortunately these converting factors are not available at present, and are difficult to analyze because the influence of a given abnormality is not a constant quantity, but fluctuates widely with variations in methods of utilization. Since an intensive study must be made of natural and economic factors before applying volume tables in a given region, and much depends inevitably upon the judgment of the estimator, it would appear to be nearly as reliable to apply a "blanket" discount to a table of average trees as to one based entirely upon sound specimens.

A third source of unnecessary expense, in the construction of volume tables, may result from the super-polishing of tables during the process of tabulation. Recurving and replotting produce uniform results which are superficially attractive, but tend to show a greater degree of accuracy than is justifiable. Furthermore, in wiping out irregularities there is always the danger of concealing the effects of natural and economic factors which should be evident in a table standardized to given conditions. Volume tables are not intended for the determination of the exact contents of individual trees. When applied to many trees irregularities due to a limited amount of basic data produce errors that are largely compensating.

The writers realize that the tables given below are open to numerous criticisms. In the first place more attention should have been given to the study of local methods of utilization and their effect upon grades and volume. In all probability the computation of grades for trees of each diameter was not justifiable. However, in as much as these tables are purely experimental it seemed wiser to record the grades than to express them in per centages for groups of trees of different diameters. In using the tables, the cruiser may combine the trees into such groups as he thinks most useful, and quickly determine the percentages of the grades for each group. It should be kept in mind that the data for these tables were secured incidentally, in the course of other investigations.

Description of Local Conditions.

1. Topography and Types.

Topographically the region is composed of hills and ridges lying between the spurs or branches of the southern extension of the Green Mountains. These hills and ridges are interspersed with numerous level and swampy tracts of considerable size. As a result there is a great diversity of types. The steep upper slopes of the higher mountains which are rocky and have little soil, are covered with spruce. It is on the middle and lower slopes of these mountains, and on the lower hills and ridges between them, that the hardwood is found. Here the soil is good and fairly deep, and the hardwood occurs sometimes in a pure stand and sometimes with a varying mixture of fir and spruce. The bottom lands are covered largely by a spruce type with scattering hardwoods, and the swamps by a typical one of spruce and fir. In many places the hardwood slopes have been cleared and used for agricultural purposes. The farms, however are, now largely abandoned, and the pastures and fields are "coming up" either with a hardwood growth, or a growth of pasture, spruce and fir. The country has been largely cut over for spruce, and there is now little old growth spruce in the region. Consequently varying degrees of density occur in the hardwood stands, ranging from those which are always pure hardwood to those in which there are a few scattering hardwood trees left after the removal of spruce.

2. *Tree Form.*

The hardwood trees in this region are for the most part two log trees. The merchantable length seldom exceeds 32 feet at which height the trees begin to branch. In the smaller diameters there are of course a number of trees from which only one log is cut, and in the larger diameters a number of three log trees occur. The following is the percentage of one, two and three log trees as obtained in collecting data for the volume tables. *Birch*: 23% one-log, 62% two-log, 15% three-log; *Maple*: 22% one-log, 60% two-log, and 18% three-log; *Beech*: 37% one-log, 58% two-log, 5% three-log trees. In connection with these facts it should be borne in mind that a tree having a merchantable length of 32 feet might be cut either into two 16 foot logs or into two 10-foot logs and a 12-foot log.

3. *Defects.*

Nearly one-half of the logs cut were defective or abnormal in some particular. These logs have been classified according to their defects and their classification is given in an accompanying table. In addition to showing the number of logs possessing the various defects, this table also shows the way in which these defects offset the volume of lumber sawn from the logs. This is done by dividing the logs into four groups. In group I. are put those in which the defect has decreased the volume of the log 10% or less from the volume of a straight and sound log of the same dimensions. Group II contains those logs in which the defect has caused a decrease of 10-20%, group III a decrease of 20-30%, and group IV a decrease of 30% or more. Under the head of "butt defects" are included butt logs in which butt rot, "dote," or some form of decay is present at the butt of the log. In addition to lowering the total board foot contents of the log these defects may, in cases, also lower the grade of what is actually sawn. In large logs where there are only four or five inches of butt rot, which does not extend more than a few feet from the butt, the effect is slight upon the volume of the log. "Top defects" include all defects due to rot in the top logs, and also defects in the top of butt logs. Top defects are commonly more serious than butt defects. This is due largely to the fact that butt defects occur, in the majority of cases, near the center of the cross section, and, in addition, to the fact that there is a greater percentage of shorter lengths among top logs, which makes the trimming of bad ends difficult. Under the head of 'crook' are included longs in which there is a sharp bend or twist. Most of the crooked logs are of smaller diameters, and when a crook is present in a large log it does not have a serious effect unless the abnormality is a severe one. Crook influences volume, but has little effect upon grade. Under 'sweep' are included curved logs or logs with a gradual bend. As in the case of crook, sweep is confined largely to logs of small diameter. When it occurs in large logs it is not serious unless the defect is pronounced. Under such circumstances it will affect grade as well as total volume. This is due to the necessity for cutting across the heartwood. 'Knotty' logs which have abnormally large or numerous knots and are almost exclusively composed of top logs of the smaller diameters. As a rule grade is affected more than volume. 'Seams' affect both volume and grade, due largely to the penetration of rot along these cavities. 'Shake' is rarely found in beech and maple, being confined almost entirely to birch logs of the largest diameters. In addition to affecting volume it has a most decided effect upon grade, in some cases almost the entire volume of a shaky log being No. 3 Common. Miscellaneous defects include such defects as fire-scars, "burls," forks, logs split in felling, etc. When a log had more than one defect it was placed in that class of defect which was considered to be the most serious. The accompanying table gives an idea of the prevalence of each defect and its influence on volume. This table includes only such defects as were apparent in the log and does not include defects which were disclosed by sawing. In birch and maple there were few hidden defects, but the beech "opened up" poorer than external appearances would lead one to expect.

4. Woods Practice.

It was the practice in the woods to utilize the trees up to their first branches or in the case of the smaller trees to a diameter of eight inches. In other words, the smallest logs sent to the mill were supposed to be 8 inches, top diameter. Practically no logs were taken above the first branches. This practice causes a large amount of material suitable for cooperage stock to be left in the woods, in the form of short lengths. Logs were cut into 10, 12, 14 and 16 foot lengths, and as a rule were sawed to good advantage. The usual stump height at which trees were cut was about 20 inches for trees under 15 inches D. B. H., and 28 inches for trees over 15 inches D. B. H.

5. Mill Practice.

In the manufacture of the logs at the mill a single action band-saw cutting a $\frac{1}{8}''$ saw-kerf was used. The lumber was graded before seasoning. This was done according to the grading rules of the National Hardwood Lumber Association. Clear boards not wide enough to go into firsts and seconds were as far as possible graded as clear strips. There was also a considerable amount of No. 1 Common strips. In order to avoid a further complexity of grades, both these grades of strips were included in the No. 1 Common grade. A small amount of No. 2 Common strips was placed in the No. 2 Common grade.

By far the greater part of the output of the mill was sawed into one inch stock, sawed $1\frac{1}{8}''$ to allow for shrinkage—85% of the birch, 90% of the maple, and 70% of the beech went into this size. While the data were being collected a considerable amount of dimension stock was sawed for construction purposes about the mill and yard. It amounted to about 20% of the total cut of beech, and less than 5% of the birch and maple. All this dimension stock was graded as No. 3 Common "Stickers," which were taken as much as possible from beech, and to some extent from the poorest maple and birch, were also graded as No. 3 Common. At one time, during the collecting of the data, there was a special order for 3 inch stock, 12 feet long, which was graded as No. 3 Common, but in reality was an intermediate grade between No. 2 and No. 3 Common. This tended to increase the amount of No. 3 at the expense of No. 2 in the 12 foot class, and its effect is plainly seen in the birch log rule. In the case of the two highest grades in birch, namely firsts and seconds, and firsts and seconds red, considerable two inch stock was sawed, more especially in the red grade. However, the amount in comparison to the total was small, less than 5%. In the maple and beech there were sawed from time to time small lots of $1\frac{1}{2}''$, $1\frac{3}{4}''$ and $2\frac{1}{2}''$ stock but the combined amount of all these thicknesses was less than 5% of the total. In all cases the boards were sawed $\frac{1}{8}''$ thicker than the standard dimension to allow for shrinkage. The beech as a whole was of poor quality, but the amount of No. 3 Common was undoubtedly increased considerably by the large amount of dimension stock and stickers sawed from this species. It will be noted that in the ten foot class in the birch log rule, there is a greater proportion of the poorer grades than in the longer lengths. This is particularly noticeable in the No. 1 Common Red and in the No. 2 Common grades. It is probably due in part to the fact that the longer logs can be trimmed more advantageously and a limited percentage of short lengths is allowed in the upper grades; but largely to the fact that the greater proportion of the 10 foot logs were top logs and hence knotty and of poorer quality. The mill crew, e. g. sawyer, edgeman and trimmer man, were men of average skill, all having had previous experience in hardwood mills of other regions.

Methods Used.

The following statistics were obtained in the woods: D. B. H. stump height, diameter inside and outside bark at stump and at small end of each log, length of each log, total height of tree,

TABLE No. 1.

TABLE OF DEFECTS

	Birch					Maple					Beech				
	Volume Reduced 10% and Less	*Volume Reduced 10—20%*	*Volume Reduced 20—30%*	*Volume Reduced 30% and Over*	*Total Defective Logs*	*Volume Reduced 10% and Less*	*Volume Reduced 10—20%*	*Volume Reduced 20—30%*	*Volume Reduced 30% and Over*	*Total Defective Logs*	*Volume Reduced 10% and Less*	*Volume Reduced 10—20%*	*Volume Reduced 20—30%*	*Volume Reduced 30% and Over*	*Total Defective Logs*
Butt Defects	54	27	30	39	150	39	9	12	14	74	16	8	1	4	29
Top Defects	26	21	10	15	72	29	15	15	8	67	8	4	6	2	20
Crook	102	45	32	28	207	46	22	24	7	99	69	29	17	6	121
Sweep	24	45	21	10	100	37	17	12	3	69	33	19	8	9	69
Knotty	47	14	6	5	72	62	15	10	4	91	29	7	3	3	42
Seam	0	6	3	4	13	4	2	4	5	15	8	5	2	6	21
Shake	7	8	6	3	24	..	...	....	....	....	....	....	....	....	....
Miscellaneous	11	5	1	3	20	3	1	2	6	12	7	4	5	2	18
Total	271	171	109	107	658	220	81	79	47	427	170	76	42	32	320

% Defective—43   % Defective—45   % Defective—51 description of defects and form of tree. Measurements of butt logs were recorded in a separate column.

In making the mill tallies the logs were measured for length and diameter at small end, and visible defects were inspected and described. The volume and grades of boards cut from each log were tallied on cards printed for this purpose. Here again butt logs were separated from upper logs.

During the process of tabulating the results, the effort was made to secure separate log scales for non-defective butt and non-defective top logs. Owing to the number of grades in birch and the somewhat limited amount of data in the case of the maple and beech, this plan was abandoned. All logs, defective, non-defective, butts and tops were then averaged together and form the basis of the log scales given below. As may be seen in table No. 2 the effect of the form of butt logs is well marked only among the larger diameters. It should be kept in mind that a high proportion of the bigger butt logs are defective, and the loss in volume due to this cause seems to offset more or less the gain produced by the 'swell' of the butt. Furthermore it should be noted that the average tree contained two logs, one butt and one top log, and therefore errors in the log scales due to non-separation of butts and tops would tend to compensate more or less when the mill tallies were used in the preparation of volume tables. In tabulating results data were averaged in the usual manner and curved once.

Cost of Preparation.

As has been stated previously one half of the data for the tables were secured by inexperienced student labor. The rest of the data were collected and tabulated by more experienced men and affords a better basis for estimating conservatively the total cost of constructing the tables.

The time consumed in measuring 1200 trees in the woods, 3500 logs in the mill, and tabulating the results was two months for two men. This gives a total cost of from $200-$300 for the preparation of the log scales and volume tables.* It should be kept in mind that the data used were secured in a one band mill

* Cost of labor figured at $50 per month per man—current wages paid to graduates of leading forestry schools by consulting foresters.

cutting approximately 20,000 feet of lumber in one 'tower,' and the grading was done by an employee of the mill. In a two band mill three or even more men would be essential to secure the data, but the increase in the size of the crew would, of course, be more or less offset by the greater number of logs tallied each day. Furthermore, in many cases, it might be necessary or desirable to replace one of the crew by an expert grader. However, even with such increases in the expense of securing the mill tallies the cost of the tables would not be greatly increased, since a considerable saving in the cost of tabulating the results would be made by not computing grades for logs and trees of each diameter and length.

Conclusion.

These facts have convinced the writers that local volume tables can be prepared rapidly and economically if based upon mill tallies made from all merchantable logs. In estimating large bodies of timber local volume tables of this type appear to simplify the methods of cruising and to place less emphasis upon the judgment of the cruiser. For, instead of estimating the contents of each tree and discounting for defect, the cruiser records diameters, which can be measured, and used-lengths, which can be accurately estimated. If the given conditions which local tables represent are carefully described these volume tables may perhaps be used in other regions by carefully studying and comparing defects, methods of utilization, etc., and applying suitable converting factors. Furthermore, if the data upon which local volume tables are based are systematically recorded and kept available, as should be done in all cases, it would be possible in time to construct valuable 'general' tables by combining the data from many localities. At the same time by comparative studies the effects of variations in defect, form, and method of utilization could be determined, and reliable converting factors obtained.

However, careful tests must be made to determine whether local tables afford in the hands of men of moderate experience more reliable and accurate estimates than existing methods of 'cruising' hardwoods.

In conclusion the writers wish to thank Mr. H. S. Janes for innumerable kindnesses.

TABLE NO. 2.

YELLOW BIRCH LOG SCALE.

Comparison of Non-Defective Butt Logs, Non-Defective Top Logs and Average of all Logs.

Total Contents in Feet Board Measure, Mill Tally.

Diameter at Small End (Inches)	*Length, Feet*	*Butts, Non-Def.*	*Tops, Non-Def.*	*Av'g. all Logs*	Diameter at Small End (Inches)	*Length, Feet*	*Butts, Non-Def.*	*Tops, Non-Def.*	*Av'g. all Logs*	Diameter at Small End (Inches)	*Length, Feet*	*Butts, Non-Def.*	*Tops, Non-Def.*	*Av'g. all Logs*
7	10	20	20	20	13	10	70	70	70	19	10	170	150	150
	12	20	20	20		12	90	90	80		12	200	180	180
	14	30	30	30		14	100	100	100		14	240	220	220
	16	30	30	30		16	120	110	110		16	270	260	250
8	10	20	20	20	14	10	90	80	80	20	10	190	170	160
	12	30	30	30		12	100	100	100		12	220	200	200
	14	40	40	40		14	120	120	110		14	260	240	240
	16	40	40	40		16	140	140	130		16	300	290	280
9	10	30	30	30	15	10	100	90	90	21	10	210	190	180
	12	40	40	40		12	120	110	110		12	250	220	220
	14	40	40	40		14	140	140	130		14	290	270	270
	16	50	50	50		16	160	160	150		16	340	320	310
10	10	40	40	40	16	10	110	110	110	22	10	230	210	200
	12	50	50	50		12	140	130	130		12	270	250	250
	14	60	60	60		14	160	160	150		14	320	290	290
	16	60	60	60		16	190	180	180		16	370	350	340
11	10	50	50	50	17	10	130	120	120	23	10	260	230	220
	12	60	60	60		12	160	150	150		12	300	270	270
	14	70	70	70		14	190	180	170		14	350	320	320
	16	80	80	80		16	220	210	200		16	420	380	370
12	10	60	60	60	18	10	150	130	130	24	10	280	250	250
	12	70	70	70		12	180	170	170		12	330	290	290
	14	80	80	80		14	210	200	190		14	380	350	340
	16	100	90	90		16	240	230	220		16	450	410	390

TABLE No. 3.

YELLOW BIRCH LOG SCALE.

Volume by Grades—Basis 1530 Logs, Feet Board Measure, Mill Tally

Diameter at Small End. (Inches)	Length, Feet	1 & 2, Red.	No. 1C, Red.	1 & 2	No. 1C	No. 2C	No. 3C	Total	Diameter at Small End. (Inches)	Length, Feet	1 & 2, Red.	No. 1C, Red.	1 & 2	No. 1C	No. 2C	No. 3C	Total	Diameter at Small End. (Inches)	Length, Feet	1 & 2, Red.	No. 1C, Red.	1 & 2	No. 1C	No. 2C	No. 3C	Total
7	10					10	10	20	13	10			10	20	20	20	70	19	10	25	20	30	30	20	25	150
	12					10	10	20		12	5	5	15	20	15	20	80		12	40	15	50	30	15	30	180
	14				5	15	10	30		14	5	5	20	25	20	25	100		14	45	20	70	35	20	30	220
	16				5	15	10	30		16	5	5	20	30	25	25	110		16	55	20	80	40	25	30	250
8	10					10	10	20	14	10		5	10	20	20	25	80	20	10	30	20	30	30	20	30	160
	12				5	10	15	30		12	5	5	20	25	15	30	100		12	50	15	55	30	20	30	200
	14				10	15	15	40		14	10	5	25	25	20	25	110		14	60	20	75	35	20	30	240
	16				10	15	15	40		16	10	5	35	30	25	25	130		16	70	25	90	40	25	30	280
9	10					15	15	30	15	10	5	5	15	20	20	25	90	21	10	35	25	35	30	25	30	180
	12				10	15	15	40		12	10	5	25	25	15	30	110		12	60	20	60	30	20	30	220
	14				10	15	15	40		14	15	5	35	30	20	25	130		14	75	25	80	35	25	30	270
	16				15	20	15	50		16	15	10	45	30	25	25	150		16	90	25	100	40	25	30	310
10	10				10	15	15	40	16	10	10	10	20	25	20	25	110	22	10	45	30	40	30	25	30	200
	12			5	15	15	15	50		12	15	10	30	30	15	30	130		12	70	25	65	35	20	35	250
	14			5	15	15	15	50		14	15	10	40	35	20	30	150		14	90	25	90	30	25	30	290
	16			5	15	20	20	60		16	25	10	55	35	25	30	180		16	110	25	110	40	25	30	340
11	10			5	10	20	15	50	17	10	10	15	20	30	20	25	120	23	10	60	30	45	30	25	30	220
	12			5	20	15	20	60		12	25	10	40	30	15	30	150		12	85	30	70	30	20	35	270
	14			10	20	20	20	70		14	20	15	50	35	20	30	170		14	105	25	95	40	25	30	320
	16			10	20	20	20	70		16	30	15	60	40	25	30	200		16	130	25	115	40	25	39	370
12	10			5	15	20	20	60	18	10	15	15	25	30	20	25	130	24	10	70	30	55	35	25	35	250
	12		5	10	20	15	20	70		12	30	15	45	30	20	30	170		12	90	30	70	35	25	40	290
	14		5	10	25	20	20	80		14	35	15	55	35	20	30	190		14	120	25	95	40	25	35	340
	16	5	5	15	25	20	20	90		16	40	15	70	40	25	30	220		16	145	25	120	40	25	35	390

TABLE NO. 4.

YELLOW BIRCH VOLUME TABLE

Volume by Grades—Basis 505 Trees.

Feet Board Measure by Mill Tallies.

Used Length: 12 feet. — 14 feet.

Diameter Breast High (Inches)	12 ft. *1 & 2 Red.*	*No. 1C Red.*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*	14 ft. *1 & 2 Red.*	*No. 1C Red.*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*
10				5	15	10	30				5	15	10	30
11				10	15	15	40				10	15	15	40
12			5	15	15	15	50			5	10	15	15	50
13			5	15	20	20	60			5	15	20	20	60
14			10	20	20	20	70			10	20	20	20	70
15		5	10	25	20	20	80		5	10	25	20	20	80
16	5	5	15	25	20	20	90	5	5	20	30	20	20	100
17	5	5	20	30	2	20	100	10	5	20	30	20	25	110
18	10	5	20	30	20	25	110	10	5	30	35	25	25	130
19								15	10	35	35	20	25	140
20								20	10	45	35	25	25	160
21								25	15	50	35	20	25	170
22								35	15	55	35	25	25	190
23								40	20	65	35	25	25	210
24								50	20	70	35	25	30	230

Used Length: 16 feet. — 20 feet.

Diameter Breast High (Inches)	16 ft. *1 & 2 Red.*	*No. 1C Red.*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*	20 ft. *1 & 2 Red.*	*No. 1C Red.*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*
10				10	15	15	40				5	20	25	50
11				15	20	15	50				10	25	25	60
12			5	15	20	20	60			5	15	25	25	70
13			10	20	20	20	70			5	25	30	30	90
14		5	10	25	20	20	80			10	30	30	30	100
15		5	15	25	20	25	90		5	10	30	30	35	110
16	5	5	20	30	20	20	100	5	5	20	40	30	40	140
17	10	5	25	30	25	25	120	10	5	30	40	30	45	160
18	15	10	30	35	25	25	140	15	10	35	45	30	45	180
19	20	10	40	35	20	25	150	20	10	45	50	30	45	200
20	25	15	45	35	25	25	170	30	15	50	50	30	45	220
21	30	15	55	35	25	30	190	35	15	60	55	35	50	250
22	35	15	60	35	25	30	200	40	20	70	55	35	50	270
23	40	20	65	40	25	30	220	50	25	75	60	35	55	300
24	55	20	80	40	25	30	250	65	30	85	60	35	55	330

YELLOW BIRCH VOLUME TABLE.

Diameter Breast High (Inches)	1 & 2 Red.	No. 1C Red.	1 & 2	No. 1C	No. 2C	No. 3C	Total	1 & 2 Red.	No. 1C Red.	1 & 2	No. 1C	No. 2C	No. 3C	Total
Used Length:			22 feet.							24 feet.				
10				5	20	25	50				10	25	25	60
11			5	15	25	25	70				15	25	30	70
12			5	20	25	30	80				20	30	30	80
13			5	25	30	30	90			10	30	30	30	100
14			10	30	30	30	100			10	35	30	35	110
15		5	15	35	30	35	120	5	5	15	35	30	40	130
16	5	10	25	40	30	40	150	10	10	25	40	35	40	160
17	10	10	30	45	30	45	170	10	10	30	50	35	45	180
18	15	10	40	50	30	45	190	15	10	40	50	35	50	200
19	22	10	45	50	35	50	210	20	10	50	55	35	50	220
20	30	15	55	55	35	50	240	30	15	60	60	35	50	250
21	35	15	65	60	35	50	260	35	20	65	60	40	50	270
22	45	20	70	60	35	50	280	40	20	75	65	40	50	290
23	50	25	80	60	40	55	310	50	25	85	65	40	55	320
24	65	30	90	60	40	55	340	70	30	95	65	40	60	360
Used Length:				26 feet							28 feet.			
12			10	20	30	30	90			5	20	35	30	90
13			10	30	30	30	100			10	30	35	35	110
14			10	35	30	35	110		5	10	35	35	35	120
15			15	40	35	40	130		5	20	40	35	40	140
16	5	5	25	45	35	45	160	10	5	30	45	35	45	170
17	10	10	35	50	35	50	190	10	10	40	50	40	50	200
18	15	10	45	55	35	50	210	15	10	50	55	40	50	220
19	25	10	55	60	40	50	240	25	15	55	60	40	55	250
20	30	15	60	60	40	55	260	30	15	65	65	40	55	270
21	35	15	70	65	40	55	280	35	20	70	65	40	60	290
22	45	20	75	70	40	60	310	45	20	80	70	45	60	320
23	50	25	85	70	40	60	330	55	30	90	70	45	60	350
24	65	30	100	70	45	60	370	70	35	105	70	45	65	390
Used Length:			30 feet.							32 feet.				
15		5	20	40	40	45	150	5	5	20	45	40	45	160
16	10	5	30	45	40	50	180	10	10	30	50	40	50	190
17	10	10	40	55	40	55	210	15	10	40	60	40	55	220
18	15	10	50	60	40	55	230	15	10	50	60	45	60	240
19	25	15	55	65	40	60	260	25	15	60	65	45	60	270
20	30	15	65	65	45	60	280	30	15	70	70	45	60	290
21	40	20	75	70	45	60	310	40	20	75	75	45	65	320
22	45	25	80	70	45	65	330	45	20	85	75	50	65	340
23	55	30	90	75	45	65	360	55	25	95	75	50	70	370
24	70	35	110	75	45	65	400	75	35	115	75	50	70	420
Used Length:			34 feet.							36 feet.				
16	10	10	35	50	45	50	200	10	10	35	50	45	50	200
17	15	10	40	60	45	60	230	15	10	45	60	45	65	240
18	15	10	55	60	45	65	250	20	10	55	65	45	65	260
19	25	15	60	70	45	65	280	25	15	60	70	50	70	290
20	30	15	70	70	50	65	300	30	15	70	75	50	70	310
21	40	20	80	75	50	65	330	40	20	80	80	50	70	340
22	45	25	90	80	50	70	360	45	25	90	80	55	75	370
23	55	30	95	80	50	70	380	50	30	100	80	55	75	390
24	75	35	115	80	50	75	430	75	35	120	85	55	80	450

TABLE No. 5

MAPLE LOG SCALE.

Volume by Grades—Basis 943 Logs

Feet Board Measure, Mill Tally.

Diameter at Small End (Inches)	*Length, Feet*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*
7	10			5	15	20
	12			5	15	20
	14			10	20	30
	16			10	20	30
8	10			10	20	30
	12		5	5	20	30
	14		5	10	25	40
	16		5	10	25	40
9	10			10	20	30
	12		10	10	20	40
	14		10	10	20	40
	16		10	15	25	50
10	10		10	10	20	40
	12		10	10	20	40
	14		15	10	25	50
	16		15	15	30	60
11	10	5	15	10	20	50
	12	5	15	10	20	50
	14	5	20	10	25	60
	16	5	20	15	30	70
12	10	5	20	15	20	60
	12	10	20	15	25	70
	14	10	25	15	30	80
	16	10	30	20	30	90
13	10	10	25	10	25	70
	12	15	25	15	25	80
	14	15	30	15	30	90
	16	20	35	20	35	110
14	10	15	25	15	25	80
	12	20	30	15	25	90
	14	25	35	20	30	110
	16	30	40	20	40	130
15	10	25	30	15	30	100
	12	30	35	15	30	110
	14	35	40	20	35	130
	16	45	45	20	40	150
16	10	35	30	15	30	110
	12	45	35	15	35	130
	14	50	40	20	40	150
	16	60	45	20	45	170
17	10	50	30	15	35	130
	12	60	35	15	40	150
	14	60	40	20	40	160
	16	75	50	20	45	190
18	10	60	30	15	35	140
	12	70	35	15	40	160
	14	80	40	20	40	180
	16	90	50	25	45	210
19	10	75	35	15	35	160
	12	85	40	15	40	180
	14	100	45	20	45	210
	16	100	50	25	45	230
20	10	90	40	15	35	180
	12	100	40	20	40	200
	14	120	45	20	45	230
	16	140	55	25	50	270

TABLE NO. 6

MAPLE VOLUME TABLE

Volume by Grades—Basis 301 Trees.

Feet Board Measure, by Mill Tallies.

Used Length:	12 feet.					16 feet.				
Diameter Breast High (Inches)	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*
10			10	20	30		5	10	25	40
11			10	20	30		10	10	20	40
12		10	10	20	40	5	10	10	25	50
13	5	10	10	25	50	5	15	15	25	60
14	10	15	10	25	60	10	20	15	25	70
15	10	20	15	25	70	10	30	20	30	90
16	15	30	15	30	90	15	35	20	30	100
17	20	35	15	30	100	20	40	20	30	110
18	30	35	15	30	110	30	40	20	40	130
Used Length:	20 feet.					24 feet.				
10		5	15	30	50		5	15	40	60
11		10	15	35	60		10	20	40	70
12	5	15	15	35	70	5	15	20	40	80
13	5	15	20	40	80	5	20	20	45	90
14	10	25	20	45	100	10	30	20	50	110
15	15	35	20	50	120	15	40	25	50	130
16	20	45	25	50	140	20	45	30	55	150
17	30	50	25	55	160	30	50	30	60	170
18	40	55	25	60	180	40	60	30	60	190
Used Length:	28 feet.					32 feet.				
10										
11		15	20	45	80		15	25	50	90
12	5	20	20	45	90	5	20	25	50	100
13	5	25	20	50	100	5	25	25	55	110
14	10	35	25	50	120	10	35	30	55	130
15	15	40	30	55	140	15	45	30	60	150
16	25	50	30	55	160	25	50	30	65	170
17	35	55	30	60	180	35	60	30	65	190
18	45	65	30	60	200	45	70	35	70	220
Used Length:	36 feet.					40 feet.				
10										
11										
12	5	20	25	60	110					
13	5	30	30	65	130	5	30	35	70	140
14	10	40	30	70	150	10	40	35	75	160
15	15	50	35	70	170	15	50	35	80	180
16	25	55	35	75	190	25	55	40	80	200
17	35	65	35	75	210	35	65	45	85	230
18	50	70	40	80	240	45	75	45	95	260

TABLE NO. 7
BEECH LOG SCALE.

Volume by Grades—Basis 631 Logs.
Feet Board Meaure, Mill Tally.

Diameter at Small End (Inches)	*Length, Feet*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*	*Diameter at Small End (Inches)*	*Length, Feet*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*
8	10			5	25	30	13	10	5	20	15	30	70
	12			5	25	30		12	10	20	15	35	80
	14			5	25	30		14	15	25	20	40	100
	16			10	30	40		16	15	30	20	45	110
9	10			10	20	30	14	10	10	25	15	30	80
	12		5	10	25	40		12	15	25	15	35	90
	14		5	10	25	40		14	20	30	20	40	110
	16		10	10	30	50		16	20	35	25	50	130
10	10		10	10	20	40	15	10	15	25	15	35	90
	12		10	10	30	50		12	20	30	20	40	110
	14		10	10	30	50		14	25	35	20	50	130
	16		10	15	35	60		16	30	40	25	55	150
11	10		10	15	25	50	16	10	20	30	20	40	110
	12		15	15	30	60		12	30	35	20	45	130
	14		20	15	35	70		14	35	40	25	50	150
	16		20	20	40	80		16	40	45	25	60	170
12	10		15	15	30	60	17	10	30	35	20	45	130
	12	5	15	15	35	70		12	40	40	20	50	150
	14	5	20	15	40	80		14	45	45	25	55	170
	16	5	25	20	40	90		16	55	55	25	65	200

TABLE NO. 8.
BEECH VOLUME TABLE

Volume by Grades—Basis 220 Trees.
Feet Board Measure, by Mill Tallies

D. b. h. (inches)	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*	*1 & 2*	*No. 1C*	*No. 2C*	*No. 3C*	*Total*
Used Length:		12 feet.					16 feet.					20 feet.			
10		5	10	25	40		10	10	30	50					
11		5	10	25	40		10	15	35	60		10	15	45	70
12		10	10	30	50	5	15	15	35	70		15	20	45	80
13		15	15	30	60	5	20	15	40	80		20	20	50	90
14	5	20	15	30	70	10	20	20	40	90	10	25	25	50	110
15	10	20	15	35	80	10	25	20	45	100	10	30	25	55	120
16	15	25	15	35	90	15	30	20	45	110	15	40	25	60	140
17	20	25	15	40	100	20	35	25	50	130	20	45	25	60	150
18	20	30	20	40	110	25	40	25	50	140	25	50	30	65	170
Used Length:		24 feet.					28 feet.					32 feet.			
10															
11		10	20	50	80		15	25	60	100					
12		20	20	50	90		20	25	65	110	5	25	25	65	120
13	5	25	25	55	110	5	25	25	65	120	5	25	30	70	130
14	10	30	30	60	130	10	30	30	70	140	10	35	30	75	150
15	10	35	30	65	140	15	35	35	75	160	20	40	35	85	180
16	20	40	30	70	160	20	45	35	80	180	25	45	40	90	200
17	25	45	35	75	180	30	50	40	80	200	30	50	45	95	220
18	30	55	35	80	200	40	60	40	90	230	45	60	45	100	250

RED AND WHITE FIR.

XYLOMETER CORDWOOD TEST.

By R. W. Taylor, *Forest Assistant.*

The test was carried on in the woodyard of the Crown Columbia Paper Company at Floriston, California, the immediate object of which was to ascertain as accurately as possible the exact cubic contents of an average cord of Red Fir cordwood such as is used in making paper pulp. The ultimate object was to apply the factor thus obtained to a Red Fir content volume table so that estimates made in reconnaissance work in the Red Fir region could be readily and accurately converted into cord measure.

The Xylometer used was a galvanized iron tank 2.465 ft. in diameter and approximately 4½ ft. high, graduated on the inside in 1/100 of a foot. Each stick of cordwood was immersed separately and its volume recorded. The cords were piled after the sticks had been immersed, making each one as far as it is possible to do so, of the standard dimension 4'x4'x8'.

The wood measured was a mixture of red and white fir cut from the Crown Columbia Paper Company's holdings near Floriston, California, averaging 35% Red Fir *(Abies magnifica)* and 67% White Fir *(Abies concolor)*. As far as can be ascertained, both by inspection and measurements, there is no difference in the form of the red and white fir cordwood. This is borne out by the figures in the table, which show that the cubic contents of the various cords bear no relation to the percentage of the two species. Moreover, the average number of sticks per cord of the 25 cords is 60. A stack of cordwood containing 10.87 cords and 91% red fir and 9% White Fir measured in another part of the yard averaged 58 sticks to the cord. Thus it will be seen that the size and form of the sticks of the two species are practically the same.

The accompanying tables show the result of the test and the resultant factor applied to the volume table.

DETAILS OF XYLOMETER TEST OF 25 CORDS.

Cord No.	*No. of Sticks*	*No Bark*	*Crooked*	*Rotten*	*Broken*	*Displacement in Xylometer Feet*	*Cubic Contents Feet*	*Percentage* *Red Fir*	*White Fir*
1	69	6		1	3	18.82	89.74	13	87
2	54	1	1	4		16.03	76.44	6	94
3	53	5		2		16.59	79.11	11	89
4	64	7			1	18.58	88.60	12	88
5	61	4	2		1	16.81	80.16	26	74
6	59	4	2		2	17.80	84.88	17	83
7	61	7	1		1	17.08	81.44	11	89
8	55	3			1	15.91	75.87	4	96
9	61	4	1			16.98	80.97	8	92
10	57	3			1	16.37	78.06	25	75
11	62	8				16.59	79.11	37	63
12	60	9	1	2		15.80	75.34	34	66
13	60	7			1	16.01	76.34	25	75
14	70	8		1	1	18.43	87.88	33	67
15	67	6	1	1	1	18.26	87.07	16	84
16	58	3	1		1	16.48	78.58	40	60
17	61	6			1	17.06	81.35	42	58
18	57	3		1	2	16.31	77.77	56	44
19	59	6			2	16.21	77.30	60	40
20	60	6			1	16.38	78.11	38	62
21	61	7			2	16.76	79.92	47	53
22	64	4	1	1		18.40	87.74	61	39
23	61	6	1	2		17.57	83.78	75	25
24	60	6			2	16.87	80.44	63	37
25	57	3	1		2	17.04	81.25	58	42
Totals	1511	132	13	15	26	425.14	2027.24	818	1682
Average per cord	60	5	5	0	1	17.00	81.06	33	67

Average length of 85 sticks—3.87 ft.

CORDWOOD VOLUME TABLE.

RED FIR.

(Abies magnifica)

Tahoe National Forest, California.

Height of Trees, feet

D.b.h.	*40*	*50*	*60*	*70*	*80*	*90*	*100*	*110*	*120*	*130*	*140*	*150*
10	.11	.15	.19	.22								
11	.13	.17	.22	.27								
12	.17	.21	.26	.32	.40							
13		.25	.31	.38	.46							
14		.28	.36	.44	.52	.58						
15		.33	.42	.51	.58	.68						
16		.38	.48	.57	.65	.75	.88					
17			.54	.63	.73	.84	.96					
18			.60	.70	.80	.92	1.06	1.23				
19			.67	.78	.89	1.02	1.17	1.32				
20			.73	.85	.98	1.12	1.28	1.43	1.58			
21				.92	1.06	1.22	1.40	1.57	1.74			
22				1.00	1.15	1.32	1.51	1.71	1.99	2.07		
23				1.08	1.25	1.43	1.63	1.84	2.05	2.26		
24				1.17	1.34	1.54	1.74	1.96	2.20	2.44	2.70	
25				1.27	1.44	1.65	1.88	2.11	2.36	2.63	2.92	
26					1.53	1.75	2.01	2.26	2.52	2.81	3.26	3.43
27					1.63	1.86	2.14	2.41	2.71	3.01	3.35	3.66
28					1.70	1.97	2.26	2.57	2.88	3.21	3.55	3.90
29					1.78	2.08	2.38	2.72	3.05	3.41	3.77	4.13
30					1.88	2.19	2.52	2.88	3.22	3.60	3.98	4.37
31						2.30	2.65	3.04	3.41	3.81	4.19	4.74
32						2.41	2.80	3.20	3.60	4.02	4.43	4.85
33						2.52	2.94	3.36	3.79	4.23	4.66	5.10
34						2.64	3.09	3.52	3.97	4.44	4.91	5.36
35						2.77	3.23	3.69	4.16	4.65	5.14	5.61
36						2.88	3.38	3.86	4.36	4.87	5.38	5.88
37						3.00	3.54	4.04	4.54	5.07	5.73	6.13
38						3.12	3.70	4.19	4.74	5.28	5.84	6.40
39							3.86	4.40	4.94	5.51	6.07	6.65
40							4.01	4.59	5.13	5.72	6.31	6.91
41							4.20	4.81	5.36	5.95	6.56	7.15
42							4.41	5.04	5.60	6.21	6.83	7.44
43							4.63	5.26	5.84	6.46	7.10	7.74
44							4.88	5.50	5.96	6.71	7.38	8.02
45								5.73	6.33	6.97	7.65	8.34
46								7.19	6.58	7.21	7.94	8.67
47								7.43	6.84	7.51	8.21	8.98
48								7.47	7.11	7.79	8.52	9.31
79									7.42	8.12	8.83	9.67
50									7.75	9.17	9.67	10.05

Basis of cord equivalent Xylometer test of 25 cords: One cord=81.06 cu. ft.

A COMPARISON OF THE DOYLE AND SCRIBNER RULES WITH ACTUAL MILL CUT FOR SECOND GROWTH WHITE PINE IN PENNSYLVANIA.

By N. R. McNaughton.

The fact has long been recognized that the old log rules, designed for use with virgin timber of large size, give results which are far from accurate when applied to our present stands of second growth timber. The reasons for this inaccuracy may be roughly outlined as follows:

(1) As stated above, the rules were designed for use with old trees, hence a greater proportionate reduction was necessarily made for defects, such as shakes, rot, etc.

(2) Logging and milling operations were conducted on a less intensive scale than at present. Measurements were less accurate, and the waste in the woods and at the mill was greater than it is to-day.

(3) Most of the rules are based on incorrect and inflexible formulas or diagrams. By the statement that the formulas and diagrams are inflexible it is meant that they cannot be modified easily so as to be made applicable to local methods of manufacture and local species and grades of logs.

It has been the custom of the Pennsylvania Department of Forestry to base its sales on actual mill cut, or on scale by the Doyle Rule plus twenty-five per cent. This latter is a tacit recognition of the painful inaccuracy of this rule in present day use, and the same words apply in greater or less degree to almost every other log rule commonly employed.

To determine just how far the old rules fall short of actual mill cut under average conditions, the Pennsylvania Department of Forestry authorized the collection of data, a part of which the following tabulations summarize. This data was collected in Cameron county, Pennsylvania, during 1912. The logs came from a stand of second growth white pine about seventy-five per cent. pure, which was killed by fire in the spring of 1911, and was cut the following winter. Only normal, sound, white pine logs were taken; that is, an attempt was made to secure a fair average lot of logs, but no log was taken for which a scaler would not allow full scale. About eighty per cent. of the logs were sawed into inch boards, and the remainder into two inch plank. All lumber was square edged.

The mill was portable, with a capacity of about 10,000 Feet B. M. daily. The saw was circular, and cut one-fourth inch kerf. Edging and cutting to lengths were done as economically as possibly, and there was little unnecessary waste in slabbing. The minimum sizes were eight feet in length and four inches in width. Even lengths and widths only were cut. Table 1 gives the averages of the mill cut for logs of each inch diameter class in the different log lengths. Table 2 gives corrected values for Table 1, obtained from curves.

TABLE NO. 1.

ACTUAL MILL TALLY OF LOGS BY LENGTH AND DIAMETER AT SMALL END INSIDE BARK.

	10 Ft. Logs			*12 Ft. Logs*			*14 Ft. Logs*			*16 Ft. Logs*			*18 Ft. Logs*		
Diam. Inches	*Basis, Logs No.*	*Total Cut Bd. Ft.*	*Av. Bd. Ft.*	*Basis, Logs No.*	*Total Cut Bd. Ft.*	*Av. Bd. Ft.*	*Basis, Logs No.*	*Total Cut Bd. Ft.*	*Av. Bd. Ft.*	*Basis, Logs No.*	*Total Cut Bd. Ft.*	*Av. Bd. Ft.*	*Basis, Logs Bd. Ft.*	*Basis, Logs No.*	*Av. Bd. Ft.*
5				13	171	13	25	358	14	58	904	16			
6				138	2146	16	110	1975	18	309	6349	21	1	29	29
7				200	4021	20	160	3847	24	623	16905	27	2	75	37
8	4	73	18	253	6347	25	189	5696	30	686	26141	38	3	138	46
9	3	62	21	254	7825	31	172	6429	37	773	33868	44	2	100	50
10	4	140	35	211	8001	38	128	6003	47	631	34478	55	2	132	66
11	2	65	33	155	7243	47	101	5981	59	504	34849	69	1	80	80
12	5	212	42	85	4910	58	87	6203	71	394	33575	85	2	243	122
13	3	169	56	67	4861	72	37	3168	86	224	22523	100	7	834	119
14				32	2619	82	26	2568	99	137	16095	117	3	448	149
15				10	898	90	18	2122	118	80	11025	138			
16				7	722	103	7	934	133	35	5885	168			
17				5	757	151	163	1	163	5	972	194			
18										5	1094	219			
	21	721		1430	50521		1061	45447		4464	244663		23	2079	

Total amount measured=343,470 Ft. B. M. (three 4-in. logs excluded from table).

Total number of logs measured=7,002.

TABLE No. 2

ACTUAL MILL TALLY OF LOGS BY LENGTH AND DIAMETER AVERAGES REGULARIZED BY A SERIES OF CURVES.

Small End Diameter Inches	10 Ft.	12 Ft.	14 Ft.	16 Ft.	18 Ft.
		Log Length			
		Board Feet			
4				13	
5		12	14	17	
6		15	18	22	26
7		20	24	29	34
8	20	26	31	37	43
9	26	32	39	46	53
10	32	40	48	56	65
11	39	49	58	69	81
12	49	60	71	85	100
13	59	72	86	102	120
14		85	101	120	141
15		99	118	140	
16		113	136	161	
17		128	155	183	
18				207	

In Table 3 the values obtained from the above tabulations are compared with the scale given for logs of the various diameters by the Scribner and Doyle Rules. The "Per cent. Increase" column is derived by taking the difference between the values given in the Rules and the actual mill scale, and dividing this difference by the value given in the Rules. For instance, for six inch logs the Doyle Rule gives four feet B. M., while the actual scale at the mill was twenty-two feet B. M.—a difference of eighteen

TABLE No. 3.

PERCENTAGE INCREASE OVER DOYLE AND SCRIBNER LOG RULES SHOWN BY ACTUAL CUT

Sixteen Foot Logs.

Diameter Inside Bark (Small End) Inches	*Actual Mill Tally Bd. Ft.*	*Doyle Rule Bd. Ft.*	*Increase Over Rule %*	*Scribner Rule* Bd. Ft.*	*Increase Over Scribner Rule %*
6	22	4	450.0	18	15.6
8	37	16	131.3	32	15.6
10	56	36	55.6	54	3.7
12	85	64	32.8	79	7.6
14	120	100	20.0	114	5.3
16	161	144	16.7	159	1.3
18	207	196	5.6	213	3.8

*Scribner rule values up to and including 10 inches as used by Santa Clara Lumber Co., N. Y. No comparison under 4 inches.

feet. Dividing eighteen by four we have four hundred and fifty per cent. increase over Doyle Rule.

The above tables show conclusively that the degree of inaccuracy of the old rules varies with the size of the logs; hence the addition of any certain percentage to the scale of a lot of logs by either of the old rules will be unjust one way or the other unless the average diameter of the logs happens to be just what it should be to make the percentage hold good.

Thus, the Pennsylvania Department's method of adding twenty-five per cent. to the scale of logs by the Doyle Rule is fairly accurate when the logs average in the neighborhood of thirteen inches in diameter inside the bark at the small end; but the application of this method to logs averaging over thirteen inches in diameter is unfair to the buyer, while its application to logs under thirteen inches is decidedly unfair to the seller under these milling conditions. (See Table 3).

From this it can be seen that it is almost impossible to so modify the old rules as to make them fit present conditions. The Scribner Rule, it is true, does not make such a poor showing as some of the other age-moulded rules, but it leaves much to be desired. The Doyle Rule is altogether indefensible from any point of view, yet it is used more frequently (in Pennsylvania, at least) than any other rule.

The remedy seems to lie not in the construction of a new rule—of these there is already a superabundance—but in a change of sales methods so that all sales may be based on cubic volume. Each purchaser could then determine his own converting factor* subject to local grades and methods.

The present slipshod arrangement of trying to modify the old rules is only putting off until to-morrow what should be done to-day, and what *must* be done eventually.

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*The converting factor from used volume in Cubic feet inside bark to board feet mill cut is 5.3 and the outside bark factor is 4.7 for this mill in this lot of logs.

LOSS DUE TO EXPOSURE IN THE TRANSPLANTING OF WHITE PINE SEEDLINGS.

By E. A. Ziegler.

The very careful handling of coniferous planting stock between nursery and final planting site is one of the "A. B. C's" in the training of every forestry student beginning work in silviculture and its importance may be easily proven. The very obviousness of the need seems to have kept it out of the field of American forest experiment. However, now and then one may find an over-zealous forester actually giving his plants unnecessary protection and thereby increasing their cost. When one remembers that an extra twenty cents a thousand added to the cost of the plants will in 80 years at 5% add $11.90 to the acre cost of the crop (planting 1200 per acre)—or more than sufficient to establish a new stand by planting a little experimental data may have some value in this direction.

With a motive arising from several sources this subject for experiment was suggested for thesis work to students of the Pennsylvania State Forest Academy. First, there was held in mind the training for the student in simple original experiment and the proper recording and analysis of experimental results; second, the emphasizing of the greater susceptibility of coniferous stock to serious injury by exposure to drying out: and third, the extent to which protective measures should be carried without adding unnecessarily to the cost of the stock.

The experiment was carried on by Mr. Robert R. Neefe and Mr. Horace F. Critchley of the Class of 1913, and the results are taken from their notes.

The material selected was average quality two-year white pine seedlings, since the Pennsylvania Department of Forestry is planting two-year stock principally. The experiment was carried out in the seven-acre Academy nursery in the spring of 1913. The plan required each man to run an independent series of exposures of one thousand plants. First, 100 plants were set out with the exposure reduced to zero as near as possible as a check; then nine lots of 100 each were fully exposed to sun and wind (lying on the ground) for periods ranging from ten minutes to six hours and planted. The period of exposure was stopped on the minute and the trees puddled for immediate planting with the planting board. The spacing was 4x4 inches and the transplanted material received no subsequent cultivation or watering although the weeds were kept out. The experiment was carried out on April 4 and 5. The days were bright and sunny: wind moderate S. W. (the nursery is surrounded on west, south, and east by a fairly close stand of 60 ft. pitch pine): the temperature was about 72°F.: barometric reading 29.2 in.: wet bulb thermometer 63° F. and dry bulb 71° F. (or relative humidty 60%) at time of observation. After planting the weather remained clear for 5 days with the first rain on the 6th day; except for 15 days of very dry weather April 29th to May 14th. The summer was rather wet and favorable to transplants.

The following are the results:

	Exposure			*Series 1 (Mr. Critchley)*	*Series 2 (Mr. Neefe)*
Lot No.	*Length*	*Time of Day*	*Trees planted*	*Trees surviving on final count Aug. 2nd*	*Trees surviving on final count July 28th*
			number	*number*	*number*
1	none	(check	100	89	83
2	10 min.	2.45-55 P. M.	100	83	89
3	20 min.	2.55-3.15 P. M.	100	92	75
4	40 min.	3.00-3.40 P. M.	100	82	61
5	1 hr.	3.15-4.15 P. M.	100	66	68
6	1½ hr.	2.00-3.30 P. M.	100	30	38
7	2 hr.	1.25-3.25 P. M.	100	36	24
8	3 hr.	11.40 A. M. to 2.40 P. M.	100	3	3
9	4 hr.	11.40 A. M. to 3.40 P. M.	100	4	1
10	6 hr.	7.05 A. M.	100	4	0
		to 1.05 P. M.	100	4	0

While there is to be noted the expected variation between lots in the different series, the data show the injury to become very serious after a 40 minute exposure and all exposures from 1½ hours up resulted in less than half the stand which was secured in the check plots. It must be borne in mind that this was *full exposure* to sun and wind on the one hand, and on the other, that some seedlings survived which still might show serious injury in later growth.

Other experiments to examine into the weakening effect of heeling in seedlings over winter; the effect of exposure on different species and different aged stock; the relative results on clear and cloudy days, etc., are pending. It is difficult to isolate the factors which it is desired to study but results of some value may be obtained. Certainly the experiments have value in student training which may be realized in every forest-school nursery, even though the results of the experiments do not lead us far beyond our present understanding of silviculture.

EFFECTIVE FERTILIZERS IN NURSERIES.

By George A. Retan,*

In the spring of 1911, on the occasion of the sudden illness and subsequent death of the Forester in charge, the writer was unexpectedly placed in charge of the Greenwood Nursery. This nursery is located near McAlevy's fort, Huntingdon County, Pa., at an elevation of about 1200 feet above sea level. The aspect is N. W. and the slope is 5-10°. The soil is formed by the disintegration of a soft rock of the Clinton group. It is very thin, the rock outcropping in the center of the nursery. The subtype of the surrounding forest is characterized by white pine as the permanent species. The nursery is trapezoidal in form embracing about two acres.

At the time of arrival the raising and shipping of seedlings were going on concurrently with 1911 bed preparation. The two year old seedlings were being removed from nearly two-thirds of the nursery area. It was noticeable that the seedlings from the lower third of the nursery were inferior in vigor, size and color. A scheme was recommended and approved for the improvement of the soil conditions. The nursery was divided into three parts, one-third remaining in beds made the year before and containing a rather poor stand of seedlings. The second third was prepared and sown, this being that part of the nursery which appeared to show least evidence of soil deterioration. The lower third, mentioned above, was put under cultivation as detailed below. This rotation was continued, and at the end of this, the third season, some results of the treatment can be observed.

The cultivated third was treated as follows. After plowing early in June, there were applied: 200 lbs. Acid Phosphate, 100 lbs. Sodium Nitrate; 100 lbs. Potash (KHO_3); 100 lbs. Bone Meal.

Cow peas and Oats were then sown and were plowed under early in September when ripening, thus giving a second crop, which was plowed under in November. In the spring of 1912

*Instructor in Silviculture, Pennsylvania State Forest Academy, Mont Alto, Pa.

the fertilizer application was repeated and the beds prepared. These were made twenty-five by four feet, and each received one pound of white pine seed sown broadcast. On some of the beds, however, red pine and Norway spruce were sown.

It should be stated that the white pine seed was not of the best quality, but an amount somewhat under the prescription of Pettis was used because too dense a stand is not desired where the seedlings are to remain two years in the seedling bed and then be planted out. About 40% of the white pine seed germinated. The red pine germination was exceptional, too good for the production of the best seedlings.

These are the practical results. In 1911, 816,000 seedlings were taken from two-thirds of the nursery area. This was by far the largest shipment ever made from the nursery, the average being between three and four hundred thousand. The yield from the third treated as above will be about 500,000 white pine and 200,000 other species, mostly red pine, or a yield nearly as largs as that previously secured on an area twice the size. The one year old beds of the present season will have about the same yield if they come through the winter in good shape.

But most significant is the condition of the seedlings. They are of an intense green color, stocky, well needled, and with good root and bud development. The contrast with the seedlings of three seasons back is striking. The one year old seedlings are also well above the average.

This season, 1913, extensive fertilizer experiments were carried on in both the Mont Alto and Greenwood Nurseries under the direction of the Department of Forestry. Forty-nine different combinations were used on as many beds, twenty-five by four feet, in each nursery. The results at the end of the first season are not conclusive as regards some of the combinations, but some of the beds have been very instructive. Acid Phosphate is the only fertilizer unquestionably beneficial at this time. Sodium Nitrate as a top dressing has been an absolute failure in every bed tried, causing considerable loss. The minimum amount used was five pounds to 100 square feet, giving .75 pounds actual N.

Another experiment of value was carried out by Forester T. O. Bietsch in the Mont Alto Nursery. On heavy clay soil, where uniform failure had met the attempt to raise conifers, charcoal residue from old pits scattered through the forest was applied very heavily so as to form from one-third to one-half the bed. These beds were sown with white pine broadcast and have stood two years. This summer they were pronounced by both Dr. Roth of Michigan and Mr. Dana of the Forest Service, exceptional in every respect. They supported seedlings fully as large as average three year olds. There is some question as to whether the charcoal acts purely in a physical manner or whether there may be present a considerable wood ash content. This season experiments in testing pure charcoal from the old furnace pile will be carried on.

These three years of experimental work have emphasized the superior value of the physical fertilizer for these nurseries. It is believed that the chemical fertilizer can best be applied in connection with the green crop, that it will do more good in this way than it will applied directly to the bed. It has been seen that barnyard manure, if well rotted, has been of equal value to any of the above. It is hoped that these results may be of value to others working under similar site conditions.

THE RELATION OF THE SURFACE COVER AND GROUND LITTER IN A FOREST TO EROSION.

(As illustrated in a Bavarian Forest).

By Maximilian J. Gleissner, *D. Ing*

Toward the latter part of May, 1912, I visited in company with others, some of the forests of the Bavarian administrative district "Pfalz" i.e. the Palatinate. This is one of the eight Bavarian administrative districts, with headquarters at Speyer. About 599,370 acres, approximately 40% of the area, are forested. Of this 300,700 acres, roughly 50%, belong to the State, nearly 13% is in private hands and the rest consists of communal institutional and association forests.

It was our pleasure to have both "Regierungs—und Forstrat" Neblich of Speyer, one of the assistant district foresters and "Forstmeister" Aull, the forest supervisor of Neustadt—Süd to accompany us through the communal forests of the town of St. Martin.

St. Martin lies in a valley surrounded by steep mountain slopes with grades ranging from 18 to 22%. The forest cover here consists largely of dwarfed pine stands *(P. silvestris)*, upon shallow brown sandstone * soils.

In the valley agriculture is practised by the peasantry and as is often the case in regions with poor soils the forest litter is locally of great economic importance, but its utilization, combined with the comparatively poor soils and the low precipitation.† has been the cause of much damage.

In Germany a part of the forest litter is annually utilized. It is either sold at auction to the highest bider or given to persons entitled to this sort of free-use. In some sections of the Palatinate each acre of the middle-aged and older stands is raked clear of litter every sixth year. In Baden the litter-gatherers are allowed but 3 days in which to collect the forest litter from the stand to which they are assigned and the use of iron rakes

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* Lower Triassic formation.

† 16 to 20 inches per annum.

is forbidden. On the other hand we find no such provisions protecting the forests and forest soils in the Palatinate. The privilege of gathering forest-litter extends throughout the whole year and when the year is passed only the mineral soil is left*. Even though the sandstone soils at St. Martin are not of the poorest quality, they are too shallow to endure such treatment without showing some decline in quality. Nor are the climatic conditions such, that would enable the treated stands to recuperate in the six years of non-use.

The utilization of the forest-litter has been in progress for a great many years. At one time the forest litter was of more importance than the wood and even to-day there is in St. Martin many a peasant who values his forest more for the litter it produces than for its timber. Many of the stands are somewhat open and the forest floor was denuded of all living and decaying vegetable matter. These nude soils have no power to absorb much water, as almost any ground cover does, nor do they in any way hinder the water from rushing down the steep inclines, but being almost entirely unprotected soon start to erode much the same as if the area had no forest cover upon it.

During and after each extra heavy rainfall great damage was done not only by the large amount of water which rushed down the steep inclines surrounding St. Martin but also by the many tons of debris which were carried down with it and deposited upon the fertile fields in the valley, destroying the crops of the peasants and sometimes even blocking up some of the village streets.

It was the duty of the Bavarian forest service to do all in their power to prevent such damage. If the utilization of the forest-litter could be prevented the vegetable surface cover would reappear in a few years, and a large amount of the water would be absorbed by the more porous and fertile soil. Yet the public needs and the public sentiment would not allow an abrupt change in the rules and regulations governing the utilization of the forest-

* In cases, such as this, it would be advisable to attempt to regulate the gathering of the litter from late Spring until Sept. i. e. until just before the leaves of the broadleaved species mixed in the stands begin to fall, thus insuring some humus for the soil. Mature stands should be protected for 5-10 years before clearing so as to provide a suitable seed-bed.

litter; moreover, the greater part of the land situated upon the slopes is either in private hands or belongs to the communal forests of St. Martin. The forest service then proposed digging horizontal transverse trenches to prevent the downward rush of the surface waters. The peasants had little faith in the plans, in fact even opposed them because they believed that it would hinder the raking up of the forest litter.

Finally, in 1899-1901, the forest service, in spite of the opposition of the people, dug a series of horizontal transverse ditches, beginning near the top of the steepest slopes of the state and communal forests and only extending them part of the way down, as there was but a very limited amount of money available. In 1905, a vehement rain storm raged in the Palatinate and while an enormous amount of debris was deposited upon the fields underlying the other slopes, those at the bases of the steeper inclines with the transverse ditches were almost entirely undisturbed.

The inhabitants of St. Martin now saw that these trenches had saved some of their farming lands and crops from damage and destruction and it was a simple proposition for the forest service to obtain money to continue the work upon the state and communal forests. The following year St. Martin raised $1,500.00, the legislature appropriated another $1,500.00 and a neighboring town contributed $250.00 to be used to pay for the construction of more trenches, to be placed at intervals upon the slopes.

The combined area of the slopes which surround the St. Martin valley is 1800 acres, but only one-quarter of the area is traversed with ditches. At present 460 acres contain on the average 3400 running feet of trenches per acre. They cross the slopes horizontally and are from 6-10 ft. long, 10-12 inches deep and have an upper width of 20, a lower of 10 inches. The excavated soil is piled along the lower edge and at the ends of each trench so as to increase its capacity. They are laid in checker-board fashion and unevenly distributed, so that the greater number of running feet of excavations are concentrated upon the steepest slopes.

At the time these ditches were dug the average daily wage per man was $0.75 and the cost per 100 running feet of trenches was $0.25 *. The total expense was $3,250; the cost per acre only $1.80. †

Just two days before my visit to St. Martin, the Palatinate was swept with one of the heaviest rain storms since the year 1905 and although the trenches were filled with water and sand, there was no damage done to the fields or the village itself. During my stay there, men were emptying these ditches and piling the sand on their edges and the lower sides, so that within a few days after the storm the trenches were again in condition to protect the property of the peasants below.

Some few of the private owners neglected to construct trenches upon their forest-lands because of the expense and they claimed that the trenches would encumber the gathering of the forest litter. The peasants had offered the same objection but now find that the forest litter has the tendency to collect in the ditches and this in no way encumbers the raking up of the litter. in fact, it facilitates the work.

Since the trenches have been constructed, the soil cover has again reappeared and a fair turf and huckleberry growth now covers the soil under the open pine stands of the steep slopes. This living vegetable cover will soon supply vegetable-mold and together they will prevent the rapid downward rush of the surface water and in doing so give the humus and the soil time to absorb a larger amount of the same. If the litter would not be collected, there would be but little need of trenches after the forest floor is again fully established.

Although I examined the diameter increment of a number of trees by the aid of a Swedish increment borer, with the expectation of finding an increase in the width of the annual rings, no marked difference could be detected, in fact, occasionally there was none at all. Yet I believe that an increase in increment must result from the greater amount of moisture which the ditches make available for the roots, even though the grass and huckleberry growth may use a large part of it.

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* An average of 300 running feet per man, per day—undoubtedly a working day of 10-12 hours.

† This is the average cost per acre considering the whole area of the slopes. Although only 460 acres are traversed with ditches (average= 3,300—3,400 ft. per acre) this is the more correct way to find the average cost per acre as the surface water of the 1800 acres is controlled by these trenches.

FOREST TAXATION ACTIVITY IN MASSACHUSETTS.

By Herbert J. Miles.

Chapter 131 of the Resolves of the Massachusetts Legislature passed during the session of 1913 provides for the appointment by the Governor of a commission of five persons, citizens of the commonwealth, two of whom shall be the tax commissioner and the state forester, to be designated the Commission on the Taxation of Wild or Forest Lands. The duties of the commission are to investigate the effect of present laws relating to the taxation of wild or forest lands in this Commonwealth, and the laws and systems of taxation of like lands in other states and countries, and to draft an act providing methods of taxation of wild or forest lands which will develop and conserve the forest resources of the commonwealth. The commission is to study the present policy of the commonwealth in the matter of the acquisition and management of wild or forest lands and report what further legislation may be necessary. The report which is to be made on or before the first Wednesday in January, 1914, will contain a compilation of statistics and other information obtained by the Commission.

The Commission has held public hearings in cities throughout the state, two of which the writer attended in Boston. The hearings were fairly well but not largely attended, and some interesting opinions were presented. The opinion was general that the land should be taxed under whatever system is practiced. The writer feels that this is right, land value should be truly assessed and taxed, and under no circumstances should this value be exempt from taxation. The chairman of the commission made it plain at the outset that no scheme of exemption is entertained, but the purpose is to ease the burden of taxation on wild or forest land until the timber is cut. The opinion that the small woodland owner should be favored over the large lumberman who owns considerable tracts and is operating at a profit was put forth. Discrimination of this kind puts the state in the position of a dispenser of favors and is wrong. Let a sharp line be drawn between truly wild or forest land and land more suitable for other purposes, and then apply to the wild or forest land a system of taxation which will encourage reforestation and management.

An assessor offered the opinion that there should be periodical re-valuation as values change, starting with stump land and increasing the valuation as timber grows. He felt that some inducement is needed for leaving seed trees, and that if management be encouraged taxable possibilities will come.

A lumberman presented the view that timberland pays for itself over and over when wisely cut, and that harm is done when the land or stumpage is sold for a lump sum to a portable mill operator; therefore a system of taxation should be applied which will induce owners to use this kind of land or let some one else use it. He feels that the state should be lenient with the owner when he begins to grow something, and thinks that the land should be taxed each year, and in addition there should be a stumpage assessment when the timber is cut. He proposes that the state take and own abandoned cutover land, putting it under the management of the Massachusetts Forestry Association. Another gentleman interested in timberland expressed the opinion that the tax on forest land might be a state tax, or that the state should adopt a general principle in the matter, leaving details of application in local cases to local authorities, providing appeal in case of dissatisfaction to state authority. This gentleman believes that abatement of taxes on wild or forest lands does not induce management.

The President of the Associated Boards of Trade of Essex County presented the views of his association which are widely supported by business men and others interested in the matter in his part of the state: Provide a system which will make reforestation as little burdensome as possible to the landowner. The landowner who wishes to have the system applied to his land shall enter or list his land with a state commission for planting or management. The commission shall examine the land to determine the advisability of the work, and to endorse it if the commission thinks it wise, in which case the commission shall make regulations to be followed by the owner. The owner, except by permission, shall cut only for personal use.

The commission shall designate trees fit to cut, seed trees to be left, and shall make regulations for reseeding, etc. To prevent the holders of private pleasure grounds from escaping taxation, the distinction between land suitable for growing timber and land suitable for other uses shall be sharply made. In answer to the question, "Would not the present state forestry department be suitable to do the work," the gentleman said it would be. The State Forester asked, "Isn't it necessary to have some mandatory laws to accomplish the work?" The answer was, "Probably."

The writer believes that land value alone should be taxed, and that timber or other forest products which has grown as a result of forest management should be absolutely free from taxation. Timber which has not grown under forest management may well be taxed as a part of the land. This system would give relief and encouragement to management of wild and forest land. Under this system no deferring of taxes until the timber is harvested would be necessary, for the tax on land value is no burden since it is simply the taking by the community that which it creates.

It is believed that the commission will recommend a system of taxation of wild or forest lands by which the land value will be taxed annually, and the crop at maturity.

It is to be hoped that any regulation of cutting on lands benefited by the new system will be by volume per acre and not by number of trees per acre as has been done in some cases.

COST ACCOUNTS FOR RECONNAISSANCE SURVEYS.

By A. B. Connell.

A simple efficient method of cost accounting is necessary in reconnaissance work if a clear and accurate idea of current, as well as final, costs of operation is to be obtained.

The system employed should be sufficiently flexible to permit of the ready ascertainment of the effects which increase or decrease in the size of the party have upon the cost per unit of land examined. Only by this means can the most efficient reconnaissance unit be determined.

The comparison of cost figures from different operations can only be made after a strict depreciation has been written off the Property Account in each case. That is to say the depreciation upon the outfit should figure and not the purchase price. This is a point which is often overlooked and operations have often been made to bear the total cost of the purchase of heavy equipment which other parties have later used without being charged a proper rental.

The cash expenditure therefore, in the case of most governmental work, which is continued from year to year, has only a minor influence on the cost of the examination per unit acre. As the size of the operation increases the field efficiency of the party becomes more and more the dominating influence upon the cost of the work.

The system of accounting which is described below was developed under practical working conditions and proved quite satisfactory in meeting all demands made upon it.

A single small ledger, 8 in. x 12 in., of 200 pages is sufficient for six months' work. Nine active ledger accounts will provide all the necessary detail wihout proving cumbersome. These should be opened, in accordance with the usual book-keeping practice, in the following order:

Head Office Account.
Cash Account.
Travelling Expense Account.
Supply Account.

Salary Account.
Property Account (Purchases).
Freight Charges.
Express, Bank and Postal Charges.
Cost Account.

The entries are made and the accounts posted in the following manner:

Head Office Account:—Debit the total amount of money allotted by H. O. for the carrying out of the work. Credit the monthly total of the Cash Account. Thus at any time the cash expenditure to date is ascertainable.

Cash Account:—Debit the cash on hand. On the credit side enter each day's expenditure in detail. At the end of the month balance it off and post the various items to the Dr. side of their respective accounts. From this account a statement for H. O. of the month's expenditures may be quickly drawn up.

The remaining accounts are posted monthly from the Cash Account. They show, assembled and in detail, the expenditure on each branch, i. e. Salaries, Supplies, etc.

Cost Account:—This account is made up at the end of the operation. On the debit side enter the H. O. appropriation. On the credit post the totals of the various accounts. The balance will show the amount due to or by Head Office together with the total expenditure on the work separated into its various branches. The credit side of this Account will, of course, agree with the total of the Credit column of the H. O. Account.

The property which is acquired by transfer should be handled by means of a Property Record Account in the back of the ledger. Each item should be entered separately together with the value placed upon it.

In figuring the depreciation upon those items which are still in commission at the close of the work the rate should be based on the estimated life of the article in question. By this method the value of any part of the equipment will have been completely written off by the time it is discharged. This will apply to pack ponies as well as to canoes, etc. Articles lost and broken should, of course, be written off in total.

Finally a Cost Statement is drawn up for the completed operation. The totals of the various accounts are entered, depreciation upon the outfit is charged and the total cost thus obtained is set over against the area examined for the determination of the unit area costs.

Sample Cost Statement.

Salaries		$1,000.00
Supplies		900.00
Travelling Expenses		200.00
Depreciation of Outfit—		
On Property Transferred	$300	
On Property Purchased	100	
		400.00
Freight Charges		20.00
Express Bank and Postal Charges		3.00
Total Cost of Operation		$2,523.00

Cost per unit area of land examined.
Cost per actual field work day.
Cost of maintenance per man per day.

FORESTRY IN AMERICA AS REFLECTED IN PROCEEDINGS OF THE SOCIETY OF AMERICAN FORESTERS.

By Barrington Moore.

The object of the present review is threefold:

First, to show the trend of thought and progress of American forestry as reflected in the Proceedings of the Society of American Foresters. For this purpose the articles have been arranged under headings, in chronological order under each heading.

Second, to make more available for reference the material contained in the Proceedings of the Society of American Foresters, from the first number of Volume VII, number 2, inclusive.

Third, to give a general view of the field already covered, in order to show the degree of attention devoted to each subject.

I—Historical.

The Application and Possibilities of the Federal Forest Reserve Policy. By Edward T. Allen. Vol. I, No. 2.

Mr. Allen's article is most interesting, throwing light on the administration of the Forest Reserves in the Land Office days. As he says, it was unfortunate that incompetent men, placed on the Reserves by political pull, antagonized the people by bad management.

The Disposal of Public Lands. By George W. Woodruff. Vol. I, No. 2.

This article has nothing to do with forestry, but is of interest to American foresters in that it gives an account of the development of the policy with regard to public lands, which gave rise to the present National Forests. Much stress is laid on the frauds practiced to secure public land.

Objections to the Forest Reserves in Northern California. By Albert F. Potter. Vol. I, No. 2.

Ten objections on the part of the people of Northern California are given to the creation of forest reserves. These objections have since disappeared; but they serve to show the opposition with which the reserves first met.

Sir Dietrich Brandis. By Gifford Pinchot. Vol. III, No. 1.

This is an enthusiastic appreciation of the forester who introduced the science into India, by the man who has done so much for forestry in America. It will serve as an inspiration to all American foresters.

Relation Between State and Private Forestry in Pennsylvania. By Joseph Trimble Rothrock. Vol. IV, No. 1.

This deals with the relation of State forestry to the public, rather than with the relation between State and private forestry. It is full of details of the difficulties encountered by the forestry movement in Pennsylvania.

II—General.

Forestry and Foresters. By Theodore Roosevelt. Vol. I, No. 1.

This is a general article showing the vital importance of forestry to the United States as a whole. As Mr. Roosevelt says, the keynote of forestry is and always should be the upbuilding and maintenance of prosperous homes.

Bibliography of Southern Appalachians. By Helen Stockbridge. Vol. VI, No. 2.

This is a compilation which will be of great value as a reference for those interested in the purchase of land for forest reserves in the White Mountains and Southern Appalachians.

III—Descriptive.

Deforestation in China. By Bailey Willis. Vol. I, No. 3.

The treeless condition of Northern China is strikingly shown. The forests of once densely covered mountain ranges have been destroyed to such an extent that the rich are "reduced to sticks one inch in diameter by eight inches long for firewood." The "saving clause," which does not save the forests but modifies the effect of their destruction, is the wonderful skill with which the Chinese terrace and cultivate the bare steep slopes.

Why Prairies are Treeless. By Alfred Gaskill. Vol. I, No. 3.

Many facts are brought together tending to prove that prairies were caused by fire. These facts, though interesting, are not conclusive; and the argumentative tone pervading the article reacts upon the reader.

Some Philippine Forest Problems. By R. C. Bryant. Vol. II, No. 1.

This article gives some of the difficulties encountered in introducing forestry into the Philippines, difficulties naturally attendant upon studying tropical forests containing vast numbers of unidentified species whose growth and silvical characteristics cannot be investigated by methods used in temperate regions. Great as are the difficulties which Mr. Bryant brings out, he does not touch upon the greatest obstacle of all, namely, the system of *Caingins*, or shifting, cultivation by which large areas of virgin forests are annually destroyed for the sake of two or three years' miserable cultivation. Native hostility is also a serious drawback. For further information on the Philippine forests, see article by H. N. Whitford in Vol. VI, No. 1.

Some Forest Problems in Hawaii. By Ralph S. Hosmer. Vol. II, No. 1.

An account of industrial conditions in the islands. The minor importance of forestry shows rather strikingly; but eventually there will be an opportunity for valuable silvical investigations. The main efforts must, just now, be directed toward protecting the forest land, most of which belongs to the government.

Some Forest Problems of the Middle West. By Hugh P. Baker. Vol. III, No. 1.

This paper presents some of the problems of small farm forestry and advocates their solution. It is a general article of the propagandist type. Although containing little specific information, yet it undoubtedly served a very useful purpose.

Forest Resources and Problems of Canada. By B. E. Fernow. Vol. VII, No. 2.

This is an account of forest conditions in Canada. The first part of the paper is devoted to a description of the timber resources of Canada as known at present, and is illustrated by a map of forest regions. There is less timber, it occurs in more inaccessible regions, and is of poorer quality than in the United States. The second part gives an instructive and astonishng account of the Government's policy and methods with regard to the disposal of its timber.

State Forestry Problems. By A. F. Hawes, State Forester, Vermont. Vol. VII, No. 2.

The bulk of this article is devoted to questions which arise in fire protection, some of which apply to other eastern States. Protection from insects and animals (chiefly hedgehogs) is also discussed.

IV—Silvics.

Results of a Rocky Mountain Forest Fire, Studied Fifty Years After Its Occurrence. By W. J. Gardner. Vol. I, No. 2.

This is the first forestry article appearing in the Proceedings discussing actual forestry work on a specific problem; and it is perhaps significant that it should have been placed at the end of the number. The author gives his observations first in a general manner on the region, then on the influence of aspen, and on the restocking of the burn, followed by a few figures on the reproduction, growth, and tolerance of Engelmann Spruce. Though no particularly important results were obtained, still this is a distinct beginning.

Principles Involved in Determining Forest Types By Raphael Zon. Vol. I, No. 3.

This is one of the first purely scientific articles appearing in the Proceedings, and one of the best. The author shows the scientific spirit in reaching after fundamental principles. He states very truly that physical factors are the causes of forest types. He makes one omission in that he fails to point out the importance of certain temporary types in forest management. An example of such a temporary type would be Douglas fir on the Pacific Coast; in this case the forester should not "endeavor to obtain in the shortest possible time the original forest type." Aside from this slight and natural omission, the principles laid down are those generally recognized by foresters to-day.

Objects and Methods of Establishing Permanent Sample Plots. By W. D. Sterrett. Vol. II, No. 1.

Brief and instructive details of the objects and methods of establishing permanent sample plots are given. The article is strictly preliminary; and the objects given are therefore general. Some work has been done, but no results as yet obtained. This work has since been more highly developed at the Coconino (now Fort Valley) Experiment Station near Flagstaff, Arizona. However, the article shows the beginnings of careful experimentation.

A New Explanation of the Tolerance and Intolerance of Trees. By Raphael Zon. Vol. II, No. 1.

The author begins with a thorough analysis of the factors affecting transpiration. He proves that on dry soils the influence of moisture is greater than that of light. Then follows account of experiments demonstrating that tree roots dry the soil. This is true enough, but does not bring out the comparative influence of light and moisture on tree growth, and this, after all, is the point, and one which it will be extremely difficult to solve considering the complex inter-relation and inter-action of the two factors.

His statement that the lack of reproduction under old trees is not due to lack of light but to lack of moisture is too strong; it might be that with the same small amount of moisture but with light, seedlings would grow. Something might be learned by experiments which would give seedlings the same amount of moisture as that found in the places under the trees where reproduction fails, but which would also give them full light. It would seem that Zon's first enthusiasm for this discovery carries him as far in the moisture theory as Pfeil was carried in the light theory. For Zon's maturer judgment see his and Graves' bulletin "Light in Relation to Tree Growth," Forest Service bulletin No. 92.

Some Further Considerations Regarding the Tolerance and Intolerance of Shade. By Herbert A. Smith. Vol. III, No. 1.

Mr. Smith speaks a word of caution against being carried too far by Mr. Zon's enthusiasm for the new discoveries of the effect of moisture on tolerance.

Silvical Notes on Lodgepole Pine. By E. R. Hodson. Vol. III, No. 1.

This paper gives some very interesting and important facts which were hitherto unknown, and draws logical conclusions about the reproduction of lodgepole pine. The discovery that too dense a stocking was injurious and that about 8,000 seedlings per acre constitute an optimum full stocking is well worth knowing. Some of his other facts are equally useful.

Experiment Stations in Connection With the National Forests. By S. T. Dana. Vol. IV, No. 1.

The author shows the far reaching significance of the new (this was in 1909) plans of establishing experiment stations on the National Forests, and touches upon some of the problems requiring solution. The establishment of these stations is probably the most important step taken by the Forest Service in placing the profession on a firm foundation. The value of the information which these stations will some day secure cannot be over-estimated.

A Study of the Reproductive Characteristics of Lodgepole Pine. By Gordon E. Tower. Vol. IV, No. 1.

The author gives basic facts concerning the reproduction of lodgepole pine. Reproduction of this species is "not always so readily secured as was at first supposed." He discovered two forms: (1) that occurring on lime soils with cones difficult to open; and (2) that occurring on silica soils with cones opening readily. He also gives data on the effect of heat and of age of the seed on the power of germination.

Economic Possibilities of Pinus Sabiana. By Charles H. Shinn. Vol. VI, No. 1.

This article belongs under Utilization as well as under Silvics, but was placed here because a large part of it is devoted to a description of the silvical characteristics of this tree. Mr. Shinn calls attention to this little known but abundant tree and gives valuable information concerning its characteristics and uses.

Efficacy of Goats in Clearing Brush Lands in the Northwest. By Charles S. Judd. Vol. VI, No. 1.

This article gives a novel if not always practicable means of clearing brush lands. The use of goats is probably cheaper than clearing by hand and as effective if the object is reforestation.

Basket Willow Culture in Germany. By C. D. Mell. Vol V, No. 1.

This is a specific article giving some interesting facts, but not all the facts. He does not say how long it takes to grow basket willow or how much it costs.

Chaparral Areas on the Siskiyou National Forest. By H. E. Haefner. Vol. VII, No. 1.

This article contains interesting information about the brush fields of Southwestern Oregon, and silvical notes on the occurrence of the different types on the different geological formations. The point that the brush areas were deforested by fire is well taken. It would be worth while to impress that fact upon the settlers. His information about the natural restocking of the brush areas is too vague. We should like to know just what effect the brush has upon reproduction, whether it really aids reproduction by preserving soil moisture or is an unmitigated evil; what effect it has upon the reproduction of the different species, that is, whether or not a stand formerly composed of pine will be changed to one of a more tolerant species which can come up through the brush; what species first comes in; and the period required for natural restocking under different conditions. His recommendation about reforesting the most favorable sites first is good.

Inter-relation Between Brush and Tree Growth of the Crater National Forest, Oregon. By Harold D. Foster. Vol. VII, No. 2.

The author has brought together a number of interesting observations on the distribution, classification, and causes of brush; also its relation to reproduction. These observations tend to show that brush is caused by thinning of the stand due to fire. Brush keeps the soil in condition for reproduction but, he says, injures as much as it aids the reproduction. On this point there is room for argument; in the northern Sierras brush is the forerunner of a second forest. His attempts to find means of eradicating the brush show the impossibility of doing so except by shading.

Sitka Spruce of Alaska. By Bruce E. Hoffman. Vol. VII, No. 2.

This article contains silvical observations, chiefly on the occurrence, form and reproduction of Sitka spruce; illuminating details of the lumber industry in the vicinity of the Tongass National Forest; and definite recommendations for reconnaissance, timber sales and methods of cutting. At the end is a volume table based on diameter and average merchantable length. It is the first detailed information of the tree and region published. The article is an example of the manner in which American foresters grapple with a new problem.

V—Ecology.

Plant Formations and Forest Types. By F. E. Clements. Vol. IV, No. 1.

Professor Clements does a marked service to the profession of forestry by applying the principles of ecology to forest types. In so doing he lays the foundation for a thoroughly scientific study of the relation of the forest to its habitat. The result is that he gives a more stable starting point from whence to attack the complex problem of determining forest types. The article is indispensable for a proper understanding of forest types.

The Relation of Soil Acidity to Plant Societies. By Arthur W. Sampson. Vol. VII, No. 1.

This article is of interest not only to ecologists but to foresters. The author has investigated in a scientific manner the effect of soil acidity and of alkalinity upon the occurrence of plant societies. His discoveries refute the theory maintained by certain scientists that the physical texture and moisture of the soil are of more importance than the chemical content. It is interesting to note that his study on the Manti National Forest showed that most of the tree genera found there prefer acid soils. He should, however, have stated the depth at which these tests were made, since forest soils are liable to be acid on the surface, but may be alkaline where the tree roots penetrate. These investigations are an important step in determining the fundamental physical factors which form the basis of forest types and on which Mr. Zon lays so much stress in his article "Principles Involved in Determining Forest Types," in Volume 1, No. 3.

VI—Silviculture

Silviculture Applied to Virgin Forest Conditions. By Alfred Gaskill. Vol. I, No. 2.

This article is a plea for getting down to principles in silviculture rather than blindly following European text books. Hence it is advice rather than an exposition or study of a specific silvicultural problem. But the advice is excellent and has since been followed.

A Rough System of Management for Reserve Lands in the Western Sierras. By W. B. Greeley. Vol. II, No. 1.

This is the best article on silviculture which has appeared in the Proceedings to date. It gives in a nutshell the essential features of the region in question and the leading silvical characteristics of the forest. From these the author evolves a thoroughly sound and practical system of silviculture. It is the work of a clear trained mind applying its training in a practical way. It marks the beginning of the true American Silviculture.

The Silvicultural Results of Marking Timber in National Forests. By Edward E. Carter. Vol. III, No. 1.

The author gives in a very interesting manner the growth of systems of marking in the important forest regions of the west. Early mistakes are shown as well as some of the difficulties encountered and imperfections in the methods used at the time the paper was delivered. The author's one oversight is that he emphasizes the value of the information which technical men can give the rangers without bringing out the fact that the technical man must have a thorough acquaintance with the forest before his advice can carry weight or even be worth following.

Condition of American Silviculture. By Henry S. Graves. Vol. III, No. 1.

Mr. Graves shows how little actual practice American foresters have had and how little is known about the fundamental American silvical conditions necessary for developing proper silvicultural methods. He emphasizes the necessity of having a definite silvicultural aim: not to forget what is desired and expected of the forest in the future, but at the same time, we must not become disappointed at failures. Finally he emphasizes one of the most important truths in forestry, the necessity of knowing *principles* rather than *systems*.

Some Notes on the Yellow Pine Forests of Alabama. By R. C. Bryant. Vol. IV, No. 1.

The figures on the growth of longleaf pine and the facts concerning lumbering clearly show the impossibility of forestry for private owners of longleaf pine land. Thorough silvical studies would apparently be useless since there is no government land in Alabama on which the findings could be applied, and conditions in Florida are somewhat different. The silvicultural systems suggested are interesting, but would carry more weight if based on more silvical facts.

The Selection System. By Henry S. Graves. Vol. V, No. 1.

In this article Mr. Graves brings together much useful information about the system of silviculture with which he has had much experience. It is the system he recommended in his Adirondack Working Plan. The last part of the article is particularly interesting, for he refers to the modification of the selection system known as the "group selection system" and now widely applied on National Forests bearing uneven aged stands.

Management of Loblolly and Shortleaf Pines. By W. W. Ashe. Vol. V, No. 1.

The author combines scientific information and practical application to a marked degree. He gives specific and fairly detailed information of considerable importance. The management, though a little crude, is probably as good as conditions will allow. The article loses by poor presentation some of the force which it otherwise would have.

Strip Thinnings. By Theodore S. Woolsey, Jr. Vol. VI. No. 1.

The author gives a method of thinning dense second growth spruce and balsam stands in the northeast. The method is adapted only to certain infrequent conditions and will probably not be widely used.

Results of Cuttings on the Minnesota National Forest Under the Morris Act of 1902. By Raphael Zon. Vol. VII, No. 1.

Mr. Zon's observations indicate very poor silvicultural results from the cuttings under the Morris act. The seed trees left are wholly inadequate, cutting was done in poor seed years, and the areas have grown up with such rank vegetation as to prevent further reproduction, particularly of white pine. His recommendation about clearing off the brush with fire at the time of cutting is of great interest, but should be most thoroughly tried out before being put into practice.

Silvicultural Systems of Management for Central Rocky Mountain Forests. By Carlos G. Bates. Vol. VII, No. 1.

The author gives an interesting sketch of the determining silvical conditions on each of the important Rocky Mountain types as far as these conditions were known at the time of writing. On this basis he builds up sound logical methods of silviculture, harmonized on the one side with the interests of the forest and on the other with those of lumbermen. Since the article was written lodgepole pine has been found to be far less intolerant than had been commonly supposed. This would make possible the application of the selection system which the author rejects, but would not prevent the use of the group selection system which he advocates.

Border Cuttings: A Suggested Department in American Silviculture. By A. B. Recknagel. Vol. VII, No. 2.

A detailed description of an European method of silviculture applicable only in accessible regions where intensive forestry is possible. Although not practicable for America's present day conditions, the method is worth knowing about for future reference.

Silvicultural Systems for Western Yellow Pine. By Earle H. Clapp. Vol. VII, No. 2.

This valuable paper brings together all the silvicultural information gathered by the Forest Service concerning western yellow pine. It reconciles the two opposing methods of handling the tree, the shelterwood method, and the group selection. Mr. Clapp shows that the latter is applicable to all but unfavorable situations on which reproduction requires shelter. Here the shelterwood system is better for securing new reproduction. The difficulty is that under present logging conditions much of the stand—up to two-thirds of the volume— must be removed at the first cut, thus largely destroying the shelter. Furthermore the area cannot be cut again for from 30 to 50 years, by which time the reproduction will have been shaded out, or will be badly damaged by the removal of the remaining well distributed portion of the stand.

Natural versus Artificial Regeneration in the Douglas Fir Region of the Pacific Coast. By Thornton T. Munger. Vol. VII, No. 2.

The author describes conditions in the Douglas fir region of the Pacific Coast, and gives the pros and cons of both methods of regeneration. He seems to be on the defensive throughout, and ends by saying that, except in four exceptional classes which he mentions above, "natural regeneration is practicable, reasonably sure of success, and as inexpensive as any method of artificial regeneration." Such opinions will, it is hoped, lead to thorough experiments to determine the applicability of both methods before the Service commits itself to either.

VII—Forestation.

Problems in Nursery Practice. By Clifford Robert Pettis. Vol. IV, No. 1.

This paper forms a very valuable contribution to all work connected with forest nurseries. It gives in a clear manner the essential details of the author's experience in directing the work of the largest scientifically managed forest nursery in the United States.

The Growing of Eucalypts. By Fred G. Plummer. Vol. V, No. 1.

Here is what a man wants to know before planting Eucalyptus. It is a general article followed by eleven pages of bibliography of Eucalyptus, so will serve as an excellent reference for anyone wishing further information on these important trees.

Experiments in Sandhill Planting. By Carlos G. Bates. Vol. V, No. 1.

This article shows very distinct progress in forestry thought and practice. It is detailed, specific, and extremely instructive. The author gives a series of very interesting experiments which were made in such a way as to show how each factor acts and why. The effect of plant competition on the moisture supply is particularly interesting. The article is, therefore, pure forestry of great future value, not only for the sandhills of Nebraska, but for every other region, as suggesting lines of investigation to be followed anywhere.

Hardy Catalpa; a Study of Conditions in Kansas Plantations. By A. E. Oman. Vol. VI, No. 1.

The author gives interesting and instructive details concerning the starting and care of hardy catalpa stands. He treats the subject in a careful and detailed manner, giving the causes of all the facts and recommendations he brings out. The article is therefore a valuable addition both to the forester's and farmer's knowledge of handling this valuable tree.

Eucalyptus Possibilities on the Coronado National Forest. By R. L. Rogers. Vol. VI, No. 1.

A thorough knowledge of conditions on the Coronado help to make Mr. Rogers' article of interest and value. He shows clearly that, although certain species of Eucalyptus can probably withstand the temperatures, it is doubtful if they could endure the drought unless previously established by irrigation. His conclusion is the need for thorough experimentation. The article is written in a careful scientific spirit, and should be read by all foresters who have under consideration the planting of Eucalyptus in arid regions.

Seed Production and How to Study It. By Raphael Zon and C. R. Tillotson. Vol. VI, No. 2.

This article is the result of painstaking and scientific effort. In the first place the authors state the four problems involved. The mere statement of these problems is a stimulus to forestry research. The history of the study of seed production is given in detail from its beginning to the present time; presented last is Zon's and Tillotson's method of studying seed production, which, briefly, consists in determining the *per acre* production of seed for any given stand. The method is somewhat complex and the idea is not concurred in by all foresters (see discussion of this article in Vol. VII, No. 1). Nevertheless the article has vigor and originality and marks a distinct step forward in the professional thought of the country.

*Seed Production and How to Study It: Discussion.** By S. T. Dana, Bristow Adams, and Raphael Zon. Vol. VII, No. 1.

This paper is wholly different from any of the others, except Mr. Herbert A. Smith's "Some Further Considerations Regarding Tolerance and Intolerance of Shade," in Vol. III, No. 1, in that it is a discussion of an article which has already appeared in the Proceedings. Mr. Dana takes the position that Mr. Zon's sample-plot method of studying seed production is too complex and expensive; furthermore it is analogous to the use of yield tables in finding the volume of stands, and yield tables, he says, are of but little use in our irregular forests. His alternative would be to estimate the seed crop by single trees instead of by area, using a previously constructed "seed-volume-table," just as a timber estimator uses a volume table of board contents.

Mr. Bristow Adams has no faith in either method of studying seed production and believes that there are other problems which are more in need of solution. He gives methods of increasing the seed crop of individual trees. Then follows Mr. Zon's reply to Mr. Dana and Mr. Dana's reply to Mr. Zon, at the end apparently neither being converted. The discussion serves to bring out the advantages and disadvantages of each method.

Forest Planting in Northern Michigan. By William B. Piper. Vol. VII, No. 2.

This paper relates to the planting done by the Forest Service on the Michigan National Forest. The work has been almost wholly experimental; something of value has been learned, but much further experimentation will be necessary.

VIII—Mensuration.

Timber Estimating. By Herman Haupt Chapman. Vol. IV, No. 1.

Professor Chapman, and one or two other foresters in the country doubtless understand forest maps and timber estimating better than anyone else. The interest and value of this article is therefore obvious. It is a brief outline of some of the more important methods of timber estimating and of the principles underlying them. Timber estimating is of course the phase of the profession closest to the old timber cruisers, a work in which foresters, lacking the experience of the timber cruisers, have surpassed these formerly infallible men by the use of scientific methods.

A Method of Studying Growth and Yield of Longleaf Pine Applied in Tyler County, Texas. By Herman Haupt Chapman. Vol. IV, No. 2.

Of all the methods of studying yield devised by foresters, this is the most original and interesting. There can be no question that the method

* The original paper of the same name by Raphael Zon and C. R. Tillotson appeared in Vol. VI, No. 2.

is thoroughly workable and productive of excellent results in longleaf and shortleaf pine; and also that it is equally applicable to western yellow pine. Furthermore there seems to be no reason why the method should not be used with any species which forms even aged groups. It is at present being tried by the Forest Service in the mixed conifer type (western yellow pine, sugar pine, incense cedar, Douglas fir and the white fir) of the western Sierras, and if successful will probably revolutionize the study of yield throughout the entire country.

The Standardizing of Log Measures. By Edwin Allen Ziegler. Vol. IV, No. 2.

This is a sound article showing clearly the variations caused by different log scales and methods of sawing, and advocating the use of the cubic foot. It is a specific article contributing something to professional knowledge and is also partly propagandist. There is no doubt that the author's recommendations will eventually be adopted, but not for a long time or without a struggle. This should not, however, prevent foresters from keeping the end in view and making every effort to attain it.

Forest Mapping and Timber Estimating as Developed in Maryland. By Fred W. Besley. Vol. IV, No. 2.

The work herein described is instructive in that it shows how to get a rough but sufficiently accurate idea of forest areas and stands in a woodlot state. It will be of considerable value to those starting forestry for the first time in a state, and to foresters in states which have for some time applied the science.

The Log Scale in Theory and Practice. By Harry D. Tieman. Vol. V, No. 1.

This article is the result of much original research in the important and complex subject of log measurement, in consequence the author is able to give in considerable detail the underlying principles of his subject. He has also evolved, as a result of the actual measurement and sawing out of 224 perfect logs, an ideal rule which he expresses by a formula. The article is a valuable contribution, not only to the scientific knowledge of the profession, but also to the practical application of this knowledge to the lumber industry.

IX—Engineering.

A System for Getting Topography in Reconnaissance Work in the Western Cascades. By Walter H. Leve. Vol. VII, No. 2.

The article gives the details of the topographic part of the reconnaissance in the western Cascades of Washington. The nature of the subject, together with the none too clear style of the author, would make this paper difficult to understand for one without much topographic experience. Since the article will be read chiefly by men engaged in this work it will have value for starting discussion and suggesting improvements. One improvement would be to have the field man complete his sketch in the field rather than turn in a series of short contours.

X—Management.

Some Government Timber Sales in the Southwest from the Practical and Technical Standpoint. By Theodore S. Woolsey, Jr. Vol. II, No. 1.

This paper gives an account of mistakes made in the earlier administration of timber sales. These mistakes, however, laid the foundation for the better administration of to-day.

Managing a National Forest from the Business Standpoint. By Theodore S. Woolsey, Jr. Vol. III, No. 1.

This paper throws an interesting light on the administration of the National Forests in 1908, and contains valuable suggestions. For example: His point about salaries and corresponding efficiency is well taken; his suggestions about keeping track of a Forest Officer's work, and about cost keeping have since been put into effect; while his recommendation of a more conservative use of the "raw product" (timber) has, owing to the necessity for making sales in order to put the Service on a paying basis, not yet been followed. However, with proper silvicultural methods of timber marking, there is no danger of depleting the capital.

The New Reconnaissance—Working Plans that Work. By Arthur Bernard Recknagel. Vol. IV, No. 1.

This article is full of details concerning the early attempts of the Forest Service to regulate the cut on the National Forests. These attempts produced valuable information, if small results in a timber sale policy. The author also gives the details of the method of reconnaissance used for securing working plan data in District 3. This method has since been applied on nearly all the Forests of the District, furnishing estimates sufficiently reliable for all practical purposes, and excellent topographic maps. The emphasis placed on mapping and estimating was, however, carried to such an extent that the silvicultural method of cutting was, until very recently, in danger of being overlooked. Although the author in his enthusiasm forgets that "working plans that work" cannot be built in a day, he, nevertheless, stirred up interest in this important line of forest activity.

Preliminary Forest Management in the Southwest. By Theodore S. Woolsey, Jr. Vol. IV, No. 1.

Under the above title the author discusses the method of fixing stumpage rates, the timber sale policy, and the method of fixing the annual limitation to the cut. His statement that all the timber in the Southwest will be needed locally is, I believe, over conservative. The population of Arizona and New Mexico is small, and will probably not increase greatly since most of the available agricultural land is already occupied. Although half of the article is devoted to the discussion of stumpage rates, the only basis which the reader can discover for the all-important minimum rate is competition; and yet it is only in exceptional cases that more than one bid is received. The timber sale policy of reserving certain areas for free use or for small sales is wise, and constitutes the soundest part of this article. The method of limiting the annual cut is correct enough, but tends to give too sanguine an impression of conditions in the region. The author fails to point out that this limitation of the cut, however necessary, is at present purely ideal and an object to be striven for, not by any means an accomplished fact. Perhaps the trouble is that he is so intent upon giving the reader an idea of what has been done that he fails to portray the conditions to which his measures must be applied, and consequently the effectiveness of these measures. The foreigner reading this article would be left with an undeservedly high impression of our rate of progress.

Regulating the Annual Cut of National Forests. By S. L. Moore. Vol. V, No. 1.

This article gives a remarkably clear and truthful picture of the conditions on which regulations of the cut on National Forests must depend. By its frank statements of facts it gives a basis for future progress.

Working Plans for National Forests of the Pacific Northwest. By Burt P. Kirkland. Vol. VI, No. 1.

In this article are two valuable contributions to the profession. First, the author explains the principles involved in making working plans, illustrating these principles with his own working plan; second, he develops strong arguments for the making of working plans. In his explanation of principles in the first part of the article he effectually destroys certain fallacies, notably the one about elastic working circles composed of any number of National Forests.

His working plan is built on the area method with a volume check. It is a sound, intensely interesting and instructive piece of work with which every forester who deals with even aged stands should be familiar. His reasons for bringing the Forests up to their full productive capacity are logical, but he ignores the danger of overproduction in the lumber market which such a course would involve. (See article by W. B. Greeley, "National Forest Sales on the Pacific Coast," in Vol. VII, No. 1). His arguments for the making of working plans are, on the whole, thoroughly sound, and should stir up those foresters who wait until the need for working plans arrives before making them. The making of a working plan is a matter of years, not of months; it is never too soon to begin collecting the data. Mr. Kirkland's article is, on the whole, one of the most thorough, detailed and specific articles, dealing with the science of pure forestry, which has ever appeared in the Proceedings. It is indispensable for reference.

The Essentials in Working Plans for National Forests. By Barrington Moore. Vol. VI, No. 2.

Methods for Regulating the Cut on National Forests. By Barrington Moore. Vol. VII, No. 1.

XI—Utilization.

Influence of Lumbering on Forestry. By Austin Cary. Vol. III, No. 1.

This is a sound, practical paper. The author shows how foresters fail to affect the management of lumbering concerns. This he attributes to the foresters' inability to see a proposition from the business standpoint.

He also points out the increasing opportunities for the practice of forestry, chief among which are the large wood-using industries, such as pulp mills, which need permanent supplies of raw material, and permanent resident ownership. The keynote of the paper is the need for a proper balance between the technical and business management. The author must have the satisfaction of seeing that his principles are now recognized by the best foresters throughout the country.

Shakes and Shake-making in a California Forest. By Charles Howard Shinn. Vol. IV, No. 2.

This article is a complete and detailed account of shakes and shake-making from the earliest times to the present. It is in the nature of a memorial and defense of that picturesque but rapidly disappearing industry. Interesting figures are given comparing the value of the same class of material worked into shakes and sawn by a small portable mill.

Wood Preservation—A Determining Factor in Forest Management. By Howard Frederick Weiss. Vol. IV, No. 2.

The author points out the importance of wood preservation in determining the composition of future forests, in increasing the value of thinnings, in giving value to top logs hitherto a loss in lumbering, and in accelerating the removal of dead material. He builds up a strong, but, it must be admitted, rather one-sided, argument in favor of wood preservation.

Notes on Management of Redwood Lands. By Swift Berry. Vol. VI, No. 1.

Mr. Berry has given us a brief, yet complete and clear account of the utilization of redwood. This is followed by notes on the disposal of cleared redwood lands and suggestions for keeping certain of these lands permanently in forest.

Conservation and Chemical Pulp. By Dr. B. Herstein. Vol. VI, No. 2.

The author gives a method of solving the hitherto vexing problem of disposing of the injurious waste from the sulphite process of pulp making. The method, now successfully used in Sweden, not only effectually does away with the damage from the waste, but yields a commercially valuable by-product, alcohol.

XII—Protection.

Better Methods of Fire Control. By W. B. Greeley. Vol. VI, No. 2.

This article gives the most clearly thought out methods of preparing against and of handling difficult fire situations. It will, of course, be remembered that Mr. Greeley was in charge of the District on which the great fires of 1910 occurred. The value of this article is such that the Forest Service had it reprinted and sent to every Forest Officer in the Service.

Fire Problem on the Florida National Forest. By I. F. Eldredge. Vol. VI, No. 2.

The author gives a striking picture of the conditions on the Florida National Forest, and shows the impossibility of protecting the entire Forest. He gives an alternate scheme for concentrating fire protection on turpentined areas. The article is extremely instructive, particularly for those unfamiliar with Southern conditions, and who would advocate indiscriminate fire protection.

XIII—Forest Influences.

Chaparral as a Watershed Cover in Southern California. By L. C. Miller. Vol. I, No. 3.

This article is a study of chaparral itself rather than of the value of chaparral as a watershed cover. The latter fact is assumed as established, and the writer proceeds with his facts about the density of chaparral on different slopes, and methods to retain and increase the cover. If his premise be granted his article is an excellent plea for fire protection in the chaparral covered watersheds of important streams.

Striking Features of the Water Situation in California. By E. A. Sterling. Vol. II, No. 1.

The author gives a clear and interesting account of the water situation in California, showing the vital importance of water, and the public understanding of the needs of the case. The article is, however, not scientific in that it does not show what influence the forests have. It is primarily of importance for its relation to forestry.

Relation of Surface Conditions to Streamflow. By William L. Hall and Hu. Maxwell. Vol. IV, No. 2.

This is a strong article. It is logical, sound, impartial and scientific. The point that increased runoff causes decreased evaporation and consequently decreased precipitation is excellent.

Forests and Streamflow—An Experimental Study. By Carlos G. Bates. Vol. VI, No. 1.

This article gives full details of the starting by the Weather Bureau in co-operation with the Forest Service of the most complete experiment which has ever been undertaken to determine the influence of forests on streamflow. Two forested watersheds of as similar character as possible have been selected. For a period of years all factors will be measured on each watershed, just as they now are, in order to obtain an accurate comparison of the two. Then one watershed will be denuded and the other left forested. The effect will be accurately noted and cannot fail to yield the most accurate and convincing results.

XIV—Economics.

How Shall Forests be Taxed? By Alfred Gaskill. Vol. I, No. 3.

This article is an exposé of the important principles of forest taxation, showing the injustice of the methods of taxation commonly used at present. It is also an attempt to adapt a complex problem to a crude and difficult situation. It shows that we must build up our own Forest Economics.

Forest Fire Insurance in Germany. By Samuel J. Record. Vol. II, No. 1.

Mr Record gives a brief and interesting outline of the methods of fire insurance used in Germany, showing that the calculation is based on one of three methods of valuation, either on the cost value of the stand, on the forest expectation value, or on sale value; and that the rate increases with fire danger of the stand. The article gives a glimpse ahead at very intensive forestry which probably will not be applied in the United States for a number of years, but is none the less worth knowing about.

Forestry for Railroads. By E. A. Sterling. Vol. IV, No. 1.

Mr. Sterling touches very closely the relation of the profession of forestry to the industrial world. The reason why the railroad has not taken up forestry is that foresters have failed to show railroad men forestry from a business standpoint. The importance of forestry to railroads lies not in planting, but in the management of timber lands.

The article is extremely interesting and instructive, but of necessity too vague. Mr. Sterling does not know enough about railroading, nor does any other forester. This ignorance is the vital trouble with the profession generally, for, unless forestry becomes an integral part of the business life of the country and answers its needs it can never be of any real value to the nation. The Service must graduate to where it feels ashamed of being unable to answer the questions which the railroad puts to it, and which Mr. Sterling so clearly enumerates. Most certainly, as he says, the Forest Service should uphold the railroad in the ownership of timberlands and in the disposal of minor products.

National Forest Sales on the Pacific Coast. By W. B. Greeley. Vol. VII, No. 1.

This article shows clearly the underlying economic and business principles which should and actually do guide the Forest Service in handling the problem of timber sales. The principles are broad, sound and thoroughly practical and justly a deviation from the strict silvicultural requirements. The article is the result of clear thinking.

Timber Bonds. By Edward A. Brainiff. Vol. VII, No. 1.

This article contains a long and very detailed account of bonds issued by lumber companies on the security of their timber lands. The author goes into all the features of these issues, giving many warnings to the prospective investor, but leaving impressed upon his mind a very favorable opinion of timber bonds and a keen desire to secure some. The article is well written and the information imparted interesting, but its connection with forestry is too remote.

XV—Legislation.

What are the Essentials of a State Fire Law? By E. A. Sterling. Vol. I, No. 3.

This paper deals chiefly with the provisions of the California fire law, at that time before the State Legislature. It nevertheless shows clearly the essentials of any ideal State fire law, which are: first, the prevention of fires; and second, adequate machinery for the execution of the law. Although the paper was written eight years ago, it is still well worth while reading and understanding, particularly for those engaged in State forestry.

XVI—Education.

Some Problems in Forest Education. By Henry S. Graves. Vol. II, No. 1.

In this paper the author strikes the keynote of the policy which should and does prevail in the best forest schools of the country. It is the importance of a broad and thorough technical training. He shows that American foresters need a broader training than do foresters in Europe. He mentions the leading subjects and shows their bearing, pointing out especially the need of learning to do research work, and of an understanding of fundamental principles in order to build up the new profession. His proposal for giving a different kind of training for technical foresters and for lumberman and rangers is the answer to the cry, at that time very insistent, for a more practical training. In fact, the paper might be considered somewhat in the nature of a defense of the system of thorough technical training.

XVII—Botany.

The Catalpa Septum: A Factor in Distinguishing Hardy Catalpa. By William H. Lamb. Vol. VII, No. 1.

Mr. Lamb gives one dependable characteristic by which the two catalpas may readily be distinguished; in distinguishing two similar species one dependable character is worth any number of variable ones.

A Synopsis of the Red Firs. By William H. Lamb. Vol. VII, No. 2.

The author describes and illustrates with plates a few characteristics of the leaf and bract of the three firs, Abies nobilis, Abies shastensis and Abies magnifica, which render possible the sure and easy distinguishing of these hitherto confusing species.

XVIII—Auxiliary Subjects.

SOILS.

Forests as Gatherers of Nitrogen. By Treadwell Cleveland, Jr. Vol. V, No. 1.

The author of this paper relates in a manner which can be understood by the layman some interesting experiments proving that forests increase the nitrogen content of the soil. He also states the opposing theories of Boussingault and R. Hartig as to how this complex and little understood process is carried on.

FOREST PATHOLOGY.

Parasitism of Phoradendron Juniperinum Libocedri Engelm. By E. P. Meincke. Vol. VII, No. 1.

In this article the author gives with scientific precision the details of his study of this interesting and peculiar mistletoe. He discovered that this plant, when it reaches a high age, lives without green exterior organs, and concludes that from the beginning it normally abstracts not only water and inorganic salts from the incense cedar, but organic food as well. This conclusion, as he states, still needs anatomical proof.

Use of Soil Fungicides to Prevent Damping-Off of Coniferous Seedlings. By Carl Hartley. Vol. VII, No. 1.

This article presents briefly the results of experiments at the Halsey nursery in the sandhills of Nebraska, aiming to check the loss caused by damping-off. Different acids were used in different strengths. The results with sulphuric acid were satisfactory, but of course can not be applied directly to other conditions. They, however, serve as a valuable suggestion for carrying on similar experiments elsewhere.

WOOD TECHNOLOGY.

The Philippines as a Source of General Construction Timber. By Dr. H. N. Whitford. Vol. VI, No. 1.

The author gives a concise account of the commercially important timbers of the Philippines; showing where they are found, the stand per acre, and important technical qualities of each. He emphasizes the predominance of the Dipterocarp family of which the most important are the lavans, the apitongs, and the yacals. It is interesting to note that these forests, contrary to the popular idea, do not contain merely "hard, durable timbers, scattered and hard to extract," but large quantities of cheap construction timbers. (For further information on the Philippines see article by R. C. Bryant, Vol. II, No. 1.)

History of the Investigation of Vessels in Wood. By C. D. Mell. Vol. VI, No. 1.

This article is a history of the investigation of vessels in wood, beginning with Malpighi (1628-1694) to Von Mohl (1842), most space being devoted to Von Mohl. The article contains no original researches, but is a resumé of the investigations of European scientists, and, as such, forms a useful contribution to this phase of wood technology.

GRAZING.

Grazing in the National Forests. By L. F. Kneipp. Vol. VII, No. 2.

This paper deals with relationship between the live stock industry and the National Forests, and the dependence of this industry upon the forage which the Forests contain. The effect of grazing on the Forests, and of forestry on grazing is mentioned, and the importance of not disturbing the grazing industry is emphasized. The great benefits which the live stock industry has received from regulation of the range by the Forest Service are barely touched upon.

Range Improvements and Improved Methods of Handling Stock in National Forests. By J. T. Jardine. Vol. VII, No. 2.

Range management is one of the big problems of the Forest Service. Mr. Jardine gives clearly the main lines of work; first, the improvement of the forage crop, both through artificial reseeding (only practicable on limited areas) and through natural reseeding by allowing the grass to produce seed before it is eaten, thus strengthening the plants, seeding the area, and utilizing the forage at the same time; second, the study and application of new methods of handling sheep, which both increase the carrying capacity of the range, and the value of the sheep; third, experiments to determine the effect of grazing on tree reproduction; fourth, a grazing reconnaissance, to map and collect notes on the grazing resources of the National Forests. The paper gives a glimpse of scientific grazing work.

Translations.

Translations, in that they are not original articles, and do not belong to American forestry are placed at the end. Since, however, they will be useful for reference, they are included.

A New Method of Planting. By Morris Kenzenik. Translated from the German by S. T. Dana and E. H. Frothingham. Vol. IV, No. 2.

This article is well worth while knowing about, and adds greatly to the American foresters' knowledge of planting.

Experiments in the Preservation of Forest Seeds. By E. Zederbauer. Translation by Max H. Foerster. Vol. VI, No. 1.

This article gives the results of some important German experiments in preserving the germinating power of tree seed by different methods of storage. The important point is to check as far as possible respiration and transpiration. This is done by means of temperatures below centigrade, sufficient moisture, and, sometimes, by the exclusion of air without using such low temperature.

Conclusion.

The foregoing papers show the subjects to which the Society of American Foresters have given most attention. The strength of Silvics and Silviculture stand out particularly since these are subjects about which Americans must secure their own data and build up their own practice. Utilization has two strong articles which, it is hoped, are a sign of the connection which will eventually be established between the profession and the lumber industry,—a connection necessary for the welfare of both.

The papers taken in chronological order do not show a perfect upward curve, some of the best papers appearing in the early numbers, yet the general progress is noticeable. American foresters are more and more devoting themselves to specific problems, rather than generalities.

INDEX.

CURRENT LITERATURE.

Guide to the Study of Animal Ecology. By Charles C. Adams, Ph. D. The Macmillan Company, New York. 1913. Pp. 1-183. Price $1.25.

While the book of the above title is concerned entirely with animal ecology, yet its general discussion of the aim, content and point of view of ecological study is so apt and so applicable to forest ecology that it seems worth while to present an abstract. Ecology has no aim, but ecologists have. The problems of an ecologist are not fundamentally different from those of any other kind of naturalist. The superficial differences in aim are due to different points of view or methods of approach, rather than to any essential difference in the character of the problems. The relations which different branches of ecology bear to one another may be discussed under three headings, namely, individual, aggregate and associational ecology.

The study of individual ecology is the investigation of the development (process of formation) of the structure, function and behavior of a given individual from the standpoint of its relations and responses to the complete environment. Such a study may be limited to a single habitat or locality, or extended throughout the entire geographic range of the form. From this standpoint, the individual studied becomes the hub of the microcosm from which all relations and responses radiate. The organism is thus considered as an agent which, transforming and utilizing substance and energy, produces a varied number of physiological conditions and forms of activity, which, in turn, furnish the basis for the constant process of response between the organism and its environment.

The study of aggregate ecology is the investigation of the ecological development, relations and responses of animals and plants based upon hereditary or taxonomic units, as in a family community or in genera, families and orders. These groups or aggregates are made the basis for ecological study, as a hive of bees or the genus *Pinus*. From this approach the activities and responses of the group are traced within the area studied or throughout the world. The hereditary or taxonomic unit is here the hub of the microcosm. Here also the aggregate is considered as an agent or entity which produces many kinds of activities and adjustments to the environment.

Associational ecology is devoted to the investigation of the development, inter-relations and responses of animals and plants which are grouped or associated in the same habitats and environments. In this case the associates in a given association and habitat are considered as a unit whose activities and inter-relations and responses are investigated in the same manner as if it were a single animal or plant. The interactions among members of an association are to be compared to the similar relations existing between the different cells, organs or activities of a single individual. Such groupings have a composition which has developed into an arrangement or "spacing" of individuals within it, and which produces a particular plan or pattern, as a result of the innumerable responsive activities on the part of individuals which live together. For example, when the tiers of vegetation in a forest are treated as a unit, the entire history of the plants in the habitat is considered as a response to the conditions of life therein. In this form of study the association becomes the center of all radiating relations and responses. Such an association is an agent which transforms substance and energy, producing varied physiological conditions and responses in that continuous process of adjustment which constitutes life.

In discussing the value of ecological surveys, the author concludes that their main advantages are: (1) the record of natural environments and their associations for future generations; (2) the study of natural biotic conditions, giving a perspective not derived in any other way; (3) the clearer conception of the dynamic relations of the balance of nature, biotic base and climax associations; (4) emphasis of the process and interpretative phase of scientific investigation over that of purely descriptive study; (5) facilitating the invention of multiple working hypotheses which bear upon animal and plant responses in nature; (6) furnishing important conceptions to the study of the processes of adaptation and the struggle for existence; (7) furnishing important general principles of great value in applied ecology; (8) furnishing one of the best methods of learning how to get acquainted with the living aspect of the animals and plants of any region.

Some of the other chapter headings are: The laws of environmental change; the laws of internal change; the continuous process of adjustment.

The volume should be in the hands of every investigator or teacher whose subject includes or impinges upon the field problems of biology. C. D. H.

Michigan Bird Life. By Walter Bradford Burrows. Michigan Agricultural College. 1912. Pp. 1-802.

In the introduction to the technical descriptions of the birds and their habits, the author discusses briefly the bird life in relation to vegetative regions. In the Prairie Region, an extension of the prairie regions of the adjoining States of Indiana and Illinois, one finds in the more open country the prairie chicken, meadow lark, killdeer, mourning dove, marsh hawk, turkey buzzard, prairie horned lark, lark sparrow and bobolink. Along the tree fringed streams are found the bronze grackle, red-shouldered blackbird, red-headed woodpecker, flicker, and less often the red-bellied woodpecker, orchard oriole, prothonotary warbler and the sycamore warbler. The knolls and ridges here and there harbor the bob-white, the tufted tit, blue gray gnat catcher, and an occasional yellow breasted chat, mocking bird and Carolina wren.

The White and Red Pine Forest Region is now little more than a name, and it comes more properly under the head of cut-over lands and much of it under burned-over lands. In the southern peninsula it formerly extended northward of a line extending from Van Buren County in the southwestern corner of the State, northeastward to Gratiot County and thence eastward to Port Huron. The pines were always distributed irregularly with areas of hardwoods and swamps, the pure stands being on the sandy uplands drained by the rivers. The characteristic birds of the real pine forest are comparatively few. Among them may be included the pileated, three-toed and hairy woodpeckers, the two species of nut-hatch, the black-capped chickadee, brown creeper, Canada jay, black and white, pine blackurnian and black-throated green warblers.

The Jack Pine Plains lie in general within the pine region outlined above, and they are the more sterile soils farther from the streams. They are characterized by an abundance of Jack Pine, several scrub oaks, aspens, pin cherry and service-berry. The undergrowth is chiefly composed of sweet fern, wintergreen, bracken fern and various blue berries. Areas of this description cover about two million acres in the State, and their summer bird life is characterized by the vesper sparrow, chipping sparrow, field sparrow, robin, bluebird, night hawk, kingbird, brown thrasher, catbird, bluejay, red-eyed vireo, indigo bird, sparrow hawk, goldfinch and cowbird.

The Hardwood Forest Region in the upper half of the lower peninsula still includes many hundreds of thousands of acres where there is a heavy growth of beech and maple, with which is intermixed birch, basswood, hemlock and scattering White Pine. Among the more characteristic birds of this region in order of abundance are: Hairy and downy woodpeckers, wood pewee, hermit and wood thrushes, solitary vireo, sapsucker, crow, rose-breasted grosbeak, scarlet tanager, oven-bird, broad-winged and cooper's hawk.

Burnt-over lands, of which there are millions of acres in the State, vary much in their bird life according to the nature of the original forest, whether largely pine or hardwood, and especially the length of time which has elapsed since burning. One may travel for hours through the more desolate regions and see but few birds, the most common being the vesper sparrow, field sparrow, chewink, nighthawk, kingbird and cowbird.

The deep woods, whether swamp or upland, never shelter the wealth of bird life found in partly cleared or well cultivated districts. Stream borders, lake margins or other openings of the forest always teem with bird and insect life, for here a greater variety of conditions is found and larger numbers of birds seek the sunlight and shade, the food supply and shelter which insure, so far as wild nature can, the welfare of their young.

The greater part of the volume is concerned with technical descriptions, habits and distribution of the Michigan birds.

C. D. H.

"A Working Plan for the Woodlands of the New Haven Water Company." By Ralph C. Hawley, Assistant Professor of Forestry, Yale University. Yale Forest School—Bulletin 3. New Haven, Yale University Press, 1913, 8 Vo., 30 pp., 1 map.

It is refreshing to read a forest working plan which has been working in the forest for some years. The title page explains that the plan is "prepared after five years of forest practice," and the text is full of meat as regards things that have been done, and of helpful suggestions in and between the lines to those of us who are trying to do something with hardwoods and white pine in the northeast. A managed forest area of about 8,000 acres, in the midst of one of the most densely populated regions of the United States, yet in a section about one-half of which is forested; with unusual markets because of a wide variety of manufactures; handicapped by the fact that the holdings are widely scattered in many separated and irregular blocks, and by the further fact that a large part of the area either is in the younger age classes, not yet merchantable, or is open land to be planted—here is a combination which makes the working plan one of real interest to those who are located where intensive forestry is possible. And to others, working where "we might as well forget for the time being most of what we learned in the forest school," it should be an earnest of good things that, with patience, will come to us as American foresters.

The bulletin should be placed in the hands of every Water Company and every City Water Board in the country. Lands permanently controlled for the purpose of protecting potable waters offer so exceptional an opportunity for the practice of forestry, even under adverse economic conditions, that in this field should come one of the next substantial developments in forestry. The present low financial returns from the New Haven property, as described in the working plan, may at first thought be discouraging to officials who may become interested. In reality, however, these figures are not discouraging when one considers the fact that the lands were in such unproductive condition at the start, and that the property must be held anyway, whether or not forestry is practised. In reading the bulletin with the idea of using it to incite the interest of water companies in forestry, one cannot help but wish that some attempt had been made to predict future financial returns. But on the other hand, one realizes that his satisfaction with the bulletin rests upon the fact that it tells things which have been, and which are sure, rather than things which may—or may not—be.

A number of copies of this working plan, sufficient to loan one to each student in the class in forest management for purposes of seminar discussion, would be valuable laboratory material for every forest school. It would serve as the starting point for the useful review and discussion of many topics, such as the purpose and structure of a working plan; forest description; the relation of various site factors to practical operations in the woods; forest types; planting; thinning; protection; yield; utilization; stumpage prices; financial returns.

A few questions might be asked about some things in the bulletin. In classifying the lands, the distinction between grazing land and forest land is "based more on the present condition and probable use for the next few years than on the actual value of each site for producing farm or forest crops"; has the author been able to arrive at a satisfactory basis for the final separation into grazing land on the one hand, and forest land on the other hand, in cases where he wishes to make the final choice? Would it not be desirable to include a list of the scientific names of the species? ("Whitewood" may be applied to only one species in Connecticut, but it is applied to other species elsewhere.) Are the overhead charges included in the expenditures, in Table 7? What is the labor wage, on which the planting costs are based? In view of the deficiency in growing stock, why would it not be well to leave for the present the stands seventy years of age and older (p. 26, bottom), if these stands are still sound, thus restricting the cutting to the two classes of timber mentioned in the previous paragraph as being the only ones to be removed? *

Among the points of interest in the bulletin, the following may be mentioned.

"In a few cases cordwood and timber have been sold to reliable purchasers on a basis of 60 per cent of the difference between the total expenses of manufacture and the total receipts from sales. By this arrangement the Company receives 60 per cent of the difference and the purchaser, who finances and attends to the entire operation, 40 per cent.

*There is a slight typographical error on the last page, where "plant" should be "plan."

The results so far have been fully as good as could have been secured through selling by any other method."

Stumpage values are: cordwood, $.30 to $1.50 per cord; No. 1 ties, $.30 to $.45; 30 and 35 foot poles, $1.00 to $2.25 per pole; hardwood lumber, $4.00 to $10.00 per M. bd. ft.; hemlock $3.00 to $5.00 per M. bd. ft.

The annual growth per acre per year is: hardwoods (chestnut and oak), 0.3 to 1.0 cords; hemlock, .25 to 0.8 cords; white pine, 0.4 to 1.0 cords.

"One (chemical) extinguisher or pump to every fifty acres of plantation would be good economy" in protecting from fire.

"Except in rare cases the brush and tops will be left as they lie after cutting. It is considered unnecessary to dispose of them as an aid in protection, because the chief fire danger comes from the hardwood leaves spread in a comparatively uniform layer over the ground. A fire will start and spread readily in leaves, and tops only add to the intensity of the fire. Hardwood tops inside of two years partially decay and absorb so much moisture that they burn with difficulty. The brush should be piled and burned on clear cut areas which are to be immediately planted."

Most of the planting is with white and red pines. (It is good to see that this tract was not reached by the Scotch pine fad, which for a time, in some sections, seemed likely to rival the catalpa mania in extending these species beyond their legitimate sites.) Poor planting sites are avoided until the best sites are planted—let more of us remember this. Three-year-old, once transplanted stock is ordinarily used. Spacing is 6 x 6 feet. The total cost of the transplants, grown in the company's nursery, "was $3.80 per thousand or $4.60 per acre of plantation." Planting "cost $7.20 per acre, thus making the total cost of the plantation $11.80 per acre." "Fail places in the plantations made the preceding year should be filled each year if the loss exceeds 25 per cent., or in case of a smaller loss if in the form of a few relatively large patches instead of being scattered uniformly.

"Certain stands in the old field and hardwood types are suffering from the grazing of cattle. In nearly all of these cases the land is owned by the Company but subject to the life use or use for a period of years by the former owner." (Avoid rights and servitudes whenever possible!).

"Stands (of hardwoods) younger than fifty years rarely yield enough merchantable timber to be considered mature. The site must be quality I and the stand contain a large percentage of chestnut to be merchantable before the fiftieth year."

The classification of forest types is based exclusively on present condition, without regard to what the area is capable of producing. The types are hardwood, hemlock (80 per cent. or more of hemlock, as judged by the crown space occupied), pine (80 per cent. or more of pine), old field, agricultural, administrative, and barren. Old field type automatically becomes pine type as soon as it is planted. There is a wide variation in the composition of the hardwood type. All hardwood stands, except gray birch, are grouped together as the hardwood type, regardless of whether the dominant genus is chestnut, oak or maple.

"Boundaries of compartments are usually ridges, streams or public roads and are easily recognizable. Compartment divisions are permanent. A compartment may contain a number of different forest types and age classes. There are in all fifty-one compartments, ranging in size from less than 50 to over 400 acres. Each compartment is divided into as many sub-compartments as it has individual stands, that is, portions of the forest differing in age or type. A single sub-compartment contains only one type and only one age class, and serves as the smallest unit considered. There are few sub-compartments of less than an acre, while the largest contain about a hundred acres. Sub-compartment boundaries are often not marked on the ground, being distinguishable as lines of difference between types and age classes. These boundaries are subject to change with each revision of the maps. There are more than 700 sub-compartments."

The working plan records are kept "on 5 x 8 inch cards printed with the proper headings. Each carries the description of a single stand or sub-compartment."

W. M.

Report of the National Forest Reservation Commission. Senate Document No. 307, 63rd Congress, 2d Session. Washington, D. C. Dec. 8, 1913. Pp. 8.

This report shows that during the fiscal year ending June 30, 1913, the Commission approved for purchase 425,717 acres, making a total of 713,415 acres approved up to that date. This area is classified as follows:

	Acres
Virgin timberland, ...	222,120
Cut-over or culled timberland, ...	397,390
Lands on which timber is reserved, ...	33,224
Abandoned farm land, ...	7,878
Unmerchantable or barren, ...	52,803
	713,415

The lowest price paid per acre during the fiscal year ending June 30, 1913 was $1.09 and the highest $13.25. The average price for the purchases during the year was $4.71 per acre, while the average of all purchases has been $5.07 per acre.

The Forest Service examined during the fiscal year 542,202 acres at a cost of 10.6 cents per acre. The Geological Survey has examined 88 per cent. of all the area within the proposed purchase areas, so far having made no unfavorable reports.

The Commission has adopted the policy of purchasing only on an acreage basis, the acreage being determined by a survey by horizontal measurements. The rough character of the country surveyed and the indefiniteness or entire absence of marked liens and corners has made the cost of surveying relatively large, the average during the past year being 20.5 cents per acre. This will be reduced during later years because it has been necessary to survey lines of other tracts which are not now under consideration but which may later be offered for sale.

Titles are examined as the surveys are in progress by officials of the Department of Agriculture, who report to the Attorney-General through the U. S. Attorney for the District in which the lands are located. During the past year the Attorney-General has approved the title to 15 tracts, comprising 72,183 acres and has declined to approve the title to 12 tracts comprising 106,824 acres. The Secretary of Agriculture has requested that condemnation proceedings be brought to perfect the title of the tracts which were not approved.

Where there are no special difficulties in the way of perfecting a clear title, the Government has been able to make final purchase from six months to one year after the purchase is approved. Where condemnation proceedings must be brought a further period of from six months to a year is required.

The lands already acquired or whose purchase has been approved are now in charge of forest officers who have charge both of administration and of the examination and survey of other lands within their area which are under consideration for purchase.

Two hundred and fifty miles of trail have been constructed for protection purposes and the construction of a few telephone lines has been undertaken where their need is imperative.

The Commission recommends that legislation be enacted to increase the allotment of all moneys received from each national forest created under the Act of March 1, 1911 from 5 per cent. to 25 per cent., because the proceeds are insufficient to compensate the counties for the loss of taxs on the lands acquired by the Government.

R. C. B.

Cottonwood in the Mississippi Valley. By A. W. Williamson. Bulletin 24, U. S. Department of Agriculture. Dec. 31, 1913. Pp. 24.

This bulletin deals in a comprehensive manner with the economic importance of the cottonwood, botanical characteristics, growth and yields of stands, and management.

Under the head of "stumpage values and logging costs," the author offers the following formula, based on operating costs, for the determination of stumpage values, namely

$$S = \frac{M}{1.0p} - (L + Mf)$$

in which S equals the stumpage value; M equals the sale value of the manufactured product; 1.op represents the rate per cent. profit on each thousand board feet; L equals the logging costs; and Mf equals the sawmill costs.

The principle of profit on operating costs, on which the formula is based, is not sound economically, since profits should be based on the amount of capital invested in the business. The reasons for this are many and cannot be discussed here in detail.

The author has been led astray in handling his stumpage values after they have been determined by the erroneous conception of the proper method of determining profit. He says "if several years are required to complete the logging operation, however, this formula should also include the interest on the money invested in stumpage, and the stumpage value in such an event would be found by deducting the interest at a fair borrowing rate, say 6 per cent., for the average length of time invested." In other words, after finding what an operator can afford to pay for stumpage to-day, he discounts that value if the buyer does not wish to cut the timber until some future time. It is evident that if a purchaser did not choose to utilize his stumpage, say for 20 years, that the seller, according to the above reckoning, might not only have to give his stumpage away but also present the recipient with a good sum of money besides. In actual sales we know that this is untrue and that the man who buys timber to cut 10 or 20 years hence has to pay just as much to the seller as does the man who expects to cut it within a year—since the present value is the same in either case. This erroneous method of handling interest is due to the attempt to calculate profits on the basis of operating costs instead of investment. The buyer should get interest on his investment in stumpage and if he makes a good buy he does so through the increase in the value of his stumpage, if in no other way.

During the early years of an operation which carries a heavy investment in plant and stumpage, the amount of money on which interest and profit may be secured often is so great that for the first few years little or no profit can be actually made. As the investment is reduced—the stumpage also gradually rising in value—the returns are sufficiently great to permit a gradually increasing profit, and during the later years of the operation, the profits will be far above normal and will more than compensate for the passing of the dividend during the first years the business was conducted.

It is inconceivable, however, that the operator would expect the seller to reduce his stumpage price as the length of time it was to be held increased.

In discussing the growth and yield of stands the author states that fully stocked pure stands, 40 years of age, yield an average of 31,000 board feet per acre and that some stands will cut as high as 36,000 board feet on the overflow bottom lands of the Mississippi Valley. Fifty year old stands in Minnesota and Iowa uplands will seldom cut more than 20,000 board feet.

The author points out the practicability of growing cottonwood on a commercial basis in the bottom lands of the Mississippi river. On account of the expense of establishing new stands by planting, it is recommended only where there is an uncertainty of securing a new crop from seed trees. Natural reproduction is recommended on bottom lands subject to overflow in the spring but which are only moist when the seed falls. It is not successful on low ridges, or where spring overflow is uncertain, and planting is recommended for such sites.

Coppice reproduction is not recommended because many stands will not be cut until they reach 35 or more years, at which age the stumps have lost much of their sprouting vigor. The latter declines rapidly after the tree is 20 to 30 years old. Sprout management is recommended only for stands managed for pulpwood on a rotation of from 10 to 13 years. At the latter age the largest average annual yield per acre is secured, namely 47 cords.

A rotation of 35 years is recommended for saw-log production in natural stands of pure cottonwood, at which time the maximum mean annual yield is about 840 board feet per acre. This is based on present market requirements.

The average returns from growing cottonwood for saw-logs is estimated at from 6 to 7 per cent., and on pulpwood only from 4 to 6 per cent. due to the low value of cottonwood cordwood.

In summarizing, the author states that cottonwood is destined to play a large part in the future production of lumber, veneer and pulpwood in the Mississippi Valley.

Cottonwood will not renew itself on cut-over land unless special care is taken in logging. Natural reproduction may be employed to advantage in some places but in others it will be necessary to employ artificial reproduction exclusively, and it will be desirable in most cases to supplement natural with artificial reproduction to secure a fully stocked stand. R. C. B.

Annual Report of the Director of Forestry of the Philippine Islands for the fiscal year ending June 30, 1913. Manila Bureau of Printing. 1913. Pp. 65.

In discussing legislation passed during the fiscal year, mention is made of the attempt to revise a portion of the Forest Act, passed in 1905, providing for the method of payment for stumpage cut from Public Lands. The legal forest charges are based on the volume of the round log but if the licensee elects to manifest his timber after it is sawn, he may do so by paying an additional 15 per cent. on the lumber manifested. The latter practice has been adopted by all millmen since the 15 per cent. addition is absurdly inadequate to cover the waste in manufacture.

Great encouragement has been given to wasteful practices in slabbing, edging and trimming lumber. The millmen also saves only the best grade boards which he can sell at a good profit and throws away inferior grades with no loss to any one except the Government. The law is so favorable to millmen that efforts to change it have so far not met with success.

A new policy has been adopted in the management of the forests which are now being cut under exclusive licenses. The areas are being classified into agricultural land and forest land and a definite policy of cutting prescribed for each.

Fire protection is also being forced on the licensees with good results. The requirements include the use of spark arresters on locomotives and logging engines, and the maintenance of an adequate patrol. These are the chief features at present but if licensees do not keep fire from their areas by these means, they will be forced to burn their slash.

Authority is to be requested from the next Assembly for the appointment of Field Assistants, who will be drawn preferably from the ranger staff of the U. S. Forest Service. These men, if appointed, will be placed in charge of large timber sales. The appointment of a lumberman will also be requested.

The records show an increase of 17 per cent. in the number of licenses granted for all classes of forest products and the amount of timber cut was 23 per cent. greater than in the previous fiscal year. The greater increase in production was in the lower group woods which are used chiefly for construction purposes in the domestic markets, but which are being used in increasing quantities in the United States for furniture, finishing lumber and cabinet purposes.

The total revenue from forest products was $195,331.94 (gold) and the Bureau expenses were $113,524; an increase in revenue of $17,989, and in expenses of $13,104 over the previous year.

An interesting feature of the work is the rapid establishment of communal forests, forty-five having been set aside during the year, the total now reaching 148.

Among the activities of the Division of Investigation are mentioned a study of the planted mangrove groves, which are used for the production of firewood; the nipa swamps; durability tests of timber; and of reforestation of lands covered with cogon grass. Well established stands of ipilipil (Leucaena glauca) are reported to produce annually 10 cords of firewood per acre.

Considerable space is devoted to a report on a forest reconnaissance of the Island of Bailan containing 120,601 hectares. The estimated stand of timber is 3,585 million board feet. The average stand per acre on the commercial forest areas ranges from 16,000 to 24,000 board feet per acre. The cost of the reconnaissance, which covered a period of five months, was $2,258.50 (gold), which is regarded as a very low figure for this kind of work.

The report shows substantial progress in all lines of forest work and with the increased efficiency measures constantly being inaugurated in the administrative work, we may reasonably hope for still greater results in the future. R. C. B.

Report of the Director of the Bureau of Forestry (Philippines) to the Secretary of the Interior (Phil.) on the Forest School. 1913.

This is a manuscript covering the work of the Philippine Bureau of Forestry, Forest School, which was submitted to the Philippine Legislation through the Secretary of the Interior.

As early as 1903 an agitation was started in the Bureau to establish a school in which Filipinos could be trained for Ranger and other positions but it was not until 1910 that the project became possible.

In April of that year the Philippine Legislature authorized the Director of Forestry to appoint twenty forest pensionados and to construct temporary buildings for their use. This marked the beginning of the Forest School, which was established in cooperation with the College of Agriculture of the University of the Philippines, at Los Banos, Laguna.

The number of forest pensionados authorized has now been increased and the number of scholarships at present is fifty-three.

There are at present 58 students in attendance, representing twenty-seven provinces, in addition to two rangers detailed from the Bureau, three Chinese students, two students from the Island of Guam and one private Filipino student.

Two courses of study are offered; a two-year course for the pensionados and a four-year course leading to the degree of Bachelor of Science in Forestry which is open to students who are graduates from the Philippine high schools or who have equivalent training.

The law provides that "such scholarships shall be awarded to students who have completed at least the second year of the high school course and who shall be appointed by the Director of Forestry upon recommendation of the Director of Education.

The scholarships entitle the holder to reimbursement of his traveling expenses from his home to Los Banos: to free living quarters, free tuition, and to a monthly cash allowance of $12.50 gold. From this it can be seen that the Government is very liberal in its attitude towards the student who is fortunate enough to secure a scholarship.

The curriculum of the two-year course covers the following subjects:

Junior Year

Botany	Physiography
Mathematics	Silviculture
Forest Engineering I	Forest Engineering II: summer vacation
Dendrology	

Senior Year

Wood technology	Silviculture
History, law, and procedure	Forest Management
Forest Engineering III	

The four-year course is more comprehensive and includes among other things chemistry, physics, advanced silviculture and the preparation of a thesis on some forest subject.

The faculty consists of employees of the Bureau who are assigned to the Forest School staff temporarily.

The chief field for graduates of this school is in the government forest service, which has already absorbed the two classes, comprising forty-two men, which have left the institution.

These men, on appointment, receive a salary of $25 to $30 (gold.)

The marked improvement noted in the efficiency of the native force since the school has been established, is sufficient proof of its great value and it is to be hoped that the institution may be continued and placed on a sound financial basis in the near future.

It is neither practicable nor desirable that the majority of the Bureau staff should be composed of Americans and it is believed that the way has now been paved for the upbuilding of an effective native force which will handle the valuable forest resources of the Islands in a wise and conservative manner.

R. C. B.

Western Grazing Grounds and Forest Ranges. By Will C. Barnes, Inspector of Grazing, U. S. Forest Service. Pp. 390. The Breeders' Gazette, Publisher. Chicago, Illinois. 1913. Price, $2.00.

This excellent volume, written by a practical stockman of many years experience, is a pioneer in the field of grazing literature, written from the standpoint of the wise use of our National forests.

The author has brought together in a very clear and readable form a vast amount of material which is of especial value to the forester who is concerned in any way with grazing. While it is written primarily for foresters, it will also prove of great value to practical stockmen, especially the chapters on Range

Management, Poisonous Plants, Symptoms and Remedies, and Diseases of Animals.

Although the volume contains a large number of illustrations, the author has selected only those which apply to the text and render it more clear.

The book is welcomed as a new and valuable contribution to the forester's library.

The views of stockmen in regard to this book are well reflected in a review which appeared recently in the Southwestern Stock Review:

"Probably one of the best informed men in the United States on the subject of stock grazing in the west is Will C. Barnes, the author of "Western Grazing Grounds," who 'way back in the '80's was associated with Albert F. Potter in range ventures in both sheep and cattle up on the Mogollon mesa and Little Colorado sections of North Arizona. Mr. Potter is now associate forester and in charge of the grazing branch of the forest service, while Mr. Barnes is inspector of grazing in the same service.

"Mr. Barnes was raised on a cow ranch in California; ranged through that state, Arizona, New Mexico and Texas in the early days; has been secretary of the Live Stock Boards of both Arizona and New Mexico; has made special studies of range live stock problems throughout all of the western states in the interests of the Forest Service and the recent tariff board of the Taft administration, and is essentially the man to father such a book as Western Grazing Grounds.

"This book deals with the vast ranges of the west in detail from the time that stock began to appear on them down to the present day. It shows the various methods of handling stock as practiced in the different sections of the west; discusses the problems of range control; by text and illustrations treats of the poisonous plants, predatory animals and stock diseases of the range, giving preventatives, remedies and other valuable information concerning them; gives figures on costs of running stock in the western states, and in fact is filled with just the kind of information that every sheep and cattle man wants. Western Grazing Grounds is also an excellent text book for the man new to the west and makes excellent reading for anyone at all interested in the subject." R. C. B.

The Chestnut Blight Fungus and a Related Saprophyte. By P. J. and H. W. Anderson. Bulletin 4, Pennsylvania Chestnut Tree Blight Commission. 1913. Pp. 26.

During the scouting operating in Pennsylvania to discover the extent of the Chestnut Blight, a fungus at first diagnosed as the true blight fungus *(Endothia parasitica)* was found in the south western counties quite beyond the affected areas. Strangely enough it was doing no serious damage, and the question arose as to the cause of this phenomenon. Careful cultural studies conducted by the authors have shown that this fungus named by them *E. virginiana* behaves differently from the true blight fungus on certain artificial media. These differences and certain minute morphological differences are so constant that no doubt remained that two distinct species were in question. This has been one of the rather infrequent instances in which the settlement of a fine taxonomic point has had a direct and immediate bearing on economic operations. Since this article went to press the home of *E. parasitica* has been located in China. It is worthy of note that our authors were not drawn into erroneous theoretical deductions as to the origin of *E. parasitica* based on its very striking resemblance to *E. virginiana*.

J. H. F.

The Blights of Coniferous Nursery Stock. By Carl Hartley. Bulletin 44, U. S. Department of Agriculture. Washington, D. C. 1913. Pp. 21.

This paper gives a satisfactory account of several blights occurring in coniferous nursery stock. Damping-off diseases are not included. They are restricted mainly to seedlings under two months old, and have already been more or less thoroughly investigated. The most important of the blights studied is sun scorch. The loss from this cause is often very great, especially on sandy soils, in soils lacking in humus, in crowded beds, and in raised parts of beds. Watering, shading, and avoidance of crowding are successful preventive measures. Other causes of blight are winter-killing, mulch injury, and various fungus diseases, for all of which more or less effective preventives have been tested and are recommended. J. H. F.

Biographical Records of the Graduates and Former Students of the Yale Forest School. Compiled by the Yale Forest School, assisted by the Class Secretaries Bureau. New Haven, Conn. 1913. Pp. 350.

This volume is of interest through the very large share which graduates of the Yale Forest School have had in the development of the Federal Forest Service.

A short historical sketch of the School is given in the beginning. It was opened in 1900, following a private endowment of $150,000, with seven regular students and a staff of two instructors. From its establishment it was a graduate school with a summer school for rangers, teachers and others, held at Milford, Pa. The attendance rose rapidly, with an enrollment of 31, 44, 66, 63, in the years 1901-1904. In the latter year the Junior course was lengthened by the addition of a three months' field term in the summer, but with the work distinct from the ordinary summer school course. In the following year, the work of the Senior class, previously held at Milford, was transferred to virgin timber tracts in the south, and has since been so conducted. The same year, the National Lumber Manufacturers' Association established a chair of lumbering, with an endowment of $60,000, and an additional $40,000 in 1910. The summer school was discontinued (1910), having had, since its inception, an average attendance of 18. In 1911, the School graduated its largest class (43), and since that the registration has dropped, reaching 50 in 1912. The admission requirements are now quite high, eliminating the need of covering, after entrance, many of the general science subjects basic to forestry study, with consequent increased time for technical subjects. The School has been endowed to the extent of over $400,000 in cash, and in addition has received various gifts in the shape of buildings, libraries, herbaria and equipment. The staff numbers 5 regular instructors in forestry, in addition to men from allied departments and special lecturers.

The bulk of the volume is devoted to individual biographies arranged by classes. The enrollment from 1900 to 1912 included 402 names, of which 286 received the degree of M. F., and 14 certificates. Of the graduates, 57 per cent. are now engaged in government forestry (81% Federal) 7 per cent. in private forestry practice, 11 per cent. in educational work and 8 per cent. in lumbering. In addition to the 139 Yale foresters now in the U. S. Forest Service, some 80 others were formerly so employed.

J. H. W.

Report of the Forest Branch of the Department of Lands of the Province of British Columbia for the year ending December 31, 1913. Victoria, B. C. 1914. Pp. 61.

The cutting and manufacturing of timber is the greatest of British Columbia's industries. One-half the industrial capital of the province is invested in the lumbering and wood working business, and from forests is derived one-half the pay-roll of the province. It is estimated that one-half the standing timber of Canada is situated in British Columbia. Recognition of the importance of the forest wealth to the people of a province largely non-agricultural in character led to the passing two years ago of a Forest Act which provided for the establishment of a Forest Branch with complete charge of the administration of the timber lands. The organization of the Branch not taking place till late in 1912, this, though the second report, is really the first statement of the administration.

Of the provincial area of some 250 million acres, 150 million are under forest administration. This is divided into 11 units, with all the various lines of forest work in a specified district, such as supervision of logging operations, scaling, collection of royalty, timber examinations, land classification, construction of permanent improvements, and protection of forests from fire, under the direction of one man. The permanent force in 1913 numbered 154, of whom 43 were clerks. For fire protection, the additional temporary force comprised 286, which was augumented by 50 more from the permanent force. The 11 administrative units varied in size from 5 million to over 36 million acres; the ranger districts from 2 to 11 million, and the individual "patrol" territory from 350,000 acres to over 3 million acres.

About 11 million acres have been taken up by lumbermen under grant, lease or license. From this, in 1913, the total forest revenue (rentals, bonus, royalty, taxation) was $2,999,328, of which $2,832,788 was collected by the Forest Branch. The remaining $166,540 represented taxes at 2 per cent on 922,948 acres of private timber lands with an average assessment of $9.02 per acre. This large forest revenue represents $6.63 per head of population of the province, as compared with 79 cents in Ontario and 77 cents in Quebec, the two next leading lumbering provinces.

The expenditure of the Forest Branch was $250,000 for administration, and $285,000 for forest protection fund, of the latter only one-half being contributed by the Government.

The returns in connection with the collection of the above revenue show a cut of about 1,457 million feet, board measure; with the inclusion of material (free of dues) used in railway construction the total would approximate 2 billion feet. In all, 794 logging operations in progress were inspected. About one-half of these are in the Coast district, using steam, and running most of the year; the remainder, in the Interior, are mostly fall and winter operations, using horses. The Coast operations produce about three-quarters of the total. The number of mills is about 425.

The home consumption is less than one-fifth of the total production. The markets for manufactured logs are the Canadian prairies, United States, eastern Canada and overseas. Of these the Canadian prairies are the most important, taking about 60 per cent of the cut, and using all grades. Export to United States consists in a small quantity of cedar shingles for the middle West and cedar finish for the New England States. The same products are shipped in small quantities to eastern Canada, as also a little high grade dimension material of Douglas fir. The cargo trade is small, some 3 or 4 mills shipping about 50 million feet, mostly to Australia, Great Britain, South America, China and Japan.

The export of unmanufactured logs is forbidden, except from some early Crown-granted areas. These exported last year some 58 million feet, mostly for shingle manufacture in Washington. The total value of unmanufactured logs, poles, piles, posts, ties and props exported from the province in 1913 was $1,321,640. The smaller unmanufactured products are shipped largely from the Cranbrook and Nelson districts, and mainly to the interior provinces to the east.

The pulp and paper industry has made a beginning in the province, the export totalling about 3 million dollars last year. The Powell river mill with a capacity of 225 tons of paper daily ships largely to the northwestern States; while the second mill on Howe sound, produces 40 tons of sulphite fibre daily, most of it for Japan.

In addition to the regular field work incident to administration, the Forest Branch during the past year has conducted reconnaissance work covering over 12 million acres. This has included land tributary to new railroads; unknown timbered regions of the north, particularly the Nation lakes, Omineca, Nass and Bella Coola valleys; and the valleys of the Okanogan, Columbia, Kootenay and Kettle rivers of the more settled districts of the south. The report includes 18 summarized descriptions of areas covered by the different parties.

As distinct from this reconnaissance work, special detailed examinations covering 662,280 acres were made. By statute, land carrying timber in excess of 5,000 feet east of the Cascades, and in excess of 8,000 feet west of the Cascades, is not open for sale or pre-emption. All expiring timber licenses or leases remain under reserve until examined by the Forest Branch, and all pre-emptions and applications for purchase are referred to it by the Lands Department for field examination. In this way injudicious settlement on non-agricultural land and fraud are prevented.

The report on forest protection for the year, unusually favorable climatically, is very gratifying. A total of 578 fires was reported attributable, 25 per cent to campers, 19 per cent to railway locomotives, and 10 per cent to railway construction. The total area burned over was 10,270 acres, classified as 5,835 acres of merchantable timber, 1,900 acres of valuable second growth, and 2,535 acres of slash. The damage was estimated at $18,354, viz., standing timber $4,387; logs on skidways, $12,084; and other property, $1,883. The total expense of fire-fighting was $8,930. Of the 578 fires, 420 were extinguished by the regular force without extra expense; 300 were extinguished in an incipient stage (less than ¼ acre); only 80 fires reached serious proportions (over 10 acres).

The permit system during the closed season, May 1 to October 1, again justified itself. Nearly 12,000 permits to burn over 31,000 acres were issued; 95 per cent of these, totalling one-half the area, were for clearing land. Of the total, 17 escaped control. But 2 of the forest fires of the year were due to clearing land without a permit.

The fire hazard along railway construction has been controlled for the first time in the history of the province. The right of way cleaning is covered by the Railway Act. The slash situation as regards the neighboring areas of Crown lands, which are logged free of dues by construction contractors, has been met by requiring the Railway Companies to take out permits for specified areas, these permits requiring disposal of the debris by the companies as stipulated. The Forest Branch in this matter does not deal with the contractors. In all, 90 of these permits were issued, covering cutting on 138,276 acres. Some 1800 miles of railroad were under construction the past season.

Voluntary slash burning by lumbermen aggregated some 10,000 to 15,000 acres in 1913.

As a result of the weather conditions the protective force were enabled to complete an unusual amount of permanent improvement work. This included 1200 miles of trail, 360 miles of telephone line, and 10 ranger cabins.

The Forest Branch in co-operation with the Commission of Conservation for Canada has in progress a general survey of the forest resources of the province, the work to be completed in two years. A system of control of the range for grazing is also foreshadowed.

The province is to be congratulated on the very considerable progress it has made in such a short time toward a businesslike administration of its timberland resources. Not only does this augur well for the prosperity of British Columbia, but in time must have its effect on the less progressive administrations in the east.

J. H. W.

Durch König Tschulalongkorns Reich. By Dr. Carl Curt Hosseus. Strecker und Schroeder, Stuttgart, 1913. Pp. 219 4°, 125 illustrations and map.

This is an elegantly printed record of a botanist's first exploration in Northern Siam. It is not a systematic discussion of country or flora, but a rather diffuse account in detail of a journey or journeys with all its minor incidents, and the main interest is in these incidents. Floral descriptions are interspersed. Of most interest in this latter respect is the ascent of two mountains, the Doi Sutaep, altitude 5500 feet, and Richthofenpeak, 8,350 feet, in which the various forest types from the tropical to the temperate zone are passed. In the first case, Teak and Albizzia, the former the main commercial timber, form the important forest of the lower levels, mainly on south and west exposures, to be followed on the other exposures by what the author terms the Dipterocarp-hill forest, formed mainly of *Dipterocarpus laevis and turbinatus,* which is bled for its oil. At about 2,000 feet a new type is entered, characterized by lianas and other climbers, absent in the former type. Here a Salix, a Juglandacea *(Englehardtia spicata)*, Thunbergia, etc., are found. At 2,500 feet a mixed oak forest is entered [*Quercus Lindleyana, lineata, Junghuhnii, oidocarpa (deciduous),* with chestnut *(Castanopsis indica),* a variety of leguminose trees, and the Magnoliacean *Michelia Champaca,* with many others. At about 3500 feet, pine forest appears *(Pinus Khasya)* of excellent development, which becomes pure. At 4500 feet the pine is replaced by a dense evergreen forest of oak *(Quercus incana and Junghuhnii)* with some other species; and at about 5,000 feet the only known (?) Asiatic species of Prunus, *Hosseusii* appears. Above this, Theaceae, Ericaceae, Euphorbiaceae, Myrtaceae and Quercus species form an inferior growth, which on south exposures reaches hardly over 25 feet, interspersed with grasslands, which the author refers to as result of fires. For the explorer in tropical lands many valuable suggestions are given.

The illustrations are not always of the best: a map showing the location of the most valuable teak forests shows that Northern Siam has perhaps the most extensive forests of this species.

B. E. F.

OTHER CURRENT LITERATURE.

An Economic Study of Acacias. By C. H. Shinn. Bulletin of U. S. Department of Agriculture, No. 9. Washington, D. C. 1913. Pp. 38.

Discusses characteristics of various species, history of Acacia culture in California, and economic uses.

Range Improvement by Deferred and Rotation Grazing. By A. W. Sampson. Bulletin of U. S. Department of Agriculture, No. 34. Washington, D. C. 1913. Pp. 16.

A discussion of the factors which cause ranges to deteriorate; requirements of plant growth; effect of grazing on the forage crop; application of deferred grazing to range management.

The Blights of Coniferous Nursery Stock. By C. Hartley. Bulletin 44, U. S. Department of Agriculture. Washington, D. C., 1913. Pp. 21.

The writer summarizes as follows the blights most common in nurseries:

1. Sun scorch.—The most common summer trouble which is caused by excessive water loss. Successful preventive measures are watering, shading, and avoidance of crowding.
2. Winter killing.—Due to tops of plants drying out when soil is frozen. Preventive measures most used consist of a light straw mulch and windbreaks.
3. Mulch injury.—Killing of tops through mulching may be prevented by avoiding heavy, close mulches.
4. Needle diseases.—There are a number of needle-destroying fungi, which so far have done little damage in nurseries in the United States. Bordeaux mixture spray will prevent damage from any of them.
5. Red cedar blight.—Common on red cedar seedlings and transplants. Causes and methods of prevention are unknown.

Report of the Forester, U. S. Forest Service, 1913. Washington, D. C. Pp. 56.

National Forest Areas, June 30, 1913. U. S. Forest Service.

A tabular statement showing the location by State, National Forest District in which located, Supervisor's headquarters, acreage, etc., of each National Forest.

The net area of National Forest lands is given as 165,516,518 acres.

The Use Book: A Manual for Users of the National Forests. U. S. Forest Service. Washington, D. C. 1913. Pp.

This contains the greater part of the information found in the National Forest Manual which is of direct interest to forest users.

Fifth Annual Report of the State Forester, Forestry Practice in Vermont. 1913. Pp. 43. illus. Burlington, 1913.

Report of the Chief of the Biological Survey, U. S. Department of Agriculture. (Reprint from Annual Reports of the Department of Agriculture for 1913.) Pp. 14.

Wages and Hours of Labor in the Lumber, Millwork, and Furniture Industries, 1890 to 1912. U. S. Bureau of Labor Statistics. Whole Number 129. Wages and Hours Series No. 2. Washington, D. C. 1913. Pp. 178.

Fifth National Conservation Congress. Report of the Forestry Committee. Washington, D. C. 1913.

Printed as separates for distribution at the meeting of the forestry section of the Congress were reports of the following sub-committees: Publicity, pp. 16; Forest Planting, pp. 46; State Forest Laws, pp. 15; Forest Taxation, pp. 32: Forest Investigations, pp. 21; Forest Education, pp. 36; Lumbering, pp. 39; Forest Utilization, pp. 15; Forest Fires, pp. 56; Federal Forest Policy, pp. 36; State Forest Organization, pp. 62.

Proceedings of the Society of American Foresters. Volume VIII, Number 3. Washington, D. C. October, 1913. Pp. 261-370.

Contains: In Memoriam—Fred Gordon Plummer; Reforestation on the National Forests, by W. B. Greeley; The Use of Frustum Form Factors in Constructing Volume Tables, by Donald Bruce; Darwinism in Forestry, by Raphael Zon; Nature's Law of Selection, by Patrick Matthew; Is Eucalyptus Suitable for Lumber? by Harry D. Tiemann; Co-ordination of Growth Studies, Reconnaissance, and Regulation of Yield on National Forests, by H. H. Chapman; Management of Western White Pine in Northern Idaho, by N. C. Brown; The Himalayan Forests, by W. H. Gallaher; Methods and Cost of Brush Piling and Brush Burning in California, by J. A. Mitchell; Combating the Larvae of the June-bug in Forest Nurseries, by Professor

Decoppet (Translated by G. A. Pearson and A. J. Jaenicke); Some Financial Forest Problems, by W. B. Barrows.

Spruce Bud Worm and Spruce Leaf Miners. Bulletin 210, Agricultural Experiment Station. Orono, Maine. 1913. Pp. 36.

The spruce bud worm *(Tortrix fumiferana Clem.)* for the last two or three years has been one of the most serious pests of the spruces in Maine. This bulletin treats of its history and distribution in the State, habits and description, natural control, remedial measures, and bibliography.

The notes on the two spruce leaf miners *(Recurvia piceaella, Kearfott* and *Epinotia piceafoliana Kearfott)* are confined chiefly to their life history.

How to Make Fence Posts Last Longer. By W. D. Clark. Vol. III, No. 5, Facts for Farmers. Extension Service of the Massachusetts Agricultural College. Amherst, Mass. Pp. 4.

Silviculture of White Pine (Pinus strobus.) By F. B. Knapp. Bulletin 106, Massachusetts Forestry Association. Pp. 4.

Twenty-fifth Annual Report of the Massachusetts Agricultural Experiment Station, 1913. Report of Botanist. Pp. 104.

Contains: Diseases more or less Common during the Year, pp. 6-8; A New Rust, pp. 9-12; Effects of Illuminating Gas on Vegetation, pp. 13-28; Shade Tree Troubles, pp. 41-51; Device for Planting White Pine Seed, pp. 84-85; Chestnut Blight, pp. 86-87.

Warden and Woodsman. By Jesse B. Mowry, Commissioner of Forestry. Rhode Island Department of Forestry. Providence, R. I. 1913. Pp. 24.

The Birds of Connecticut. By J. H. Sage and L. B. Bishop, assisted by W. P. Bliss. Bulletin 20, State Geological and Natural History Survey. Hartford, Conn., 1913. Pp. 370.

Part I Contains a catalogue of Connecticut birds and Part II is devoted to economic entomology.

Woods used in Patternmaking. By E. F. Lake. Reprint from "The Foundry," October, 1913. Published by Thomas E. Coale Lumber Company, Philadelphia, Pa. Pp. 14.

Discusses the various woods used in pattern-making and value of each for this purpose.

Wood-Using Industries of South Carolina. By S. L. Wolfe. Department of Agriculture, Commerce and Industries, in co-operation with U. S. Forest Service. Columbia, S. C. 1913. Pp. 53.

An Act of the Legislature of West Virginia providing a Workman's Compensation Law. Passed February 21, 1913, in effect May 22, 1913. State of West Virginia Public Service Commission. Charleston, W. Va., Pp. 21.

This law provides for a Public Service Commission to administer the Act. The funds for the payment of injured employees are subscribed, by employers 90 per cent, and by employees, 10 per cent.

Yellow Pine, A Manual of Standard Wood Construction (4 ed.) By A. T. North. Published by the Yellow Pine Manufacturers' Association, St. Louis, Mo. 1913. Pp. 130.

The purpose of this handbook is to give information concerning yellow pine which cannot be obtained in other publications. It deals chiefly with the physical and mechanical properties of actual size timbers of yellow pine manufactured in accordance with the grading rules of the above association. A very useful and valuable handbook for engineers, architects and others who have occasion to use yellow pine timbers.

Notes on Diseases of Trees in the Southern Appalachians. I. By A. H. Graves. Reprinted from Phytopathology, Vol. III, No. 2, April, 1913. Pp. 129-139.

Forest Planting in New Jersey. By A. Gaskill. Reports of the Forest Park Reservation Commission. Trenton, N. J. 1913. Pp. 31.

Wood-Using Industries of New York. By J. T. Harris. Series XIV, No. 2, New York State College of Forestry, in cooperation with U. S. Forest Service. Albany, N. Y. 1913. Pp. 213.

Second Annual Report of the Conservation Commission, 1912. Division of Lands and Forests and Fish and Game. Albany, N. Y. 1913. Pp. 297.

Contains annual report of the Forestry Bureau, pp. 67-114, which is well illustrated with half tones and one map showing the forest conditions.

Control of two Elm-Tree Pests. By G. W. Herrick. Bulletin 333, Agricultural Experiment Station, Cornell University. Ithaca, N. Y. Pp. 491-512.

Woodlot Forestry: A Manual of Forestry for Use on Farms and Country Estates. By R. Rosenbluth. Bulletin 9, State of New York Conservation Commission. Albany, N. Y. 1913. Pp. 104.

An excellent bulletin on this subject.

The Influence of Forests upon Climate. By Prof. DeC. Ward. Reprint from the Popular Science Monthly, April, 1913. Pp. 313-332.

The Power of Growth in Plants. By G. E. Stone. Reprinted from Popular Science Monthly, September, 1913. Pp. 231-239.

Tree Planting for Shelter in Minnesota. By P. C. Records. Bulletin 1, Forestry Board. 1913. Pp. 30.

Contains data on species to plant, and methods of planting and care.

Illinois Arbor and Bird Days. Circular No. 68, issued by F. G. Blair, Superintendent of Public Instruction. Pp. 71.

Contains popular articles on various topics related to birds and trees.

The Trees and Shrubs of Oklahoma. By C. W. Shannon, Circular 4, Oklahoma Geological Survey. Norman, Okla., 1913. Pp. 41.

Contains a list of the trees and shrubs of the state and a few notes in regard to the distribution of each; preliminary.

Trees and Shrubs of New Mexico. By E. O. Wooton. Bulletin 87, New Mexico College of Agriculture and Mechanic Arts. State College, New Mexico. 1913. Pp. 159.

Contains a brief botanical description of the woody plants found in the State.

Forest Protection Law. State Board of Forest Commissioners, Washington. Olympia. Pp. 24.

Contains the text of the forest law, also a few suggestions regarding burning logged-off land, slashings, etc.

State vs. National Control of Public Forests from the Viewpoint of a Western State. By the Oregon Conservation Commission. Portland, Ore. 1913. Pp. 8.

A defense of national ownership of public forests.

Volume Table for Redwood. Compiled by A. W. Elam. Published by H. K. Starkweather. Alameda, Cal. 1913.

Forty-Third Annual Report of the Entomological Society of Ontario, 1912. Legislative Assembly, Toronto, Canada. 1913. Pp.

Contains among other papers, Faunal Zones of Canada, pp. 26-33; Notes on Some Forest Insects of 1912, pp. 87-91.

Fodder and Pasture Plants. By G. H. Clark and M. O. Malte. Department of Agriculture. Ottawa, Canada. 1913. Pp. 143.

Report of the Minister of Lands and Forests of the Province of Quebec, 1913. Quebec, Canada. 1913. Pp. 155.

Sixth Annual Report of the Forestry Committee, University of Cambridge (England) Forestry School. 1913. Pp. 4.

On the Economic Value of Shorea robusta (Sal.) By R. S. Pearson. Volume 11, Part II. Economy Series, Indian Forest Memoirs. Calcutta, India. 1913. Pp. 70.

Discusses the physical and mechanical properties, durability, uses, minor products obtained from the tree, fuel value, prices and annual cut.

Report on the Forest Administration of the Central Provinces for the year 1911-1912. Nagpur, India. 1913. Pp. 64.

Annual Progress Report upon State Forest Administration in South Australia for the Year 1912-1913. Adelaide. 1913. Pp. 12.

Annual Report of the Department of Public Lands for the Year 1912. Brisbane, Queensland. 1913. Pp. 96.

A Critical Revision of the Genus Eucalyptus. Volume II, Part 9. By J. H. Maiden. Sydney, N. S. W. 1913. Pp. 267-289, plates 81-84.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forests of Asiatic Russia.

Generally speaking the forests of Asiatic Russia are confined to the mountains of Caucasus and the northern part of Siberia. The interior country is too arid for forest growth.

Conifers are more important in the north while the hardwoods reach their best development in the mountain valleys of southwestern Asiatic Russia. Among the latter, beech and oak are most important commercially although walnut, birch, elm, maple, ash, linn and poplar also occur. Pine, spruce and fir are the important conifers.

Exploitation has been confined almost entirely to the shores of the Black Sea and northeastern Siberia. From both of these sections ship transport is comparatively easy and supplies are sent at a low cost to the nearby markets. The vast softwood wealth of western and central Siberia has as yet been scarcely touched. Since the rivers drain north, transport must be through the Arctic Ocean and the summer is so short that a vessel can rarely make a round trip from England or Holland in a year. Unless cheap railroad transportation to the south can be secured the forest wealth of northern Siberia must remain uncut for some time to come. K. W. W.

Aus Russland. Forstwissenschaftliches Centralblatt, Aug., 1913. Pp. 451-454.

Forest Conditions in Transcaucasia.

Transcaucasia is the Russian province lying south of the Caucasian Mountains and north of Persia. In spite of the long time it has been settled, its dense population, and its stormy history nearly 30% of the total area is still forested. The private forests have, however, been badly abused and even the Government holdings are not in very good condition. If these latter are properly handled they will be able to furnish the greater part of the timber needed by the province even though only the poorer and more inaccessible sites have been set aside for this purpose.

The three main types of forest are those in which pine is the predominant species, the spruce types, and a mixed hardwood type. The author subdivides the pine types into three main sub types with site classes in each. There are only two important spruce types.

The principal timber trees comprise 110 different species, among which pine, spruce, oak, elm, basswood and boxwood are the most important commercially.

Satisfactory reproduction can be secured whenever proper attention is paid to the light requirements of the species to be regenerated and the seedlings do not have too much competition from grass and weeds.

The report from which this article was prepared was made for the Imperial Russian Forest Institute in 1913 by a forester especially delegated for this purpose. It is to form the basis for the future forest policy for Transcaucasia.

K. W. W.

Aus Russland. Forstwissenschaftliches Centralblatt, Dec., 1913. Pp. 651-657.

BOTANY AND ZOOLOGY.

Root Parasite of Oak.

The range of *Polyporus dryadeus* is probably co-extensive with that of the oak in Europe and America. Many species of both red and white oaks are known to be susceptible. The virulence of the parasite does not seem to be very great, as vigorous trees usually withstand attack. A white mottled sap rot of the roots is produced which later involves the heartwood, but which does not extend up into the trunk beyond the soil line. It is here, at the surface of the soil, that the fruiting bodies are formed. The study is of interest because it adds to our meager knowledge of root diseases, and because it establishes the fact that the stem heart rot ascribed by Hartig to *P. dryadeus* is due to an entirely different fungus, namely *P. dryophilus*.

J. H. F.

Journal of Agricultural Research, Department of Agriculture, Vol. I, No. 3, 1913, pp. 239-248.

Heart-rots of Hardwood Trees.

Investigations conducted by the author in 1912 on the condition of the oaks in the Ozark National Forest and elsewhere resulted in finding twenty different kinds of heart-rot. Six of these have been for the first time associated with the producing fungi, and an account of three of them is given in this paper. The number of affected trees in some districts is very great—in one instance up to 64.8 per cent of some thousands of oaks that had been felled for commercial purposes. The infected trees were as a rule old trees, and the fungi had gained entrance in general through fire-scars. "So marked is this association of fire-scars with heart-rots in the Ozarks that one could tell the areas in the forest which had been most frequently burned over from the percentage of trees affected with heart-rots."

The three types described are: (1) a pocketed or piped rot of oak and chestnut caused by *Polyporus pilotae* Schw.; (2) a string and ray rot of the oak caused by *P. berkeleyi* Fries; and (3) a straw-colored rot of oak caused by *P. frondosus* Fries.

J. H. F.

Three Undescribed Heart-rots of Hardwood Trees, Especially Oak. Journal of Agricultural Research, Vol. 1, No. 2, 1913, pp. 109-128.

Toxicity of Smoke.

Prof. Crocker and his assistants are carrying on extensive experiments in gas injuries to vegetation at the University of Chicago, and the present paper is the first of a series of articles to be published on the subject. They find that chimney smoke is only slightly toxic to the seedlings of sweet pea, 500 times less so than the smoke from a loosely rolled paper cigarette. Injuries from coal smoke are generally attributed to tars and oxides of sulphur, while reduced carbon-bearing gases have never been considered as a factor. The authors think, however, that carbon-bearing gases, especially ethylene might be in sufficient concentration to do injury and still be in too small quantities for detection by chemical analysis. One part of this gas in 10 million of the atmosphere inhibits the growth of an etiolated epicotyl of the sweet pea. The processes of civilization are continually adding to the ethylene in the atmosphere, as the burning of all carbohydrates, burning of coal, escaping of artificial illuminating gas, producing of gas in the bee hive method of coking, escaping of certain sorts of natural gas, and probably other processes. So far as known, there is in nature no special absorbent for ethylene, also no cycle for the gas as there is for carbon dioxide and oxygen. Having no estimate of the total additions to the atmosphere from the sources indicated above, one cannot calculate whether accumulation up to the danger point is likely to occur. One factor that favors the effectiveness of the oxides of sulphur as plant poisons in the open as against heavy hydrocarbons is their great solubility in the plant cell which would lead to their accumulation even under great variation in atmospheric concentration, whereas the heavy hydrocarbons would accumulate to a far less degree and variations in concentration greatly reduce their injurious effects.

C. D. H.

The Botanical Gazette, May, 1913, pp. 337-371.

SOIL, WATER AND CLIMATE.

Soil Fungi. Goddard is one of the latest investigators to attack the much debated question of the power of non-mycorhizal fungi growing freely in the soil to fix free nitrogen. Eighteen species were isolated from samples of garden soil and grown on culture plates. Seven of them were the same as those found in forest soil by investigators in Holland. It appears that, unlike bacteria, these fungi are rather uniformly distributed in the soil, at least to a depth of about six inches. Most of the fungi studied were taken from three plots; one of which was untilled and unfertilized, one well tilled but unfertilized, the other both well tilled and well fertilized with stable manure. The fungous flora, however, did not differ materially in species or abundance in the three cases. The most abundant in all of the plots were members of the genera *Mucor* and *Fusarium*. The author made tests of some 14 species and none of them showed any power of assimilating free nitrogen when grown in nitrogen-free media. In looking over the literature of the problem, however, one finds more evidence that soil fungi do have the power of fixing free nitrogen than the contrary. Yet it is only fair to say that the tendency of the later investigations with their improved methods of experimentation is towards conclusions like that of the present investigator.

C. D. H.

The Botanical Gazette, October, 1913, pp. 249-305.

Solar Energy in the Forest.

A scholarly study by Forstmeister Wagner of Pommerania of the power of the sun in the forest, deserves more than the brief mention which can here be given. Wagner starts out by showing the important rôle which solar-energy plays in the growth of forests. This energy he seeks to determine quantitatively and qualitatively; which, from the standpoint of silviculture has never heretofore been done.

Of course, the solar energy on unshaded areas has been determined. Wagner sums up the data along these lines and then, from the standpoint of solar energy directs his inquiry along four main lines:

I. The influence of latitude upon crown formation, volume production, number of trees, basal areas and branch formation.

II. The extent of sun rays in the forest, with special reference to Border Cuttings (Blenderaumschläge.)

III. The absorption of solar energy in the green leaf and its relation to site and to volume production.

IV. The measurement of light in the forest; results and practical importance.

Much of what Wagner writes about is of a physico-chemical character and yet it all has its direct application in practical forest management. For example, his studies show that a pure stand of 130 year old oaks, "closed," and with the crowns almost touching each other, passes half of the red light waves, on which, he has previously shown, growth energy chiefly depends. Poor soil conditions are evidenced by the presence of short light waves under the crowns. From this Wagner concludes that under the north German solar conditions, pure stands of oak involve an unjustifiable waste of solar energy and mean soil deterioration. A complementary species such as beech must, therefore, be introduced into the stand if half the solar energy is not to be wasted.

Wisely Wagner (unlike his namesake in Tübingen!) refrains from making world-wide deductions on inadequate premises or recommending his findings as being of universal applicability. Very rationally he confines the use of his spectralphotometer and, indeed, of all photometric methods in the forest, to the realms of research. In practice, e.g. in the marking of thinnings, the findings of investigators can be applied. The essential thing is to utilize the solar energy just as completely as possible by securing the maximum of absorption in the crown cover. Besides this, the crown spread and hence the growing space of the individual tree must be larger in northern than in southern latitudes if all the solar energy is to be absorbed, since in northern latitudes the sun's rays fall less vertically. Of course, the exact growing space depends also on age, species and site quality. This adequacy of future crown spread is not always properly regarded in marking, so that stands approaching maturity have often been too severely thinned in their youth. This means enforced isolation of crowns in mature trees; often breaks in the crown cover with attendant loss of solar energy.

Wagner has introduced a new aspect of Conservation: i. e. Conservation of Elemental Energy. That this energy is limited is a thought strange to even our era of conservation.

In this line of research Wagner admits science has only made the barest beginnings. The solar energy and the composition of solar rays are inadequately known. The analysis of chlorophyll composition is far from completed. Physics and chemistry have not yet, determined the exact chemical effect of light in the forest.

Wagner concludes these exhaustive studies with the modest assertion that the future will see the study of solar energy play as important a role in forest management as it already does in medicine and in general technology.

"Die Sonnenenergie im Walde." Allgemeine Forst- und Jagdzeitung, June, July, September, October, 1913. Pp. 185-200, 225-242, 297-319, 333-351.

Temperature Coefficients in Plant Geography and Climatology.

In the last number of the QUARTERLY (p. 576) a paper by Livingston on Plant Growth and Climate was reviewed. Now, in collaboration with Mrs. Livingston, he has advanced a step—several steps—farther in consideration of the subject. The authors point out that plant association boundaries must be considered as peripheries of certain complexes of environmental conditions. Thus far, investigators of ecological conditions have been unable, successfully, to unravel the tangle of conditions which effect the success of organisms in a given habitat. These environmental factors are water, non-aqueous materials, heat, light and mechanical conditions. What makes the problem of distribution still more complicated is the fact that each separate component of the environmental complex is variable in intensity, in duration and often in quality, as well as variable according to the stage of development of the organism acted upon. The authors in the present paper deal with only one of the environmental factors, namely temperature. As is well known, the usual method of dealing with temperatures in their effect upon plant distribution is to add up all the degrees of temperature, above a certain limit, experienced by the plants during the frostless period. It, however, seemed to the authors that the apparent value of temperature summations must rest upon some basic principle of physiology not indicated in the summations themselves. To this end the chemical principle of Van't Hoff and Arrhenius is employed, that is, within certain limits the velocity of most chemical reactions doubles or somewhat more than doubles for each rise in temperature of 10 degrees Centigrade. This principle has been applied with general corroboration to the functions of plants, since such functions are mostly chemical or at least dependent upon chemical reactions. For example, it has been found, beginning with resting buds, that in the case of the flower buds of plum, peach, apple and other fruits, the time required for blooming is reduced by one half for each rise in temperature of 10 degrees Centigrade. If the processes of growth and development do really exhibit temperature coefficients, it is plain that the study of environmental temperature factors should deal with these rather than with temperatures directly, or at least they can be used as a check upon the temperature summation method. The latter plan the authors carry out. That is, they sum the normal daily mean temperatures of 106 stations in the United States for the period of the average frostless season (the direct index); they sum the temperature efficiences corresponding, respectively, to the normal daily means and to the adopted coefficient (2) for each 10 degrees variation (the efficiency index.) Then they plot both sets of temperature indices on a map of the United States, and the map is then divided into areas by climatic lines in the usual way. To compare the two series of indices thus charted, the ratio of each direct index to the corresponding efficiency index was obtained, thus giving a ratio for each station. These ratios were also charted on a map. In a roughly approximate way the two methods are in agreement, since for most of the area of the United States they give results which agree within the limits of a plus or minus variation no greater than 5 per cent. For local areas, however, there are considerable variations—sufficient to negate the correspondence of the two methods on an area which one man would be likely to study in actual field work. The direct index (summation) is a measure of the duration of the temperature factor of climate, while the efficiency index (10 degree variation) is a measure of the intensity of the temperature factor. Which of these more nearly approximates the measure of the temperature effectiveness of a climate, so far as plant growth is concerned, will no doubt remain for a long time undetermined.

C. D. H.

The Botanical Gazette, November, 1913, pp. 349-375.

Forest Protection to Hill Slopes.

An extract from "Indian Engineering" brings up a controversy as to the value of forests on steep slopes. One school has assumed that the roots of forest growth extend into the crevices of rock and thereby assist disintegration and erosion. The other school believes that the roots envelop the rock and soil masses and "tie them together as a cord would do." Moreover, it was argued that the action of water and frost was more severe when there was no forest cover. The conclusion was reached "There is no doubt that in the first place they never promote slips while deforestation frequently does." The reviewer, however, has noticed an interesting exception to this rule in the French Alps where in a certain instance the forest acts as a sponge and tends to promote land slips by concentrating a large weight of water upon a thin subsoil which slides upon the rock foundation. Here, one of the means of attack to prevent a land slide is to cut the forest. This is, of course, an extreme measure.

T. S. W., Jr.

Indian Forester, November, 1913, p. 551.

SILVICULTURE, PROTECTION AND EXTENSION.

Root Competition vs. Predisposition.

Frömbling contends that the uneven development of individuals in a dense crop is not, as modern silviculturists claim, a matter of root competition rather than of individual predisposition. For, he says, since the raw humus, which in time normally is transformed into assimilable substance, accumulates in the dense stand under the protective shade, it furnishes ample food, and root competition can only be for food. Competition for room can also not be the cause of uneven development or thinning out of stands, for just the species with characteristic tap roots, oak and pine, which get their water supplies from the depths, thin out most surely, while on the other hand the species with shallow roots, spruce, fir, beech, thrive and keep dense in close crown cover, although here root competition would be expected. He calls root competition a most dangerous term.

Welche Rolle spielt die Wurzelkonkurrenz im Haushalte des Waldes. Forstwissenschaftliches Centralblatt, April, 1913, pp. 170-175.

Extensive and Intensive Management.

Now that there is a definite revolt broken out in German forest circles against the old clear cutting method with artificial regeneration, practised so extensively, especially with pine, Dr. Endres' summary of the advantages and disadvantages of intensive and extensive management is very timely.

Naturally it goes without saying that all forest management is intensive as compared with agriculture because the yield per unit area is small and large tracts must be secured to have appreciable results. There is, however, a great difference in intensity even with schemes of forest management. Clear cutting followed by artificial regeneration of pure stands is an example of extensive forest management and the bad results which have often followed this method have led to the demand for more intensive systems in which groups of trees and not whole stands are the unit of management.

However, Dr. Endres points out that all the evils ascribed to the clear cutting system as applied to pure stands are not inherent. The defects urged against it are that it leads to soil deterioration and increases the danger of wind and insect damage. Dr. Endres asks questions whether the latter evils are any more prevalent over long periods in pure even aged stands than in irregular stands. Most of the present day troubles are with pure even aged stands but there is not the same detailed data as to insect and wind damage in irregular mixed stands because such forests are very rare at this time in Germany. Soil deterioration in pure stands can be avoided in great part according to the author by refraining from opening up the mature stand preliminary to the final felling operations and by immediate replanting.

An argument often used in favor of an intensive system which produces mixed stands is that pure stands are unnatural. Pure, even aged stands occur in nature, however, over wide areas. Two illustrations familiar to all American foresters are white pine and lodge pole pine stands. The fact seems to be that there is wide range of adaptability. Some species reach their best development in mixture while others occupy large areas to the exclusion of other species.

The most telling argument against more intensive silviculture such as the methods of Gayer and Wagner demand is the economic one. While an increase in the cost of administration may bring larger revenues up to a certain point the forester must consider very carefully whether the greater expense necessary to carry out a "group" or "border" cutting will yield commensurate returns in soil enrichment, more rapid growth, freedom from damage, and greater adaptability to future market conditions.

Summarizing, the author would point out the danger of over emphasizing the defects of extensive, cheaply administered methods of handling pure stands by cutting clean and planting during the present admiration for more intensive silviculture.

K. W. W.

Grossflächenwirtschaft und Kleinflächenwirtschaft. Forstwissenschaftliches Centralblatt, Aug., 1913, pp. 401-412.

Reforestation in France.

Paul Buffault gives an interesting account of the forestation on the federal forest of Vierzon, based on a study of the work executed since the year 1670 when the forest comprised 294 acres of brush and openings, and 7,670 acres "entirely ruined and devastated either by fires or by the grazing of ordinary stock and sheep." At this time 89 per cent of the forest area was unproductive. In 1779, the openings only amounted to 3,358 acres, or 25.6 per cent of the entire area. In 1859, the blanks had increased to 4,077 acres, owing to faulty working plans. In 1879, with the exception of 741 acres burned over, the blanks had practically disappeared. This was the situation at time of the disastrous winter of 1879-80 when 2,362 acres of Maritime Pine reforestation was destroyed by frost. These openings were increased by the burning of 1,591 acres. In 1890, there remained about 2,718 acres to restock. From 1891 to 1904, 2,157 acres were restocked. During this period the total expense was on an average of $23.56 per ha. or $9 per acre forested. The writer gives in detail an account of the reasons for the failures which may be summarized as follows: Crowding by undergrowth, poor quality seed and drouth, rabbits, fire and lack of drainage. Of these causes for poor success in sowing, heather and underbrush were the most disastrous. The plantations during the period 1891-1904 covered 2,179 acres of which 1,326 was new work. The average success was 50 per cent for new plantations and 37.7 per cent for the maintenance of old plantations. The average expense here was $5.64 per acre forested, or about one half of the cost of sowing. But the average cost of plantations for the entire forest has been about $7 per acre; this figure would be increased to $10 if the value of the plants were included. The main causes of failure in planting have been excessive moisture, invasion by heather and brush, damage by game, (especially stags), and drouth. Buffault concludes that direct seeding must be abandoned as too costly and because the results are too uncertain. On the other hand, the plantations give sufficiently satisfactory results to justify being continued provided the soil is first drained and cleared. Preference is given to Scotch Pine and Pedunculate Oak. Interesting experiments are to be carried on with important American and foreign species.

T. S. W., Jr.

Revue des Eaux et Forêts, November 15, 1913, pp. 673-681.

Silvicultural Systems for Chir Pine.

Smythies of the Indian Forest Service reviews at length the silvical characteristics and methods of handling Chir pine. He shows that during the past 50 years a number of silvicultural methods have been used in the Himalaya Mountains in British India, notably the shelterwood selection and group methods. The shelterwood system seems to be unsatisfactory where it is necessary to sacrifice young stands in order to obtain regularity. There are also objections to the application of the group and selection methods. Mr. Smythies makes a plea for the treatment of the species without respect to a system of management, the method to be varied in each compartment according to the needs of the species.

T. S. W., Jr.

Indian Forester, November, 1913, pp. 513-525.

Forest Fire Insurance in France.

Before 1870 various fire insurance companies wrote insurance against forest fires, but the experiences of the large fires in 1870, especially in the Gascony pineries, led to the abandonment of this kind of insurance. Since that time mutual insurance has been successfully attempted. It was figured that if the whole pineries of the departments of Gironde and Landes had been insured at 20 cents per acre and on average valuation of $24 per acre a company would have made $200,000 from 1858 to 1900 and $311,000 from 1900 to 1908. Upon this calculation the mutual insurance company was founded.

Schweizerische Zeitschrift für Forstwesen, June and July, 1913, pp. 222-23.

Fire Protection.

The controversy in regard to fire protection in the teak forests of Burma is continued by H. C. Walker. The main point at issue seems to be whether the damage caused by fire is sufficient to justify the cost of protection. For example, Mr. Walker estimates that the average cost of protection amounts to $13.00 per square mile per year whereas the damage is but little over $3.00. He summarizes his reasons for discontinuing fire protection in the moist teak forests of Burma as follows: (1) "The first reason is to avoid the deterioration of the growing stock which it has been proved that fire protection causes." (2) "The second ...... is to divert the funds and the energies which are now utilized on fire protection to attending our forests." Mr. Walker makes a rather interesting review of the fire protection policy in Burma. In 1896, a large majority of the local officers were in favor of continuing protection. In 1902, the four conservators "assuming the desirability of fire protection was beyond dispute, proposed to extend protection to all teak forests in Burma within the following five years." This started a lively controversy and the scheme to extend protection was quietly dropped. In 1913, it appears that the majority are now against fire protection. The results of the experiences in Burma are of significance to American foresters.

T. S. W., Jr.

Indian Forester, November, 1913, pp. 532-540.

MENSURATION, FINANCE AND MANAGEMENT.

New Yield Tables.

In an exhaustive article, Dr. Borgmann of the Royal Saxon Forest Academy at Tharandt, critically appraises and compares the results of recent yield investigations from the scientific and practical standpoints.

In no phase of forest mensuration has American practice lagged further behind European precedent than in the construction of yield tables, (and this is not to be wondered at!) hence this study by Borgmann is so far in advance of our times that a detailed review thereof is scarcely justified.

One or two points of especial interest shall, however, find mention here:

The newer yield tables, based upon a heavier degree of thinnings have brought about a later culmination of the mean annual increment and with it of the maximum soil rent (financial rotation.) The culmination is later on good site qualities than on poor ones, as the following average table shows (calculated with a uniform interest rate of 2½%.)

Site Quality	I	III	V
Financial Rotation (in years)			
1. Spruce *(P. excelsa)*, ...	85	80	75
2. Fir *(A. pectinata)*, ...	100	90	80
3. Pine *(P. silvestris)*, ...	110	100	90
4. Beech *(F. silvatica)*, ...	120	110	..
5. Oak *(Q. pedunculata)*. ...	140	130	..

Dr. Borgmann's article includes the latest Saxon yield table for spruce which is herewith reproduced in full. The reviewer is especially glad of this opportunity since the table given in his article "Management of Spruce in Saxony" (Forestry Quarterly, Volume XI, No. 2, p. 147) is unfortunately misleading through the use of a conversion factor (.17) which gave too high results. Indeed, a general factor for translating cubic meter per hectar into feet board measure being impossible, only the figures for the financial rotation (80) years) are so translated by using the factors. .01-.08.

YIELD TABLE, NORWAY SPRUCE (*Picea excelsa*)

SITE I-V

CUBIC FEET PER ACRE

	I		II			III			IV			V	
Age	Min.	Aver	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Aver.	Max.
10	443	458	372	400	429	300	329	358	229	257	286	148	215
15	887	958	715	801	872	558	629	701	386	472	543	243	372
20	1316	1430	1058	1173	1301	801	915	1044	529	658	787	329	515
25	1931	2131	1530	1730	1916	1130	1330	1516	715	915	1115	443	701
30	2530	2789	1988	2259	2517	1444	1702	1973	887	1158	1430	543	872
35	3261	3618	2531	2889	3246	1802	2159	2517	1073	1430	1788	672	1058
40	3975	4419	3060	3504	3961	2159	2603	3046	1244	1687	2145	772	1230
45	4762	5320	3647	4204	3748	2545	3089	3632	1416	1973	2531	887	1401
50	5548	6192	4233	4876	5534	2917	3561	4219	1587	2245	2903	987	1573
55	6364	7136	4833	5591	6349	3303	4061	4819	1759	2531	3289	1101	1745
60	7179	8051	5420	6292	7164	3675	4533	5405	1916	2789	3661	1287	1902
65	7994	8980	6020	7007	7979	4061	5034	6006	2074	3060	4047	1287	2059
70	8809	9896	6621	7708	8795	4433	5520	6607	2231	3318	4419	1387	2217
75	9610	10811	7207	8408	9595	4805	6006	7193	2388	3589	4791	1487	2374
80	1039	11697	7779	9081	10382	5162	6464	7765	2531	3832	5148	1573	2517
Ft.bd.	**43,600**	**65,400**	**32,600**	**44,500**	**58,000**	**14,900**	**22,600**	**32,600**	**3,500**	**8,000**	**14,000**	—	—
85	11140	12541	8323	9724	11125	5506	6907	8308	2674	4090	5491	1673	2660
90	11869	13371	8852	10353	11855	5834	7336	8837	2803	4304	5820	1745	2789
95	12555	14157	9352	10954	12541	6149	7751	9338	2932	4533	6135	1830	2917
100	132285	14915	9838	11526	13213	6449	8137	9824	3046	4733	6435	1902	3032

Dr. Borgmann concludes:

(1) That the yield investigations conducted by the German Experiment Stations are scientifically accurate.

(2) The data in recent yield tables furnish an invaluable basis for deciding questions of practical management aside from their obvious value in determining the volume and increment of individual stands.

(3) Yield tables are especially useful in

(a) Forest Organization: as basis for choice of species and method of management; for deciding upon the most favorable rotation age as well as for judgment site and stand quality; especially for the estimate of the volume and increment of individual stands.

(b) Forest Valuation: e.g. in damage calculations.

(c) Forest Statics: e.g. in determining the most advantageous degree of intensity in thinnings; in the ascertaining of value increment.

(4) Continued investigations of the yield according to classes of product and a closer relation with wood technology is to be desired.

"Wie sind die Ergebnisse der neuren forstlichen Ertragsuntersuchungen nach ihrem wissenschaftlichen und praktischen Wert zu beurteilen?" Allgemeine Forst- und Jagd-zeitung, December, 1913, pp. 397-412.

Forest Organization.

Dr. U. Müller of Karlsruhe reviews the second edition of Hufnagl's book on Forest Organization. After commenting on the increased literary activity among foresters, the reviewer cites this noteworthy case of a book on a highly specialized subject receiving a second edition in two years' time. The changes from the first edition are slight ones.

Hufnagl's working plan methods are those adapted to extensive conditions. His yield regulation is by the Stand method. The yield determination may be by any standard method excepting, of course, the period methods (Fachwerks methoden.) Hufnagl's own methods he cites as means of yield determination. To the American reader Hufnagl's methods are available in "The Theory and Practice of Working Plans" (John Wiley and Sons, N. Y., 1913.) Pp. 49, 75, 81, 82 and 83.

Hufnagl's book is remarkably free from obscuring technicalities. Its title of "practical" has been justified by the rapid sale this book has had.

"Praktische Forsteinrichtung." Allgemeine Forst- und Jagdzeitung, November, 1913, pp. 380-381.

Organization of Communal Forests.

He who is interested in the development of working plan procedure in Europe, should read Dr. Hemann's proposals for yield regulation in communal forests of Prussia.

These differ quite markedly from the prescribed practice for the State forests of Prussia promulgated on March 17, 1912* since the communal conditions to be served require different treatment.

Dr. Hemann believes that the regulation of yield should be by the stand method in conjunction with an area-period framework. Supervisors and rangers of communal forests should receive extra pay for the additional duties of preparing the working plan—this in default of a provincial bureau of Forest Organization.

The subject is too specialized to warrant protracted discus-

*For description see Allgemeine Forst- und Jagdzeitung for January, 1913, pp. 19-25.

sion here; however, it is of considerable interest in view of the possible development of communal forests in New York* and Pennsylvania.

Opinions divergent from those of Dr. Hemann are expressed by Oberförster Dr. Gehrhardt in an open letter on the same subject. The matter is of too restricted interest to warrant reproducing it here, however, the discussion is quite illuminating as showing present tendencies in Forest Organization abroad. Among these is the insistence that so specialized a subject as working plans be placed in the hands of a Central Bureau of Forest Organization rather than left to each Forest Supervisor. As Dr. Martin has said: "The assumption that the Forest Supervisor can make the working plan for his forest in a manner satisfying the demands of the present day, can only come from those persons who do not know sufficiently the far-reaching significance of working plans."

Ertragsregelung in Preussischen Gemeindewaldungen. Allgemeine Forst- und Jagdzeitung, November, 1913, pp. 384-389.
Ueber die Anwendbarkeit der neuen Preussischen Betriebsregelungsanweisung auf die Rheinischen Gemeinde Waldungen. Allgemeine Forst- und Jagdzeitung, December, 1913, pp. 422-429.

Douglas Fir in Denmark.

In a review of investigations by Appermann, there is cited an interesting yield of Douglas Fir which was introduced into Denmark towards the middle of the last century. A sample plot planted in 1880 yielded in the first thinning (1905) 200 cubic meters of timber wood to the hectare, and had, when 29 years old in 1909, a total volume of 377 cubic meters to the hectare, which amounts to an annual production of 20 cubic meters per hectare for the first 29 years, (286 cubic feet per acre.)

T. S. W., Jr.

Revue des Eaux et Forêts, December 1, 1913, p. 720.

*"County, Town and Village Forests," Cornell Reading Course, Vol. II, No. 40, May 15, 1913.

UTILIZATION, MARKET AND TECHNOLOGY.

Transport by Aerial Cable.

H. W. Glover of the Indian Service describes in detail a local method of transporting fuel at Murree in the Himalaya Mountains. The ropeway is three miles in length and the loading station is situated at an elevation of 6,387 feet, the unloading station at an elevation of 6,567 feet, with the lowest intermediate point 5,454 feet. An endless wire cable, which passes around horizontal wheels, is suspended at intervals along its course on sheaves supported by trestles and steel beams which rest on concrete foundations. Detailed drawings and figures accompany the description. A very detailed estimate of cost of construction and operating expense is appended.

T. S. W., Jr.

The Patriota Ropeway. Indian Forester, October, 1913, pp. 463-471.

Prices of Wood in Prussia.

Prices for mine timbers increased in 1913 over 1914 by from 5 to 10 per cent, and in some cases up to 31 per cent, due to increased demand and decreased importation. Railroad ties (2-15%) and pulpwood also brought substantial increases (2-6%.) On the other hand, the market for sawmill products was poor or at least uncertain, although in South Germany conditions were more favorable, the imports there playing an important rôle, and these have become more expensive, due to increased cost of production in the export countries. In general, 1 to 4 per cent may be considered the average increase in wood prices for the year.

Silva, October, 1914, pp. 341 and 353.

Metal vs. Wooden Ties.

By 1909 the German railroads had over 20,000 miles (31%) of metal track; the largest percentage (46%) in the heavily forested States of Württemberg and Baden, while Saxony was almost without metal ties. At first 88 lb. ties were used, which did not last more than 15 years; then 118 lb. ties, and finally 154 lb. ties were introduced, increasing the cost considerably, the tieing on wood in Saxony costing $3,200 per mile, the metaling in Baden about $5,800. Such cost would necessitate a duration from 50 to 60 years, considering also the increased cost of the better substructure of track necessary. This, in the face of treated beech ties lasting 30 years (in France), would speak against the metal tie. But there are other advantages from metal track which the author does not bring into his calculation.

Holzschwelle oder Eisenschwelle. Schweizerische Zeitschrift für Forstwesen, August, 1913, pp. 254-56.

Mangrove for Tanbark.

Owing to the decreasing shortage of tanbark in Europe and in America, the note prepared by Mr. Pearson of the Indian Forest Research Institute at Dehra Dun, is of special interest. According to his investigations, in the Tan Extract Factory at Rangoon it was clearly demonstrated that Mangrove bark yielded extracts of good quality which were saleable in Europe. The largest forests of this species are found down the coast of Arakan, extending along the Bassein coast towards Rangoon, and again along the coast of Mergui and Tavoy in south Tenasserim.

T. S. W., Jr.

Indian Forester, November, 1913, pp. 545-548.

STATISTICS AND HISTORY.

Bavarian Statistics.

The recently published Bavarian official forest statistics for the management years 1910 and 1911 are reviewed by Stamminger. They show out of a total area of 6,472,000 acres a total timber growing area in state forests of 2,016,831.5 acres in 1910 with a net yield of $3.87 per acre; and 2,018,402.5 acres in 1911 with a net yield of $4.12 per acre. This is in sharp contrast with the net yield of $1.76 per acre in 1868 and $3.61 in 1898! The volume of business is shown by the following statement:

	Gross Income	Expenses	Net Income
1910	$14,447,175	$6,536,481	$7,811,694
1911	$15,251,898	$6,932,643	$8,319,255

Of the expenditures the leading ones for planting and road building were as follows:

	Planting	Road-building
1910	32c per acre	30c per acre
1911	33c per acre	33c per acre

Fires in 1910, 42 in number destroyed 1 acre in 18,000 in 1910, but in 1911, 237 fires destroyed 1 acre in 4326 of State forests.

Mitteilungen aus der Staats forstverwaltung Bayerns. Allgemeine Forst- und Jagdzeitung, November, 1913, pp. 382-383.

Finnish Statistics.

According to the Proceedings of the Finnish Forestry Association, the wood industry of Finland (on 50 million acres or 63 per cent. of total land area) has increased during 1910, by over 25 per cent. to around $34,000,000. There were manufactured into buttons and spools over 12 million cubic feet of birch, the products being worth over $1,200,000. Ground pulp with $4 million; chemical pulp with nearly $5 million and altogether paperstock with $15 million was manufactured. The wood industry represents 29.5 per cent of all industries, the paper industry 15.4 per cent, or altogether 45 per cent.

Forstwissenschaftliches Centralblatt, April, 1913, p. 220.

Forests of Alsace-Lorraine.

According to an article in the Revue Scientifique the wooded area in Alsace-Lorraine comprises 1,111,950 acres or 31 per cent. of the total area as compared with 27 per cent. for the entire German Empire and 18 per cent. for France. This wooded area has not varied since 1871. Two-thirds of the species are broad leaved trees, beech, oak and others and the remainder conifers of which one-third are pine and two-thirds spruce and fir. 308,875 acres are treated by coppice and coppice under standards, and 370,650 acres as high forest. The total annual cut averages 21 million cubic feet and the annual production per acre has increased from 44 cubic feet in 1871 to 62.7 cubic feet in 1911. The proportion of saw logs has increased during this period from 33 to 44 per cent.

T. S. W., Jr.

Revue des Eaux et Forêts, November 15, 1913, pp. 697-698.

Forests of Belgium.

The latest ownership statistics of federal, communal, public institution and private forests of Belgium are as follows:

Federal forests, ...	79,800	acres
Communal, ...	410,000	"
Public institution, ...	16,440	"
Private (census of 1894), ...	678,200	"
Total, ...	1,184,440	"

The figures show that the per cent. forested is 18.32.

T. S. W., Jr.

Revue des Eaux et Forêts, November 15, 1913, p. 694.

History of a City Forest.

Oberförster Müller having delved in the archives of his home city, Leipzig, tells most interestingly of the history of that city's forests. These are now comprised chiefly in the two royal Saxon "reviers" Burgaue and Connewitz, a total of 2,412 acres. Originally the major portion of these woodlands belonged to local monasteries; but the Reformation ended this and gradually possession passed to the city of Leipzig.

The first survey of the city forests was made in 1563 by division of the area into triangles and the measuring, on the ground, of the base and altitude of each (triangulation!). The survey also included a rough description of the component stands.

The need for better bases of yield determination led to a resurvey in 1714. Again, triangles were used to calculate areas. Careful descriptions of the forests formed a part of this survey.

The boundaries were fixed accurately for the first time in 1597. Stones and scribed trees were used as monuments, the latter only till the eighteenth century when, for greater permanency, stones were substituted. The completion of the boundary work in 1597 was followed by an inspection on the part of a Commission appointed by the City Council. A protocol tells of this inspection and of how *more majorum*, the celebration-dinner ended in one local nobleman and the parish pastor becoming completely inebriated.

These forests were then and are still, comprised almost wholly of hardwoods. The need of wood for fuel and of larger sizes for construction timber (oak), naturally led to a system of Coppice with Standards. Though a sustained yield was not always possible owing to the exigencies of frequent war-times, the stands seldom suffered for want of intelligent care. Always there was the realization of what was needed to improve existing conditions in the forest, and the striving for this ideal.

From the administrative standpoint the Leipziger forests are most instructive. The monasteries called the forests *silva* or *mirica or*, if coppice, *rubetum* and *virgultum*. The *forestarius* (hence our forester and the German förster) had charge not only of the *silva* but of all that was *foris* with respect to the monastery, including ponds, meadows, etc. The title of forestarius or Förster was continued under the city administration. One of the Förster became in the 16th Century an Oberförster (present title of all German supervisors) and, because of this headship, was made mounted with all that this signified in improved social standing.

Regulation of the yield was by area, the aim being to cut an equal area annually. As early as 1538 this principle was announced. At first this area was merely determined in amount, later, 1617, it was also distributed on the ground according to the ages of the component stands. The resurvey of 1714-1716 resulted in a complete working plan based on area with a 20 year rotation for the coppice.

Regeneration of the stand was by natural means. Gradually the coppice began to deteriorate and, in 1726,, first mention is made of artificial restocking of fail places and of unthrifty stands. But not till fifty years later was anything really accomplished in the way of planting.

In 1804 a new working plan was prepared which marks the beginning of a new epoch in forest management. The author, however, ends his essay with the close of the old order or about the time of the battle of Leipzig, 100 years ago.

"Zur Geschichte der Waldungen der Stadt Leipzig." Allgemeine Forst- und Jagdzeitung, November, 1913, pp. 365-372.

MISCELLANEOUS.

Forestry Books for Laymen.

The various semi-popular texts on forestry which have recently appeared, among which may be cited Graves' "Handling of Woodlands," Hawley and Hawes' "Forestry in New England," and the forthcoming book on "Elements of Forestry" by Moon and Brown (all published by John Wiley and Sons, N. Y.), lends especial interest to the review by Dr. Mueller of Schüpfer's "Outlines of Forestry."

It seems that, in Germany, interest in forestry is spreading among laymen owners of forest property. For them, primarily, this compendium is designed. Aside from a brief introduction on the economic importance of forests and forestry, the book is, therefore, confined to the subjects of forest production and forest management, omitting forest policy, history and administration as irrelevant to this purpose. The reviewer rather criticizes this omission since even the layman should be acquainted with the elements of these important phases of forestry. On the whole, though, he adjudges the book as a distinct success.

"Grundriss der Forstwirtschaft." Dr. V. Schüpfer, Professor of Forestry at the University of Munich, pp. 268, plates 53. Stuttgart, 1912. Allgemeine Forst- und Jagdzeitung, November, 1913, pp. 379-380.

Associations of German Foresters.

At this stage in our development Dr. von Fürst's article is very timely because our own Society of American Foresters can undoubtedly learn much from the history of similar organizations abroad.

The German "Forstverein" as newly constituted has now been in existence since 1900 and its present thriving condition is evidence that it is filling a real need in a satisfactory manner. Prior to its formation there was an annual gathering or Congress of German foresters but through lack of a permanent organization these meetings were not as effective as they have since been made. There was no continuity of policy, little was accomplished in the way of standardization, and the lack of funds created deficits which were hard to meet.

As early as 1881 Dr. Danckelmann proposed a permanent organization but preliminary education was necessary before the idea secured general acceptance. Since it was not until 1897 that the "Forstverein" was really launched in Frankfort a. M., "Aus dem Walde" was made the official organ and a membership of 244 enrolled. At the forest congress of the following year the movement was given a truly national scope by the enrollment of 1,100 members and by the appointment of a directorate of 28, composed of 16 delegates at large, 8 from local forest organizations, and 4 from forest schools. This number was later increased to 55 by adding more members from the forest schools and from the ranks of the private practitioners.

The functions of the board of directors are to choose the officers, decide the themes, and in general legislate for the association. For each meeting two subjects are chosen for discussion. One of these is silvicultural and the other economic, as for instance: 1905:—Forest aesthetics and private forestry; 1904:—The humus question and the taxation of forest land.

In addition to the wide discussions which the annual meetings afford important standardizations have been effected in German forest practice through the agency of this organization. Furthermore projects of national scope have been carried through, like the collection of forest statistics so that the Proceedings have become records which every German forester needs.

K. W. W.

Der Deutsche Forstverein und seine bisherige Tätigkeit. Forstwissenschaftliches Centralblatt, Aug., 1913, pp. 413-424.

OTHER PERIODICAL LITERATURE.

American Forestry, XIX, 1913,—

Federal Forestry. Pp. 909-918.

Economic Factors in Private Forestry Work. Pp. 932-945.

Lumbermen and Our National Development. Pp. 946-951.

[XX, 1914]

Forest Planting in Pike's Peak. Pp. 14-21.

Reconnaissance: Its Relation to Forest Working Plans. Pp. 22-30.

Public Knowledge of Forest Economics. Pp. 58-63.

Bulletin of the American Geographical Society, XLVI, 1914,—

Notes on the Sources of the Peace River, British Columbia. Pp. 1-24.

Pulp and Paper Magazine of Canada, XII, 1914,—

Chemical Utilization of Southern Waste. Pp. 33-40.

Transactions of the Royal Scottish Arboricultural Society, XXVIII, 1914,—

The Development Commission and Forestry. Pp. 14-27. Extracts from the report of the commissioners for year ended 31st March, 1913.

The State Forests of Saxony. Pp. 28-46.

Continental Notes—France. Pp. 60-72.

The Formation of Plantations on Deep Peat. Pp. 72-78.

The Excursion to Switzerland. Pp. 83-97.

Visit to German Forests. Pp. 100-104.

The Gardeners' Chronicle, LV, 1914,—

Conditions Affecting Germination. Pp. 24-25. A classification of some seeds according to their behavior when exposed to various conditions of humidity.

The Timber Trades Journal, LXXIV, 1913,—

Swedish Statistics. Pp 857.

Reclaiming Sand Dunes in Belgium. P. 857.

Bulletin de la Societe Dendrologique de France, No. 30, 1913,—

Graines et Plantules des Angiospermes. Pp. 185-244. Continuation of the series.

Monthly Bulletin of Agricultural Intelligence and Plant Diseases, IV, 1913,—

Moor Cultivation in Austria. Pp. 1672-1677.

Present Conditions of Forestry in Italy. Pp. 1682-1688.

The Selection System in Forest Economy. Pp. 1688-1695.

Distribution of Forests in the Natural Regions of Switzerland. Pp. 1822-1825.

Yale Review, October, 1913,—

Who Should Own the Forests? Pp. 145-156. The writer concludes that public ownership is essential.

Rod and Gun, XVI, 1914,—

The Dominion Parks. Pp. 905-910.

NEWS AND NOTES.

For the first time the Western Forestry and Conservation Association held its annual meeting in Canada at Vancouver, B. C., December 15 and 16. This association has been a most important factor, not only in timber protection, but in moulding public opinion. At the meeting, reports of progress made in the five States of the West were given, and, in addition, a large share of the time was devoted to the discussion of problems pertaining particularly to British Columbia. Practical questions were discussed during the two days' session, participated in by timberland owners, forestry officials and railroad officials, on both sides of the line. Fire protection in all its phases was the principal topic, involving modern methods for fire-prevention, fire-fighting, and communication in the forest. The session was brought to a close by a banquet given by the British Columbia lumbermen.

It was stated at the meeting that "The best single result of the 1913 fire season has shown that systematized co-operative effort at an insignificant cost per acre, or per thousand, can reduce our forest losses of an average year from four or five million dollars to about as many thousands, on the twenty million acres of timber lands controlled by the lumbermen forming this association."

There are now thirty timber-owners' associations in the United States, the members of which have got together to adequately protect from fire their combined holdings, which now total about 25,000,000 acres.

In Canada, there is but one association of this kind, the St. Maurice Fire Protective Association. The Quebec limit-holders comprising this association have, by a self-imposed tax of one-quarter cent per acre, installed a fire protective system on their 7,000,000 acres of holdings. In 1913 over 275 forest fires were extinguished with practically no danger, proving, in the words of the members, that "The success of co-operative forest fire protection has been established without a doubt."

After the disastrous forest fires in 1911 the Michigan State Forestry Department conceived the idea of organizing the Boy Scouts into a protective association. Last year 3,000 scouts were enrolled in this work and extinguished 731 fires. The fire loss of $3,500,000 in 1911 was reduced to $67,000 in 1912, and to $23,000 last year.

The Forest Service of the Province of Quebec now employs a total of sixteen professionally trained foresters. Nearly all these men have received their professional training at the Forest School at Laval University, Quebec.

During the summer of 1913, the Quebec Forest Branch had fourteen parties in the field, each in charge of a technically trained forester. The work undertaken by ten of these parties was a valuation survey of unlicensed Crown timber lands. Of such lands, there are approximately 125,000 square miles in the Province of Quebec. The Crown lands under license aggregate approximately 70,000 square miles. The revenue from these lands during the past year has aggregated nearly one and three-quarter million dollars.

In addition to the ten parties engaged as above, four parties were engaged in an examination of licensed lands, to determine the boundaries of permanent forest reserves. It is the policy of the Quebec Government to segregate non-agricultural forest lands into permanent forest reserves as rapidly as the necessary information can be secured.

The Canadian Northern Railway has taken a very progressive step in connection with the prevention of fire along its lines by the appointment of Mr. William Kilby as Fire Inspector. Mr. Kilby is to have general charge of all phases of the Company's fire protection work. This practically involves the creation of a new department in the Company's organization. This includes right-of-way clearing, fire patrols through timbered country, and the construction of fire guards through prairie sections in Alberta, Saskatchewan and Manitoba. The prosecution of these lines of work is required by the Railway Act and the orders of the Board of Railway Commissioners.

The Canadian Northern is the first large railway company in Canada to organize a special department to handle fire-protection work. Experience has demonstrated that the best results in this class of work are secured by specialization. The example of the Canadian Northern might be followed to excellent advantage by other lines.

A National Forestry Congress, similar to the one in 1906, will be held in Ottawa next January. This was decided, on the suggestion of the Premier, by the delegates to the sixteenth annual meeting of the Canadian Forestry Association.

The Lieutenant-Governors of all the Provinces, members of Parliament and of the Senate, prominent lumbermen, and in fact everybody who is prominently identified and in sympathy with forestry, will be invited by the Premier to attend the congress, at which matters pertaining to the preservation of the forests will be discussed.

Prior to deciding on holding the convention, the delegates waited on the government and submitted resolutions covering such matters as the extension of forest areas, more care in deciding what lands shall be opened for settlement, free distribution of young trees, and that appointments in the forestry service be based on capability and experience.

During the past year, much progress has been made in the province of British Columbia in connection with minimizing fire risks through the disposal of slash resulting from lumbering operations. In 1913, according to the Provincial Forest Branch, about 20,000 acres of lumbering slash were burned in that province, and a much larger area would have been burned had it not been for an extremely wet autumn. On the Coast and in the Interior, several experimental areas were burned by the Forest Branch, which, also, in co-operation with the Department of Public Works, burned a great many miles of slash along public roads. Such inflammable debris constitutes a serious fire menace as long as it is allowed to remain undisposed of.

The Forest Branch, in co-operation with private land owners, secured the burning of quantities of slash created by road and railroad construction through private lands. It was a condition of the charter of the railways now building through the province, aggregating 1,800 miles in length through timbered territory, that where timber is taken from Crown Lands for construction purposes, the slash shall be piled and burned, scattered and burned, or lopped, according to the direction of the forest officers. This was done over an area of nearly a quarter of million acres.

About one hundred and twenty timber sales are completed or under negotiation with private companies, both lumber and pulp companies, and brush disposal is an important provision of each timber sale contract. Specific information is being collected by the Forest Branch as to the cost of brush disposal, but it is too early as yet to make definite announcement of the results.

The Massachusetts Forestry Association offers prizes for the revival of tree planting in the State, the prize to go to the town or city which properly plants this spring the greatest number of shade trees on its streets in proportion to its population. The prize is a novel one, consisting of the planting of one mile of street or road or an equivalent, by the Association, in the precincts of the winner.

Under the auspices of the National Lumber Manufacturers' Association a Forest Products Exposition will be held in Chicago April 30 to May 9, 1914, when the exhibits will be moved to New York and be displayed May 21 to May 30.

Merritt Berry Pratt, deputy supervisor of the Tahoe National Forest, has been appointed assistant professor of Forestry in the University of California, in the new department of forestry to open next autumn.

Frederick E. Olmsted announces the removal of his office from 21 Lime Street, Boston, to 255 California Street, San Francisco, where he will continue work as a consulting forester.

COMMENT.

An insert published with this issue is to correct a number of errors which have occurred in the previous volume arising from the use of an erroneous factor of conversion from metric into foot board measure.

This leads us to make some observations on points to be considered when handling and especially when converting German figures into our measure. In the first place the forester should realize early that all his measurements (except in some special scientific work) are merely approximations to the truth and mostly averages. Hence it is ridiculous to attempt to be accurate to tenths, hundredths, and even thousandths. Fractions are almost invariably unnecessary, a rounding off to full figures is almost invariably preferable, and often a rounding off to tens, hundreds and even thousands is nearer the truth than a statement to units. For instance, a statement of the forest area of a country to units is really ridiculous, for there is no survey accurate enough to permit such a statement. Here accuracy to thousands of acres will convey to the reader better than a more detailed figure the status of things. To be sure, when a single forest property is concerned in a commercial transaction, it is quite a different matter.

Still more ridiculous may become attempts to state with painstaking accuracy relationships, as for instance yield table statements, especially if expressed in board measure, say to the foot. Not only do we know that the original measurements are capable of widest variation, but the variety of standards and log rules is such that a statement to hundreds and even thousands is all that we may accept as within the limits of attainable accuracy. Hence why burden the reader with the untruth contained in the closer figures?

The painstaking accuracy is particularly ill advised when translating statistics and other data from foreign measures into our own, for the simple reason that not only do the data themselves partake of the same uncertainty (although sometimes not to the same extent) as our own, but the conversion factors for practical handling are, for practical reasons, shortened, introducing an additional source of variation; hence rounding off is still more justified.

The rounding off, to be sure, must be done with judgment and such judgment is in part based on the use to which the figures are to be put, and the character of the measurement involved. If you convert kilometers into miles, it would be foolish to work out a translation to feet; if tree heights are involved an approximation to say five feet may still be acceptable when timber is involved, but if seedling growth is to be investigated the statement may be needed to even fractions of an inch.

Still more judgment is required when attempting translations of assortments into other assortments, especially into feet board measure, for the foot board measure in itself is an entirely uncertain quantity when applied to the round log, depending on the size of the log and the log scale used. An article in this issue throws interesting light on this phase. Even the German figures, although they appear as definite cubic measure are variable in their meaning, since the standard of classification is variable from State to State, from time to time, and, to some extent, from species to species (taper!). German yield tables state quantities in cubic meter (at 35.336636 cubic feet) per hectare (2.47114 acres); hence 14.3 will be the factor by which to multiply to make cubic feet per acre. The statement will be either for all wood including brush, or else only for "stout wood" or "timber wood" *(derbholz)*, leaving out the brush with a diameter of 7 *cm* or less, i. e., including all the wood, branches as well, of more than 2.7559...inches.

Here we may stop to point out that it is of little if any value to set the limit for conversion at anything closer than the round 3 inch, for the quarter inch or so less does not approximate the truth any closer than the round figure, as will be readily admitted by those who measure diameters by two-inch classes.

The brushwood per cent., which, of course, in the young age classes is 100 varies with age, species, and site, hence a direct translation from all wood to timber wood is not possible without a brushwood per cent. or else sawlog percent table.

The "stout" or "timber" wood is by no means log material for mill purposes, but includes cordwood, etc.: it is merely the useful wood, as it would be with us where fuelwood is saleable. *Locality* also influences the translation!

What we would call *logs* in German usage must be over 14 *cm* (5.5 inch) measured at 1 *m* from the smaller end; this we can readily round off to 5 inch at the small end, and if it were stated at 6 inch it would also not be egregiously wrong, and for Eastern conditions at least we could accept either as standard. Unfortunately, few German yield tables contain this differentiation into saw logs, the statement of generally useful wood production satisfying the German forester. Even those yield tables which make this differentiation, like Schwappach's, do not state them in the simple board measure statement but, by percentage of the stout wood product, in a classification which must be understood, but is too complicated to elucidate here.

The first thing that must be recognized is that *it is absolutely impossible to construct one conversion factor that is applicable for translating a whole yield table into board measure*, for the simple reason that from decade to decade, from site to site, from species to species the log per cent. varies. By using one and the same conversion factor we come to the evidently *absurd result, that a 10-year-old, or 20- or 30-year-old stand contains feet board measure, i. e. saw logs.* It is not even possible to secure a single conversion factor which can be used for the same species at the same age, because different sites will vary in their log production in a given time. We must then have different conversion factors for given conditions, the variation being due to a variable log content.

Taking the Scotch Pine at 100 years, a usual rotation, the percentages of log material run from site I to site V: 71, 60, 36, 18, none. These percentages may be increased by material taken from thinnings and otherwise by a small amount.

Taking Schwappach's yield table for Scotch Pine, we find that considering only the logs of the main stand on a first site no logs are found before the 50th year. In the 50th year 9 per cent. of the stout wood produced are recorded and then from decade to decade the percentages are 20, 40, 53, 64, 71, 79, 84, 90, 90. That is to say after 130 years there is no change in log wood per cent. The corresponding conversion factors run ($\frac{14.3}{124}$ x per cent.): .02, .04, .06, .074, .081, .09, .097, .104. Who will average these variables for translation of a whole yield table! We see then that a direct translation from cubic meter per hectare to board feet per acre is impossible except by referring to stated conditions.

Yet it is desirable to have some data for rapid comparison, and such we may secure by averaging conditions, somewhat as follows. On better sites in old timber 60 per cent. of saw timber, and 40 per cent. for poor sites; for medium old timber (80 to 100 years) 50 and 30 per cent. respectively; for young timber (below 80 years) 40 per cent. on good sites and 20 per cent. on poor sites, keeping in mind that poor sites have often hardly any saw logs before 60 to 80 years. The corresponding conversion factors would then be reduced to say .05-.07; .03-.05; .02-.04 for the three different positions, using the lower figure for poorer conditions. Since most of the rotations of German forests circle around 100 years for statements of final yield, the likely saw log output found by using the factor .06 will probably hit the average of yields including thinnings, the average product at that age being 40,000 feet board measure, with a maximum of over 100,000 feet and a minimum of say 2,500 feet.

The Biltmore bubble is burst! We do not intend to convey any invidious insinuations on the enterprise by this alliteration, but only to express in the picturesque language which the director of the Biltmore school would be apt to use the cessation of a picturesque institution. Dr. Schenck has written himself its picturesque obituary, and in doing so has departed from the usual mode of obituaries, which are built on the maxim *de mortuis nil nisi bene,* by giving a slap to its graduates. He insinuates and complains that none of them "had made notable successes," that they "did not make any striking successes," that "none had become a live advertisement for the Biltmore forest school," and that they had to "start at the bottom everywhere." This last statement is indeed amusing. What did the director expect? Did he suppose they would start at the top? We can name at least a half dozen of his men who have made good, and a few who are first-class and do not deserve the slap. It is our suspicion that they made good in spite of the school, which was carried on upon mistaken pedagogic principles, when introducing immediately to the practical field without previous fundamental or systematic theoretical training a motley crowd with various degrees of even general education. The lack of quiet study time alone would be inimical to results. For such kind of introduction to a complex practical profession the time, one year, was much too short, and hence a heterogeneous mass of undigested information could in most cases be the only result, except for a few better prepared or exceptional men. What would have been an excellent post-graduate course after the theoretical work had been done was bound to become an impossible pedagogic abortion for under-graduates.

The hunting after practicality before the theoretical foundation is laid is a fad, which will usually revenge itself by short duration. In this respect as in the advertising line, Dr. Schenck tried to outstrip the American notoriety hunter by calling his school the "really American Forest School." He is right, there is "no more need of such a unique school as Biltmore;" it was, as he now admits, "visionary."

There were other reasons why the Biltmore school was not one to recommend itself, which it would lead us too far to enumerate; and there are perhaps other reasons for its cessation than those given by the director.

Dr. Schenck in his obituary gives to the American public parting advice. He calls for an organization for the distinct purpose "of acquainting the American public with forestry as an American business possibility," and in the same breath he declares, that private forests are "not maintained because they cannot be maintained at a profit." He is right in thinking that the task in the woods of introducing forestry methods had better be entrusted to a logger who knows some forestry, but it will be well to have it done under the direction of a forester who knows *some* logging —without necessarily being a logger. It cannot be accentuated enough that the present-day logger in America is in an entirely different business from the forester.

Dr. Joseph T. Rothrock, whom every forester on this continent knows as one of the pioneers in the forestry movement, having reached his 75th year has resigned as a member of the Pennsylvania State Forestry Board, after serving on it for 20 years, although he is still hale and hearty, and active.

Dr. Rothrock was originally a medical man, in which capacity he served during the civil war, then turning to botany and acting as botanist on various explorations, he became Professor of Botany at the University of Pennsylvania. He also gave the lectures, endowed by the Micheaux fund, intended to popularize silviculture, and, when in 1886 the Pennsylvania Forestry Association was formed he was naturally the man to become the leader of the movement. It was the first forestry association that could afford a paid Secretary, and send him through the State lecturing. It is not too much to say that the whole sane, consistent and persistent development of forest policies in Pennsylvania is due mainly to the efforts of Dr. Rothrock. He formulated the original legislation, which established the first governmental agency, and became the first head of the Forestry Division, and afterwards Forestry Department.

Long may he be spared to give his valuable advice to his State!

A very important and very sane re-adjustment of royalties for timber licenses has been embodied in a bill before the legislature of British Columbia by the Minister of Lands, Hon. Wm. R. Ross.

Those familiar with Canadian conditions will recall that six or eight years ago the provincial government of British Columbia disposed of most of their timberlimits under the license system, charging a uniform royalty per M feet of 50 cents irrespective of location; reserving, however, like all Canadian license systems the right, on the part of the Crown, to change conditions. It is evident that a uniform royalty charge for all locations is unfair, and that an arbtrary right of one of the parties to the contract to change conditions is unfair to the other party and immoral, and, on the other hand, that a royalty which does not change with change in timber value is unfair to the people and unbusinesslike.

The Minister of Lands, who was responsible for the establishment, two years ago, of an efficient forest service, has boldly taken hold of the situation and solved the problem of equitable dealing in a most practical manner. In this bill the province is divided into three localities as regards timber dues: the coast territory, where 85 cents per M feet is charged, but only on the better grades, the lower being relieved of dues—a very wise distinction; the southern Rocky Mountain district where 50 cents royalty is charged throughout, but by applying the B. C. log rule as against the Doyle rule, the discrepancy of values is somewhat relieved; the northern interior, where conditions are still quite undeveloped and little activity exists carries a royalty of 65 cents. The government pledges itself for 15 years not to raise royalties for small dimension material, but there is to be every five years until 1955 a revision of the royalties on logs, namely by establishing the average lumber price and adding a certain percentage of the increase, if any, above $18, the present price, to the royalty, namely 25 per cent. at the first revision and increasing percentages at each revision until finally 40 per cent. of the increase is added to the royalty in 1945.

Grading applied in the Coast region is specially taken care of in the bill and a revision for such grading in ten-year periods provided for.

While in this re-adjustment the government does not perhaps secure as much as would have appeared fair had it not in the first place made a disadvantageous bargain, we must consider that as fair a compromise as possible, doing justice to all parties concerned.

It gives stability to the lumber business for forty years without fear of disturbances, and, while we miss provisions for improved forestry practice, at least the financial side of the government interest is better taken care of and changes to introduce forestry methods are at least forshadowed.

With this legislation, if enacted, British Columbia takes the lead in Canada in modern and efficient timberland administration, which by passing into the hands of a forest service promises a final forest management for their future.

In the exuberance of his enthusiasm at having solved the ticklish problem the Minister in a public address is misled into asserting that the principle of such re-adjustment has never been enacted before by any other nation. In this the Minister is misinformed. In Prussia the government rate, under which no timber is to be sold, is adjusted every three years.

CONTENTS.

Volume XII No. 2

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

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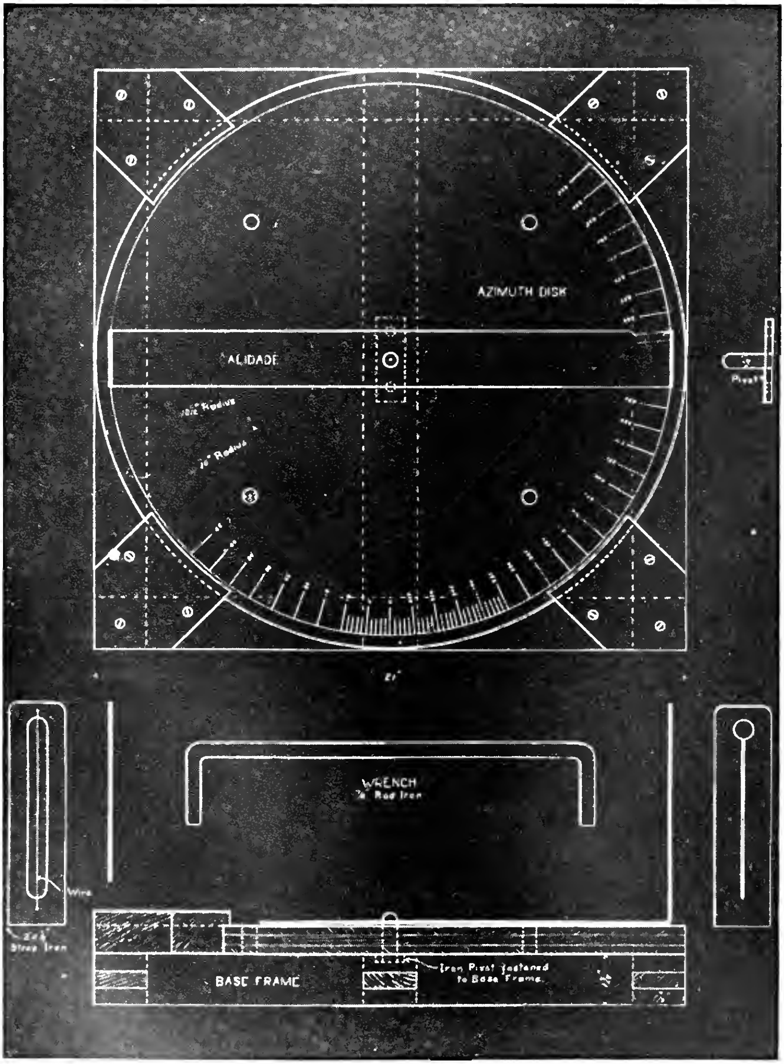


Design of a Range Finder.

FORESTRY QUARTERLY

VOL. XII.] JUNE, 1914. [No 2.

DESIGN OF A RANGE FINDER.

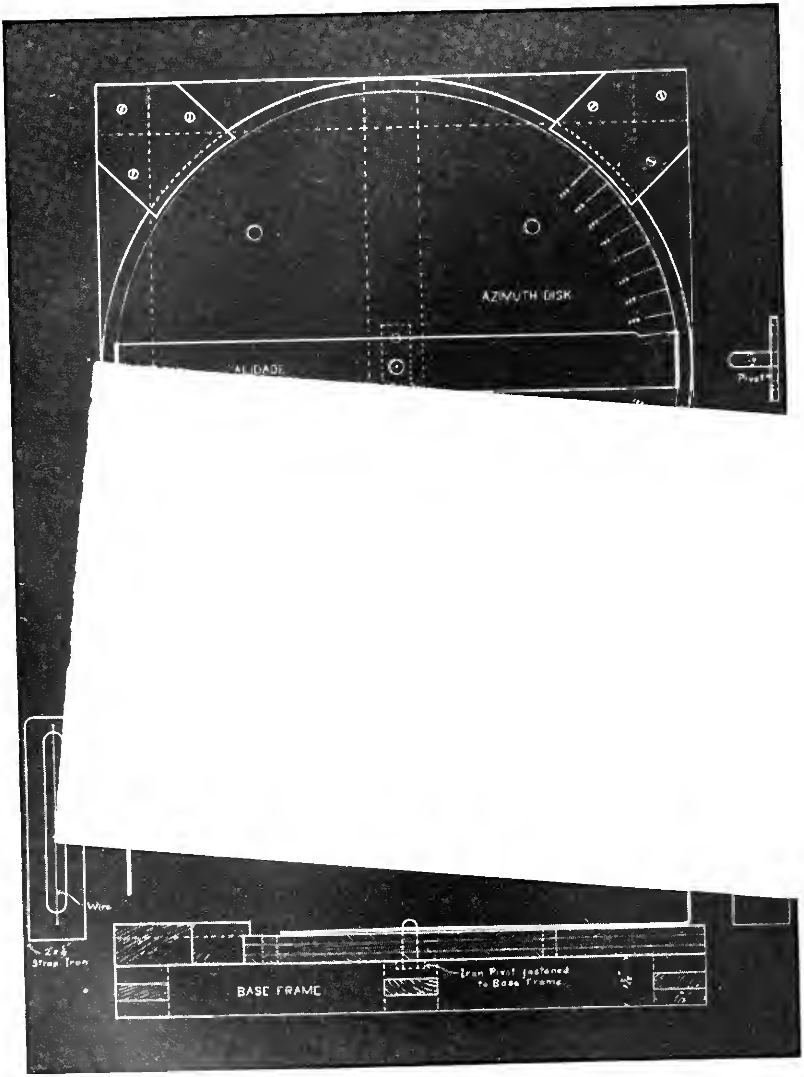
BY LINCOLN CROWELL.

Some time ago, I designed a range finder for lookout stations to be constructed entirely of metal. At present the accuracy and expense of such an instrument do not seem warranted. Therefore I have devised another range finder, which, while quite accurate, is nevertheless cheaply and easily constructed.

ERRATA

On page 137, volume XII read in 8th line: "strap iron" for "scrap iron;" in 19th and 20th lines: "minutes" for "feet."

Upon the circumference of such a circle graduations of 30 feet or 15 feet can be accurately drawn. Five degree graduations are obtained by measuring their natural tangents along the edge of a circumscribed square, and by laying off the single degrees with dividers along the circumference of the inscribed circle. By this method the azimuth circle can be quickly and accurately drawn. The paper disk and alidade are covered with a heavy coat of shellac. When exposed to the weather the instrument is covered by a box with a pitch roof.



Design of a Range Finder.

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DESIGN OF A RANGE FINDER.

BY LINCOLN CROWELL.

Some time ago, I designed a range finder for lookout stations to be constructed entirely of metal. At present the accuracy and expense of such an instrument do not seem warranted. Therefore I have devised another range finder, which, while quite accurate, is nevertheless cheaply and easily constructed. (See frontispiece.)

It consists, first, of a wooden base frame; second, of a disk of three-ply veneer or thin boards upon which a paper azimuth circle is glued; third, of an alidade made of scrap iron.

The azimuth disk and alidade turn about a pivot fastened to the base frame. The disk is turned by means of a U-shaped iron rod, the ends of which fit into holes placed diagonally on the disk. When oriented, the azimuth disk can be secured in place by clamps at the corners of the frame.

The sights of the alidade are cut out with a hack saw. The azimuth readings are made at the right hand edge of the base of the alidade adjacent to the slit sight, where a knife edge is filed on a radius with the pivot.

The most practical diameter for the azimuth circle is 20 inches. Upon the circumference of such a circle graduations of 30 feet or 15 feet can be accurately drawn. Five degree graduations are obtained by measuring their natural tangents along the edge of a circumscribed square, and by laying off the single degrees with dividers along the circumference of the inscribed circle. By this method the azimuth circle can be quickly and accurately drawn. The paper disk and alidade are covered with a heavy coat of shellac. When exposed to the weather the instrument is covered by a box with a pitch roof.

To adjust the azimuth circle:

1. Determine the azimuth of a line between some point that can be seen from the look-out station and the range finder.

2. Sight on this point with the alidade.

3. Turn the azimuth circle until the reverse bearing of the point coincides with the knife-edge on the alidade.

4. Secure the position of the azimuth disk by screwing down the corner clamps.

Last summer, I constructed three range-finders on the plan of the one described, and so far they have proved very satisfactory.

A MECHANICAL TREE PLANTER.

By Forman T. McLean.

A machine which will plant forest trees more rapidly and as well as a man with a mattock can do it, would be a useful instrument to foresters. The device shown in the accompanying diagram gives promise of doing this. It is an invention of Mr. N. P. Jensen, of Ephraim, Utah. It was tested experimentally at the Utah Experiment Station in the spring of 1913, and gave very satisfactory results.

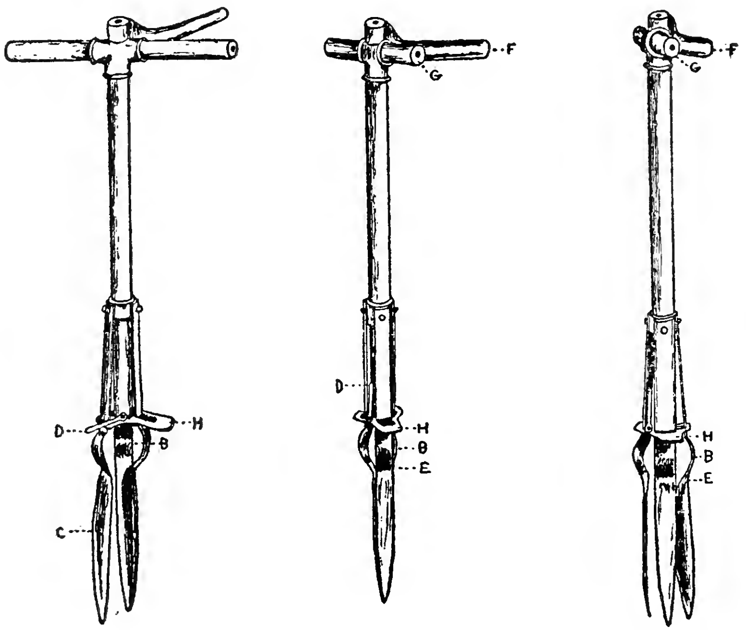
The machine is specially adapted to plant tap-rooted conifers on rough, brushy lands and burns, where hand planting, in holes dug with a mattock or spade, is the method usually employed. The tests made with the machine at the Utah Station were with 30 Western Yellow Pine, 2-year-old seedlings. They were planted in oakbrush chapparal, on a north hillside at 7,500 feet elevation. They are alongside an experimental plot planted by hand to the same species at the same time. The planting was done about May 15. The trees were examined in August, three months after planting, and at that time 28 of the 30 trees planted were alive and growing. They looked as thrifty as the hand-planted trees. The main advantage of the machine is its speed. The 30 trees were set by one workman in a half hour. This is about as rapid as two men ordinarily plant on similar ground, and was much faster than the planting on the experimental plot, to which it was compared.

While the above showing appears favorable, the work was on entirely too small a scale to be conclusive. Several hundred plants were set on different experimental plots with this device in the fall of 1913. These plantings should begin to show results by the end of the field season of 1914.

The operation of this machine is quite simple, as is shown in the accompanying diagrams. Fig. 1 shows the machinery ready to receive the plant. The roots are strung in the groove at A, made by the two blades at the base of the picture. The top of the plant projects into the flare at B at the top of the blades.

With the plant in place, the third blade of the machine, at C, is closed over the plant by raising the lever D. The machine is then in the position shown in Fig. 2. It is thrust into the ground with the foot on the tread H until the base of the flare, E, is level with the surface. Then the machine is rotated in a clockwise direction, meanwhile pulling the lever F at the top of the machine to the handle at G. This opens the blades as shown in Fig. 3, and releases the plant. At the same time the rotating blades thrust soil in around the plant, and thus pack it firmly in a core of earth.

Fig. 1 Fig. 2 Fig. 3

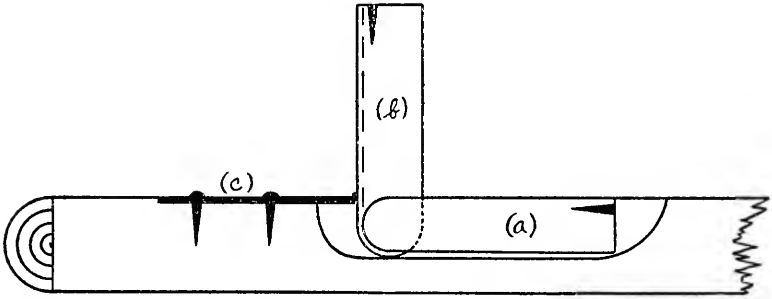


A NEW MEASURING INSTRUMENT.

By H. W. Siggins.

The forester, in his daily work in the woods, frequently has the opportunity to collect odd bits of data or make measurements which might later be of considerable value to him if accurate. Often, too, he desires to have an occasional check on his ocular estimate. It is out of the question for him to be carrying around at all times the several instruments required to make these varied observations. There is seldom a time, however, that a straight walking-stick would seriously discommode him. The idea occurred to the writer that a combination of the Biltmore stick, the Christen Hypsometer, and the Doyle rule in a single stick would solve the problem, since it would be very compact and at the same time would cover quite thoroughly the common requirements of a forester, not engaged in special detailed researches. Such a combination would enable him to measure total height, crown height, merchantable height, or the height of any point on the bole; to measure the diameter of the standing trees at breast height and the diameter of logs at any point; to determine the volume of logs, either by the Doyle rule or by the application of any formula; to estimate the volume of standing trees by measuring the diameter b. h. and merchantable height, allowing for taper, and then referring to the Doyle rule; to make any measurements that can be made with an ordinary yard-stick.

In pursuance of the idea, the Christen and Biltmore stick scales were carefully calculated to hundredths of an inch and transcribed to a suitable stick. The completed instrument consists of a round, hard maple stick, three and one-half feet long and shod at each end with a brass ferrule. The folding arms for the Christen are set in at points approximately 5 and 20 inches from the top. They consist of brass strips 2 x ½ x 1-12 inches, rounded at one end, and provided with a hole through which a nail is driven, hinging the blade like that of a jack knife. Brass seats are set into the wood behind the blades, so as to allow them to open only to a position perpendicular to the stick. A notch on one side of the slot in which the blade is seated and a nick in the blade facilitate opening.



A longitudinal section showing Christen arm (a) folded and (b) extended; (c) is the brass seat.
The distance between the two arms when erected is exactly 15 inches.

At one side of the stick and along the lines connecting the arms is marked the Christen scale, based upon the use of a 10-foot pole and a distance between the arms of exactly 15 inches. It is derived according to the formula:

$$\frac{\text{height of tree}}{\text{height of pole}} = \frac{\text{distance between arms}}{\text{scale distance}}$$

$$\text{or scale} = \frac{\text{height of pole} \times \text{distance between arms}}{\text{height of tree}}$$

The Christen, so constructed, is very accurate up to a height of about 50 feet, and is thus suited to the second growth found in this vicinity. If larger trees are to be measured the same degree of accuracy can easily be obtained to a much greater height by making slight adaptations. For instance, using a 15-foot or a 20-foot pole the reading can be made accurately to 75 or 100 feet respectively by multiplying the original scale reading $1\frac{1}{2}$ or 2. The capacity for accurate measurement could be raised to 100 feet by the use of a 30-inch distance between arms and a 10-foot pole, to 150 feet with a 15-foot pole, or to 200 feet with a 20-foot pole. Since the 15-inch distance between arms is much more convenient to handle in small growth, it might be advisable to put in both 15 and 30 inch Christen (using the same upper arm and putting the scales one on each side of the arms) where the height of trees to be measured varies greatly. If measurements are to be made in a country where 10-foot saplings of weed species are not abundant, a hole might be bored in one end of the stick to receive a piece of chalk, thus providing a method of marking off a 10-foot distance on the tree to be measured. If many measurements are to be made it would be profitable to use a bamboo rod, jointed in 10, 15, and 20 foot lengths.

The scale for the Biltmore stick is printed on the side opposite the Christen arms, using the top of the stick as a zero point. In order to get the scale marks at the proper angle to be in line with the eye, the rule was fastened to a drafting board and the cross-head of a T-square placed against one side. A pin was placed in the shaft of the T-square, 25 inches from the far side of the stick, in other words in the position of the eye. The T-square was then shifted to points half way between the zero point and the point being marked. A thread running from a pin in the zero point, around the pin on the T-square, and thence to the scale point being marked, indicated the course which the scale mark should follow across the stick.

The Doyle rule scale for 16-foot logs and the inches of diameter occupy the remaining space on the stick. The 16-foot length was chosen because it is the easiest to reduce to all other lengths. It is to be noted that the Doyle rule is used on this stick because it is the accepted rule of the region. Any other rule which would fulfill local requirements could be used in its place.

The scales were marked with India ink and the whole was then given two coats of shellac to render it water-proof and to protect the scales from defacement.

The appended tables show the scales that were used.

DATA FOR CONSTRUCTING THE BILTMORE STICK

Based Upon an Arm Length of 25 Inches

Diameter. inch.	*Scale.*	*Diameter. inch.*	*Scale.*	*Diameter. inch.*	*Scale.*	*Diameter. inch.*	*Scale.*
1	.94	16	12.50	31	20.73	46	27.30
2	1.92	17	13.12	32	21.20	48	28.09
3	2.83	18	13.73	33	21.66	50	28.87
4	3.71	19	14.32	34	22.13	52	29.63
5	4.56	20	14.90	35	22.59	54	30.38
6	5.39	21	15.48	36	23.05	56	31.11
7	6.19	22	16.05	37	23.50	58	31.83
8	6.96	23	16.60	38	23.94	60	32.54
9	7.72	24	17.14	39	24.38		
10	8.45	25	17.70	40	24.81		
11	9.17	26	18.21	42	25.65		
12	9.86	27	18.72	44	26.49		
13	10.54	28	19.23				
14	11.21	29	19.73				
15	11.86	30	20.23				

DATA FOR CONSTRUCTING THE CHRISTEN HYPSOMETER

Distance Between Arms = 15″			*Distance Between Arms = 30″*		
Height in feet using a 10-foot pole.	*Scale in inches.*	*Height in feet using a 20-foot pole.*	*Height in feet using a 10-foot pole.*	*Scale in inches.*	*Height in feet using a 20-foot pole.*
10	15.00	20	10	30.00	20
11	13.63	22	15	20.00	30
12	12.50	24	20	15.00	40
13	11.54	26	25	12.00	50
14	10.71	28	30	10.00	60
16	9.38	32	35	8.57	70
18	8.33	36	40	7.50	80
20	7.50	40	45	6.67	90
25	6.00	50	50	6.00	100
30	5.00	60	60	5.00	120
35	4.29	70	70	4.29	140
40	3.75	80	80	3.75	160
50	3.00	100	90	3.33	180
60	2.50	120	100	3.00	200
70	2.14	140	110	2.73	220
80	1.88	160	120	2.50	240
90	1.66	180	130	2.31	260
100	1.50	200	140	2.14	280
110	1.36	220	150	2.00	300

A PROPOSED METHOD OF PREPARING WORKING PLANS FOR NATIONAL FORESTS.

By Joseph C. Kircher.

The writer has seen no recent working plans for private holdings, so that these cannot be criticised. In the Forest Service, however, there has been in the past a great deal of agitation for at least preliminary plans for all of the Forests. To accomplish this, an outline for a plan was prepared and submitted to Forest Supervisors. The preliminary plan was to be based on this outline. A number of these have now been written. A review shows them to be failures so far as the administration of the forest is concerned. On the other hand, the time spent upon them has not been wasted, since they bring together data which will be useful, in writing practical plans.

The outline submitted to Supervisors called for complete information in regard to timber, silviculture, etc. A brief tabulation of the subjects, which is as follows, shows this.

1. Timber.
   Estimates, Descriptions, Forest Types, Timber Operations, Object of management, Silvicultural systems, Regulation of yield, Sales, Free Use, Record of Timber Business, Timber Reconnaissance.
2. Forestation.
   Policy, Areas requiring forestation, Methods and Species, Detailed Plan, Record of Operations, Nursery.
3. Investigations.

A number of subdivisions were placed under each of these subjects. The outline for District 3, which included a number of tabulations, contained 23 pages. With such a formidable array of subjects before them, supervisors were naturally confused, for they could not see that much would be accomplished by the plans. The result was that most of the preliminary plans were simply routine reports, in which the really important points were lost in a mass of details. They were really long reports on past accomplishment. As preliminary working plans they have failed.

They were written, not with the idea of aiding in the management of a forest, but simply as a report called for by the District Forester. After being written they were promptly filed. For example, most of the plans devote much time to silvical and type descriptions and past timber operations. Of the future and of silviculture they say very little. In fact some of them say nothing of this.

On several of the Forests working plans have also been made by specialists. These have for the most part also failed for the same reasons. An added reason for the failure of these plans is that most of them were written with the idea of publication, instead of making them plans, which would actually aid in administration. Plans written so as to be interesting to the layman, will rarely be of actual practical value in the administration of a forest.

The main reasons for the failure of past plans of the Forest Service are as follows:

1. They are long reports and largely silvical.
2. They give in detail unimportant considerations and often slight the important ones (Good silviculture).
3. They fail to take local and American conditions into consideration (Accessibility).
4. They are too academic.
5. They attempt to regulate the yield by scientific and mathematical principles, based on insufficient data without reference to local conditions.
6. They are not practical.

1. They are long reports which are largely silvical. Most of the plans are very long. For the proper administration of a forest, plans must be short and concise since the man on the ground does not care to, nor has he the time to go through a long report to look up some point, say on policy, especially when the greater part of the report consists of silvical data. The important facts and deductions may be hidden somewhere among unimportant details. The result is that the plan is not referred to when it should be. Instead, the Supervisor makes a guess at the point in question.

Large parts of the plans consist of silvical data. Much of this information is known to every man who has been on the Forest for some time. The more technical part of it is not necessary for every day administration. For this reason local men get the idea that the plan contains mainly data which they cannot use. The result is that it is filed and seldom referred to.

Plans to be of use must discard all useless data. The remainder must be a clear cut and concise statement of policy and facts which are essential in administration. It is not the object of the writer to belittle silvical data, because these are of importance. They, however, have no place in the plan proper, but should be separately filed or placed in the appendix for reference.

2. They go into detail and emphasize unimportant details and slight the important consideration.

Plans to be practical should go into details on timber sale and free use policy and silviculture. Yet in the plans submitted, these points are often dismissed after being merely mentioned, while much space is given to silvical data, etc. Such data should be relegated to an appendix. In many of the plans policy and silviculture are disposed of in a page or two, while many pages are written on silvics, etc. This is undoubtedly a mistake, for it makes the plans useless. The difficulty seems to be in the outlines which must be followed.

Fortunately good silviculture has not actually been slighted in the field.

3. They fail to take local and American conditions into consideration.

It must be remembered that the National Forests usually contain the most inaccessible stands in their respective regions. They consist of the timberlands which no one considered desirable before the forests were created, or else they would have passed into private ownership many years ago. This point seems to have been overlooked in many instances. For example, there are plans outlining cuttings, which because of the inaccessibility of timber cannot be made for many years. The consideration of markets has been largely overlooked also. It is a foregone conclusion that without a study of markets an intelligent timber sale policy cannot be established.

There is a further consideration. It is needless to talk of practising forestry until cutting can be done. Until sales can be made, therefore, it is useless to dream of future receipts.

4. They are too academic, i.e., they fail to apply common sense and good judgment in regard to future management.

Aside from the purely silvical discussions, plans have in most cases followed closely European ideas as expressed in books. The trouble has largely been that there was no system of American forestry, and that plans were in many cases made by men of too little experience. The foundation of their forestry education has naturally been European practice. This has been so thoroughly drilled into men that it takes a long time for them to get away from it. For this reason such books as Schlich's have been freely consulted in the preparation of plans. The following of European methods has been done at a sacrifice of sound business judgment.

5. They attempt regulation of yield by scientific and mathematical principles, based on insufficient data without reference to local conditions.

Most of the plans attempt the regulation of the yield, although they are silent on its distribution. The favorite method is by volume based on mathematical formulae. The methods used so far have been nothing less than mathematical slight of hand. The basis of such calculations has not always been sound. Thus, in one case elaborate calculations have been based on timber estimates, which are perhaps 50 per cent. below the truth and upon increment measured on 200 trees in a virgin stand. It is the writer's opinion that the *regulation of the yield on most of the National Forests is at the present time of little importance. The forests are practically all virgin and forestry cannot be practised until many of the stands are cut. The annual cut should, therefore, be based upon local conditions such as markets and accessibility regardless of whether this cut will be larger or smaller than one based on mathematical formulae.* One of the standard European methods may, however, be used as a check.

6. They are not practical, i.e., they do not work.

All of the foregoing discussion tends to show that the plans are impractical for the administration of the forest. This is a fact which has several times been brought to the attention of the writer by Supervisors. If this is true, then a radical change in working plans is necessary.

The time and effort spent upon past plans is, however, not wasted, since they bring together most of the data available in the files of the Forest, so that they may later be used for working plan purposes, and further data may be supplied where the present plans show that there is a lack.

Before taking up a proposed solution of the working plans, the conditions which are met on the National Forests and the Forest Service policy in regard to its timber holdings must be scrutinized. Based upon these two considerations a new working plan system is proposed.

The conditions to be met on National Forests may be considered under three heads: 1. Inaccessibility of stands, and large investments required to open up such areas. 2. Markets (local and export demand). 3. Large stands of over-mature timber.

1. *Inaccessibility.* For the most part the timber controlled by the Government comprises the most inaccessible forests in the country. For this reason it is difficult to place Government timber on the market. In many localities, therefore, no timber can be put on the market until the more accessible private holdings have been cut. In other places, to bring the timber to market requires large investments and, therefore, large logging operations. All of these conditions must be considered in connection with working plans. For example, if because of inaccessibility no timber can be sold from a certain forest for 10 years, it is useless for the working plan to designate certain stands for cut during this period. Or, if the Forest Service desires to sell timber from a certain forest and must sell say 1,000,000 M. feet to justify an investment, it is useless for the plan to prescribe an annual cut of 10,000 M. feet, even if this is the increment plus the per cent. of growing stock which should be cut per annum to give a sustained annual yield. The question is not so much "What should be sold" as "What can be sold."

It must be granted that to practice silviculture, cutting must take place in the virgin stands of the National Forests. If, then, because of inaccessibility, very large sales must be made to place timber upon the market, the plan of cutting must be such as to allow this. In other words, the annual yield will have to be established largely upon what can be and must be done, and not upon the basis of a sustained annual yield.

2. *Markets.* A detailed study of markets is essential before a

working plan is attempted. This is necessary, since, if there is no market for timber, there is no chance for sales. Then again, if there are no sales on a forest and the Forest Service desires to make some, it must study markets to find out whether sales are feasible. The character of the market, competition, etc., will have a direct bearing on sales, and, therefore, upon working plans.

Markets are of two kinds—local and export. Local markets must first be considered. These ordinarily consume a very small amount of the timber. Whether they are small or large, the supply for local consumption must not be endangered by supplying export markets. It is, therefore, important to make a study of local markets, and to predict the local market for some time in the future. If, as is generally the case, there is a large surplus after the local market is satisfied, export markets must be considered. A study of these is of importance, since, if the products of a certain forest cannot enter into direct competition in the general markets with like products from other producing centers, it is useless to try to make sales at the present time. On the other hand, a study of markets may show a very desirable logging chance and a good opportunity for a sale. The working plan should, therefore, recognize the market conditions which exist.

3. *Large stands of over mature timber.* It is desirable to replace the large amount of virgin and over mature stands within the National Forests by young thrifty stands. For this reason it is more important to sell timber even if the annual growth is greatly exceeded than to hold the cut strictly to a sustained annual yield.

An additional argument for the rapid cutting of the over-mature timber on the National Forests is found in the fact that the timber producing area of the United States is being constantly decreased. This will ultimately result in a timber shortage, which will probably not come, as supposed by some, as a sudden catastrophe but in the form of a slowly diminishing supply, to which the United States will adjust itself in part. This condition can be met much more effectively by the National Forests with a young thrifty stand of timber yielding its full annual increment than with old deteriorating material. It is believed that the National Forests can, by extensive cutting of over-mature timber, be converted into good producers before the "pinch" is felt.

Forest Service Policy.

The timber sale policy of the Forest Service, as expressed in Amendment 163 (of March 21, 1913) to the Timber Sale Section of the National Forest Manual (issued December 1, 1911) is as follows:

"Sales of small amounts of timber are preferred and will be encouraged by every means possible. In no instance will more timber be sold under one contract than is necessary to cover the cost of improvements which must be constructed for its exploitation and to permit logging and manufacture under practical and economical conditions. Timber which can be practically logged under Classes A, B, and C sales will be reserved for operations of this size as far as such demand exists. Class D sales, where larger investments must be made and more timber handled, will ordinarily not exceed 75,000,000 feet in amount and five years for removal.

"Where the inaccessibility of the timber requires very large investments for railroads or other improvements, enough stumpage will be contracted to justify the outlay for these purposes and the size of operation necessary to make the enterprise feasible. The cutting period in such instances will be determined by practical logging and manufacturing conditions.

"There are no fixed limits as to the size and period of sales of inaccessible timber requiring expensive improvements. The principle of contracting enough to justify the outlay will govern in each instance. It will, however, seldom if ever be necessary to exceed 1,000,000,000 feet, or a cutting period of 25 years.

Reserved areas.

"In lieu of the sale of a large amount of timber, the contract may specify that certain areas, in addition to the stumpage purchased, will be reserved from sale until the termination of the contract and then offered for competitive bids. A reserve available to the improvements of the purchaser is thus held, while the terms under which it may be bought are left for future adjustment and will necessarily be subject to advertisement and competition in the regular manner. Such agreements to offer additional blocks for sale will be made only in accordance with the plan of management adopted for the unit or watershed concerned. This method will be used where acceptable to purchasers. It is preferred to the sale of larger bodies in the initial contract.

Stable industries encouraged.

In the management of watersheds or other units, the construction of new and competing mills will be encouraged to such a number as can operate for a reasonable period in accordance with prevailing standards in the industry. Private timber available for such plants, both as to situation and ownership, will be considered together with accessible National Forest stumpage. A number of small mills is always preferred to one or two large plants; and wherever the accessibility of the timber and other local physical conditions permit, the development of the industry by small or medium sized operations will be strongly encouraged.

Reservations for future operations.

"As far as practicable, the rate at which timber is sold from any unit will insure a reasonable operating life for new mills constructed in connection with sales. Future sales to establish mills can not be guaranteed, and the National Forest timber will not be administered so as to give particular mills a monopoly; but the amount to be cut from year to year will be regulated, so that established plants, if there are successful competitors for the timber offered, can be assured continued operation for reasonable periods."

In accordance with this policy large sales are being made where timber is inaccessible and requires large investments to place it upon the market. This policy disregards sustained annual yield, but it is justified from a silvicultural standpoint, since without doing this no timber could be placed upon the market. It is also a sound business policy.

*The Proposed Plan.**

The main difference between past plans and the proposed sheme for National Forests is that under the new system, the material is so arranged as to be more easily handled, and that the plans become actual plans of management, which are a live issue of practical value in the administration of the National Forests.

Forest management, sales regulation and systematic silviculture will be carried on by means of:

1. Card records to be kept up to date by annual additions or corrections from the annual plan.
2. Annual plan by Supervisor. This should include any provisions which are necessary in the periodic plan.
3. Maps by specialists (including reconnaissance sheets).

* This follows the informal district instructions to be tried out during 1914 before being put into effect; these were prepared by the writer and Mr. T. S. Woolsey, Jr.

4. An appendix file to comprise all data on silvics, logging, etc. These to be filed by subjects and to be cumulative.
5. Preliminary plan to be made by specialists.
6. Final plan—not to be attempted at present.

1. The card records will consist of all data which are ordinarily tabulated. Tabulations are kept on separate sheets. They include tabulations of areas of types, estimates of timber, sale costs, records of stumpage rates, minimum stumpage prices, timber cut and sold, limitation of cut, lumber prices, percentage of lumber grades, species, etc. These tabluations are kept to date by annual additions to the information. The information for the revision is obtained from the annual plan.

2. Annual Plan. This is made in winter by the Supervisor. It includes the following information: General conditions of the Forest, cost of handling sales, limitation of cut, minimum prices, proposed changes in silviculture manual, recommendations for silvical report, sowing and planting, timber sale policy, seed collecting (to be submitted August 1), working plan modifications, converting factors, free use, timber sale advertising, trespass, timber reconnaissance, new sales proposed, protection of timber resources, stock excluded areas, brush burning and proposed investigative projects.

Under each caption there are sub-heads, which suggest the information necessary and desired. Practically all of the information wanted is data which are called for from Supervisors during the course of the year. The annual plan, therefore, accomplishes two things. It brings together all the information which supervisors must submit to the District Forester during the year, and it gives the Supervisor a chance to bring to the attention of the District Forester in a systematic way certain facts about his Forest, which cannot be discussed in any other place. This plan should be brief, and only subjects in which the Supervisor desires to bring changes or new policies to the attention of his superiors, should be discussed. The annual plan, in other words, is to be a practical business measure. This will also give a chance to remedy any defects in the periodic plan. In other words, if the periodic plan contains anything which is not practical and does not work, the Supervisor here has a chance to remedy it.

3. Maps. These are of great importance, as everyone will

admit. Here should be included type, stand, reproduction, planting and timber sale maps. They should be prepared on a base map showing topography. The type map may show the alienations. Others need not. All maps (or part of them only) may show logging units, inaccessible areas, protection forests and such other necessary data.

In addition to these maps, topographic township plats, section sheets (reconnaissance), and logging unit descriptions will be maintained. These descriptions will be detailed and comprise all forest description data necessary for timber sale work. They will be the most detailed descriptions of the whole plan. The description of each logging unit should be a separate report.

4. Appendix. This will comprise, in separate folders in the files, information of permanent value. From year to year this information should be built up. It need not necessarily be compiled, although all information on a certain subject should be placed in the same folder for compilation in the future. Data on silvics, lumbering, costs, scaling, marking, brush disposal, planting, insect control, etc., etc., will be included here.

5. The preliminary plan. In the past, preliminary plans have been considered by some as mere inventories of resources. They should be more than this, however. This inventory under the plan here proposed will come under the card records and the appendix file. The preliminary plan on the other hand will be a true plan of management for the forest.

The fundamental basis for the preliminary plan is that the forest is the largest unit for the plan, that the plan should not be for over 10 years, that it shall be made by a specialist, and that it should be revised annually.

It has been found that, unless the forest is taken as the largest unit for a plan, so many difficulties arise that the plan is not practical. Separate plans may, however, be made for parts of a forest if they are distinct units, which should be handled separately. The continuity of the stand of timber generally determines this.

Ordinarily, plans have covered a full rotation in a general way and a period of from 10 to 20 years very definitely; that is, plans have been attempted for a complete rotation. The writer considers plans for policies, cuttings, etc., for a period of more than

10 years as mere paper work at the present stage of the development of the National Forests. It is thought, therefore, that to be of practical value they should be confined to a ten year period or even less.

It must be conceded that to be of the greatest value, plans must represent the best thought of the District. Therefore, to secure uniformity and to obviate the need of rewriting much of the material submitted to the District Forester, a special corps of forest plans men must be organized. These men must have knowledge of timber and logging requirements, and at the same time be able to present the data collected in a clear concise and systematic way. In short, they must be practical foresters of a high type. It is not proposed that these men make the plans independent of the Supervisor. On the contrary, the plan should be drafted in closest co-operation with him.

The Supervisor must be consulted on all points of policy, for there should be joint responsibility. Field assistance, necessary to complete the plan, should be rendered by him. Annual revision of the plan is provided for in the Supervisor's annual plan. At the end of the period which the plan covers a new one should be made by a specialist.

The preliminary plan should cover approximately the following points: Introduction (very brief); Markets; Past Lumbering (very brief); Forest types (very brief).

In the introduction the objects of the management should be discussed. This is very important. A discussion, for each important type, of the kind of product desired, with special reference to present methods of cutting, should be given here. Markets must also be taken into consideration. Clear-cut conclusions as to how to attain the ends desired must be drawn.

The silvicultural methods (by type and logging unit) are to be discussed, covering the objects and methods of cutting and protection after lumbering. The plan need not go into details in reference to logging units on which no cutting is probable in the 10 year period of the plan.

The timber sale policy is one of the main points in the plan. Here should be discussed the proposed timber sale business, such as restriction, development, encouragement, location and regulation of sales. It really shows what business is to be transacted and the business policy of the forest.

The free use policy (very important) should be discussed as shown under timber sale policy.

There should be a discussion of yield based on timber sale and free use policy (above) and the fixing of the annual or periodic yield. According to this, yield regulation must be subordinated to silvicultural requirements and to market. It is clearly valueless to impose a limitation of cut, which is impractical, because of the necessity of a large annual cut to justify commercial logging. At least until the over-mature timber is removed the policy of a sustained annual yield need not be applied. Even a periodic sustained yield need not be attempted until it is clearly and positively necessary for reasons of public policy. In other words, it is unnecessary to pursue an academic ideal of sustained annual yield.

In the discussion of the yield problem, however, it will be advisable to check the practical requirements with an academic estimate of the yield capacity by formula, volume, area or such other theoretical checks as can be applied. This will necessitate a short discussion on rotation, which will be based on the class of material which it is desired to produce and not upon financial or volume returns.

Distribution of yield should also be discussed, i. e., areas corresponding to logging units which should be cut in order of importance. The discussion, while it should be practical, should consider these areas both from a silvicultural and market standpoint.

The plan will really constitute in itself a concession that policy and silviculture must overtop *regulation*.

It is not intended that the outline for a preliminary plan should be rigidly followed. It is given merely as a suggestion of the kind of material to be included in the plan. The writer wishes to convey the idea that preliminary plans should be practical and for short periods; that they should be as brief as possible yet omit no essential details; that they should be based on actual local conditions; that they should contain more policy and less theoretical regulation of yield than in the past, and that although the conclusions should be based on silvical facts, these facts need only be referred to and need not be a part of the plan.

6. Final Plans. It is believed that the time is not yet ripe for final plans. As far as the writer is aware, no practical prelimin-

ary plan for a national forest has yet been made. When one of these has proved practical after several years use, it is time enough to talk of final plans.

The system of annual and preliminary plans and other data, described above, has not been put into actual practice. If plans on this basis are attempted a great many stumbling blocks will probably be encountered and during the progress of the work numerous changes may be necessary. It is believed by the writer, however, that the general scheme is sound, and that by following it a practical form of forest management may be established for the National Forests.

The writer intends this article to stimulate discussion on this very interesting, yet most difficult of the problems which the Federal Forest Service has to solve.

STEM ANALYSES.

By John Bentley, Jr.

From the experience gained in instructing several classes in the subject of volume growth in individual trees, it is apparent that the method described in the text books in use in this country is difficult of comprehension by the average student of forest mensuration. As a general rule, the problems of *height growth* and *diameter growth* are handled by the majority of students quite readily, but they frequently have difficulty in mastering the subject of *volume growth* as exemplified in "stem analyses." In searching for the cause of this trouble, it appears that much of it arises from the *form* in which stem analyses are usually recorded in this country; and the object of this discussion is to recommend a more logical tabulation of the data usually included on a stem analysis blank.

It will be remembered that the blanks provided for stem analysis by the Forest Service (Form 334, "Tree Measurements") include a page in which the measurements on each cross-section of the tree are recorded in columns numbered 1, 2, 3, 4, 5, etc., (which represent decades), the values showing the "distance on average radius from heart to each tenth ring." If, as is generally the case, there is not an even multiple of ten annual rings on the section, the measurement of the odd years is recorded under column 1, (since the measurements begin with the innermost period and proceed outward), and from that point on, the difference between the values in any two adjacent columns represents a decade's growth. So far, so good; but when the measurements for the second and subsequent cross-cuts are recorded, the measurements in each case are tabulated beginning in column 1 again; and since there is almost always at least ten years difference in the total ages of successive cross-cuts, and sometimes twenty, or more, the measurement for the *last*, or *current* decade, falls, *not* in the column for the corresponding decade on the previous cross-cut, but in a column *to the left*. Glancing down the numbered columns, then, we find a series of measurements each one of which represents a different decade in the tree's life-history. An example of this method of tabulation is shown in Professor Graves' well known book on "Forest Mensuration," page 264, where the age of the tree at cross-section number 1 (stump) was 60 years, and the last measured radius was consequently recorded in column 6. The age of the second cross-cut was 50 years, and the last measured radius was recorded in column 5, etc. When the volumes of the several sections are computed for different decades there is a very large chance that the wrong pairs of values for cross-sectional dimensions will be selected, because, instead of being arranged one under the other in the same column, the dimensions of the cross-cuts belonging to any particular age of the tree are found in *different* columns, and they must be selected by counting *backward* from the last recorded measurement. This is one point at which the average student has difficulty, and one which can be obviated entirely by the use of a more logical method of tabulating the measurements.

A second point at which there is usually some difficulty is in the *doubling* of the measurements given for *radii,* so as to obtain the corresponding diameters. The form already referred to reads: "Distance on average radius from heart to each 10th ring — inches" and the student not infrequently forgets to double the value recorded for the radius, in order to obtain the diameter. While this may seem like a trivial point, it is, nevertheless, one which often leads to slight errors in doubling, or neglecting to double at all; and when the use of a scale reading 2 : 1 would obviate the necessity of recording radii, and permit the recording of diameters directly, it seems wise to take simple precautions and eliminate the chances of errors, by recording diameters instead of radii. Stem analysis rules as now made by instrument-makers, usually make readings of this kind easy by supplying two scales,—one graduated to inches and tenths, for measuring diameters, and the other for measuring radii graduated to half-inches and twentieths, but reading as *doubled inches and tenths,* so that radii may be read directly as diameters. The stem analysis blank would therefore read, preferably, over the columns provided for the measurements: "Average diameter of section, by decades," instead of "Distance on average radius from heart to each 10th ring."

A third point,—and one which is a source of frequent errors in computing the volume of the tree at different periods—is the somewhat laborious and involved method of determining the dimensions of the tops (above the last cross-cut), in preceding decades. These tops are generally regarded as cones (see Graves' "Mensuration," page 292), and their volumes computed as such. The difficulty arises in obtaining the heights of the several cones as they appeared further and further within the top, or down the stem, with each preceding decade. The method described by Professor Graves, namely, to take a distance *proportional* to the number of years required to grow the distance between the two sections in question, thus assuming a regular rate of growth for the period, is quite accurate, but it is likely to confuse the student, and has been the cause of more errors in computation than any other one factor, according to my observation.*

In German text books the method described for obtaining the volumes of the tree in preceding decades frequently disregards these small cones, or tips, because the sections into which the tree is divided for analysis are short,—rarely more than 2 meters. The volumes are therefore relatively insignificant. In this country, however, where we have to compute stem analyses from trees where a top of 15, 20, or even 30 feet is left, it becomes necessary to include these tops, and their dimensions at different periods, otherwise the calculated volumes would be inaccurate to such a degree that they would be of no scientific value. Some way must be devised, therefore, which will yield accurate results, and at the same time will be readily understood and applied by the student.

In the hope of simplifying the work of making and recording stem analyses, and eliminating some of the obvious causes for mistakes in the calculations, the following suggestions are made. Nothing new or original is claimed for these suggestions; on the contrary, they have all been prompted by a perusal of the standard German text books. They are presented here simply for the purpose of showing how the work may be made more logical, and

* It has even led to an error in the very example chosen to illustrate the method (page 291 in "Forest Mensuration"), where, in the computations for the tree as it was 30 years old, the length ascribed to the tip is 4.75 feet. Since the tip at that age comprised 10/16 of the length of the section (10 feet) it should evidently be 6.25 feet, and not 4.75 feet, as printed.

at the same time more comprehensible to the mind of the average student of forest mensuration.

First, as to the methods of tabulating the measurements taken in the field. Figure 1 (page 162) shows a revised form filled in with data from a White Pine, in which the usual measurements are recorded, together with a few additional ones which will render the computations in the office less liable to error. For convenience, the spaces in which the measurements are recorded are both named and lettered, to correspond with the following list; and in the discussion which follows the several columns will be referred to by letter.

(a) The number of the section; the stump being considered No. 1, the top of the first log section No. 2, etc.
(b) The age of the section, i. e., the age up to that section, and the number of annual rings on that section.
(c) The length of the section, expressed in feet and tenths.
(d) The diameter, outside bark, of each section, in inches and tenths.
(e) The diameter, inside bark, of each section, in inches and tenths.
(f) The width of the bark at each section.
(g) The width of the sapwood at each section.
(h) The average diameter of the several sections, by decades, as explained in the following paragraphs.
(j) The diameter, breast-high.
(k) The total age, obtained as explained in the following paragraphs.
(l) Clear length.
(m) Used length.
(n) Merchantable length.

FIGURE I.

SAMPLE FORM OF STEM ANALYSIS BLANK.

No.........

Locality ....*Date*.....................................*Species* (White Pine) *D. B. H.* (j)
Age 85 (k)

No. of section (a)	*Age* (b)	*Length* (c)	*D. o. b.* (d)	*D. i. b.* (e)	*Width of bark* (f)	*Width of sap* (g)	(h) *Average Diameter of Sections, by Decades.*											
							1	2	3	4	5	6	7	8	9	10	11	etc.
															85			
1	5+80	1.0	22.5	20.5	1.0	1.5	1.3	3.8	6.8	10.9	14.0	16.6	18.9	20.3	20.5			
2	15+70	16.2	18.1	17.3	0.4	1.5		2.4	5.8	9.2	12.0	14.6	16.2	17.1	17.3			
3	29+56	16.2	14.9	14.3	0.3	1.6			0.6	4.7	7.8	10.6	12.5	14.0	14.3			
4	37+48	12.2	12.4	11.8	0.3	1.6				1.6	5.1	7.6	9.7	11.5	11.8			
5	47+38	12.2	9.5	9.0	0.25	1.6					0.9	4.1	6.8	8.7	9.0			
6	52+33	4.0	7.8	7.4	0.2	1.5						2.6	5.3	7.1	7.4			
7	57+28	4.0	5.8	5.6	0.1	1.5						0.8	3.0	5.2	5.6			
8	64+21	4.0	4.2	4.0	0.1	1.2							1.5	3.6	4.0			
9	69+16	4.0	2.4	2.2	0.1	1.1							0.4	1.9	2.2			
(top)	85+0	7.2																
		81.0																

Clear length, ...(l)
Used length, ...(m)
Merchantable length, ...(n)

It must be remembered that the object of stem analyses is to secure figures of volume growth for a given species which will enable us, after compiling a large number of values and averaging them together, to construct a table showing the average increase in volume by decades. That is, it is desired to know what the volume of White Pine, or any other species, will be, under average conditions, at an age of 10 years, and again at 20 years, 30 years, 40 years, etc. Since the age at the stump (cross-section 1) is always slightly less than the true age of the tree, (from 2 to 10 years, often, depending on the stump-height, and the rate of growth of the seedling of the species), and a number of years,—usually determined by a study of seedlings—has to be added arbitrarily to secure the total age of the tree, it is suggested that these years be added *before* the stem analysis is recorded, instead of *afterward,* thereby making it possible to secure results which can ultimately be averaged together with a smaller degree of error. For example, it is known that White Pine seedlings attain an average height of one foot at an age of 5 years; a height of 2½ feet at an age of 6 years, etc. (*); if the stump of the White Pine being analysed is one foot high, it is then determined that 5 years must be added to the age of the stump to secure the total age of the tree, which is entered on the blank form at ("k"), the space provided for it.

Now, as each section is analysed, the rings are counted backward from the bark to the center, beginning at the outside and designating the outermost ring with its proper number, *viz., the total age of the tree,* and *not* the number of rings which happen to be found on that section. Thus, if the total number of rings at the stump is 80, and 5 years are to be added for a stump one foot high, then the outermost ring on the stump will be counted "85" and the next one inside "84", etc., counting backward, and placing a mark at the even decades, 80, 70, 60, 50, etc. In like manner, the outermost ring on all subsequent sections will be called "85," and the counting proceed backward, until the center is reached, marking each decade as before.†

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* Values are taken from U. S. Forest Bulletin 22, "The White Pine," by V. M. Spalding and B. E. Fernow, page 28.

†If it is preferred by some to count from the center outward, the number of rings on the section can be subtracted from the total age, and the counting begun at the age obtained. For example, on section 5 there are 38 annual rings; this subtracted from 85 = 47, and the counting may begin

In the column marked "Age" (Column "b") the age should be entered as composed of two values, the first expressing the number of years required to grow to the height of that particular section, and the second, the number of annual rings on that section.

This method of entering the age enables the reader of the form to determine the rate of height-growth very quickly, by simply glancing at columns lettered "b" and "c" respectively.

The form, it will be noticed, is practically the same as that formerly in use. The method of entering the values under "h," however, is quite different from that generally described in text-books, in this respect,—the measurements for all the sections at a corresponding age of the tree *fall in the same column*. That is, if the tree is 85 years old, showing 80 rings at the stump, the last measured diameter,* representing the size of that section in 1914, will fall in column 9, and the size at 80 years of age, in column 8. This is entirely logical, for the measurements of each decade's growth fall in the column bearing the corresponding number. The measurement of the odd years, representing an incomplete *decade,* fall in the *last* column, instead of in the *first* column, as was the case in the method formerly used. If the number of annual rings at the top of the first log (Section No. 2) is 70, the age at that section will be expressed as "15+70," in column "b," and the last measured diameter will be placed, not in column 7, but in column 9, directly under the corresponding measurement for section 1. Similarly, the measurements for the last section, although it shows only 15 annual rings, will be entered so that the diameter of the stem at that point in the year 1914 will fall in column 9. To find the volume of the tree in the year 1914, the dimensions of the several sections are read directly from column 9, where they appear one under the other in their logical order. There is now no chance of selecting the wrong pairs of values in computing the volumes of the several sections, and no chance for errors in doubling the radii, for diameters have been recorded directly. It would appear that one of the great stumbling-blocks to students in computing volumes from

at the pith (center), counting "48," "49," "50," etc., and a mark placed on the even decades, 50, 60, etc. This accomplishes precisely the same result, and obviates the necessity of counting backward, which may be objectionable to some.

*Diameters are recorded instead of radii.

stem analyses could thus be removed by tabulating the data in the manner described. The advantages of recording the data and measurements in this form are obvious, and at the same time the whole arrangement is much more logical, since the measurements for any particular decade all fall in the same column.

The second point,—namely, the recording of diameters directly instead of radii, which will necessarily be doubled later, has already been sufficiently explained, and the advantages are self-evident.

For the determination of the dimensions of the several "tips" or "tops" or "cones," which appear as we trace the history of the tree from decade to decade, (which was the third source of trouble mentioned), it is recommended that the graphic method be employed. It is a simple matter to plot the height on age by taking the values given in columns "b" and "c"; and once a curve has been drawn connecting the several points plotted, the height of the tree at an age of 10 years, 20 years, 30 years, etc., etc., can be read directly from the curve. For example, the data in columns "b" and "c" give the curve shown in *Figure 2,* (page —), and from this curve it is easily learned that the height of the tree at the age of 50 years was 60 feet. The top of the tree, then, at the age of 50 years, fell between sections 5 and 6; and the length of the cone which had a base of 0.9 inches diameter (column 5, under "h," and opposite section 5) at that period, is obtained by subtracting the height of section 5 from the total height of the tree at that age,—that is, 60-57.8 feet, or 2.2 feet In like manner, the heights of the other small tips, or cones, can be just as readily found for any and all other decades.

As a test of the accuracy of this method when compared with the old method, the calculations were carried out for the volume of the tree at every decade, by both methods, and the results are shown graphically in figure 3. It will be observed that the plotted values fall at different ages,—those by the new method falling at the ages of 10, 20, 30, 40, 50, 60, 70, 80 and 85 years, while by the old method they occur at the ages of 5, 15, 25, 35, 45, 55, 65, 75 and 85 years. When the two curves are drawn, they are found to coincide throughout their whole course. This proves the accuracy of the new method, and its adaptability to any age tree.

While the introduction of any departure from a method which has long been in general use is almost always regarded with more or less skepticism, it should be remembered that any innovations tending to simplify the work of the student, especially if they are very obviously more logical, should be acceptable. It is hoped that this method of recording a stem analysis, and the method used for obtaining the dimensions of the tree at different decades, will lead to a clearer understanding of the principles of volume growth in individual trees.

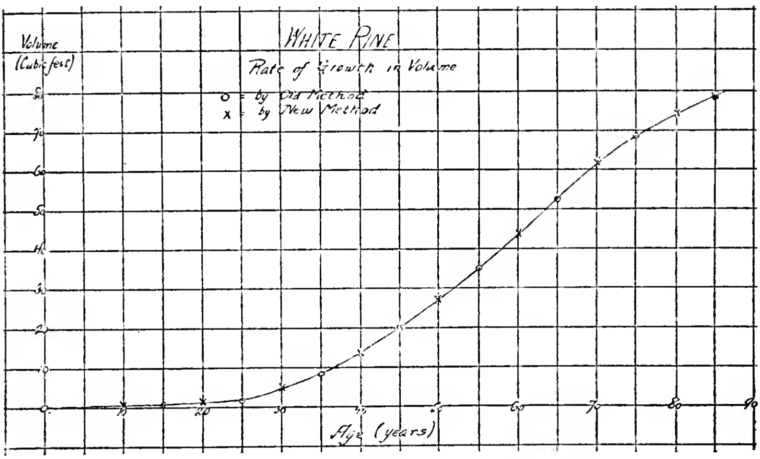

Figure 3.

ERRORS IN ESTIMATING TIMBER.

By Louis Margolin.

A timber estimate, at best, is an approximation of the actual amount of timber on the ground. The very term "estimate" indicates this. The accuracy of the approximation will depend on the accuracy and the intensiveness of the estimate, though the true error involved can never be determined because the actual volume can never be determined with absolute accuracy.

The sources of error in timber estimating may be divided into three classes, as follows:

1. Errors inherent in the method of estimating used. It stands to reason that if the principles on which any system of timber cruising is based are fallacious, the results obtained will be inaccurate, no matter how carefully the work is done.

2. Errors in the application of the system. The system of estimating used may be sound in principle, yet if it is not applied accurately, the results will not be correct. Personal mistakes, carelessness and negligence, as well as errors due to the use of unreliable volume tables, come under this heading.

3. Errors involved in making an estimate on only a small part of the area. Even if the system used is correct and it is applied carefully, there may still be errors in the estimate due to the fact that the cruise does not cover an extensive enough proportion of the area to which it is applied and the proportion covered is not representative of the rest of the area.

This paper will confine itself largely to the last mentioned source of error.

It is hardly necessary to enter here into a detailed discussion of the different methods of cruising timber. With the exception of a very few systems of ocular estimating, most of them are based on a per cent. estimate. That is to say, only a given per cent. of the area is measured and the content of the entire stand is obtained by proportion. Other things being equal, the higher the per cent. of the area actually measured, the more accurate, of course, is the cruise. Still it is only in very rare cases that a 100 per cent. estimate is practicable. The usual cruise covers either 5 or 10 per cent. of the area.

The accuracy of any given per cent. cruise will depend:

1. On the uniformity of the distribution of the timber. The more evenly distributed the timber, the more accurate is the estimate, because the sample areas measured are then most likely to be representative of the entire forest.

2. On the size of the area to which it is applied. While a 5 per cent. estimate may give very inaccurate results when applied to a single "forty," it may give quite satisfactory results when applied to an entire section, because the errors in the estimate of the individual forties are then compensating, the cruise on one being too high and on another too low.

Assuming that a given system of estimating is correct and that its application is faultless, the question arises: How small a per cent. of area is it safe to estimate to obtain a satisfactory cruise of a given stand, and for a given per cent. cruise how small an area can it be safely applied to?

Some light on this question has been thrown by work done in California by the Forest Service during the past year. Here a complete 100 per cent. estimate was made on 2200 acres of forest. By comparing a 5 per cent. and a 10 per cent. estimate on the same area with the 100 per cent. cruise, the errors involved can be determined and studied.

The area of 2,200 acres on which the test was made consists of two parts; one, an area of 640 acres on the Plumas National Forest, and the second, an area of 1,560 acres within the Yosemite National Park. On the Plumas, the work was done primarily for the purpose of determining the relative accuracy of a 5 per cent. and a 10 per cent. cruise. In the Yosemite, the test was necessary for administrative purposes. The two areas will be discussed separately.

The Plumas Area.

The area selected contains 640 acres and is of irregular shape, covering parts of four sections. The stand of timber averaged about 28,000 board feet per acre, and the forest was mainly of the mixed conifer type in which yellow pine and Douglas fir each averaged about one-third of the stand, sugar pine about one-sixth, incense cedar about 5 per cent., the remainder being white fir. Although the topography was not as rough as is typical on most of the Sierra forests, several exposures were represented. The work consisted of:

1. Measuring the breast high diameter of every tree on the area more than 12 inches in diameter.

2. Measuring the heights of a sufficient number of trees for reliable height curves.

3. Running valuation survey strips, one chain wide, at intervals of 10 chains.

The diameters of the trees were measured with Biltmore sticks, checked up frequently with diameter tapes. In order to avoid measuring the same trees twice, the lines were run in strips and the outside strip on every trip was marked with white chalk or crayon. There were 18,072 trees on the area, 12 inches and over in diameter, an average of 28.2 trees per acre. Only comparatively few trees were more than 42 inches in diameter.

It was, of course, impracticable to measure the height of every tree on the area with a hypsometer. A sufficient number of heights of the different species was therefore taken to furnish the data for a reliable curve. Height measurements were taken on over 1,000 trees well scattered over the entire area and representative of all the types and situations found on the area. These were then curved and a local volume table was constructed for each species from the regular District volume tables.

After all the trees on the area were measured and a sufficient number of heights were obtained, the work of estimating the timber was begun. The total tract of 640 acres was divided into five lots, as below.

It would have been more satisfactory to have divided the area into 40 acre tracts, and estimate and compute each forty separately. This, however, was impracticable for various reasons.

Strip lines were run 10 chains apart twice through a forty. By taking only one of these strips through each forty, a 5 per cent estimate of the timber was obtained. By taking the other strip through each forty, a second 5 per cent. estimate was obtained. By combining these two strips, one gets a 10 per cent. estimate. In estimating the timber, the personal equation of the cruiser was eliminated as far as possible. Most of the diameters were measured, the hypsometer was frequently used, and the distance from the compass line to the edge of the strip was frequently paced or measured in order to get the proper width. The crew consisted of the most experienced reconnaissance men in the District.

Table I shows the results of the estimate. The percentages of error have been worked out for each species, for each lot and for the totals.

TABLE I.

PLUMAS AREA.

Comparison of Estimates.

Area.	Species.	100% Estimate Board Feet.	5% Estimate. First. Board Feet.	% Error.	5% Estimate. Second. Board Feet.	% Error.	10% Estimate. Average. Board Feet.	% Error.
Lot A 80 acres	Yellow Pine	718,521	584,800	—19	550,200	—23	567,500	—21
	Douglas Fir	304,545	171,000	—44	628,200	106	399,600	31
	Sugar Pine	278,287	190,000	—32	294,800	6	242,400	—13
	Incense Cedar	73,120	13,200	—82	24,800	—66	19,000	—74
	White Fir	8,436			148,800		74,400	
	Total	1,382,909	959,000	—31	1,646,800	19	1,302,900	— 6
Lot B 80 acres	Yellow Pine	1,100,615	1,150,400	5	980,600	—11	1,065,500	— 3
	Douglas Fir	832,897	693,400	—17	926,000	11	809,700	— 3
	Sugar Pine	389,545	339,600	—13	201,200	—48	270,400	—31
	Incense Cedar	134,849	107,400	—21	96,000	—41	101,700	—25
	White Fir	5,244						
	Total	2,463,150	2,290,800	— 7	2,203,800	—10	2,247,300	— 9
Lot C 120 acres	Yellow Pine	1,262,095	987,700	—22	902,800	—28	945,250	—25
	Douglas Fir	1,431,463	1,515,600	6	798,000	—44	1,156,800	—19
	Sugar Pine	646,234	628,000	— 3	1,081,400	67	854,700	32
	Incense Cedar	325,872	364,000	12	267,800	—17	315,900	— 3
	White Fir	63,879						
	Total	3,729,543	3,495,300	— 6	3,050,000	—18	3,272,650	—12
Lot D 120 acres	Yellow Pine	1,467,544	1,311,200	—11	1,420,000	— 3	1,365,600	— 7
	Douglas Fir	1,219,173	749,800	—38	832,000	—32	790,900	—35
	Sugar Pine	731,322	836,800	15	1,294,600	77	1,065,700	46
	Incense Cedar	304,945	257,000	—13	146,800	—45	201,900	—29
	White Fir	149,937	15,200		28,200		21,700	
	Total	3,872,971	3,170,000	—18	3,721,600	— 4	3,445,800	—11
Lot E 240 acres	Yellow Pine	2,153,465	2,840,400	30	2,541,600	18	2,691,000	24
	Douglas Fir	2,410,881	1,616,000	—33	2,260,200	— 6	1,938,100	20
	Sugar Pine	1,459,038	1,573,200	8	1,872,200	28	1,722,700	18
	Incense Cedar	389,843	207,800	—47	240,800	38	224,300	—43
	White Fir	230,857	122,400		364,600		243,500	
	Total	6,644,084	6,359,800	— 4	7,279,400	10	6,819,600	3
Totals 640 acres	Yellow Pine	6,702,240	6,874,500	3	6,395,200	— 4	6,634,850	— 1
	Douglas Fir	6,198,959	4,745,800	—23	5,444,400	—11	5,095,100	—18
	Sugar Pine	3,504,426	3,567,600	2	4,744,200	40	4,155,900	19
	Incense Cedar	1,228,629	949,400	—23	776,200	—37	862,800	—30
	White Fir	458,403	137,600		541,600		339,600	
	Total	18,092,657	16,274,900	—10	17,901,600	— 1	17,088,250	— 6

There are a number of interesting points in the above table worthy of note. It will be noticed, for example, that in many instances the 5 per cent. estimate gave better results than the 10 per cent. estimate. This is to be expected since the 10 per cent. estimate is the total of the two 5 per cent. strips, and the error is half way between the errors involved in the 5 per cent. estimates. It also shows that a particular cruise line often happens to pass through a stand more typical of the entire area than is represented by the average of the two strips. On the other hand, the maximum error, as might be expected, is very much greater in the 5 per cent. than in the 10 per cent. cruise. Thus, while the greatest error by the 10 per cent. method, considering only the totals, is minus 12 per cent, in Lot C, the greatest error in the 5 per cent. estimate is minus 31 per cent in Lot A.

The totals for individual lots show greater error than the total for the entire section, the greater errors being respectively minus 31 per cent. and minus 10 per cent. in the 5 per cent. cruise, and minus 12 per cent. and minus 6 per cent. in the 10 per cent. cruise.

The individual species, especially on the separate lots, show the greatest error, which in one case amounts to over 100 per cent. When the totals for the entire section are considered, the greatest per cent. of error is plus 40 for sugar pine in the 5 per cent. estimate and minus 30 for incense cedar in the 10 per cent. cruise.

The Yosemite Area.

The check-cruise on the Yosemite tract covered an area of 1,560 acres, located at an elevation varying from about 4,000 to 6,800 feet. The forest consists of a fine stand of timber averaging over 46,000 feet per acre. The species in mixtures are yellow pine 37%, sugar pine 32%, fir 19% and cedar 12%. The topography is quite level and all exposures are represented. The usual types are yellow pine and sugar pine. There were 35,529 trees, 12 inches and over in diameter, on the area measured, or an average of 22.8 trees per acre. Of this number, 491 trees or an average of .3 trees per acre were more than 60 inches in diameter.

The original estimate was made by a crew consisting of nine men, four of whom had had previous reconnaissance experience. Before the actual work of estimating was begun hypsometer height measurements were taken on about 4,000 standing trees on the tract to be cruised. From these data three height curves were constructed for each species, showing the average height of trees of each diameter class on site I, II and III. Cruise strips one chain wide were then run 10 chains apart, giving the 10 per cent. estimate of the area. All trees on the strip more than 12 inches in diameter were tallied by species in 2 inch diameter classes. Trees 32 inches in diameter or less were estimated, but the eye was checked several times a day by taking actual measurements. Trees more than 32 inches in diameter and less than 60 inches were measured by means of a Biltmore stick. Trees more than 60 inches in diameter were measured by means of a diameter tape. Every strip on each "forty" was classified by the cruiser into its proper height class. The result of this cruise was two 5 per cent. estimates which, when combined, gave a 10 per cent. estimate.

The 100 per. cent. estimate was made by a four-men party as follows: One man ran compass and lightly blazed the trees along his course; a second man ran through the center of the strip tallying the trees and watching the cruisers to see that no trees were omitted. The other two men measured or estimated all the trees on the tract and called them out to the tallyman. A strip 2½ chains in width was taken on each trip, which necessitated 32 trips for each section. The height class of each species was determined from the height curves as in the original estimate, the hypsometer being frequently used to check the eye.

Table 2 shows the results of this check-cruise.

TABLE II.

YOSEMITE AREA

COMPARISON OF ESTIMATES

Acres Area	100% Estimate Bd. Ft.	First 5% Estimate Bd. Ft.	First 5% Estimate Per cent. Error	Second 5% Estimate Bd. Ft.	Second 5% Estimate Per cent. Error	Average 10% Estimate Bd. Ft.	Average 10% Estimate Per cent. Error
160	7,315,370	5,520,620	—25	4,886,580	—33	5,203,600	—29
160	6,790,570	5,876,420	—14	4,381,860	—35	5,129,140	—24
160	6,461,450	5,480,560	—15	4,709,880	—27	5,095,220	—21
160	5,757,870	3,774,760	—34	4,183,260	—27	3,979,010	—31
640	26,325,260	20,652,360	—22	18,161,580	—31	19,406,970	—26
40	1,530,480	2,388,840	56	1,475,640	— 4	1,932,240	26
120	5,563,640	6,537,280	18	4,252,250	—24	5,394,770	— 3

	160	7,620,980	8,236,900	8	6,813,700	—11	7,525,300	— 1
	160	7,324,340	9,941,540	36	8,310,160	13	9,125,850	25
	480	22,039,440	27,104,560	23	20,851,760	— 5	23,978,160	9
	80	2,755,150	3,628,100	32	2,979,320	8	3,303,710	20
	40	1,600,440	2,207,540	38	2,203,040	38	3,205,290	38
	40	1,624,490	3,170,840	34	2,292,940	41	2,231,890	37
	40	2,924,100	2,909,300	— 1	5,005,380	71	3,957,340	35
	40	2,833,680	2,638,220	— 7	1,756,540	—38	2,197,380	—22
	40	1,873,360	1,553,220	—17	1,234,320	—34	1,393,770	—26
	40	2,398,840	2,692,480	12	3,102,220	30	2,897,350	21
	40	2,750,900	2,888,180	5	2,853,900	4	2,871,040	4
	40	2,698,760	2,028,940	—25	1,911,960	—29	1,970,450	—27
	40	2,208,220	1,637,240	—26	1,986,860	—10	1,812,050	—18
Total	1560	72,032,640	72,110,980	0	64,339,820	—11	68,225,400	— 5

The above table emphasizes more strongly the points brought out in the first table. To bring them out more clearly the maxima errors have been picked out and listed below, beginning with those occurring on the largest area. Section 16, covering a total of 640 acres, has been omitted from this tabulation because it is a very erratic section and a check on the ground showed that the original estimate on it was very poorly made, being quite unreliable.

TABLE III

GREATEST ERRORS (PER CENT.).

Area Acres	*5 % Estimate*		*10% Estimate*		*Difference between 5 and 10%*	
	Tot. Est.	*By Spec.*	*Tot. Est.*	*By Spec.*	*Tot. Est.*	*By Spec.*
1560	11	17	5	12	6	5
480	23	40	9	37	14	3
160	36	75	25	68	11	7
80	32	116	20	45	12	71
40	71	179	38	111	33	68

The first column in the above table shows the area of the tract considered. The second column shows the greatest mistake found in the total estimate of each tract by the 5 per cent. method, while the third column shows the greatest error in any one species in the tract by the 5 per cent. estimate. Columns four and five are repetitions of columns three and four respectively, but consider only the 10 per cent. cruise. Column six shows the difference between the greatest error by the 5 per cent. and the 10 per cent. estimate, when the total cruise of the tract is taken under consideration, while column seven shows the same for the individual species in each tract.

The last two columns in the table are the true measure of the relative accuracy of the 5 per cent. and the 10 per cent. estimates. It will be seen that when the entire area of 1560 acres is considered the 10 per cent. estimate cuts down the maximum error by 5 or 6 per cent., but when individual "forties" are considered the difference in the greatest error between the 5 per cent and the 10 per cent. cruise amounts to 33 per cent., if only the total estimate is considered, and to 68 per cent., if the individual species are taken into consideration.

The table brings out very clearly the danger of giving out detailed estimates by small areas when only a comparatively small per cent. of the area has been estimated. It shows, for example, that when a 5 per cent. cruise is made and the error is as high as 71 per cent. on an individual "forty" it drops to a maximum of only 11 per cent. on 1,560 acres. In a 10 per cent. cruise the greatest error drops from 38 per cent. to 5 per cent. When individual species are taken into consideration the increase in accuracy by lumping the estimates is still more apparent.

The inaccuracy of the estimate on individual "forties" in the Yosemite tract was no doubt increased by the occurrence of a few very large sugar pines from 70 to over 100 inches in diameter. It stands to reason that where these large trees occur sparingly on a "forty" and the cruise strip happens to strike one or more of them the estimate will be too high; if it misses them the estimate will be too low. In either case the error will be large unless there is a sufficient number of these big trees to allow of a uniform distribution.

It should be borne in mind that the object of the discussion is to show the *relative* accuracy of a 5 per cent. and a 10 per cent. cruise, and that we are therefore not concerned with the actual errors made. It must be remembered also that Table 3 gives the *greatest* errors and is no indication of the actual accuracy obtained by the original cruise.

Since most of the government timber on the National Forests is sold by actual scale, and not by estimate, it would seem that a very careful cruise is not required. However, since the stumpage price charged will depend to some extent on the amount of timber on the area for sale, an accurate cruise becomes of considerable importance. To discover how serious a change in the stumpage price would be made by an error in estimating, two bodies of timber, one in the Yosemite and the other on the Plumas, each containing approximately 300,000,000 feet, were appraised and then reappraised after changing the timber estimate by 5 and then by 10 per cent. It was discovered that an error of 5 per cent. in the estimate would make a difference of approximately 8 cents per M feet in the case of the Yosemite timber, where the appraised stumpage was $3.15 per M. and about 7 cents in the case of the Plumas, where the appraised value was $2.37. An error of 10 per cent. in the estimate will make a differenc of about 20 cents per M. feet in either case. Figuring an average cut of 20,000 board feet per acre, this error means a loss per acre of $1.40 if the error is 5 per cent. and $4.00 if the error is 10 per cent., either to the Government, if the cruise is an underestimate, or to the operator if the cruise is an overestimate. This expressed in terms of per cent. of stumpage price means that an error of 5 per cent. in the estimate will affect the price by 2½ per cent. and an error of 10 per cent. will affect it by 7.2 per cent.

Cruisers estimating timber for private purchasers or sellers as a rule aim to get the estimate within 10 per cent. In other words, a cruiser's work is passable if he comes within 10 per cent. of the actual timber on the tract. Providing his cruising is uniform this would mean an error of 10 per cent. in the value of the timber on the area. It appears advisable, therefore, to spend a little more money in order to get a more accurate cruise.

The following deductions may be safely made from the above discussion and tables:

Assuming that the method of estimating is correct and it is carefully applied, a 5 per cent. estimate will give fairly satisfactory results for an area not less than about 1,500 acres. A 10 per cent. estimate may give fairly satisfactory results for an area as small as a section in extent, but for smaller areas than that even a 10 per cent. cruise is not very reliable. Where more detailed estimates are desired more intensive cruises are essential. The practice of making a 5 per cent. or even a 10 per cent. cruise and then giving out the estimate by 40 acre units is inaccurate and misleading and should be discontinued, especially so since such a detailed estimate seldom serves a useful purpose.

The greater accuracy obtained by a 10 per cent. cruise over a 5 per cent. cruise is entirely out of proportion to the difference in the costs, and it appears to be good business therefore to make the more intensive cruise, especially where detailed figures are desired.

EXPLOITATION OF CROSSTIES IN NORTHERN NEW MEXICO*

By Clarence F. Korstian.

The following data on the various operations in the exploitation of crossties are based on the methods employed by a company which has been operating for the past six years in northern New Mexico. The area which is now being exploited lies on the west slope of the Sangre de Cristo Range, at elevations of 8,000 to 11,000 feet above sea level. The lower slopes of these mountains merge into rolling hills and gently sloping mesas. The upper portion of this area is quite rugged, consisting of deep canyons which have steep slopes. Most of the timber is found on the mesas, slopes and ridges. The soil is usually of sufficient depth to cover the underlying rock, so that it does not interfere with logging to any great extent.

Hewn Ties—Woods to River.

The following species suitable for hewn ties are found in this locality: Western Yellow pine *(Pinus ponderosa)*, Douglas fir *(Pseudotsuga taxifolia)*, White fir *(Abies concolor)*, Engelmann spruce *(Picea engelmanni)*, Alpine fir *(Abies lasiocarpa)*, and Limber pine *(Pinus flexilis)*. Western yellow pine, Douglas fir and White fir are the most important species on the area now being cut.

The following defects were found common to Western Yellow pine: stump and heart rot, cat-faces, mistletoe and injury caused by the pine bark-beetle. The cat-faces were caused by fires, occurring from 25 to as much as 100 years ago, and by the removal of the inner bark for food by Indians, a custom which has been discontinued but which seems to have been prevalent 25 to 50 years ago. Trees having stump rot and cat-faces require long-butting, which not only increases the waste but results in a lower grade of ties. Mistletoe and the bark-beetle cause the

*The writer is indebted to Assistant Forest Ranger Wayne Russel for assistance in collecting the data contained in this article.

trees to become pitchy and burly, which renders them difficult to work. Generally, however, western yellow pine is not difficult to work but is heavy to haul. Douglas fir is usually sound, being the least defective of the species used for ties. It makes the most desirable ties because of its durability and lightness, but is not liked by the majority of tie makers because of its hardness. White fir is very soft and easy to work, and for this reason is preferred by many of the tie makers. It is often seriously infected with stump and heart rot. This policy of seldom marking white fir about 18 to 20 inches D. B. H. has been adopted for this locality, because trees above this diameter usually show considerable rot. White fir makes the least desirable tie because the wood is soft, brittle, and does not hold the spikes firmly. When creosoted it makes a fairly satisfactory tie as evidenced by the fact that the railroad company, in this section of the country, accepts white fir ties together with those of the other species without discrimination.

Trees from 10 to 16 inches are suitable for hewn ties, although the tie makers prefer those from 11 to 13 inches. At the lower elevations where cutting is now in progress the trees average 2.7 ties per tree. This figure is kept rather low, due to the marking for cutting of all suppressed and defective trees, from which at least one tie can be made, and the short-boled timber toward the lower limit of the yellow pine type.

Three classes of hewn ties are made; squares, firsts and seconds. The butts of large trees are made into square ties, which are not less than 10 inches on the face, and do not exceed 8 inches in thickness and 8 feet long. First class ties are 8 inches wide, 7 inches thick, and 8 feet long. Only one inch increase is allowed in thickness or length. Second class ties must be 7 inches thick, so long as the log is large enough to permit, and under no circumstances less than 6 inches thick and 6 inches wide. No ties under 6 inch by 6 inch, or over 11 inch by 8 inch, are accepted by the tie inspector.

The company's agreements with all of their tie makers contain a stipulation which states that all timber of the proper size for hewn ties must be cut and if sound shall be made into ties. If not sound, it must be cut into every four feet sufficiently to show the defect. All ties must be smooth and of uniform width and thickness. The specifications further state that all ties must be free from shake, loose knots, rot, score hacks and bark.

The per cent. of the different classes, according to the past season's cut, is approximately as follows:

Class	*Per Cent.*
Squares	8.3
Firsts	35.8
Seconds	52.7
Drys (made from dead timber)	.6
Culls	2.6
Total	100.0

Making. Areas are allotted to the contractors who in turn subdivide them, allotting small areas to subcontractors who are held responsible for the proper utilization on their area. A full crew usually consists of three contractors, about 40 subcontractors, and approximately 100 laborers, most of whom are Mexicans who make their homes in northern New Mexico. From one-third to one-fourth of the laborers are from the State of Chihuahua, Mexico. These are the most efficient and rapid tie makers, each man averaging about 25 ties per day, while the natives average only 18. A few Picuris Indians have worked at intervals but cannot be depended upon for steady labor. An unskilled laborer in this locality receives $1.50 per ten-hour day, without board.

The subcontractor organizes his gang, consisting of from two to five men, and pitches his tent or some simple shelter close to water which may be near his area. The matter of available water has a great bearing on the desirability of any area. It is difficult to get men to make ties in timber that is more than a mile from a spring or stream.

The tie makers or, as they are commonly called, "tie hackers" use the following tools and equipment: one 4 to 4½ pound double-bitted axe and one 12 inch broad axe to each man, and one 5 to 6 foot cross-cut saw, one steel wedge, one light sledge hammer, one 8-foot measuring pole and a bottle of kerosene (to cut the pitch from the saw) to every two men. These are furnished by the tie makers themselves.

Enough trees for the day's cut are notched by the men, working singly, in such a manner that when they are felled any crooks the trees may contain will be perpendicular to the ground. The object of this is to face the tie so that when finished it will lie flat on the ground. Care is also taken with small trees that their greatest diameter is perpendicular to the ground. This gives the ties the widest possible face and necessitates less scoring After the trees are notched two men fall them with a cross-cut saw.

Two methods of scoring are employed. In the more prevalent method followed by the native Mexicans the chopper stands on the fallen tree and with the axe cuts into its side at an angle of about 45 degrees at intervals of about six inches. The Chihuahuans, in scoring, stand at the side of the fallen tree and split large slabs from its side until it is nearly the desired size. This method requires more skill on the part of the chopper but is more rapid and leaves no possibility of the score hacks showing after the tie has been faced. The limbs are chopped off as they are reached in scoring.

In facing, the maker stands on top of the tree in all cases and with the broad-axe works the two faces to their desired size and smoothness. The "cant" or faced tree is then bucked into 8-foot lengths with the cross-cut saw. The unfaced sides of the larger ties are hewn until they become rectangular, making them into squares. The bark is then peeled from the unfaced sides of the remaining smaller ties. As this requires no skill it is often done by boys or apprentices.

The following prices are paid for making the ties: Squares, \$0.14; Drys, \$0.12; Firsts, \$0.10; Seconds, \$0.08.

The average price, including the culls for which nothing is paid, is \$0.09 per tie. The contractors sublet the making at practically the same prices, expecting to make their profit on the haul from the woods to the river.

In timber averaging three ties per tree, two men, making 40 ties in a ten-hour day, will spend 1¼ hours felling, 3½ hours limbing and scoring, 3 hours facing, 1 hour bucking, 1¼ hours peeling. At this rate the average cost of each operation is as follows:

Felling	$0.011 per tie
Limbing and scoring	.032 per tie
Facing	.027 per tie
Bucking	.009 per tie
Peeling	.011 per tie
Total	$0.09 per tie

One man making 20 ties per day of the average grades earns about $1.83 per day. However, loss of time due to getting supplies and inspections and the wear and tear on tools reduces their daily wage to approximately $1.50 per day.

The season in which most of the hewn ties are made is between May first and October first. While the better tie makers prefer to work during the summer, some of the less skillful prefer to work during the winter, because the frozen timber is less liable to sliver, rendering it easier for the less skillful man to make a smooth face on a crooked-grained or knotty tie.

Brush Disposal. All limbs are lopped from tops which are left in the woods. Large limbs are cut up so that when piled the piles are about four feet high and eight feet across. The piles are placed from ten to fifteen feet from the nearest top, tree, reproduction or other inflammable material, except in extreme cases which would work a hardship on the operators. Such cases are left to the discretion of the Forest Officer in charge of the sale. As a rule each tie maker piles his own brush for which the operators pay him $0.03 per tree, or approximately $0.011 per tie.

Skidding, Hauling and Yarding. The contractors are desirous of allowing a month or two to elapse between the time the ties are made and the time they are hauled in order to take advantage of the weight loss in drying. In some cases it is possible for the haulers to drive to where the ties lie in the woods and load them directly on their wagons. Where this is impossible skidding is necessary. Skidding is usually done by a man and one horse. A chain about six feet long having three to four grabs about 18 inches apart is used. The grabs are driven into one of the faces near the end of the tie. Two to four ties are skidded at each trip. Where more ties are skidded at one time an extra chain is needed. With the use of an extra chain three ties are skidded in front and two or more trailers are hooked to the rear of these. The number of ties skidded in a day by one man and horse varies greatly with the distance which they are skidded and obstructions, such as underbrush, rocks, steep slopes, and arroyos. A man and horse can skid 500 ties in a ten-hour day on the mesas, which are comparatively level and free from underbrush, or where the skidding distance is short. In the canyons and on the brushy slopes of the Douglas fir type, or where the ties must be skidded 200 yards or more or where they are scattered, one man and a horse can skid but from 150 to 200 ties per day.

The ties are loaded on wagons which have been lengthened enough to permit two tiers of ties to be piled end to end. An average load for a team of the small native horses is about 25 ties. Ordinarily each man requires about one-half hour to load the ties and bind them on the wagon with a chain.

The average haul from the areas at present allotted the contractors to the yards at the river is about two miles, all of which is down grade over comparatively good roads. For this haul they receive $0.09 per tie for all classes. Subcontracts are let at different prices, varying according to the distance the ties must be hauled and the accessibility of the areas. The haulers receive from $0.05 for the shorter hauls to $0.10 for the longer and more difficult ones, with an average of about $0.065 per tie. The haulers are required to construct all but the main trunk roads, many of which are county roads. The number of trips a man and team can make in one day varies from two on the longer hauls, or where skidding is difficult, to four trips on the shorter hauls or where skidding is easy or unnecessary. One man and team can skid and haul an average of 75 ties per day. At this rate he earns about $4.86 per day actual time, but considerble time is lost due to breakdowns and inclement weather, which considerably reduces the haulers' average wage.

About fifteen minutes are required for the hauler to unload and pile his load in the yard. In piling, two ties are laid on the ground about five feet apart. About eight ties are placed across these forming the first tier. Other tiers are then laid upon these, the ties of each tier being at right angles to those of the tier below. The piles contain about fifty ties each and are placed about two feet apart. The piles are placed as close to the edge of the water as possible, and not more than five piles back from the river, to prevent carrying the ties considerable distances when they are put in the river in the spring.

Each contractor furnishes or rents his own yard. One contractor yarding about 50,000 ties this year paid $50.00 yard rent, or $0.001 per tie. However, as the majority of this year's ties are yarded on rich agricultural land which is under irrigation, this is believed to be slightly above the average annual cost of yarding.

Sawn Ties—Woods to River.

Sawn ties, at present, are being made only from western yellow pine and Douglas fir. The entire operation from the felling of the timber to the delivering of the ties at the river is covered by contract with one contractor, who in turn lets subcontracts for the cutting and hauling of the saw-logs to the mill and the hauling of the ties from the mill to the river.

Logging. The logging does not differ from that of any other small operation in northern New Mexico.

Felling, Limbing and Bucking. These operations are usually covered by a single contract. Only 16-foot logs are cut for which the choppers receive $0.75 per M. feet, Doyle scale.

Skidding and Hauling. Skidding and hauling are included in one contract. On some of the steep slopes it is necessary to skid as much as an eighth of a mile. The length of haul varies from one-fourth of a mile to three miles. The average haul is about one and one-half miles, for which $3.00 is the average price paid.

Milling. The contractor uses a portable mill having a daily capacity of about 10 M. feet B. M. The mill is composed of one 45-horsepower boiler, one 35-horsepower engine (which runs the circular saw, feed and edger), one 6-horsepower engine (which runs the cut-off saw), friction feed with cable, edger and cut-off saw. The cost of this mill is approximately as follows:

Boiler and 2 engines, second hand, ...	$650.00
Mandrel, husk, feed works, carriage and track, new, ...	300.00
Two 60-inch circular saws, new @ $100 each, ...	200.00
One edger, new, ...	250.00

One 30-inch cut-off saw, with attachments,	35.00
Freight and hauling	100.00
Total, ...	$1,535.00

The mill has been used in this condition for five years, and, with considerable repairing, can probably be used for about five years longer.

Moving Mill. The mill was moved a distance of six miles and set up in the winter on a trestle work about eight feet above the ground. The rollway is also on trestle work, and because of the small space available for the mill site, contains an angle of nearly 45 degrees. When the ground thawed in the spring the foundation settled, making re-inforcement of the foundation and re-alignment of the machinery necessary. The water supply failed with the approach of the dry season. In addition to a delay of about a month this necessitated an additional expenditure of about $100.00 for water development.

The angle in the rollway requires the services of an extra man for turning logs, and even then often causes delays. The banking ground for logs is inadequate and it has been necessary to stop logging at times because of the lack of space. The edger is on the opposite side of the carriage track from the saw. The logs used in the trestle work and rollway contain about 20 M. feet, B. M. The trestle work rendered flooring of the mill necessary, and this required 2 M. feet of lumber which would not otherwise have been needed. About 3.5 M. feet B. M. were used in roofing.

The cost of moving and setting up the mill under consideration is estimated at about $600.00, but for the reasons given above, this cost is considered excessive. Another mill of about the same capacity was moved the same distance and set up in this locality for less than $200.00. The contractor expects to be able to cut 4,000 M. feet B. M. at this set. This gives a cost of $0.15 per M. feet.

Sawing. The mill, when running at full capacity, employs, in addition to the contractor who is foreman and filer, the following crew:

1 Sawyer	$4.50	per day
1 Fireman	2.50	per day
1 Man tailing down	1.75	per day
1 Log turner	1.75	per day
1 Ratchet setter	2.25	per day
1 Off-bearer	1.50	per day
1 Edgeman	2.00	per day
1 Cut-off man	2.00	per day
1 Roller man	1.50	per day
1 Lumber piler	1.50	per day
1 Man wheeling sawdust	1.50	per day
Total daily wage	$22.75	
Allowing contractor's wages	4.50	
Total pay roll	$27.25	per day

With an average cut of 10 M. feet per day, the average cost of sawing is $2.72 per M. feet.

Depreciation on Plant. As it is estimated that the mill will have no wrecking value at the end of five years, it is now worth about one-half of its original cost, or $767.50. An annual cut of 2,000 M. feet would require $153.50 to be charged off annually, or $0.07 per M. feet.

Interest on Investment. The present value of the mill and the value of tools, belting and equipment aggregates $1,000.00. With an annual cut as above, the interest at 6% would be $60.00, or $0.03 per M. feet.

Taxes, Repairs and Maintenance. The mill was assessed at $400 or approximately one-third of its valuation by the County Assessor. The taxes at $0.04 per dollar amounted to $16.00 for the year 1912. The outlay for taxes, repairs, files and oil aggregate about $250.00 per year, of $0.13 per M. feet.

Grades and Prices. At the present time the mill-run averages about 60% ties and 40% side lumber. Side lumber is produced incidental to the squaring of a tie cant and the sawing of ties from the heartwood. The percentage of ties is low, due to the fact that the company does not accept sawn ties showing any defect or wane.

The lumber is graded in but two arbitrary grades which run 85% No. 1 and 15% shipping culls. The contractor receives

$7.50 per M. feet for both grades of sawed lumber piled at the mill. The company is able to dispose of a limited amount of lumber for local consumption at $15.00 per M. feet, B. M., for No. 1 and $8.00 per M. feet for the shipping culls. The remainder will have to be hauled 30 miles over rough roads to the railroad at a cost of $6.50 per M. No further consideration will be made of the side lumber since no data is available as to amount that will be disposed of locally and the amount to be hauled to the railroad, but it is thought that the company makes very little profit on the side lumber.

About 65% of the ties are cut 7 inches by 9 inches, 8 feet long; 25% 7 inches by 8 inches, 8 feet long; 10% 6 inches by 8 inches, 8 feet long. With the above percentages and allowing 24 7x9's, 27 7x8's and 32 6x8's per M. feet, B. M., the average is 25 ties per M. feet. The contractor receives $6.00 per M. feet, B. M. for the ties at the mill, or 24 cents per tie.

The average price received by the contractor for the mill run is:

Side lumber @ $7.50 per M. feet. B. M.	40%	$3.00
Ties @ $6.00 per M. feet, B. M.	60%	3.60
Total, ...	100%	$6.60

Summary of Logging and Milling Costs.

	Costs per M. ft., B.M.
Felling, Limbing and Bucking	$0.75
Skidding and Hauling	3.00
Gross Logging Cost	$3.75
Net Logging Cost, allowing 25% overrun, Doyle scale	$3.00
Moving Mill	0.15
Sawing	2.72
Depreciation on Plant	0.07
Interest on Investment	0.03
Taxes, Repairs and Maintenance	0.13
Total Logging and Milling Cost	$6.11
Profit	0.49
Average mill run price received	$6.60
Per cent of profit	8

Hauling Ties to River. The contractor is relieved of the side lumber at the mill, but is required to deliver the ties in the yard, at the river. For this he receives $0.05 per tie. He sublets the contract to two men at $0.04, making a profit of $0.01 per tie or $0.25 per M. feet, B. M. The haul is all down hill a distance of two miles. The haulers average about three trips per day and haul about 30 ties at each trip. At this rate their wages average $3.60 per day. The men hauling sawn ties each earn smaller wages than those hauling hewn ties, but have steady employment.

Hewn and Sawn Ties—Yards to Cars.

Placing in River. The ties are placed in the river when the spring freshet is at its height. About 200 men were employed for common labor at $1.50 per day without board, while 30 Mexican patrons received from $1.75 to $2.50 per day without board, and 10 Americans received from $2.50 to $3.00 per day with board. The head foreman received $4.50 per day with board.

Forty men with a payroll of $70.00 placed 22,000 ties in the river in one day. This gives an average of $0.003 per tie. However, when all things are considered, such as isolated yards, distance of piles from river, depth of water, and current at point where thrown in, it is believed that on the average this cost will be approximately $0.005 per tie.

Driving. About $4,000.00 is spent annually in clearing out the rivers in preparation for the season's drive. Some piles were so placed that the spring freshet carried them away before the drive started. Many of these ties became water-logged and interfered with the driving, causing trouble enough to more than offset what the cost of placing them in the river would have been. The drive proper is quite similar to a log drive in the northeast. On the smaller streams the camp or wongan is moved every few days with a wagon, but on the larger river it follows the men in the boats. A few men were put on the drive as soon as the ties were started. The drive proper started with about 150 men and ended with about 15 men, with an average of approximately 65 men, most of whom received their board. About 80 days were required, from the time the ties were first placed in the river until the rear of the drive reached the boom, covering a distance of about 90 miles. This time was required to break jams, keep the ties moving, place stranded ties in the stream, take out dead heads and remove boulders loosened by the ties.

About 6,000 ties became stranded and water-logged but will be picked up next year. A like number of last year's ties were picked up in their place. The following data is based on a drive of 30,000 ties, as the company considers this an average economical drive. Approximately 3,000 ties were broken in the jams and by dynamiting. It is believed that these ties cost the company $0.28 each at the time they were broken, making a total cost of about $840.00. During the drive damages caused to ditches and land adjacent to the rivers, for which the company is held responsible, amount to about $600.00.

The cost of driving may be summarized as follows:

Clearing river,	$4,000.00
10 Americans @ $3.00 per day, 80 days,	2,400.00
65 Mexicans @ $1.75 per day, 80 days,	7,700.00
Board, 50 men @ $0.50 per day, 80 days,	2,200.00
3,000 broken ties @ $0.28,	840.00
Damages,	600.00
Dynamite and pike poles	100.00
Camp equipment,	250.00
Total,	$17,890.00

This makes the average cost of driving $0.06 per tie.

Booming. The boom is about 800 feet long and is composed of 92 thirty-foot yellow pine logs from 18 to 30 inches in diameter, with an average diameter of about 22 inches. In the case of small logs they are often placed two deep. Two logs are fastened side by side with pieces of cull ties. Often cull ties are spiked on top of the logs. The pairs of logs are fastened together, end to end, about 18 inches apart with large chains passed through the ends of the logs. The logs were hauled by wagon a distance of 10 to 15 miles at a cost of $2.00 per log. The boom is taken out of the river every summer at the close of the loading operations. With such care the boom is replaced about every six years.

Sixteen square cribs hold the boom in place diagonally across the river. Each crib is constructed of about 6 tiers of 16-foot logs about 6 inches in diameter. These are filled with rocks. The construction of each crib required the services of 6 men for about 4 days.

The improvements to be charged off in six years are as follows:

Boom:	
60 M. feet logs, at $1.00 per M,	$60.00
Hauling, at $2.00 per log,	185.00
Boom chains, 100, at $1.50,	150.00
Cribs:	
Logs and hauling,	100.00
Building 16 cribs, 6 men, 4 days, at $1.75,	672.00
Total,	$1,167.00

This makes a charge of about $0.001 per tie on the 1,800,000 ties exploited in the six years.

A canal was dug to a pond about a quarter of a mile below the boom. This provided for the storage of the ties until they could be loaded. The digging of this canal required the work of 20 men for about 25 days, for which they received an average of $1.75 per day, which totaled,	$875.00
A levee was built along the canal and around the pond to keep the ties from escaping in case of an overflow, at a cost of	$3,500.00
The construction of an office, bunk houses, sheds and other outbuildings aggregated,	3,000.00
Total improvements to be charged off during life of operation, 20 years,	$7,375.00

On 6,000,000 ties to be exploited in the 20 years, this gives a per tie cost of about $0.001.

The annual recurring booming charges are as follows:

The services of 10 men and teams for 10 days are required to put the boom into the river. At $3.00 per day for team and driver this cost is,	$300.00
The cost of pulling the boom out each year with teams aggregates,	400.00
A care-taker is kept at the boom camp the entire year, whose salary is about,	480.00
An average of 5,000 ties pass the boom each year and must be picked up along the river below the boom and hauled to the railroad at a cost of $0.10 per tie, aggregating,	500.00
Total,	$1,680.00

This, together with the improvement charges, aggregates $0.008 per tie.

Loading on Cars. The loading is done with the aid of three endless chain conveyors. A six or seven horsepower gas engine furnishes the power for one, while the other two are run by a 15-horsepower upright boiler and engine. Each conveyor is composed of two endless chains about 50 feet long fastened together 3 feet apart with pieces of 4-inch strap iron.

The following crew, not including men along the canal and on the pond, is used for each conveyor:

Four men in car, one engineer or leverman, 1-2 tie inspectors, four men in water at foot of conveyor.

In a 10-hour day 150 men can load 40 cars. As gondolas are used they hold about 300 firsts or, as they are more commonly loaded, 425 firsts and seconds. Each car contains an average of 190 firsts and 235 seconds. About thirty days are required to load the ties working continually, but a longer time is required as the ties arrive at the boom irregularly. About 7 tons of coal and 200 gallons of fuel oil are required to run the engines. The value of the loading equipment is so small that the charge per tie is almost negligible.

The loading charges may be summarized as follows:

Labor:			Per Tie
150 men, at $2.00, loading 17,000 ties, ...			$0.018
Fuel and Oil:			
7 tons coal, at $6.00, ...	$42.00		
200 gals. fuel oil, at $0.15, ...	30.00		
		$72.00	
Oil, 10 gals., at $0.40, ...		4.00	
Total, ...		$76.00	
			0.001
Total Loading Charges, ...			$0.019

It is believed that loss of time and shortage of cars increase this cost to $0.02 per tie.

Supervision. The woods administrative force consists of one superintendent, one bookkeeper, and one tie inspector, whose salaries aggregate about $5,000.00. Since a part of their duties is to administer the grazing of 1,200 cattle and horses and 4,000 sheep and goats on the company's holdings, as well as to supervise the commissaries operated by the company, all of this sum should not be charged against the company's tie operations. A small ranch is also operated on which a portion of their forage and provisions is grown. For the above reasons it is believed that of the $5,000.00 but $4,000.00 should be directly chargeable to the tie operations.

The expenses of the main office, such as salaries of bookkeeper and stenographers, stationery and supplies, and office rent amount to $9,000.00. The total annual charges against supervision aggregate $13,000.00, or $0.043 per tie.

Interest on Capital Involved. The entire 300,000 ties have, at this point, cost the company about $0.33 per average tie. The cost of the annual output is invested for at least six months. The interest on $99,000.00 at 6% for six months is $2,970, or approximately $0.01 per tie.

Stumpage. The timber from which the hewn ties are made is valued at $2.50 per M. feet B. M. The original agreement between the U. S. Forest Service and the company under which timber is being cut contained the following clause:

> "Hewn railroad ties without disqualifying defects whose widest diameter inside the bark at the small end exceeds 12 inches will be scaled."

In actual practice it was found that this would not work out satisfactorily to all parties concerned. In the first place it was impossible for the Forest Officer to be on the ground when all ties over 11 inches by 8 inches were squared to those dimensions. The Forest Officer had no way of knowing from what sized log the tie was made. Secondly, such a clause worked a hardship on the company by causing them to pay for material which they could not use. It was more satisfactory to count all ties in number equivalent to 1,000 feet board measure according to size The squares and faced ties whose largest diameter at the small end was more than 12 inches were counted at 28 per M. feet, B. M., while the other faced ties were counted at 32 per M. feet B. M. 3.5 per cent. of the faced ties were over 12 inches, and were counted by the Forest Officer at 28 per M. This amount is too small to have any appreciable effect on the stumpage value per tie. At 28 per M. feet B. M., each tie is worth $0.089, while those counted at 32 per M. are valued at $0.078 per tie.

SUMMARY

Cost per Tie F. O. B. Cars at Boom

	Hewn Ties				*Sawn*
	Squares	*Drys*	*Firsts*	*Seconds*	*Ties**
Making, ...	$0.140	$0.120	$0.100	$0.080	$0.240
Brush Disposal, ...	0.011	0.011	0.011	0.011	....*
Hauling and Yarding, ...	0.090	0.090	0.090	0.090	0.050
Placing in River, ...	0.005	0.005	0.005	0.005	0.005
Driving, ...	0.060	0.060	0.060	0.060	0.060
Booming, ...	0.008	0.008	0.008	0.008	0.008
Loading on Cars, ...	0.020	0.020	0.020	0.020	0.020
Supervision, ...	0.043	0.043	0.043	0.043	0.043
Interest on Capital, ...	0.010	0.010	0.010	0.010	0.010
Total, ...	$0.387	$0.367	$0.347	$0.327	$0.436
Stumpage, ...	0.089	0.078	0.078	0.078	....*
Grand Total, ...	$0.476	$0.445	$0.425	$0.405	....*

Total cost of average hewn tie, $0.415.

*Cut on Company's own holdings where they make no disposal of brush and no data is available on stumpage.

THE CISPUS BURN.

A Discussion of the Present Condition of the Burn and Plans For Its Improvement.

By E. J. Fenby.

On the second day of September, 1902, a fire of unknown origin, but generally supposed to have been set by a prospector to aid him in his search for metal bearing rock, burned over 73,600 acres of timber land on the Cispus watershed in the Rainier National Forest. The sources of the Cispus river are the glaciers on Mt. Adams and the Goat Rocks, on the summit of the Cascade mountains. The river flows westward in the shape of a sickle for fifty miles to its confluence with the Cowlitz river. The river flows in a northwesterly and westerly direction for 12 miles through the northern part of the burn. There are three separate bodies of timber in the interior of the tract which escaped the fire; they are confined to the bottoms of deep canyons and comprise in all 9,400 acres of land. Practically all the timber on the burn is dead. There are clusters of green trees in coves and other sheltered places and here and there an occasional living tree in the open, but green trees are too few and far apart to serve as seed trees for any considerable area.

The Cispus Valley, through the burn, is from an eighth to a half mile wide, and the mountains facing the valley rise abruptly from the river bottom, from an elevation of 1,400 feet to 5,000 feet or more. Facing the valley the slopes have north and south exposures. The main tributaries of the river, which flow through the burn, run in a northerly direction through deep canyons, the sides of the canyons then have east and west exposures. The rock formation over most of the tract is basaltic and the soil is a loose coarse volcanic ash, locally known as "pumice stone." This increases in depth towards the southwestern portion of the burn which is in the vicinity of Mt. St. Helens, an extinct volcano cone and the source of the "pumice stone." The chief characteristic of this soil is its inability to retain moisture, but although it is deficient in fertility for agricultural purposes it can nevertheless be classed as good forest land.

Three forest types are included in the burn, the Lower Slope, Upper Slope and Alpine. The Lower Slope type embraces 15,360 acres of the whole, and the Upper Slope practically all of the remainder, for the Alpine type is confined to a few rocky mountain crests so small in extent, that they may be left out of consideration.

The Lower Slope Type

The burn included in this type was very heavily timbered before the fire. The stand in the valley would have averaged close to a 100,000 B. F. At present the surface is thickly covered with fallen trees, bark and debris. The bottom land is largely shaded by black-berry briars, growing over the debris and by soft and vine maple, elderberry and along the river banks by cottonwood and willow. There are small scattered areas over the bottom which are restocked by dense stands of Douglas fir and western hemlock seedlings and there is more or less reproduction throughout the whole lower slope type, although it is not dense enough at present to produce a satisfactory stand of timber. The factors which determine the occurrence of the dense patches of seedlings are the presence of seed trees and the condition of the surface. On the best soils in the valley there is generally the least reproduction, for although there may be seed trees present the land was quickly overgrown by vine maple which has so completely shaded the ground as to choke out all the seedlings. On poorer soil the underbrush is not so dense and, whereever the ground is covered by debris, seedlings have become established. The amount and variety depend upon the proximity and kind of seed trees. On account of the thick bark of the mature Douglas fir more large trees of this species survived than either hemlock or cedar. For this reason and because until recent years the seed bed has been favorable to its reproduction the Douglas fir is the predominant species in the young growth. But each year more dead trees, bark and branches are falling and covering up the mineral soil and the conditions become less favorable for reforestation, particularly by Douglas fir. As the debris and logs decay the advantage is given to hemlock for it will germinate in vegetable matter and endure more shade than fir. It is desirable to secure conditions which will result in reforestation by Douglas fir. This can best be done by the use of fire.

Another fire in the burn would increase the area of the seed bed in the valley by a third, and over the whole Lower Slope by a fourth merely by removing the debris. Most of the reproduction now on the ground would, to be sure, be destroyed, but the opportunity for the ground to become restocked after this fire would be greater than it has been in the past. The Douglas fir seed trees which survived the previous fire are large ones with very thick bark and most of them would live through another fire. The damage inflicted upon them would serve as a stimulus to the production of greater quantities of seed.

While it is true that reproduction is generally denser in the vicinity of seed trees yet the seeding of burns in the Lower Slope types is not dependent entirely upon seed trees occurring in the burn. This statement is sustained by observation on many old burns in the surrounding country which have become densely restocked by Douglas fir. An old burn on the mountain side north of Randle on the Cowlitz river, a watershed adjoining the Cispus, was frequently burned over by the early settlers as long as there remained sufficient inflammable material to spread the fire. No veterans remain on the burn but it now supports a dense stand of large Douglas fir poles. Eight miles above on the Cowlitz river, near the Cora ferry, there is a large area of land on the Davis mountain which is completely restocked by Douglas fir saplings 12 years old, although there are no old seed trees on the mountain side and it is a safe assumption that there were few if any when the present stand began. There are no small logs nor litter on the ground, showing that the land was burned over several times. Again, on the Cispus watershed, bordering the burn under discussion there is a tract of very dense Douglas fir poles 20 years old and the old seed trees are not so frequent as one in a forty. There too the forest floor is free from the remains of the primeval forest excepting large tree trunks. All the litter could not have decayed in 20 years. It must have been burned by a series of fires following the one which killed the original stand. Many other similar cases could be cited. Indeed it is a rare occurrence to find a stand of young growth which has reached pole size amid the debris of the former stand.

It would seem then that the proper method to handle recent burns may be in many cases to fire them again to clear away the remaining litter and reduce the fire risk on the future young stand. The fire which kills the green timber usually burns up but little of it. In accessible locations the dead timber may be logged. This results in bringing enough tops, branches, small poles, etc., to the ground to make a consuming fire. In inaccessible locations where it is not practicable to log the dead timber, a period of years must elapse before there will have fallen a sufficient amount of litter and timber to make a consuming fire. The length of time before the conditions are favorable for the second fire depends largely upon the amount of snow and wind in the succeeding winters after the timber is killed.

This particular burn is sure to be set afire sooner or later either by lightning or by the carelessness of one of the many fishermen, berry pickers, or other campers who frequent the valley. In the middle of the summer the entire burn within the Lower Slope type is one continuous mat of dry timber. Each summer all the conditions are favorable for a fire to start which could not be kept under control and each summer a miracle has prevented it from starting. The fire would be a destructive one if it started in the dry season, for with the great heat to be generated by so large a quantity of inflammable material as occurs on the burn the fire could escape into the large bodies of timber to the north, south and west. With this inevitable fire but a few years off, the reproduction now on the ground has no value for it will never reach pole size, and each year the fire is delayed increases the length of time this tract of land is kept non-producrive. This loss may be expressed in figures, for if the expectation value of the soil be capitalized at $50 an acre the interest at 3 per cent. on the value of the 15,000 acres of non-productive land would amount to $22,500 yearly.

There are five private holdings in the burn, a patented homestead, a listed homestead, a shingle bolt camp, a prospector's cabin, and a mining company's property. Two of them present the only difficulties in carrying out the plan to fire the burn. They are the patented homestead and bolt camp. The most valuable asset on the patented homestead is the dead cedar on it, about 2,000 cords, which would be cut if the bolt camp resumed operations. About 6,000 cords remain on shingle bolt sale area, and although an extension of time was allowed, until June 30, 1914, the company seems disinclined to take advantage of it. After the close of the sale the buildings on the sale area revert to the government. They have but a nominal value. The prospector's cabin would not be in danger for he set fire out around it in the spring of 1912. The improvements on the listed homestead consist only of a shack which could be replaced for $50. But the advantage of a fire as a help in clearing the land would so greatly exceed the value of the shack that the homesteader's permission could be secured free of charge. These holdings are all in the valley. The mining property is situated at an altitude of 3,200 feet and the dead timber around it has been cleared away to a large extent, besides there has been a second fire over the property and there would be small risk of destroying it. It is quite likely the miner's consent could be had. The plan depends upon the bolt camp resuming and logging the cedar on the patented land. If the bolt camp does not resume then the only alternative is to purchase the cedar on the patented land or pay an indemnity for the damage. While this would be highly profitable to the Government from a financial standpoint, it would be as a matter of policy out of the question. In addition to these private holdings there is a ranger cabin on the sale area worth $150. This could be protected. There is also perhaps 10,000 cords of cedar shingle bolts scattered over the bottom land but this cedar is so scattering and the cost of logging so high that it could not be sold. The remainder of the dead timber is not merchantable.

It is possible to fire this burn and keep the fire in control and direct its course to a large degree so that it will be confined to serve the purpose and at the same time do no damage excepting to the cedar and fences on the patented land and camp buildings on the sale area. To accomplish this every advantage must be taken of wind, weather and natural barriers. It is not practical to build fire lines there because of the prohibitive cost in such a jungle. The fire could be started at the end of summer after the first few rains of fall. The weather always becomes stormy in the high mountains first, so the fir season ends several weeks earlier in the highlands, than in the lowlands. This is an important fact, for by the time there has been enough rainfall in the valley to prevent fire from running too freely, there has been sufficient rainfall in the mountains to prevent it entirely. So there would be no possibility of the fire sweeping up the mountain sides into the Upper Slope type. It is when fire can get such a run up hill that strong drafts are created which drive it along and spread the fire by sparks in front of the main fire. Besides it is desirable to keep fire out of the Upper Slope type entirely. The fire would be started around the edges of the burn and there would be little danger of it spreading into the green timber for more moisture from the first few rains is retained in the green woods than in the burn. The success of the plan depends largely upon the judgment of the man put in charge of the undertaking. He should have large experience in handling fires and should be familiar with the country. There are several local forest officers who are well qualified and competent for the job. The responsibility of inviting a possible disastrous conflagration in the dry season by permitting the present condition to continue is a greater one than that assumed by the man who would undertake to fire the burn after the close of the fire season. A portion of the burn in the valley is included in the Cispus classification project and if it is decided to list any of the land it would be advisable to fire the burn before the land is opened to entry and avoid additional complications by increasing the number of private holdings.

The Upper Slope Type

The natural reseeding of the Upper Slope type is a much slower process and the problem a more complicated one. A larger number of seed trees is required in this type than in the lower one, and in the absence of seed trees it is sometimes a difficult matter to predict of what composition the coming stand will consist. Fire in the uplands is a dangerous instrument, for the results differ widely. But then the quantity of debris is never so great after the first fire as on the bottom lands, for the timber is smaller and the fires have stronger drafts and burn more of it up. Fire is followed by huckleberry brush and willows. In the eastern part of this burn numerous patches of huckleberry have come in since the fire. When fire recurs frequently, chaparral sometimes replaces the huckleberry brush as is illustrated on Lone Tree mountain, which is a part of this burn and was fired continually every spring for a number of years before the big fire by a homesteader who settled at its base. On this mountain there is three-fourths of a section captured by chaparral, and there are several other patches of it, from 10 to 30 acres apiece scattered over the eastern one-third of the burn. But chaparral is otherwise of infrequent occurrence on this forest, although it might become more common if fire was not suppressed at the higher altitude of this burn. In time, a few Noble fir, Amablis fir or White pine creep into the open spaces in the brush and by shading the brush out and scattering seed the patches slowly become restocked by coniferous trees. There is such an example near the head of the Cispus river. It does not require so long a period for the growth to become established in the berry patches as in chaparral, and on the eastern borders of the burn there are many berry patches which are becoming restocked. A good illustration is found between the forks of Cat creek. There once was a large huckleberry patch at this place as is evident from the numerous old Indian camp ground and burnt logs where the berries were dried, and by remaining bushes. It is now grown up with a good stand of White pine, Amabilis and Alpine firs, saplings about 15 years old. There is no way of determining how long the berries usurped the land before the growth reappeared, though it probably required several decades for the transition. Unexpected species and stands are sometimes found on old burns along the eastern edge of the Cispus burn. The old burns are in a berry country frequented by Indians who in former times burned the country to expand the berry patches. As one Indian expressed it, they used to "burn some country every year, sometimes a little bit, sometimes a big bit." Near the Chain of Lakes there is a pure stand of Lodgepole pine and in the same locality are specimens of both Western larch and Western Yellow pine. This is one of the very few places where these species are known to exist on the west slope of the mountains on this Forest. Fire was undoubtedly the controlling factor in introducing these species so far from their usual range. Reproduction is generally found to start first in moist situations at the bottom of draws and other sheltered places, and it often happens that seed trees survived in such sheltered locations and the reproduction around them is sometimes very dense. On the west side of Juniper Mountain there are deep draws carved out by streams flowing down the mountain; in these draws, especially in those with seed trees, the Douglas fir and hemlock reproduction is excellent. On the dry ridges between the draws White pine and Noble fir form 3% of the reproduction, although there are no White pine or Noble fir seed trees in the vicinity. The ages of the seedlings show that most of them became established during the moist summers. Very few four year old plants were found; four years ago the summer was an exceptionally dry one.

On the burn east of Niggerhead Creek quite a little vegetation has started to grow. It consists mostly of fire weed, cheat grass, willow and huckleberry. Scattered through the vegetation there are a few seedlings but very few, and in the most favorable places there are small patches of good reproduction. Judging by older burns on the localities which nave become restocked, one can expect this tract to become restocked also in the course of time. The growth on the ground affords the necessary protection to young plants from frost and from withering sunlight, but it is quite probable that the tract will not become fully restocked until the seedlings now on the ground develop into seed trees and restock the areas around them.

The prospects for much of the land west of the Niggerhead Creek are not so encouraging. The soil there is very loose and porous and is subject to excessive dryness in the summer. Much of it is totally denuded and where vegetation of any kind appears it is thin and limited to fire weed, wild strawberry and rye grass. Much of this land will have to be restocked artifically.

Assistant District Forester C. S. Judd, commenting upon the above article expresses himself as doubting the wisdom of burning over the area for the purpose of securing a better reproduction. He says:

"If there is already a tolerably good stocking of reproduction over much of the area, I should hesitate to burn it up intentionally merely because it *might* be burnt up anyway before it reached maturity. In any operation of timber growing, we have to take some chance that our investment will be lost; on an area of this kind our chance of loss is merely increased in degree but not in principle. Most studies that we have made of the natural reproduction of Douglas fir show that after every successive fire the reproduction becomes poorer and poorer, and therefore to burn off a tolerably good stand of reproduction with the idea of getting a better one would be fallacious. A very intensive study of a portion of the Yacolt Burn made this last season showed that on most of the area looked over the reproduction was excellent, but it was almost all of 11-year old seedlings. These had evidently sprung either from the seed stored in the ground and not consumed or from seed which survived the fires on trees which were themselves killed. A second fire on this area that wiped out existing reproduction would necessitate artificial reforestation, since it is evident that not enough reproduction is starting from the extremely scattered seed trees to restock the whole area, although surface conditions appear favorable."

BARK DISEASE OF THE CHESTNUT IN BRITISH COLUMBIA.

By J. H. Faull and G. H. Graham.

Early in the summer of 1913 Mr. H. R. Christie of the British Columbia Forest Service sent us specimens of bark taken from diseased chestnut trees growing on the Experimental Farm at Agassiz, B. C., with the information that several trees were dead and others dying. This material was implemented by other sendings and additional information from the Superintendent of the Farm, Mr. P. H. Moore. Naturally the chestnut bark disease was suspected, although at that time it was not known to occur outside the confines of the Eastern States, and no plantings of chestnut trees had been made at Agassiz since 1890, or more than a decade before the blight had been first observed in America. The confirmation of that surmise would have been of peculiar interest just then, because of the bearing it might have had on the discussions relating to the dissemination and eradication of chestnut blight, and on the views held regarding the origin of the causative agent. Happily the latter has since been permanently removed from the bogs of hypotheses. In June, Meyer, who had been prosecuting a search in China under the direction of the Department of Agriculture of the United States reported that he had found a bark disease of a native Chinese species of chestnut, and that the Chinese have been treating their chestnuts for this disease for centuries. A specimen forwarded by him was turned over to Drs. C. L. Shear and N. E. Stevens, who at once isolated a fungus from it, which they have proved beyond question to be identical with *Endothia parasitica,* the cause of chestnut blight in America.* It is noteworthy that the action of this fungus on the oriental species is much less virulent than on *Castanea dentata*.

How long the Agassiz trees have been diseased is not known.

*Shear and Stevens, "The Chestnut-blight Parasite (Endothia parasitica) from China," Science, Aug. 29, 1913. Fairchild, "The Discovery of the Chestnut Bark Disease in China," Science, Aug. 29, 1913.

The only certain fact is that they were quite badly affected four years ago.

The appearance of the material sent us is the same as any that might be collected from diseased trees in the affected areas of the East. There are the same pustules and cankers, and under the bark the same characteristic mycelial fans. Photographs likewise show that there is the same tendency to produce water sprouts below the killed portions of the trees. The pycnospores in respect to color, form, and size coincide with those of the true blight-fungus. No perithecia have been found, and if present at all are not abundant.

Cultures were made on various media. Their characters are those of *Endothia parasitica.* The cultures on potato agar were compared side by side with those of the blight fungus obtained from Pennsylvania, and they were found to be alike. For purposes of identification of the Endothias, potato agar cultures have been pronounced by the Andersons and by Shear and Stevens to be the most distinctive. The latter emphasize one feature of tube cultures as being especially characteristic of the blight fungus, namely a peculiar brassy appearance in the lower part of the tube. They state that "this metallic appearance has been found to be the most constant and reliable distinguishing character of *E. parasitica,*" as it never occurs in the case of closely related species.†

We have found, as stated above, that the potato agar cultures of the British Columbia fungus are indistinguishable from the Pennsylvania material grown alongside, even to this metallic appearance by reflected light. We are further permitted to state that Dr. P. J. Anderson has confirmed our observations. Under date of October 13 he writes, "Your cultures from British Columbia grow like typical *Endothia parasitica* up to the present," and under date of October 25, "I have cultivated on potato agar the form from British Columbia, and the regular strains from Pennsylvania, and cannot tell the difference between them." It

† Anderson, P. J., and Anderson, H. W., "The Chestnut-blight Fungus and a Related Saprophyte," Phytopathology, II, 1912, pp. 204-10, and Bull. 4, Penna. Chestnut Tree Blight Commission, 1913. Shear and Stevens, "Cultural Characters of the Chestnut-blight Fungus and its near Relatives," Cir. 131, pp. 1-18, Bureau of Plant Industry, Washington, D. C., 1913.

thus seems reasonably certain that this fungus is the true blight fungus. Inoculations constitute the final test, and they will be reported on later.

Where the infection came from remains uncertain, though it is significant that a connection with the Orient exists. The chestnuts growing at Agassiz are of Oriental, European and American origin. The stock was purchased from nursery firms located in New Jersey, Ohio and California. One of these at least "was a heavy importer of Oriental trees and shrubs."

REFORESTING CUT-OVER CHESTNUT LANDS.

By E. C. M. Richards.

A large percentage of timber found in the forests near New York City—in Connecticut, New Jersey, Long Island and Southern New York—is chestnut. Most of this is still too small to be cut if the maximum value is to be obtained from it, and the best management would, under normal conditions, advise thinning and postponement of cutting for ten to thirty years. The advent of the Chestnut Blight has, however, made severe damage cuttings necessary over much of this area, and with it a new forest problem has presented itself. What shall be done with the cut-over chestnut timberlands in the blight-infected section of the country? This is a question of importance and it is the purpose of this article to discuss it and if possible, to render some service towards arriving at an effective answer.

There are several points which need to be considered before taking up any general conclusions as to the treatment of cut-over chestnut lands. Among them are the following: What will result if the chestnut sprouts are allowed to grow unmolested? What is to be found in the way of reproduction of species, other than chestnut—oak, hickory, etc.—on the cut-over lands? What will be the result if the cut-over lands are left untouched after the removal of the chestnut? When these questions have been answered then some general conclusions may be reached in regard to the proper treatment of land now producing chestnut.

In order to secure accurate information concerning cut-over chestnut lands, a study was made of the conditions found on such areas in northern New Jersey. The method of procedure in this study was as follows: Sample plots were taken on all qualities of soil where

First: The chestnut had just been cut.
Second: The chestnut had been cut six months before (containing one year's growth).
Third: The chestnut had been removed seven years before.

On these sample plots the number, size and species of every stump were recorded, along with the age and number of the sprouts coming from it and their apparent present condition. In the case of the chestnut, the age, number and size of the dead sprouts and the number and size of the sprouts infected with the disease, but still alive, were also recorded. The number of seedlings of each species was noted down, and with it their height and growth, and in each case where dead sprouts or seedlings were found, the cause of such death was ascertained and noted where possible. Notes on the rock, soil, subsoil, humus, slope and exposure to wind, sun, snow and rain, completed the sheet for each plot. When a sufficient number of plots had been taken the results were tabulated and studied and a good idea of the actual conditions existing on such cut-over lands was obtained.

To make more valuable the results of the study, a brief description of the local conditions influencing forest growth should be given:

The forest land on which the study was made is located in Somerset County, New Jersey, on the extreme Southern boundary of the geological region known as "The Highlands." The rock is entirely composed of granite gneiss of the Archean period. The region is a few miles south of the limit of glaciation and the soils are to a large extent residual, having been derived from the rock upon which they now lie. These soils are almost wholly of a silty loam in texture, containing a slightly lower percentage of silt than silt loam, and, as the subsoil is of the same material and the depth of the bedrock below the surface is fairly great, the drainage is very good. In fact this porosity of the subsoil tends to aid droughts too much during the severe heat of summer. The soil is very thickly intermingled with pieces of gneiss, varying in size from masses weighing several tons to small irregular stones, the usual size being about as large as a saucer. On the hilltops these rock fragments are so numerous as to give an appearance somewhat similar to that found on a talus slope. The average annual rainfall is about 45″ and is well distributed throughout the year. The average temperature for the year is 49° F. The topography of the country is that of a group of rounded hills rising from an elevation of 300 feet above sea-level at Bernardsville to about 850 feet on the highest hilltops. The valleys are often deep and the slopes abrupt, but one characteristic of the region is the absence of rocky outcrops or cliffs. The number of small brooks and springs make the region very attractive and beautiful.

The greater portion of the forest land is found on the upper slopes and tops of the hills, where the presence of so many rocks in the soil renders agriculture impossible. Most of the land is held in the form of large estates, and is used for summer residences and country places.

The forests are almost entirely hardwood in composition—occasional stands of hemlock on steep, cold, north slopes and in ravines, being the only natural evergreen forests found. Three main types of forest exist: 1. the Hilltop; 2. the Slope; 3. the Bottom.

Each type is characterized by the presence of certain species of trees. The Hill-top Type contains a high percentage of Chestnut Oak, *Quercus prinus*, L.—which on account of its exacting light requirements and ability to grow on dry sites, excludes most of the other species. The chief trees of the Slope Type are the Chestnut, *Castanea dentata*—which exists in practically pure stands, with some Butternut—*Juglans cinerea*, and Oaks, and on the lower portions of the type, with some Ash and Tulip. This latter portion of the type is so characteristic that it seems best to call it a sub-type under the name of the Lower Slope Type. The Bottom Type is found only along streams and near springs and it is made up largely of Black Birch—*Betula lenta*, Ash—and Tulip, White Oak, *Quercus alba*, and now and then a Cherry, Basswood or Black Gum. In percentage of area covered, the Slope Type is the largest, and the Hilltop the second, while the Bottom covers only a small portion of the forest lands.

On the sample plots, the total number of chestnut stumps examined was 107. The average number of sprouts on each stump for all three types was so nearly uniform that it may safely be assumed that the site has no effect upon the number of sprouts produced. The average number of sprouts per stump was 21.3 and 5.5 of them, or 26% had already died. These figures are general for the whole area covered by the study, but the majority of the plots were taken, perforce, on areas cut over less than a year previous. From the few plots taken on land cut over seven years ago, nearly every chestnut sprout was infected by the blight and over 65% were dead. On no plot was a chestnut sprout or seedling found, that exceeded three inches in diameter, which was not badly infected by the blight. In fact the conclusion reached after the study had been completed is that only for a year or, at the most, two, are the sprouts and seedlings free from the disease. There is little or no reason to hope for securing an uninfected forest of chestnut, either sprouts or seedlings, as long as the blight continues to remain as virulent as it is to-day.

The second question inquired into the number, variety and vigor of the reproduction of other species occurring on the cut-over lands. In answering this, it seems best to consider each type individually, for in passing from one to another the differences of composition are strongly marked.

On the Hilltop Type the percentages of each species present (chestnut excepted) show, a very marked favoritism for Rock Oak, 44% of the reproduction being of this species. This of course is to be expected from the prevalence of mature seed trees of this species which had been left standing. As to the other species, it was found that 11.8% was Pignut Hickory—*Hicoria glabra;* 6.8% Red Oak, *Quercus rubra,* and 3% White Ash, *Fraxinus Americana.* These were the most valuable of the species found and they comprised a total of 65.6% of the reproduction. The remainder, 34.4%, more than one-third of the total stand, was made up of Red Maple, *Acer rubrum,* Cherry, Butternut, Birch and Sassafras, all trees of little or no value.

On the Slope Type, the Rock Oak was present in large numbers but the more favorable site caused it to be somewhat replaced by other species. Only 22% of the reproduction was Rock Oak, while the total percentage of Maple, Cherry and "others" was 62. This brings out a fact which is of great importance in connection with the regeneration of these forest lands. In passing from the poorest type, the Hilltop, to types occupying the better sites, a decrease in the percentage of Rock Oak is evident. But the loss is made up entirely by inferior species—Cherry, Maple, Butternut, etc.—the better species even losing ground. The remainder 16%, was Red Oak, 6%, and Pignut Hickory, 10%. Adding these to the Rock Oak a total of 38% is obtained which represents the whole of the reproduction present of desirable species.

The Lower Slope Sub-Type is of particular interest, there being a marked change in the composition of the reproduction found upon it from that found upon both of the other upland types. Hickory, Red Oak and Rock Oak combined make up only 8% of the reproduction, while 72% is composed of ash and others. The increase in the amount of moisture and the deeper and more fertile soil of this type account for these changes, but only two species of the "others" so predominating this type are desirable—the Ash and the Tulip. The remainder is made up largely of Birch and Butternut, both of which are undesirable. There is present, however, a fairly large number of seed trees of these desirable species and natural regeneration from seed should be very successful if properly encouraged. If left, however, to the undisturbed occupation of the soil, the competition with the Birch, Butternut and other worthless species will end in producing only a moderate amount of Ash and Tulip. A careful handling of the cutting on this type, therefore, is necessary to secure the best results.

Owing to the fact that the Bottom Type contains no chestnut, it therefore does not come under the head of this article.

Originally the forest on each one of the three types containing chestnut was characterized by one species or group of species. On the Hilltop the Rock Oak, on the Slope the Chestnut, and on the Lower Slope the group designated as "others," along with the chestnut. The chestnut has been cut on the Slope and, except for the Tulip and Ash, the "others" are not good species to encourage on the latter type. Although the Rock Oak is a good species, producing valuable timber, its rate of growth is not rapid and the substitution of a fast growing conifer which could endure the severity of conditions found on the Hilltop Type, would tend to increase the productivity of the forest. It can be seen therefore that, except for the preservation of the Ash and Tulip on the Lower Slope, a change of type in some form appears to be the most logical solution of the problem of handling all of this land. And in changing the type, the predominance of the chestnut, which now is rapidly dying, has left little in the way of species native to the region with which to build up a new forest.

This scarcity of suitable native species upon which to rely for natural reproduction necessitates the selection of some tree which may be satisfactorily introduced, and the White Pine suggests itself for this purpose. But the White Pine has been largely planted for ornament in the neighborhood, and in practically every instance the leader has been destroyed by the weevil, so that the planting of White Pine for forest purposes would not, in all probability, prove successful. Scotch and Austrian Pine are both good species, being of rapid growth and suitable for planting on poor sites, but it has been found that they are not to be wholly relied upon in this country for producing the best results under forest conditions. The native Red of Norway Pine seems to be much more suitable. This tree ranges naturally as far South as Pennsylvania and should be excellent for planting in Northern New Jersey. It is entirely immune from the weevil, grows at approximately the same rate as the White Pine and is well able to thrive upon a poor site. Although the wood is not quite as good for commercial purposes as that of the White Pine, it will make satisfactory lumber for many uses and taking everything into account, the Red Pine seems to be the logical tree to substitute for the fast disappearing chestnut.

In dealing with the planting of Pine on these cutover lands, it should be remembered that for the most part, these areas have been cut clear, the few scattered oaks or clumps of oaks in no way being adequate for the distribution of seed, either in distribution over the areas or in production for distribution. This being the case, artificial regeneration in some form is the only solution to the problem.

The plan of procedure in changing to the Red Pine Type, suggested above, is to plant the pine at intervals of six feet—as nearly as possible—on the cut-over lands, disregarding the presence of chestnut or other stumps, as far as possible. For the first two years or so the sprouts of the chestnut will cover the pine, but within four years the blight will have killed the greater part of these sprouts and with their death, and the resulting opening up of the young stand, the pine will receive more light with a corresponding stimulation of growth. The two or three years partial shading will not seriously injure the young pine, but will keep the forest floor in good condition. In dealing with the reproduction of the other species, which for the most part are undesirable, cleanings can be made as it becomes necessary to allow the pine to come up, but after a few years its rapid growth will enable it to compete with the native hardwoods. On the Lower Slope Sub-

Type the artificial regeneration will be aided to a certain extent by the natural seeding from the scattered Ash and Tulip, while the Rock Oak will likewise be of assistance on the Hilltop Type, but the chief reliance should be placed upon the plantation of pine.

The result of the adoption of the above system of handling cut-over lands will lead to the complete alteration of type in the forests of the region, but now that the chestnut has to go, leaving no suitable native species to take its place, the pine appears to be the best answer to the problem of how to reforest the areas denuded by the Chestnut Blight.

THE ADMINISTRATION OF A FOREST EXPERIMENT STATION.

By G. A. Pearson.

The creation of nine forest experiment stations during the past five years has given rise to a new form of administrative work in the Forest Service. The principles and many of the specific regulations laid down in the National Forest Manual apply to experiment stations as well as to National Forests; but the administration of an experiment station is more specialized, and in many ways quite different from that of a National Forest. While the experiment stations in the various Districts of the Forest Service are affected by different local conditions, it is believed that the administrative problems have been sufficiently similar to warrant a discussion of the subject on broad lines, with the object of developing policies of general applicability. This article is based upon five years' experience as director of the Fort Valley Experiment Station. Undoubtedly many of the problems which have arisen here have been met and solved at other stations, perhaps in different ways. It is hoped, therefore, that this article will stimulate discussion from experiment stations and the Service in general.

The administration of a forest experiment station falls under two general heads: (1) operation, including the establishment and maintenance of the plant; and (2) scientific work.

Operation.

Location. The location of the station is a matter demanding thorough consideration. Ready access to typical stands of exploitable timber is a primary requisite. Both virgin and cut-over stands in different forest types or life zones are desirable. To handle scientific problems bearing on the work of the Service, the station should be located on or near a National Forest on which important forest activities, particularly timber sales, are in progress. There should be facilities at the station headquarters for at least a small forest nursery. Proximity to a railroad station, while less essential than natural facilities for research, is important from the standpoint of economy and general efficiency.

Construction. It need scarcely be stated that the plant should be built according to a definite plan. The most economical procedure is to construct all the buildings for which there is present need within a short period. The ideal way would be to devote the greater part of the first year to building and acquiring equipment. Then this phase of the work would be to a large extent disposed of, and the station force would be free to devote the greater portion of its time to scientific work. A building program extending over several years is uneconomical because both the cost of construction and cost of supervision will be greater than if all the work is done at one time and under one or a few contracts. The supervision and office routine incident to the construction of one building is almost as great as for several erected during the same season. A building program is, however, dependent upon the availability of funds, and in any event the plans must always provide for expansion with the growth of the station.

The purchase of equipment requires judgment and foresight. This applies not only to scientific apparatus, but to other equipment such as tools, wagons, horses, etc. It is poor economy to work with inadequate or unsuitable equipment, but it is almost equally bad to purchase equipment which is not needed or which is unsuitable. More or less waste of this character is unavoidable where the character of the work is changing from year to year; nevertheless this is a phase of the administration which requires careful study.

Maintenance. The upkeep of buildings and equipment requires continuous attention. For extensive repairs, the employment of skilled workmen, if available, is generally most satisfactory, but since experiment stations are located at a distance from towns, it is usually impracticable to send for a carpenter, plumber, mason or machinist for the small jobs which come up from day to day. A common laborer can often be used as a "handy man," but such men can not as a rule be given much responsibility. At larger establishments, such as agricultural experiment stations, this problem is solved by the employment of a foreman or superintendent who is made responsible for keeping the entire place in proper condition; but the average forest experiment station is too small to warrant the employment of such an officer. The director of the station should give this work his personal attention, but the details should, as far as possible, be left to assistants, preferably non-technical men.

The standards of the Forest Service require that all stations be kept in presentable condition. This end can be attained only by insisting upon the observance of certain rules by the entire station force. Here there is perhaps as much danger from one extreme as the other. The appearance of a station should be in keeping with the dignity of the Forest Service. The public expects this of any government institution. Moreover, order and system are necessary to efficiency. A Forest Assistant who habitually neglects to replace and care for tools and instruments, wastes materials, and is generally careless about the appearance of his quarters, shows that an important branch of his training has been neglected. On the other hand, to make a forest experiment station into a public show place is both unnecessary and unjustifiable. An experiment station is essentially a work shop and the casual appearance of a few working materials should not offend the eye of even the most fastidious visitor.

On account of the isolation of experiment stations, some provision for boarding the men is usually necessary. At the Fort Valley Experiment Station, the usual force, including laborers, during the field season is about five men. Temporary men employed on improvement work and visitors frequently bring the number up to ten or twelve during short periods. It is presumed that practically the same condition exists at other stations. When three or more men are employed at a station, the Service can afford to pay the salary of a cook, rather than have the men prepare their own meals. It may be argued that they should do their cooking outside of official hours. This they do to a great extent, but the question can not be settled on this basis. Scientific men are frequently called upon to do a great amount of work outside of official hours. This they can not do if they must devote several hours per day to culinary duties. Moreover, proper food and regular meals are essential to high efficiency. Usually it is not necessary for the Service to pay all the cook's salary, but it should assist to such an extent that the men employed at the experiment station can secure their meals at a reasonable figure.

The following plan has been followed at the Fort Valley Experiment Station. A man is employed to do the cooking and janitor work, at $60.00 a month and board. Of this amount, the Service pays $40.00 per month for janitor services and cooking for day laborers, while the permanent employees pay $20 per month and the man's board, or the equivalent of about $40, as their share of the cooking expense. The cost of food supplies, dishes, cooking utensils, table linens, etc., is pro-rated among the men according to the number of meals received, excepting the temporary laborers who are charged a flat rate of 25 cents per meal, since they usually can not afford a higher rate. All moneys are paid to the treasurer of the mess who is responsible for the payment of bills, excepting that in case of temporary day laborers who can not be relied upon to pay, the amount of their meals is deducted from the daily wage and the difference applied on the payment of bills for supplies on government vouchers. With an average force of three permanent men and two temporaries, the cost to the former, including their share of the cook's salary, is about $1.00 per day per man.

Office Routine. The efficiency of the scientific staff may be greatly impaired by devoting too much time to office routine. The situation is generally that work of this character is not considered sufficient in volume to warrant employing a clerk. At stations employing two or more technical men, however, the usual office routine, particularly if the station has supervision of District work, together with the compilation of scientific data and typewriting reports, is usually sufficient to occupy the time of a first-class clerk. Because of the diversity of clerical work at an experiment station, it requires fully as broad training and involves as much responsibility as the position of chief clerk in a Forest Supervisor's office. A clerk of limited capacity and experience can not be employed to good advantage. Viewing the situation in a broad light, it is considered more economical to keep a clerk at $1,200 per year, even though he may be idle an hour per day, than to have two or three higher salaried men who are specially trained for scientific work spend a half or a third of their time on clerical duties for which they are not fitted.

Scientific Work.

This is the primary and only vaild justification for the existence of an experiment station. Such a statement seems self-evident, but it is a fact which is often in danger of being overlooked. Current matters, such as correspondence, accounts, improvements and maintenance, often demand immediate attention, and the director of the station naturally feels that if such work is not handled promptly it will reflect upon his administrative ability; but if it should become necessary to sacrifice one for the other I have no hesitancy in saying that the scientific work should take the right of way.

Organization. The supervision of scientific work is the first duty of the director of a station. Under proper conditions, the individual investigator should require but little supervision once his project and plan of procedure are approved. This is the policy followed in higher institutions of scientific research, such as universities and agricultural experiment stations, but such a system can not at the present time be put into effect in the Forest Service. In the former class of institutions, the scientific staff is made up largely of persons of recognized ability, and when an individual undertakes a problem he is expected to complete it. The great majority of men engaged in scientific work in the Forest Service are new to the Service; they have no record of scientific achievements; and they may be transferred at any time. Under such circumstances it is necessary for the supervising officer to keep every project under his direction well in hand, first, to prevent costly errors by inexperienced men, and secondly, because it may be necessary at any time to assign the problem to a new man who will be expected to take up the work where his predecessor left it. Under such circumstances, the presence of a directing head who has followed the study from year to year, profiting by the experience of each year's work, is of the greatest importance.

While more or less supervision is necessary, for the reasons given in the preceding paragraph, individuals who have shown themselves capable of independent research should be given practically free range after the project and plan of procedure have been approved. A system whereby all investigators merely carry out instructions from their superiors will stifle initiative and will develop a corps of clerks instead of scientists.

Because of the changes in personnel and the employment of more or less inexperienced men, all scientific data should be submitted to the director of the station for inspection at frequent intervals, and should be placed in the office files instead of being carried by the investigator until he is ready to submit a complete report. Field data should be compiled from time to time by the man who gathers them. If they are left in rough form until the end of the season when a report of the year's work is due and when the original collector may have gone, the man who prepares the report will find himself confronted by a formidable task, to say nothing of the loss from his inability to interpret another's notes. The original field notes should be filed with the compiled results. They are often of value in checking errors and in clarifying various perplexing problems.

The director should examine and correlate the data on each project sufficiently often to keep in touch with all developments. In addition to this, he should make frequent inspections on the ground, particularly if the work is being conducted by inexperienced men. This is necessary not so much for the purpose of checking the accuracy of his assistants' work as to check their judgment and to observe facts which may have escaped their notice. Many instances could be cited where absolute reliance on the data gathered by assistants, though accurate and in accordance with instructions, would have resulted in overlooking important facts, the omission of which might have materially changed the conclusions. No investigator can foresee all the factors which may enter into an experiment, and consequently he can not prepare instructions sufficiently complete to cover all points. The highest type of scientific work is done by scientists who, if they can not actually perform all the work themselves, personally supervise all important details.

While the preceding paragraph shows the inadequacy of instructions unaccompanied by thorough inspection, it is by no means the intention to belittle the value of detailed instructions. Fortunately the Forest Service now requires that a working plan be prepared for every experiment before the work is begun. The value of the plan is not so much in guarding against improper methods of study as in the assurance that a plan of work is actually made. The working plan should cover every detail, if for no other reason than that it requires the investigator to think out these details in advance. A complete plan is especially valuable when the responsibility for the project is delegated temporarily or permanently to an assistant. If the director of the station should be called away for a month during the field season, satisfactory progress would be practically impossible without complete plans for every line of work. The working plan for each project should be revised each winter, indicating all changes in the previous plan with respect to time and extent of operations, location of plots, and other details which may change from year to year. To guard against overlooking details at the proper time, a summarized schedule of operations should be made up for each project. In addition, a schedule showing the work planned for all projects at different times through the year is recommended.

The director of a station may frequently be called upon to make minor modifications in his plans. Perhaps the work outlined for a certain period is found too heavy, and then he must decide what work can be deferred and when it can be done to the best advantage. Climatic conditions or other circumstances may arise which render it advisable to defer or omit entirely certain operations, or to add others not provided for in the plan. Obviously, the number of changes which become necessary in the execution of the plan is determined to a great extent by the amount of forethought exercised by the writer of the plan and his knowledge of the conditions under which it is to be carried out.

The preceding statements apply to experiment stations under present conditions. As scientific standards rise, more responsibility will be placed upon individual investigators, with a corresponding decrease in supervision.

Personnel. The general qualifications required of the scientific staff of an experiment station are much the same as for other forest officers. Until recently it seems to have been taken for granted that a Forest Assistant who showed any scientific inclination, even though he failed generally in the usual work on a National Forest, was qualified for scientific work. Fortunately, this impression is being corrected. Men of poor administrative ability or unfortunate personality may be well fitted for certain kinds of scientific work, but the man who fails in National Forest work through lack of character, industry or mental capacity will also fail at an experiment station. An understanding of National Forest work and the aims and problems of the Service is of great value to every man engaged in scientific work, and at least one year's service on a National Forest should be required of a Forest Assistant before he can be permanently assigned to an experiment station.

The number and training of men on the scientific staff will obviously be determined by the amount and character of work carried on. The director and one assistant, who will be called upon to take charge in the absence of the director, must have at least ordinary administrative ability. In addition, if the amount of work warrants, one or more purely technical men may be employed. For detailed work involving comparatively little judgment and responsibility, young men of incomplete scientific training can be used to good advantage. Forestry students are as a rule exceedingly ambitious and energetic, and on work more or less routine in character, requiring physical activity rather than scientific knowledge, they are often more efficient than older men of higher technical training. But the mistake of placing students in positions requiring training and experience should be avoided. Two technical men assisted by one or two students generally constitute a more effective force than one technical man assisted by three or four students.

A common mistake of technical men is to devote too much of their time to work which can be performed more economically by a common laborer. Often such work is necessary as, for instance, when the amount of work does not warrant employing a laborer; but it is clearly poor economy for a $1,200 technical man to spend much of his time building fences, digging ditches or packing burros, when the same work can be done better by a laborer employed at $2.50 per day. The above does not apply to students who generally receive no more pay than a laborer, and who can often be employed temporarily at manual labor when not needed on scientific work.

The greatest need of the scientific branch of the Forest Service is for higher scientific standards in the personnel. Foresters must be developed within the profession, and since forestry is new in this country few of our scientific men rank with the leaders in the older scientific professions. To remedy the situation, men of high training and ability are needed who will devote their lives to forest research.

Forest experiment stations should in years to come represent the highest scientific talent in the Forest Service. The personnel should be made up of specialists. The director of a station should be a recognized authority who has perhaps spent his life time in the study of forest problems. Such men should rank with the highest officers in the administrative branch of the Forest Service. There is, however, little danger that the director of a station will not receive due recognition. The danger is with the subordinate officers. Every man wants to be able to see something ahead, and if he can not he is going to look for a new field. At present, a position as assistant at a forest experiment station carries with it no scientific recognition and gives little promise of leading to anything higher. Occasionally one of these men will be called upon to fill a vacancy as director of a station, but such promotions will be rare.

The best solution of this problem is to make the subordinate positions carry with them responsibility, remuneration and dignity commensurate with the abilities of high class scientific men. At agricultural experiment stations a specialist is in charge of each line of work and he is designated by a title such as agronomist, horticulturist or botanist, which gives him recognition in the scientific world. A similar system could be put into effect at forest experiment stations, although there are objections to adopting a number of highly technical titles. The following scheme proposed by District Forester Ringland seems to meet the requirements. The officer in charge of the station would be designated "Director" and the assistants in charge of the various lines of work "Assistant Directors." There would be as many assistant directors as there are men in charge of special lines of work, and all would be of equal rank.

The following tentative division of work and designations of officers are suggested:

Class of Work.	*Designation.*
1. General supervision. Should also include one of the following special lines of work.	Director.
2. Management and mensuration. 3. Forestation, forest influences and special ecological studies. 4. Dendrology, pathology and other botanical work. 5. Entomology. 6. Grazing studies.	Assistant Directors (Usually not more than two).

Ordinarily only one or two Assistant Directors will be employed at one station for the present, but a growing volume of work and need for greater specialization will in time necessitate an increase in the force. The rank of Assistant Director should be reserved for men of proven ability, and should require in addition to other qualifications at least two years' previous service as Forest Assistant on a National Forest, or equivalent training. Ordinarily a period of apprenticeship at an experiment station should be required, although it would not be advisable to make this an inflexible rule. Higher requirements would be desirable, but are not practicable at present for the reason that qualified men are not available. As the scientific standard rises, the requirements should be greatly increased, until after perhaps ten or fifteen years only seasoned men of high scientific training and ability are eligible to one of the higher positions at an experiment station.

Scope of Scientific Work. The primary purpose of our experiment stations and, in fact, of all scientific investigations in the Forest Service is to furnish scientific data needed in the management of National Forests. To accomplish this, the station must be actively in touch with the work on National Forests. Every investigator should be given an opportunity to see the conclusions of his studies put into practice. The specialist in forest management at the experiment station should take an active interest in marking, cutting, brush disposal, etc., and his services should be utilized in the inspection of timber sales. When extensive planting operations are undertaken the specialist in charge of reforestation at the experiment station should be consulted in regard to technical matters, such as the selection of areas, methods, species, etc. He should make inspections of the work from time to time with a view toward lending helpful suggestions and solving problems which can not be solved by the administrative force. Similarly, the services of officers in charge of insect, grazing and botanical investigations should be utilized within their respective fields.

Obviously such a system of co-operation can not be fully realized until specialists in the various lines become available. Moreover, experiment station men should not be required to give an undue amount of time to District inspection at the expense of individual research. They should act in advisory capacity in co-operation with administrative officers and should not ordinarily be burdened with administrative responsibility. In special cases, however, it may be desirable for such officers to take entire charge of a project in order to familiarize themselves with the conditions met in actual practice.

What promises to be a new field of activity for the experiment station is developing out of the demand of the public for technical advice on forestry. Already a considerable number of requests for information in regard to tree planting are being received from western states outside of the field of the Washington Office of State Co-operation. If these requests increase materially in number, as they undoubtedly will, some provision must be made for handling them. In some states, a large portion of this work can be referred to the agricultural experiment station, but in states which do not maintain a Department of Forestry, it will fall upon the Forest Service. It has been the experience in District 3 that many of the requests for information, particularly in regard to tree planting, are difficult to handle because they come from agricultural sections in the lower altitudes where conditions are entirely different from those on the National Forests. If the Service continues the policy of furnishing advice to private owners it must make the investigations necessary to give reliable information. These investigations will logically devolve upon the experiment station, but routine correspondence and the execution of co-operative agreements should as far as possible be handled by administrative officers.

The experiment station has an unusual opportunity for educational influence. The public is rapidly awakening to the importance of forestry and is looking for evidences of the work of the Forest Service. An experiment station, if at all accessible, is visited by a great number of people annually. Many are attracted by mere curiosity, but others show a genuine interest in the work. Not a few of these visitors are persons of scientific prominence. The experiment station is thus called upon to uphold the scientific prestige of the Forest Service. A well conducted nursery and a few successful plantations are a revelation to the average layman. Reforestation appeals to the public more than any other phase of forestry, and for this reason it is desirable that the experiment station locate its nursery and some of its plantations where they can be conveniently reached by visitors.

Advantage should also be taken of the opportunity to explain the broader aspects of forestry. The object and possibilities of forest management through the practice of good silviculture, conservative lumbering, fire protection and regulated grazing should be pointed out and demonstrated as far as possible. To this end, a model forest managed by the experiment station would serve an excellent purpose. Forest influences, especially if studies of this character are being carried on at the station, can be profitably discussed. The time which must be given to visitors by officers of the experiment station is a considerable item which should be considered in fixing the annual program of the station.

THE PROBABLE ORIGIN OF THE FORESTS OF THE BLACK HILLS OF SOUTH DAKOTA.

By P. L. Buttrick.

In 1896, the U. S. Department of Agriculture published a list of plants from the Black Hills Section of South Dakota.* It was compiled by Dr. P. A. Rydberg, mainly from his own collections. In the introduction he speaks briefly of the probable manner in which the various species reached the region.

Perhaps an amplification of the subject as it applies to forest trees may be of sufficient interest to foresters to warrant publication. Most of the conclusions expressed here were reached by the writer before seeing Dr. Rydberg's Bulletin.

The Black Hills in southwest South Dakota and eastern Wyoming rise to a height of nearly 5,000 feet above the surrounding plains, and cover an area about the size of the State of Connecticut. They present conditions in every way different from the treeless plains and Badland surrounding them. In contrast the Hills are (or were) heavily timbered.

They form what is essentially an island—an island in the midst of the land. Like other islands they have received their fauna and flora from neighboring but larger lands, and, after receiving it, have modified it to suit their own peculiar insular conditions.

Islands receive such plants and animals as are, in some manner able to cross the barriers to them. Wind, water, birds and insects are among the agents supplying islands with plant life. Doubtless these have done their part in the colonization of the Black Hills. However, migrations along well defined lines are responsible for the presence of most, possibly all the tree species of the Hills.

Western Yellow pine *(Pinus ponderosa)* is the most important tree, constituting at least 90 per cent. of the forest. The other pines, Lodgepole *(Pinus murrayana)* and Limber pine *(Pinus*

*Contributions from U. S. National Herbarium, Vol. III, No. 8, 1896. Division of Botany, U. S. Department of Agriculture.

flexilis), are found as scattered trees or in small groups, so rare that they long escaped notice.

White spruce *(Picea canadensis)* occurs in a few solid bodies on the slopes of the highest hills. Elsewhere it is largely confined to canyon bottoms and steep north slopes in mixture with other species.

Red cedar *(Juniperus* sp.*)* is scattered about the foothills, chiefly in the Wyoming section. The form in the Hills seems intermediate between the eastern and the western Red cedar.

There are a large number of hardwoods, all of minor importance. The list comprises such species as: elm *(Ulmus Americana)*, hackberry *(Celtis occidentalis)*, Bur oak *(Quercus macrocarpa)*, boxelder *(Acer negundo)*, Paper birch *(Betula papyrifera)*, Red ash *(Fraxinus pennsylvanica)*, Trembling aspen *(Populus tremuloides)*, cottonwood *(Populus deltoides)*, and others. There are several other species but they are too insignificant to mention.

Bur oak is the only hardwood reaching any size. Occasionally in stream bottoms in the foothills it becomes large enough for railroad ties.

All the hardwoods, with the exception of aspen and paper birch, and in a few sections Bur oak, are confined to the stream bottoms or the vicinity of water. They are more numerous and better developed in the foothills and at lower elevations. Aspen and birch often form temporary types after fire or clearings.

It will be seen that the species in the Black Hills fall into four groups according to the forest regions where they are most common. These are: Rocky Mountain species; Northern Forest species; Eastern Forest species; and Transcontinental species. Most of the last group might be classed also in the third.

The pines belong in the first group. The spruce and Paper birch in the second. The other hardwoods in the third. Transcontinental trees such as aspen and boxelder are undoubtedly of eastern origin.

How have these representatives of different forest regions found their way to this prairie island—the Black Hills?

There seem to have been three migration lines. From the north, the east and the west.

At one time, the climate of the west was much more humid than now, and much of the treeless area north and west of the Black Hills was doubtless forest covered. The Rocky Mountain forest extended more or less completely across that strip of relatively high land called the Wyoming Badlands, which stretches from the Bighorn Mountains in Wyoming to the Black Hills. Even to-day a few stunted yellow pines are found scattered across this area. Undoubtedly across this forest isthmus came all the pines of the Hills.

From the north a tongue of forest may have stretched southward along the isolated buttes and ridges lying in what is now eastern Montana and western Dakota. If so, this slender strip of forest is responsible for the presence in the Hills of the white spruce and the paper birch. It may be, however, that these species owe their place to the accidental agencies of birds or winds, as is apparently thought by Dr. Rydberg to be the case with the spruce.

From the eastern forest long tongues extend westward across the plains following the river banks and smaller water courses almost to the foot of the Rockies. It is probable that most of the hardwoods of the Hills reached there by this "river route," ascending the Missouri and then the Cheyenne and its tributaries which enter the Hills.

The transcontinental trees such as aspen and hackberry probably came up the rivers from the east in the course of their journey across the continent. The Red cedar which follows the uplands may have come from the east or the west or both.

It is a law of island colonization, that of the various forms which reach an island, some are rejected as unfit to cope with the conditions of their new environment, and others are modified to conform to it. Perhaps still others well suited to the insular conditions never reach them.

These are well illustrated in the Black Hills. Lodgepole and Limber pines have not found suitable conditions, and have been reduced to a subordinate position. In time they will probably disappear from the Hills. It is possible that other Rocky Mountain species crossed the forest isthmus only to be unable to get a foothold or to be later driven back by the unfavorable conditions they encountered in the Hills.

The trees from the northern forest, which of all the species have probably been longest in the Hills, have been more or less modified by their environment and isolation. The specific status of both the spruce and the birch is in doubt, some authorities make distinct species of both.

The species from the east have, in most cases, been modified both botanically and silvically. In some cases this modification took place on the long journey across the plains, in others since the arrival in the Hills. The narrow-leaved cottonwood *(Populus acuminata),* a varient of the common cottonwood of the plains, is an example of the first. The various willows are examples of the second. These after the cool moist canyons of the eastern Hills after their long prairie journey under such vastly different conditions, have after the well known habit of willows varied greatly. It is almost impossible to separate them into recognized species. Bur oak and American elm, being old and stable species, have not varied botanically, but were dwarfed by the long plains journey, and have only partly succeeded in regaining their size. Perhaps the relatively dry climate is a factor in this.

The cosmopolitan Yellow pine has not varied botanically in the Hills as it has in its further eastward journey in the sand hills of Nebraska, where it has developed into a sub-species *(Pinus ponderosa* var. *scopulorum)* as a result of its changed environment. Nevertheless Black Hills Yellow pine is silvically quite distinct from that in the Rockies.

If the supposition that a narrow strip of forest once connected the Black Hills with the great northern forest of the continent is correct, it is probable that at one time other species of the northern forest occurred there. Eastern larch, Balsam fir and Jack pine or forms very closely resembling them, would likely have been represented. A climatic change or the competition of the Yellow pine could account for their disappearance.

The path from the Rocky Mountains was closed by the advancing aridity of the region, perhaps aided by forest fires.

The migration from the east is still going on. Many hardwood species, such as the backberry and the ash, have scarcely yet penetrated beyond the eastern foothills. Few of those which have, have as yet been able to adapt themselves to grow upon the uplands, Bur oak and aspen being those which have come closest to it. If natural conditions were not interfered with in time it might be that some of the eastern hardwoods would regain the capacity to grow abundantly on upland sites as they do in their old eastern homes.

It is possible that there are other species from the three forest regions which are more or less suitable for the Black Hills, but which have never been able to reach them.

It is probable that the forces of evolution will continue in the future as they have in the past to produce specialized forms for insular conditions and that the differentiation of the trees of the Black Hills into local varieties and species will continue, chiefly among the hardwoods. It is not impossible that further accessions will be made from the eastern hardwoods as they work their way further and further west. And those species now at the gate-way of the Hills will climb higher and higher into them. Whether these changes will be rapid enough to be perceptible to us remains to be seen.

It is unlikely that any species will of itself usurp the place of the Yellow pine, which despite the ravages of fire and insects holds its own so well. For the purposes of the forester and the lumberman the development of the forests of the Black Hills is complete.

THE SCOPE OF DENDROLOGY IN FOREST BOTANY.

By H. de Forest.

Any new branch of science, in its earlier stages, is necessarily in a plastic condition. For some time its organization represents little more than accumulations of more or less closely related facts. Exactly what scope and proportions the subject shall ultimately assume remains a matter of conjecture and discussion. Then, later, as experience and further investigation lead to clearer comprehension and greater definiteness of intention, these facts are classified and arranged in established categories, so that, while the subject even then is still not a body of unchangeable form, it nevertheless has taken on definite proportions and occupies a more or less fixed space.

It is peculiarly necessary at the present stage of the development of forestry in this country that the concepts of several branches of the general subject be subjected to critical analysis with a view to their occupying their proper places in the forestry system and so most effectively discharging their functions. It is only by such methods that real advances in the technique of any line of scientific work can be made. Furthermore, such critical investigation, in order to serve best its object of establishing sound bases for technical training, must be divorced from any purpose of making an acceptable popular appeal, a purpose that rightfully prevails in the presentation to the public of many lines of forestry work, and remain based solely upon scientific principles, with the somewhat abused term scientific employed here in its implication of technical service of a utilitarian object. It is proposed to examine briefly the subject of dendrology. For the clearest understanding of its scope it will be desirable to consider first what relations it bears to the rest of the general subject of forest botany to which it belongs.

Place of Dendrology in Forest Botany—Its Relation to Ecological Science.

Forest botany, it is believed, consists of two distinct parts. One deals with tree species, with facts concerning the individual trees that go to make up the forest. This is non-ecological. The other deals with associations of such trees, with those dynamic, organic entities known as forests, and is ecological. The former of these two parts is dendrology, while the latter is silvics. Sometimes the term silviculture, which originally was reserved for the *art* of establishing, developing, and reproducing forests, is used to denote also the *science* back of that art, that is to say as a synonym for silvics, just as, for example, the single term medicine is often used to denote either the science or the art. Dendrology will be handled in the main body of this short article. Here it is necessary for a complete understanding to treat briefly the subject of silvics. It appears to the writer that the natural subdivision and the arrangement best suited for presenting the materials to students lies in this already well recognized separation into dendrology and silvics. In addition to this there must be remembered the powerful and all-important fact, that alone should bring about such a subdivision to-day, to wit that now all ecological investigation, in order to facilitate scientific development in the methods of attack upon the intricate problems involved, is placed in a category by itself under some one or more ecological sciences.

Silvics covers, it is believed, all *ecological* investigations of forests. Ecological investigation of vegetation is to-day pursued by means of the two sister sciences known as plant-geography and plant-ecology. The former of these is also known internationally as phytogeography, while the latter has the international term phytecology proposed. They cover the field of ecological science in botany. Exhaustive expositions of the territories included within these respective subjects or of their present stage of advancement would be both out of place here and impossible within limited space. Suffice it to say, by way of furnishing accurate indicators of their meanings rather than exhaustive definitions, that plant-geography is essentially a *regional* study of vegetation and proceeds along three lines, the genetic, the floristic, and the ecological. The first considers the historical origin and development of the vegetation of a region and is largely geologic. The second interprets the present regional flora from the point of view of its origin, migration, etc. Its delimitations are largely topographic. The third puts the present regional vegetation in its proper categories (*ergo* plant associations, forest types), based upon the types of vegetation found in it. Its delimitations are on the basis of the vegetative responses to environmental conditions. Plant-ecology, on the other hand, is distinctly *local*. One part deals with the ecological significance of the morphological and physiological characteristics of the plants of a locality. The other part deals with the local minutiae of the vegetation of that locality (habitat),—with the relation of its vegetation units and their subdivisions to the climatic and edaphic conditions, etc., i. e. to the summation of their habitat complex. Forest-geography and forest-ecology are, of course, both branches of the broader subject of plant-geography and plant-ecology. It is never implied that other growth forms than trees are ignored in the former subjects, but only that the attention and interest are focused upon their forest rather than upon shrubby or herbaceous vegetation. Further, such investigations when made, not by botanists for botanical purposes, but by foresters for forestry purposes, have features that serve to make the subject of silvics not coterminous with forest-ecology, as is sometimes supposed, but broader in scope, including such manner of investigations, for instance, as the effects of methods of brush disposal upon forest regeneration, the effects of fire damage upon the quantity and quality of the yield, etc., embodying technical questions of forest management belonging distinctly to forestry and not to botany. Hence silvics covers in large part the very ground of forest-ecology and yet, as well as this, covers also a part of the investigative field not included within the botanical subject of forest-ecology. Furthermore, the point of view of silvics throughout is different because of its different object. The forest-ecology of the botanists is concerned with adding to the sum total of botanical knowledge. Silvics of the foresters, on the other hand, is concerned with any and all forest investigations, whether of indirect or direct value, that bear in any way upon the practical questions of forest production.

Dendrology—Its Scope.

An examination of what the writer considers the specific scope of dendrology is now in order. Dendrology, the science of trees, as the word itself indicates, deals with tree species and not with communities of trees, not with forests. Within this still broad compass four distinct subdivisions may to-day be distinguished.

Systematic dendrology dealing with such characteristics of trees, in their summer and winter conditions, as are of practical service in field identification. The distinctively winter characters are usually not dwelt upon in botanical field courses. All this differs, too, from the taxonomic study of botanists in being confined exclusively to those characteristics that are of service in the field. In almost any botanical manual, except to some extent in the newer ones for trees designed along forestry lines, half or more of the taxonomic characters mentioned are not used in systematic dendrology, whose sole purpose is to afford a field basis for distinguishing one tree species from another, and not to present a complete taxonomic scheme. So much of botanical taxonomy as the forestry student requires belongs to his botanical study proper and not to his dendrological work in forest botany. Dendrology, in its four subdivisions as here detailed, covers a very wide range. The practical needs are for drawing its boundaries closer rather than for extending them.

Geographic dendrology, or the ranges of tree species.

Biologic dendrology, or the systematic consideration of those characteristics of tree species that relate to their life-histories, pursued along non-ecological lines. This part of the subject verges upon the domain of silvics. Biologic dendrology is, however, systematic, that is to say rather a recital of the facts involved in the climatic requirements of the species, their edaphic needs, habits of growth, tolerance, reproduction, and so on, than an analytical exploration of the ecological problems embraced within these matters, which properly belongs to the subjects of forest-ecology and silvics. Biologic dendrology may, indeed, fairly be thought of as preliminary to this. Quite aside from this aspect of the subject as one preliminary to the study of silvics is its important aspect of furnishing the student of forestry with information that is indispensable to him from almost the beginning of his study of forestry, a selected array of facts that he would best get first in clear-cut, systematic form, before involving himself in the far more difficult considerations of their ecological meanings. This has been recognized in educational practice to the extent that so far in the teaching of forestry in this country it has been largely biologic dendrology that has been taught rather than silvics, whatever titles may have appeared in the curriculum. Silvics, with its immense significance for the attainment of substantial scientific results in forest investigations, remains, in its lack of scientific organization, one of the least developed technical branches of American forestry.

Structural dendrology includes a consideration of the external features and structural elements of wood; the value of macroscopic and microscopic characteristics in identification and classification; and the classification and identification of commercial woods. If dendrology is the science of trees then the study of wood structure belongs to it rather than to the study of forest products, which, as its title indicates, would be confined to the branches of wood technology or the application of wood in the arts, and to timber physics or the physical and chemical properties of wood and minor forest products, both having to do with the woody product, while the structural features of the wood itself is more closely related to the science of the trees themselves.

Critical Examination—Not Pedagogical Discussion.

It should be distinctly understood that this paper presents a short critical analysis of the subject of dendrology, with some necessary preliminary explanation of the rest of forest botany, i. e. the ecological science of silvics, in order to make clear their relations, and does not present an outline of a plan for teaching dendrology. Hence it is not within the province of the article to discuss the various methods of presenting the different parts of the subject to students. How many species within different genera or groups of genera should be included for typical representation in a course in biologic or in geographic dendrology belongs to another topic altogether. The teaching of the different subdivisions must ever be subject to the exigencies of particular cases, and, quite aside from the needs of any particular curriculum, the successful presentation of any part of the subject will, of course, always depend upon the individual initiative of the instructor. It seems, however, a ripe time for an endeavor to establish certain fundamental principles as to the scope of the subject that shall be abreast with the best present-day development. On the one hand it is highly desirable that foresters shall not confine the subject of dendrology to its systematic aspect alone, nor solely to its systematic and geographic aspects, as is still being done in some places. And surely geographic dendrology, or the ranges of tree species, a single phase of dendrology, should not be taught under the title of forest-geography. The latter is a branch of the established science of plant-geography, the ecological science known internationally as phytogeography. It appears to the writer inadvisable to a high degree to attempt to take over one of its titles to denote one single phase of the non-ecological science of dendrology. On the other hand, it appears to the writer equally inadvisable to go to the other extreme and endeavor to avoid the natural distinction between the non-ecological study of the various features of trees as individual species and the ecological study of forests as organic entities by attempting to force all of this into one subject called dendrology. The best investigative tendency over all the world to-day is directly opposed to this course. And one of the chief present needs of American forestry is a solid scientific basis for its practice, a basis that can be secured only by the use of the best investigative procedures. The study of vegetation as the dynamic thing it is now recognized to be is immensely facilitated by this logical separating-out of all ecological matters. As direct witness to this may be cited the two established botanical sciences of plant-geography and plant-ecology, distinct signs of the times. Silvics, as conceived by the writer, is but the natural forestry outcome—forest-geography plus forest-ecology plus the widening of the field through differences brought about in investigations by the distinctive forest production point of view of forestry.

Practical Discussion Not Academic.

While the essential problem in teaching what is considered in this paper as the subject of dendrology is obviously to cover the necessary ground, it is not, at the present stage of development of American forestry, whatever it might have been at an earlier stage, a purely academic matter to endeavor to determine and define the scope of its constituent parts and their place in the general scheme of forestry. It seems reasonable to account such systematizing quite as practical as the determination of a definite policy for the carrying out of any prolonged piece of work. It may, indeed, even be likened to the planning and outlining of the most advantageous route to follow in undertaking a long journey. One could probably arrive at his destination without such careful planning, but the best way to shorten a long trip is to do it. Nor are such plans ever iron-clad and unchangeable. Certainly if forestry is to take its rightful place among scientific subjects its technical phases must be handled by scientific methods, and among these that of critical analysis with the object of a logical and therefore most useful classification of its parts is essential.

Remarks on Above Article by the Editor.

We agree most decidedly with the author in the last sentence, but we do not think that he has been altogether successful in securing a logical classification, although he has used much language in trying to secure it.

The gist of his contention is that the term dendrology should be confined to non-ecological parts of the knowledge. We fail to see any logic in so circumscribing a self-explanatory term, which means "all about trees." Such circumscription is merely arbitrary, not forced by logic, and not acceptable or accepted. Dendrology is merely a segregation from the general field of botany of that part which concerns itself with trees. This part can be considered, like any other vegetation, from various points of view.

The first point of view is from the standpoint of description of the material: descriptive dendrology—which may confine itself to the botanist's narrow point of view or extend to the dendrologist's more complete analysis, including even wood-structure.

As a result of the descriptive knowledge, we come to dendrological classification or taxonomy, a self-explanatory field of botanical inquiry limited to trees. We next come to study trees from the physiological point of view; plant physiology with special reference to the physiology of arborescent forms. Last we may take up the biological (in the narrower German sense) phenomena of tree life, which includes phaenology and ecology of trees, i. e. a study of their cycle, of the causes of tree form, of their habits, of their biological requirements on the environment, etc.

This completes the whole field of dendrology. These subdivisions are, of course, nowhere strictly limitable, for Nature defies our classification, which is only a device for limiting fields of inquiry practically and to enable us to overlook a large field of inquiry.

But what about silvics? Before Dr. Gifford coined this unfortunate word—unfortunate because of its linguistically bad form!—the subject which it comprised was known to foresters—and botanists had nothing to do with it—as "silvicultural characteristics of species." As this term explains itself, it is a segregation of the ecological knowledge (biological dendrology) which is of special interest to the silviculturist in the practical application of his art—the behavior of the species under forest conditions included.

This very simple classification of the subject seems to us complete, and is hardly needful of argument, except for those that misuse terms and they are often incurable.

The fact that a Committee for the Revision of Terminology of the Society of American Foresters has just begun its work, makes this discussion, however, timely.

Remarks on the Above Article by C. D. Howe.

The statement of the author that dendrology "deals with tree species, with facts concerning the individual trees that go to make up the forest," would include the study of the biological relationships of single trees. Such a study should be included under *silvics*. Silvics is not alone a study of associations of trees as the author states.

The term dendrology without a limiting adjective carries with it, I think, the idea of descriptive and taxonomic relationships. Dendrology might be included in the term forest botany, but silvics should not be so included. The study of biological relationships is a science co-ordinate with a study of the descriptive relationships, as in botany proper we have taxonomy (systematic botany) and plant ecology, or as in zoology we have systematic zoology and ecological zoology. Therefore dendrology and silvics (granting the use of the term) should be regarded as co-ordinate branches, and only the former may be included under forest botany.

Silvics is not a "sister" to plant geography and plant ecology but is a daughter of the latter and only a cousin to the former From its derivation, plant ecology means the household relations the home life of plants. Trees are plants. Therefore the study of the conditions of the home life of trees (silvics) is a subdivision of the study of the conditions of the home life of plants as a whole (plant ecology).

Plant geography deals with the distribution of plants as individuals or as aggregations. It locates and tabulates the habitats of these individuals or aggregates. It is a census of plant habitats. Strictly speaking, such a census could be made (and often has been made) with only a very general knowledge of the causes which have brought the habitats enumerated into existence. A knowledge of the conditions of a habitat and its resultant vegetative structure, however, would increase the efficiency of a plant geographer. The plant geography of the past has been chiefly descriptive, while the modern plant geography is both descriptive and causal. The study of the causal relations is plant ecology; the application of such causal relations is plant geography. The one is concrete, the other discrete; the latter, the application to wide areas of deductions from the intensive study of small areas. Therefore logically plant geography is a child of plant ecology. I am perfectly well aware that historically there has been no such relationship between them. In fact, so far as actual lineage is concerned the relationship is reversed, but we are discussing now a logical arrangement of the subjects.

Since silvics is a subdivision of plant ecology, its relation to plant geography is the same as that of plant ecology one degree removed. Silvics is to *forest* geography as plant ecology is to plant geography.

I can not see why the two terms *Forest Ecology* and *Silvics* may not be considered as synonyms. A forest ecologist studying only for botanical purposes would not lose caste by investigating the effects of brush disposal and fire upon reproduction. In fact an ecologist would have to go far afield nowadays to study vegetation *unmodified* by man. He is studying such modifications continuously and he remains a botanist, not a forester or an agriculturist. To say that forest ecology stops the moment practical considerations enter, is similar to saying that the study of the chemical nature of wood is not organic chemistry because the results of the study may be applied to such practical considerations as the making of paper.

Systematic dendrology. Here again the author is splitting hairs with the "practical" and the "scientific." A botanist distinguishes herbaceous plants in the field by readily recognizable "ear marks." This does not make him any less a botanist.

Biological dendrology. A forest is a collection of trees of the same or different species. The character of the forest is the sum of the characters of the individuals composing it. It seems to me that if one made a study of "the facts involved in the climatic requirements of tree species, their edaphic needs, habits of growth, tolerance, reproduction and so on," he would be making "an analytical exploration of the ecological problems embraced within these matters." But according to the author, if he performed the work indicated under the first quotation he would be in the domain of biological dendrology, while if he performed the work indicated under the second quotation he would be in the domain of silvics. I think this all I need to say of the author's attempt to separate the two.

It is possible that there may be a logical division between the concept of biological dendrology and silvics, but the author does not make it clear. It is helpful in many respects to regard the forest as an organism, an entity, with its own structures and functions and with environmental interactions differing from those of an individual tree. The study of a forest from this point of view might be called silvics, while the study of trees in their ecological relationships as individuals might be called biological dendrology. For example, the reactions of the forest as an entity upon light and temperature conditions, upon soil and hydrographic conditions might be considered as a distinct compartment of forest knowledge. When, however, we begin to apply these reactions in their influence upon living plants, we must consider such plants as individuals, and then we fall back into the domain of biological dendrology as defined above. For example, if we study the influence of the forest as an organism upon reproduction as expressed by the kind or the nature of the young growth, we are dealing with one of the components of the forest, not with the forest as a whole. I do not know, however, that the intergrading of these two concepts would be any greater than that of other divisions of forest knowledge.

Cone Borer vs. Squirrel.

An Important Correction.

Mr. J. M. Miller, Entomological Assistant, Branch of Forest Insect Investigations, Bureau of Entomology, and in charge of investigations of insect damage to forest tree seeds, writes the following:

The January number of the Proceedings of the Society of American Foresters (Vol. IX, No. 1) contains two articles on squirrels and sugar pine reproduction (pages 95-101). These articles are of some interest as I note that the description of damage to sugar pine cones, which is ascribed by both authors to squirrels, corresponds to that which I have usually found to be caused by the cone beetle. I would be interested to know just how close an examination was made of the sugar pine cones which were found on the ground during July and the first part of August. In Mr. Jotter's observations of August 20, 1911, he records 75 cones on the ground and only 6 of them eaten by squirrels, but the squirrel is evidently assumed as the cause of all the damage. There is a question as to whether or not the remaining 69 cones showed teeth marks on the stem, which would indicate that they had been cut by rodents. I have examined great numbers of these cones which fall before maturing, yet have very rarely found the teeth marks of squirrels until just before the seed was ready to ripen. Practically all of these fallen cones did show, however, the attack of the cone beetle. Usually there was a tiny mass of pitch on the stem to indicate the entrance of the beetle, but where this was lacking either the beetle or presence of its attack could nearly always be found by close examination and sectioning of the stem. I am satisfied from observations made in different localities in California, that 90% of the damage to immature sugar pine cones, ordinarily referred to the squirrel, is caused by the cone beetle.

This hardly seems fair to the squirrel. Both of these articles would indicate that the gray squirrel cuts the greater portion of the sugar pine crop before it ripens, thereby deliberately destroying its own food supply. It is also worth noting that the extermination of the squirrel is recommended as a measure for preventing this loss to sugar pine. This measure would have little effect on the falling of immature sugar pine cones as long as the ravages of the cone beetle continue.

These articles only emphasize the need of some published information on the cone beetle. The material for a bulletin on this subject will be ready by the close of this season.

CURRENT LITERATURE.

Third Annual Report of the State Forester to the Governor, State of Oregon. Salem, Ore. 1913. Pp. 46.

This third report of the State Forester is devoted to a record of the fire losses and to a statement of the fire protection work of the State and private agencies.

Forty-six per cent. of the land area, or twenty-eight million acres, requires protection from fire. Sixteen million acres are protected by the United States Forest Service, while twelve million acres are patrolled on the co-operative basis by the state and private owners.

The average area burned over per fire on private lands has been reduced from 137 acres in 1911 to 30 acres in 1913. Nearly 27,000 acres of slashings were burned in accordance with the Oregon slash burning law.

In 1913 a law was passed requiring every owner of timber land to provide a sufficient fire patrol for his land. This law has resulted in doubling the membership of existing fire patrol associations and in forming several new associations.

Half the report is taken up with detailed statements of the work of the sixteen fire patrol associations. The cost of protection in these associations ranged from one-half cent to three cents per acre. R. C. H.

Annual Report of the Potlatch Timber Protection Association for 1913. Potlatch, Idaho. Pp. 16.

This contains the annual reports of the President, Chief Fire Warden, and Treasurer of the Association.

Eight members, paying assessments on 309,887 acres, (two and one-fourth cents per acre) are enrolled, but 594,000 acres lie within the boundaries of the Potlatch Timber Protective Association and are regularly patrolled. The total acreage burned over in the season of 1913 was less than 70 acres, with injury to 13,000 feet of timber, which was promptly cut and used. The

Association shared in the Government funds distributed under the Weeks Law. Two hundred miles of trail and a telephone system are maintained. R. C. H.

Third Annual Report of the Conservation Commission, State of New York. Albany, N. Y. 1913. Pp. 52.

The Commission received in direct revenue (chiefly from hunting and fishing licenses) $316,407.87, and spent $744,103.99. If timber could be sold from the state lands, the Commission would turn in a large surplus, the annual revenue from the sale of timber being estimated at $1,000,000.

Special emphasis is placed on the problem of the water resources of the state, which is considered to be the most important conservation question now needing attention.

In the report of the Division of Lands and Forests, increased efficiency in fire protection and decrease in trespass on state lands is shown. New legislation is urged to permit the leasing of camp sites and the utilization of dead, down and ripe timber within the Forest Preserve. R. C. H.

The State Forester of Massachusetts, Tenth Annual Report. Public Document No. 73. Boston, Mass. 1913. Pp. 114.

This report in appearance and arrangement is similar to that of the last few years. It gives full details of the work accomplished during the year. One cannot peruse its pages without being impressed by the variety and amount of work under way.

A decade has passed since the establishment of the office of State Forester. Substantial progress has been made in this first decade, and indications point to even more rapid development in the next ten years.

In 1913 the first organized attempt was made to apply forestry to the moth problem, and with distinctly successful results.

The object aimed at is to encourage tree growth which will furnish unfavorable food for the moths. This is done by cutting out the non-resistant species, such as oaks, willow, cherry and gray birch. Both trees and brush on which the moths like to feed are removed. The final result will be the replacement of oak forests by pine, ash and a few other resistant species.

A relatively intensive survey and mapping of the forests of the state has been started.

Among the recommendations of the State Forester for future work are the following:—

1. Development of state forests on a more pretentious scale than is now possible under the reforestation act.
2. Enactment of legislation to regulate disposal of slash.
3. Change in present methods of taxing forest land.

R. C. H.

The Woody Plants of Kentucky. By H. Garmen. Bulletin 169, Kentucky Agricultural Experiment Station. Lexington, Ky., 1913.

The author of a tree flora is confronted with two problems, each capable of consuming the bulk of the manuscript and both essential to a complete flora. The first is the proper presentation of the distinguishing characteristics of the trees, and the second is the detailed account of their distribution. Consideration of the distinguishing features of the species is perhaps of greater value to resident students, while detailed range data is of great interest to outside investigators who are concerned with the geographical distribution of trees. A detailed account of the tree ranges by counties may not be of as much assistance to resident students as would a work with keys and distinguishing descriptions, but to the outside investigator who has ample references on these botanical distinctions, it is of great value, as it gives specific information as to just what species may be found in the state and in what situations they occur.

An ideal preliminary list undoubtedly is one which presents distribution data in the greatest detail and gives the authorities for those trees reported but whose presence seems quite doubtful on account of their range outside of the state. Distribution of such a preliminary list necessarily brings to the author many range extensions, corrections and confirmations which could not be secured in any other manner.

In this bulletin such emphasis has been placed upon detailed distribution data. Stating that the work is to be regarded as preliminary to a more complete account of the woody plants of the state, the author presents an interesting historical account of botanical work in the state. The character and peculiar features of the forest flora are then discussed, together with the influences which may have been operative in limiting the ranges of species.

The author notes that owing to the intermediate position of the state, northern and southern species are here associated. Twenty-two of the eastern oaks and all of the elms are represented. It is noted that all of the ashes probably occur in the state, although pumpkin ash (*Fraxinus profunda*) has not been found on the Kentucky side of the Mississippi. The statement, however, is not corroborated by the list of species, as *Fraxinus caroliniana* and its near relative, *Fraxinus pauciflora* are not mentioned and do not grow in Kentucky.

Of interest, is the record of *Pinus palustris* in Kentucky, as reported by Lafayette De Friese from near Pound Gap. Although this observation was made many years ago and at a time when the forest flora of Kentucky had not been disturbed by farming and lumbering operations, yet the author very properly questions such an unexpected northern range extension of this southern pine.

It is observed that soil influences appear to have less control on the distribution of Kentucky trees than have climatic influences and means of dispersal. With one exception, the trees all appear to grow on almost any soil, if only climatic conditions are not unfavorable. Chestnut alone appears to be influenced by the character of the soil and is found almost entirely in soils containing sand. It can be transplanted to the clay loams of the Bluegrass Region but does not grow there spontaneously.

The author presents a list of species, following the arrangement of the seventh edition of Gray's Manual. A question mark precedes the names of species whose presence is doubtful and the authorities are given for those species reported by other investigators but not observed by the writer. A brief note on special peculiarities of the plant is added and a detailed statement of its distribution by counties is included, which constitute a most valuable record. A number of half tones and line drawings of trees are added. In some of these (Bur oak, magnolia, and holly), no advantage has been taken of the great refinement in line which may be secured by drawing for reduction, but they are sufficiently accurate to add to the value of the volume.

On account of the large number of our eastern hardwoods which have either their northern, western or southern line of termination passing through Kentucky, this publication will be greatly appreciated by investigators who are concerned with larger problems of forest distribution. W. H. L.

Forest Tree Diseases Common in California and Nevada. A Manual for Field Use. By E. P. Meinecke, Forest Pathologist, Bureau of Plant Industry. U. S. Forest Service. Washington, D. C. 1914. Pp. 67.

"This manual, designed for practical use in the field, discusses only the more important tree diseases found in California and parts of Nevada, though most of them are common also in other forest regions. Its aim is to enable the field man to determine the cause of the commoner diseases and injuries and to understand their effect on the living tree. It discusses also ways and means of control of fungi and mistletoes, as well as climatic, biological, and soil conditions which bring about diseases in forest trees."

The above opening paragraph of the manual states admirably the scope of the publication. The author deserves much credit for successfully presenting a highly technical subject in popular form well adapted to the use of forest rangers and other field men.

Before entering into a discussion of the common tree diseases and the fungi which cause them, several pages are devoted to a brief, comprehensive description of the structure and normal functions of the tree, as a basis for the understanding of disease which the author defines as an unbalancing of normal functions. This is followed by a brief discussion of disease and its more common causes in trees, methods of examining and diagnosing abnormalities, and a description of the more common symptoms of poor health.

The nature and development of fungi, their mode of growth and their effect on plant tissues are next discussed, and the more common forms of their fruiting bodies are described.

The description of the diseases of trees is divided into two parts; first, the diseases affecting the increment, that is the future timber supply, and second, the diseases affecting the present supply of timber.

Under the first are discussed the various more common needle diseases such as *Lophodermium* and *Hypoderma.* The incense cedar rust, (*Gymnosporangium blasdaleanum*), and the pine gall fungus (*Peridermium harknessii*), are described at some length.

Among the more important diseases of the second group discussed are the following:

Fomes annosus, which is very destructive to trees in Europe and Eastern United States, but which is as yet not dangerous in California. *Trametes pini,* the ring scale fungus, which is the cause of destructive diseases of mature and overmature conifers. *Fomes laricis,* the chalky quinine fungus, which causes red heart-rot in various valuable conifers, including the sugar pine. *Polyporus sulphureus,* the destructive sulphur fungus, most often found on oak, chinquapin and red fir, but occurring also on Douglas and white fir, and yellow and Jeffrey pine. *Polyporus amarus,* which in producing dry rot of incense cedar, causes enormous damage on the Pacific Coast. *Polyporus schweinitzii,* one of the most serious enemies of Douglas fir and which also occurs on certain pines and on white fir. *Fomes pinicola,* the red-belt Fomes, which is the commonest timber-destroying pore fungus in California, attacking all the important conifers except incense cedar, juniper, redwood and bigtree. *Polyporus dryophilus,* which causes a destructive heartrot in living oaks. *Fomes igniarius,* the false tinder fungus, which is confined to the deciduous trees and is especially common on willows, cottonwood and quaking aspens, causing a white heartrot which sometimes extends into the sapwood. *Echinodontium tinctorum,* the Indian paint fungus, which is one of the most common wood-destroying fungi in California, found almost exclusively on white fir, causing the characteristic stringy brown rot. This is the fungus, the effect of which has brought the white fir into great disfavor among the lumbermen. *Armillaria mellea,* the honey fungus, which is one of the most destructive root fungi of oaks and orchard trees. It is not very common in our forest trees, but sometimes attacks coniferous trees of all ages, often spreading through diseased roots to roots of sound neighboring trees which it kills in a short time.

Several pages are then devoted to the two types of mistletoes found in California, *Phoradendron* and *Razoumofskya,* which latter are the common causes of witches' brooms on coniferous trees.

The manual concludes with a discussion of the practical methods of controlling tree diseases. Two general rules for control are laid down:

First—Save the merchantable timber of a tree as long as the amount to be saved justifies it. This simply means closer utilization of our timber supply. Second—Prevent the infection and infestation of sound timber by getting rid of all diseased and insect infested living or dying trees. This means sanitation of our forests.

"Systematic elimination of the common fungi or mistletoes will take many years. The method which gives the best results is illustrated by a stipulation inserted in the Forest Service timber sale contracts. This requires the purchaser to cut all trees marked upon the cutting area, whether merchantable or apparently unmerchantable. Trees must be opened up sufficiently to satisfy the Forest officer in charge of their condition, and any logs in such trees which, in his judgment, are merchantable, must be removed from the woods, scaled and paid for. This enables the Forest Service to get rid of all undesirable stuff and to leave only sound seed trees and sound reproduction in healthy surroundings. It also makes possible utilization of merchantable timber left in undesirable trees, which would otherwise go to waste." L. M.

Forest Management of Loblolly Pine in Delaware, Maryland and Virginia. By W. D. Sterrett. Bulletin 11, Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1914. Pp. 59.

This bulletin covers the subject of the management of this species in a comprehensive manner, and it is presumed represents the results of a large amount of data collected during past years by the Forest Service in the states mentioned. The tables are especially valuable, those on costs and net profits should be helpful to private owners, and those on growth and volume to the professional forester.

The recommendations under Fire Protection for piling and burning slash after lumbering are of doubtful value to private owners of loblolly timber since it is not believed that these rules can be profitably carried out. Before even a very rough system of fire protection can be inaugurated there must needs be practical and comprehensive state laws enacted by the states concerned in this bulletin, and especially in Virginia, where such rudimentary laws as exist at present are inoperative. A hopeful sign, however, is that in Virginia at the present writing the question of up-to-date and efficient forest laws is being seriously considered, and it is hoped that such bills may be enacted into law by the present State Legislature. There must, however, ensue a long period of education and publicity before such laws, if passed, will become really effective.

An unusual omission in the publication is that nowhere in its fifty-nine pages is the scientific name of loblolly pine mentioned, not even under the paragraphs Forest Types and Characteristics, nor even in the Appendix under Nomenclature. It is understood, of course, that *Pinus taeda*, Linn. is referred to. Associated species are honored with their scientific nomenclature but the species whose adaptability to forest management is so fully discussed is overlooked.

From the writer's personal knowledge of the species in Virginia he doubts the absolute accuracy of the range of botanical distribution as shown on the map on page 3, believing that the species is found considerably farther west in the Piedmont Plateau than shown on the map.

On the whole, the bulletin is a valuable contribution on this economically important species, and should be very helpful to the private owner of loblolly stands as well as to the consulting forester. J. D. G.

The Reseeding of Depleted Grazing Lands to Cultivated Forage Plants. By A. W. Sampson. Bulletin 4, Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1913. Pp. 34.

Excellent results have been secured in reseeding depleted ranges to cultivated forage plants on certain of the national forests where this system has been inaugurated. The best results were obtained by sowing a mixture of timothy, red top and Kentucky blue grass on moist mountain meadows, sowing 16 pounds of seed per acre and brushing it in with a brush drag, at a total cost of $1.40 per acre. Timothy gave the best results in these studies and October is named as the best month of the year for sowing. Reseeded areas should be very lightly grazed during the first year.

J. H. S.

Range Improvement by Deferred and Rotation Grazing. By A. W. Sampson. Bulletin 34, Department of Agriculture. Washington, D. C. 1913. Pp. 16.

This report gives the results of three years' study of range grazing and its effects on the principal forage plants. It is written in a popular style and is apparently intended primarily for grazers and range managers, as well as for federal forest officers. The results secured by this study give information of great value on the proper seasons for grazing summer ranges, a problem on many national forests. It is clearly shown that close grazing in the early spring and summer months prevents reproduction of palatable plants by retarding seed maturity, and results in an increase of the non-palatable species and a decrease in carrying capacity. The figures secured show that the best results can be obtained by close grazing in the late summer, after seed has matured, at which time the grazing animals tend to thresh out the seed and trample them in the ground, which answers the purpose of harrowing.

J. H. S.

The Shrinkage in Weight of Beef Cattle in Transit. By W. F. Ward. Bulletin 25, Department of Agriculture. Contribution from the Bureau of Animal Industry. Washington, D. C. 1914. Pp. 78.

Some interesting and valuable figures to the forester, who must know facts outside of his forestry work, are contained in this bulletin on the shrinkage of beef cattle in shipment, covering three years' study in the southwest and the northwest. That the method of handling cattle, the distance they are driven from the range to the loading pens, and the fill given them just before loading play an important part in the per cent. of shrinkage en route are clearly brought out in this report, but for the reasons given above, the figures given in the tables can be considered as only approximate. The old practice of giving a herd a light water and 3 or 4 hours grazing before loading is shown to be better than giving the cattle a good fill, or none at all, and the reasons for this are also clearly shown. Taking an average of the shipment, the report shows that the shrinkage is greater on fed cattle than on range cattle. This is due largely to the fact that most range cattle are driven a considerable distance to the railroad and some shrinkage takes place before they are loaded, while fed cattle are usually loaded close to the feeding place and have not yet begun to shrink when they go in the cars. It is found that as a general rule bulls shrink more than any other class of cattle, with cows a close second. Heifers shrink less than cows and steers less than heifers. Calves shrink less than the other classes but the general average in proportion to weight is close to that of steers. It is unfortunate for foresters on the national forests that this study did not include figures on the shrinkage of cattle from the time they leave the range until they are loaded, since had such figures been given the study might have been of very great value in the utilization of unused range, which is a problem confronting many of the national forests, and which is a problem confronting many federal forest officers at the present time. J. H. S.

The Gipsy Moth and the Brown-Tail Moth, with Suggestions for their Control. By A. F. Burgess. Farmers' Bulletin 564. Washington. 1914. Pp. 24.

This bulletin summarizes the past and present status, the life history, food plants, injury caused, natural and introduced enemies, and methods of control of the gipsy and brown-tail moths in a way to be of great value to the citizens of the northeastern states.

A map showing the area infested by and quarantined for these moths is an interesting feature. The habits of the moth are too well understood to need repetition, but conclusions in regard to methods of control are worthy of note. Orchard, street, park and ornamental trees can be protected without prohibitive cost by methods now generally employed. "The control of these insects in forests is extremely difficult, owing to the small amount of money that any owner can afford to expend in preventing injury to his woodlands."

"Experiments have shown that coniferous trees are not injured by the gipsy moth if grown in isolated pure stands, and if the growth is such that the trees can be thinned to a stand of conifers no hand suppressive measures are necessary in order to prevent injury by this insect. (See fig. 10.) Such lots will also be immune from attack by the brown-tail moth, as the larvae of this insect do not feed on conifers.

"If mixtures containing a large percentage of deciduous trees are to be protected from moth injury, it is very necessary that the species involved should be carefully considered before a decision is reached as to the best methods of treatment. Sometimes practical methods of thinning can be adopted so that species will be left that are only slightly subject to injury by these insects. A limited number of experiments have shown that mixtures of chestnut, pine, red maple, ash, and hickory, regardless of the proportion of each species, are seldom injured by the gipsy moth.

"In woodlands the oaks are the most favored food plant of this insect, and unfortunately the infested region abounds in large areas where these species predominate. At present there seems to be no means aside from hand treatment which will prevent serious injury to oak woodland. . . .

"This problem is being given special study and consideration in the hope that some economical method may be devised for protecting and improving wood lots of this character at moderate expense. . . .

"The damage caused by the brown-tail moth is ordinarily not so severe as is that resulting from gipsy-moth infestation because the former species does not have so wide a range of food plants and, further, because the bulk of the feeding is done early in the season so that the trees have an opportunity to recover before midsummer. In the territory where both insects exist the caterpillars of the gipsy moth supplement the work which is done by those of the brown-tail moth and the injury is therefore greatly increased. The large acreas of oak-sprout growth furnish abundant food for brown-tail moth caterpillars. . . .

"Elimination of oak, scrub apple, and wild-cherry trees would assist greatly in reducing the numbers of this pest."

At the present time both the New England States and the

United States Bureau of Entomology are engaged in the fight against the moths. The United States Forest Service is carrying on silvicultural investigations to determine whether a practicable system of forest management to hold the insects in check can be devised.

The final conclusions of the writer are expressed in the following paragraph and are in general encouraging:

"During the past season conditions in the oldest infested area have not been as serious as in previous years. The records show that the mortality of the gipsy moth and brown-tail moth caterpillars as a result of the attack of parasites, predaceous enemies, and disease has been greater than in any of the years preceding. The experiments which are being conducted are giving information which will serve as a basis for handling infestations more satisfactorily and economically, and although new territory has been found infested the outlook for diminishing the aggregate amount of damage which results from the work of these insects is more favorable than it has been heretofore. It is necessary, however, that aggressive measures should be continued in order that the pests may be brought under better control."

R. C. H.

Forest Fire Protection by the States. As described by Representative Men at the Weeks Law Forest Fire Conference. Edited by J. Girvin Peters. Forest Service. Washington. 1914. Pp. 85.

This is a detailed record of the proceedings of the conference held in Washington on January 9-10, 1913, between representatives of the United States Forest Service and other parties co-operating in fire protection under the provisions of Section 2 of the Weeks Law.

Valuable information is given on various phases of forest fire protection from Maine to Washington and south through the Appalachians. The pamphlet should be read by all those interested in the question of forest fire prevention. R. C. H.

The Air-seasoning of Timber. By William H. Kempfer, U. S. Forest Service. Reprint from Bulletin 161, American Railway Engineering Association. 1913. Pp. 163-231.

This valuable publication comprises the various data collected by the Forest Service in regard to the air-seasoning of cross-ties and, to a less extent, of poles and sawed timbers. Much of this has already been published in various circulars and bulletins, but the present work brings all of it together in comparable form and adds considerable data not previously made public. It is all too evident, however, that much remains to be done before our knowledge of this important subject is satisfactory.

The cross-ties tested were procured at monthly intervals throughout the year and each month's cut piled in different ways so as to ascertain the effect of the form of pile on the rate of seasoning. The piles of 50 ties each were exposed to the weather without cover other than that afforded by the solid tier of ties on top. The progress of the seasoning was determined by weighing each tie at intervals usually of a month. The data from these experiments is presented graphically in numerous curves.

Seasoning experiments on western yellow pine, white fir, and Douglas fir were conducted at Pecos and Rociata, New Mexico. where the elevation is between 7,000 and 8,000 feet above sea level. Ties cut in January and February required from 4 to 5 months to reach a constant moisture content; those cut in May and June only 2 months at Rociata and 1 month at Pecos; those cut in November and December, 6 months. There was not much variation in the rate of seasoning of the different species.

Lodgepole pine, Douglas fir, and western larch of the Northwest were tested. Lodgepole cut in Montana in May, June or July was practically air-dry in 3 months, and even when cut in September became fairly well seasoned before winter; but if started in winter it required until the next July to become dry. Larch in Idaho and Douglas fir in Idaho and Washington, when cut in early spring, required from 4 to 5 months to season, while if cut in July they lost almost as much moisture in the succeeding 2 or 3 months as they did by holding them until the following summer.

Local climate effects on seasoning were shown by tests at Tacoma in the western and at Pasco in the eastern part of Washington. Both lots of ties came from the same place and the weights were taken at the same time, but the seasoning was more rapid and a lower rate was reached in the drier climate at Pasco than at Tacoma.

Of the eastern conifers only hemlock and tamarack ties from Michigan have been tested. The hemlock had a very high moisture content when green and lost water rapidly during the summer months but did not reach a constant weight within the period of the observation which varied from 11 to 16 months. There appeared to be practically no difference in the rate of seasoning of ties openly piled (7x2 and 8x1) and those closely piled (7x7). It required from 4 to 9 months, according to the time of year, to reduce the moisture content of hemlock from a green weight of 55-57 pounds per cubic foot to 40 pounds, while the average dry weight of the wood is only 24 pounds per cubic foot.

Seasoning records were obtained on loblolly, longleaf, and shortleaf pine at Silsbee, Texas, and on loblolly at Ackerman, Mississippi. Ties cut in January and February were fairly dry at the end of 4 or 5 months, but continued to lose weight for several months longer. From April to October the seasoning was so rapid that the ties lost little weight after the first 2 or 3 months, even if held till the following summer.

Tests were also made on some southern hardwood ties. Hardwoods in general dry more slowly than conifers. Red oak ties cut in Arkansas in spring and early summer were far from dry when they ceased to lose weight at the approach of winter, and the following summer they lost nearly two-thirds as much moisture as during the first summer. When the ties were cut in winter and carried through two years the loss of weight during the second summer was nearly half that of the first. The tests on other hardwoods were not conclusive but indicated that red gum and beech dry faster than red oak.

Data on the rate of seasoning of northern hardwood ties are very meagre. The data on the pole-seasoning tests will not be reviewed here as they are presented in the present publication in only slightly different form from Bulletin 84, "Preservative Treatment of Poles."

The accelerating effect of warm, dry weather on the rate of evaporation, and the retarding effect of cold, damp or wet weather are plainly visible in the tests started at different times of the year, and also when the weighings were continued from one summer through the winter into the succeeding summer. Timbers which had become fairly dry ceased to lose or even absorb moisture during rainy or cold, damp weather. Timbers cut under such conditions showed a moisture loss regardless of the weather, and by the time warm, dry weather arrived their seasoning had advanced so far that the rate of loss was fairly constant throughout both periods.

"Of two pieces of wood differing in moisture content, other conditions being equal, the one with most moisture will dry the more rapidly, and in a comparatively short time both pieces will reach about the same condition. This rule does not apply strictly between different species, even when of similar structure and in pieces of the same size and form, but with conifers the usual variation between the species does not seem sufficient to necessitate separate treatment.

"Sapwood of the conifers contains, as a rule, very much more moisture than does the heartwood, and the difference in the proportion of heartwood and sapwood in two timbers of the same species accounts for a large part of the difference in moisture content, But sapwood loses moisture more rapidly than the heartwood, and this tends to equalize the time required for the two pieces to become air-dry. . . .

"The complaint is not at all uncommon that cross-ties or other timbers of certain species, such as the soft pines, the gums, beech and maple, will decay before they will season. It is believed that this can be prevented usually by piling the timbers so as to dry rapidly. The tree should be barked as soon as felled, and the timbers piled openly. Injury by insects may be prevented in the same manner.

"While quick seasoning prevents injury by decay and insects, it is not always necessary or desirable. Timber cut and set drying in hot weather checks more seriously than in cold weather, and sometimes becomes 'case-hardened' and very resistant to preservative treatment. Timber cut in the late autumn or winter seasons more slowly and evenly; if peeled and properly stacked, or skidded off the ground, it dries enough before warm weather to resist attack by insects or fungi. But whatever the time of cutting, careful attention is needed in piling the timber, either more openly or more closely, according as local climatic and other conditions are found to require. . . .

"The extreme rapidity with which saturated wood loses moisture when exposed to drying conditions is doubtless responsible for the belief that the seasoning of timber may be facilitated by soaking it in water. In the tests to determine the effect of this process, timbers which had been soaked for short periods, upon removal from the water, lost the extra moisture so fast that they soon reached practically the same condition as similar timbers not immersed. Whether the soaked timber ultimately reaches a lower moisture content is still open to question." S. J. R.

Tests of Wooden Barrels. By J. A. Newlin. Bulletin 86, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 12.

This paper describes tests made at the Forest Products Laboratory in co-operation with the Bureau for the Safe Transportation of Dangerous Explosives, the purpose being to obtain data upon which specifications and changes in the design of wooden barrels used in the transportation of dangerous liquids might be based. The tests do not afford comparisons between barrels made of different material or of different kinds of timber.

The barrels which were made of quarter-sawed white oak, were completely filled with water, closed and tested. Two barrels of each group were tested in side compression, two in diagonal compression, one each in side and diagonal drop, and two by internal pressure.

The tests indicated that the chimes should not be less than one inch long; that the spacing between the bilge hoops should not be less than eight inches; that the weakest part of the barrels was the heads which should be much thicker than the staves; that the dowel holes weakened the heads materially, making desirable some improvement of the head joints; that it is advisable to grade the staves and heading with reference to the strength.

S. J. R.

Tests of Rocky Mountain Woods for Telephone Poles. By Norman de W. Betts and A. L. Heim. Bulletin 67, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 28.

This paper gives the results of tests on western red cedar, lodgepole pine, and Engelmann spruce poles to determine their suitability for telephone poles. The tests included fire-killed pine and spruce. Although pine and spruce are not naturally durable in contact with the ground, the general adoption of preservative treatment by railroad and telephone companies would permit their use if otherwise satisfactory.

On a basis of the fiber stress developed, the air-seasoned lodgepole pine is superior to the cedar in all of the mechanical properties tested. Fire-killed lodgepole pine proved to be only 80 per cent. as strong as the cedar, but in elastic values was practically equal to it. Fire-killed Engelmann spruce was found to be inferior in all mechanical properties to the cedar and pine.

Since a comparison based on the fiber stress developed is equivalent to one based on uniform ground-line diameter, while in practice it is customary to specify top diameters, it is evident that a difference in taper, such as ordinarily exists between poles of the different woods, would affect the strength of the poles. On a basis of equal top diameters it appears that there is practically no difference between air-seasoned lodgepole pine and western red cedar, while in stiffness the pine exceeds the cedar by about 25 per cent. The fire-killed poles of both lodgepole and spruce were practically equal to the cedar in strength at elastic limit and about 20 per cent. below it at maximum load. S. J. R.

Balsam Fir. By Raphael Zon. Bulletin 55, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 67.

This paper deals with all aspects of balsam fir, its distribution, the forest types in which it occurs, the present stand and cut, its economic importance, particularly in relation to the pulp industry, methods and cost of lumbering, life history of the tree, characteristics of the wood, rate of growth and yield, and suggested methods of management.

The total stand of balsam fir throughout its range is roughly estimated to be five billion board feet which, not counting the increment, should last thirty years at the present rate of cutting.

The principal objections to the use of balsam for pulp are: (1) In the ground-wood process the pitch covers the felts and cylinder faces. The writer contends that this is not due to any property of the wood itself, and must either come from bark left on the surface of the blocks or else is formed in the process of grinding. The statement is made that balsam fir is one of the *few* conifers that lack resin ducts entirely, when as a matter of fact only four out of thirteen indigenous genera contain ducts normally. (2) The fiber of balsam fir is weaker, shorter, and softer than spruce fiber. (3) The yield in paper and pulp per cord of wood is less than in spruce.

Under present methods of cutting, balsam fir is increasing at the expense of red spruce in the second growth throughout the entire range of the two species. The fir grows much faster throughout its whole life than the spruce, but is shorter lived and reaches maturity very much sooner. The fir should be cut at an age of from 100 to 125 years, while spruce as it now grows in natural forest should be cut at an age of from 175 to 200 years. The annual increment per acre of balsam over its entire range varies from one-sixth to one-third of a cord.

Selection cutting in small groups is recommended as the best silvicultural system for balsam. The natural reproduction of both spruce and balsam is assured under this system, with the possibility of increasing the proportion of spruce in the new stand.

S. J. R.

Tyloses: Their Occurrence and Practical Significance in Some American Woods. By Eloise Gerry. Reprint Journal Agricultural Research. U. S. Department Agriculture Vol. 1, No. 6. 1914. Pp. 445-470.

This paper embodies the results of a careful study of a considerable number of specimens of both hardwoods and conifers with reference to tyloses. Emphasis is laid on the previously known fact that tyloses may occur in the sapwood of all species in which they occur in the heartwood, sometimes in the outermost rings near the bark.

Attempt to explain the relation of tyloses to the properties of the wood is not very satisfactory. "The woods in which tyloses are abundant as a rule are durable," yet there is nothing to prove that the presence of the tyloses is in any way responsible for the increase in durability. It is shown that tyloses when strongly developed in the vessels of wood tend to keep air and liquids out of the vessels, but in the case of impregnation of the wood with creosote they apparently have no effect on the penetrability of the other wood elements.

This paper may well be considered a valuable contribution to the knowledge of the subject, but more so because of the questions it raises than those it settles. Much remains to be learned regarding the "practical significance" of tyloses. The plates are excellent and demonstrate the great possibilities of photomicrography in the study of wood structure. S. J. R.

A Meteorological Study of Parks and Timbered Areas in the Western Yellow-Pine Forests of Arizona and New Mexico. By G. A. Pearson. Reprint from Monthly Weather Review. Washington D. C. Vol. 41, 1914. Pp. 1615-1629.

The object of the study was to determine the influence of the forest cover upon climate locally in the Southwest, in so far as this influence might be of importance in the management of timberlands and the possible afforestation of parks and denuded areas. Comparatively little attention was devoted to purely meteorological problems or to the influence of the forest upon the general climate of the region.

It was found that the mean annual temperature in the forest is 2.7° F. higher than in the park, and the maximum averages 0.9° F. lower and the minimum 6.4° F. higher. The mean daily range is 7.3° F. smaller in the forest. This relation is believed to be due to the influence of the forest canopy, partly by the action of the tree crowns in checking the loss of heat by radiation, but mainly by the deflection of cold air currents from surrounding mountains and high mesas. The temperature of the soil in the forest during the summer, when shaded by the trees was found to be about 5° F. lower at a depth of two feet than at the same depth in the park.

The snowfall in the park is more even and the depth somewhat greater than in the forest where the crowns of the trees interfere, but it remains from two to three weeks longer on the ground in the forest and a greater proportion of the snow water is absorbed by the forest soil. The average wind movement in the forest is only about half as great as in the park, while the evaporation from a free water surface is only 70 per cent. as great.

"The influence of the forest upon all factors studied, with the exception of relative humidity for which our data are inadequate, is similar to that shown by European observations. In the European forests, as in those covered by this study, the extremes of temperature are modified; but in European forests the maxima are lowered more than the minima are raised, with the result that the mean temperature is lower in the forest than in the open, while in our forests the maxima are lowered less than the minima are raised, with the result that the mean temperature is higher in the forest than in the open. The influence of the forest in decreasing evaporation is 30 per cent greater in Europe than is shown in this study."

This investigation shows that the climatic conditions are decidedly unfavorable to the establishment of forest growth in the parks, and that little or nothing can be expected from natural seeding. In cutting original stands it is highly desirable to leave a portion of the stand not only to furnish seed but also as a protection to the young growth. The Forest Service had previously adopted this shelterwood system and this report states that the reasons for doing so are well founded.

Some planting experiments of 1912 gave excellent results, due presumably to the use of a higher grade of plants than had previously been tried. There is no assurance, however, that the plantations will grow to maturity, as it is probable that unfavorable soil conditions, as well as adverse atmospheric conditions which make it impossible for the seedlings to survive the first year, are involved. Although the most of park areas in the yellow-pine type will eventually be devoted to agriculture, yet there are some portions too rocky for farming which should be forested if possible.

"Further investigations on cut-over areas, with special reference to the effect of different degrees of cutting upon the physical conditions which are now being conducted by the Fort Valley Forest Experiment Station, will undoubtedly determine with greater scientific certainty how our western yellow-pine forests should be managed. This study merely attempted to lay the scientific foundation upon which to base the broad principle of forest management of western yellow pine in the Southwest."

S. J. R.

Annual Report of the Director of the Department of Botanical Research. By D. T. MacDougal. 1913. Pp. 1-87.

Dr. MacDougal's annual report contains an interesting account of the treelessness of the prairie regions, by W. A. Cannon, and the root characters of trees grown in the coastal climate of California, by the same writer. It appears that "Mesophytic trees should attain a perennially moist soil—such resistant species as mesquite may persist—if the water table lies within 40 feet of the surface." In Kansas and Nebraska the water table is often less than 40 feet along streams, but on adjacent higher lands it is from 60 to several hundred feet, where, although the soils may be favorable, forests are unable to exist. The open character of the oak forests so typical of Southern California, Dr. Cannon found, were directly the result of far-reaching superficial roots.

T. S. W. Jr.

Makers of British Botany. A Collection of Biographies by Living Botanists. Edited by F. W. Oliver. Cambridge University Press. 1913. Pp. 332.

This book consists of a series of delightful essays on the life and work of outstanding British botanists of the past, from the earliest down to Sir Joseph Dalton Hooker who died in 1911—Morison (1620-1683), Ray, Grew, Hales, Hill, Robert Brown, William Hooker, Henslow, Lindley, Griffith, Henfrey, Harvey, Berkeley, Gilbert, Williamson, Ward, and Joseph Dalton Hooker. The title is not a happy one, for neither has there been a school of British botany as distinct from German, Italian, or any other, nor does the editor make any such assumption.

British botanists have taken a part in most of the important advances made in the science of botany and some have been pioneers.

Morison and notably Ray were among the first to successfully attempt a rational classification of plants. Grew shares with the Italian botanist Malpighi the distinction of laying the foundations of plant anatomy. It is noteworthy that Grew's *Anatomy of Plants* (1672) appeared the very day on which Malpighi's manuscript was submitted for publication. Hales was probably the first plant physiologist (1727), standing "in the solitude of all great original inquirers." Brown was foremost among modern morphologists, worthy of Von Humboldt's estimate of him—"facile botanicorum princeps." The elder Hooker occupies a place with the elder De Candolle of Geneva, as a great descriptive botanist, the last of the pre-Darwinians, and as an organizer of botanical gardens—his name is indissolubly associated with the making of Kew. Henslow was a pioneer ecologist and botanical educationist. Lindley (1799-1865) linked botany with horticulture. Gilbert (1817-1901) has done the same with agriculture, making the Rothamstead experiment station perhaps the best known of all its kind. Harvey was a pioneer algologist, and was the first to give an account of the seaweeds of our continent in a magnificent work published by the Smithsonian Institution (1858). Berkeley ranks as a foremost mycologist, and "it is not too much to pronounce Berkeley as the originator and founder of Plant Pathology." Some measure of the extent of his labors is possible when it is remembered that in his herbarium of fungi presented to Kew in 1879—10,000 species in all—5,000 were types of his own description and naming. Williamson leads in the van of British palaeobotanists. Joseph Hooker fills a large place as a systematist of the post-Darwinian era. His natural system of classification (Bentham and Hooker's) held the field for a generation. It was the immediate predecessor of the Engler system now in vogue. Ward was among the first to apply strict bacteriological methods to the study of fungus diseases of plants. He was associated for a time with a forest school, and published the well-known Manuals on Trees. His leading studies were in the field of parasitism and one of his books, worthy of perusal by every forester is "Disease in Plants."

J. H. F.

OTHER CURRENT LITERATURE.

Hearing before the Committee on Agriculture, House of Representatives, Sixty-third Congress, Second Session, on the Estimate of Appropriations for the Fiscal Year ending June 30, 1915. Forest Service. Washington, D. C. 1913. No. 75.

This contains the substance of the hearings before the Committee on Agriculture of the House of Representatives on the Appropriation bill for the Forest Service.

Society for the Promotion of Agricultural Science: Proceedings of the Thirty-fourth Annual Meeting, November, 1913. Washington, D. C. 1914. Pp. 115.

The Birds of North and Middle America. By R. Ridgway. Bulletin 50, Part VI. U. S. National Museum. Washington, D. C. 1914. Pp. 882.

Forest Fire Protection in Maine Forestry District, 1913. By B. S. Viles. Bulletin Department of State Lands and Forestry. Augusta, Me. 1914. Pp. 11.

Forestry in New Hampshire: Twelfth Report of the Society for Protection of Forests, 1913. 1914. Pp. 96.

Fifth Annual Report of the State Forester of Vermont. By A. F. Hawes. Burlington, Vt. 1913. Pp. 43.

Connecticut Forest Fire Manual, 1914-1915. Issued by the State Forest Fire Warden. New Haven, Conn. 1914. Pp. 39.

Includes the Connecticut forest fire laws and full instructions to all persons concerned with the execution of these laws.

The Brown-tail Moth. By W. E. Britton. Bulletin 182, Agricultural Experiment Station. New Haven, Conn. 1914. Pp. 26.

The brown-tail moth is now present throughout the northeastern portion of Connecticut, about one-third of the area of the state being infested. Though not yet sufficiently abundant to cause noticeable injury, the pest is spreading gradually and will soon infest the entire state. The bulletin describes in detail the life and habits of the moth and suggests methods for its control.

Annual Report of the Connecticut Agricultural Experiment Station, 1913: Part III, Thirteenth Report of State Entomologist. By W. E. Britton. New Haven Conn. 1914. Pp. 181-256.

Contains numerous notes on forest insects.

New York Conservation Commission: List of Lands in the Forest Preserve, January 1, 1914. Albany, N. Y. Pp. 503.

Check-list of the Woody Plants of a Portion of the South Mountains near Mont Alto, Pennsylvania. By. J. S. Illick. 1913. Pp. 10.

The list is based primarily upon the author's observations during five seasons of field work in dendrology with the students of the Pennsylvania State Forest Academy, and was prepared primarily for the use of such students.

First Biennial Report of the State Forester of Kentucky, 1913. Frankfort, Ky. Pp. 104.

The bulk of this report is devoted to shade trees.

Yellow Poplar in Tennessee. By W. W. Ashe. Bulletin 10. C, Geological Survey, in co-operation with U. S. Forest Service. Nashville, Tenn. 1913. Pp. 56.

Alabama Bird Day Book. Prepared by John H. Wallace. Department of Game and Fish. Montgomery, Ala. 1914. Pp. 88.

The seventh of a series of books designed for use in the schools on Bird Day, and containing numerous selected sketches and poems appropriate to the occasion, and rendered very attractive by the beautiful illustrations, of which seven are in colors.

Thirteenth Annual Report of the State Board of Forestry, State of Indiana, 1913. Indianapolis, Indiana. Pp. 121.

Minnesota Foresty Board: Third Annual Report of the State Forester, 1913. Duluth, Minn. 1914. Pp. 147.

Minnesota is to be congratulated on the third annual report, which conclusively shows a decided accomplishment during the past year, notwithstanding the fact that the appropriations asked for were not granted by the State legislature. While the report specializes on fire protection, it also contains data on tree planting for shelter in Minnesota, on tree diseases, woodlot management and wood using industries.

Tree Planting for the State of North Dakota. By Fred W. Smith, State Forester. Quarterly Bulletin North Dakota State School of Forestry, Vol. 1, No. 1. 1914.

In accordance with the action of the North Dakota legislature of 1913 which created the office of state forester to be filled by the president of the School of Forestry and provided for the growing and distribution of forest tree seedlings, the school is making an effort to supply the nursery stock needed for planting on the prairies of the state. In 1915 they expect to have ready at least a million trees. This article answers questions relating to the distribution of forest trees, seeds, seedlings and cuttings.

Proceedings of Forest Fire Conference, Western Forestry and Conservation Association, Vancouver, B. C., December 15-16, 1913. Reprint by The Timberman, Portland, Oregon. Pp. 32.

Forest Windbreaks as a Protection to the Light Soils of the Columbia River Basin. By George L. Clothier. State College of Washington, Series 1, No. 4. Olympia, Wash. 1914. Pp. 12.

Urges the planting of trees for protective purposes on the light and easily blown soils of the Columbia basin, particularly that part embraced in central Washington, and gives advice regarding how and what to plant.

Annual Progress Report upon State Forest Administration in South Australia for the Year 1912-13. Adelaide, S. A. 1914. Pp. 12.

New South Wales, Report of 1912, Botanic Gardens and Government Domains. By J. H. Maiden. Sydney, N. S. W. 1913. Pp. 45.

The Production and Utilization of Pine Timber in Great Britain. Part I. Production. No. 2. Sample Plot of Scots Pine *at King's Lynn.* By E. Russell Burdon and A. P. Long. Bulletin No. 2, University of Cambridge School of Forestry. Cambridge, 1913. Pp. 16.

The plot selected for measurement formed a small part of a block of woods, some 450 acres in extent, situated in the parishes of Gaywood, Mintlyn and Bawsey. The trees were 91 years old, had an average height of 65 feet, and the number per acre was 216 with a mean diameter of 13.3 inches. For the most part the boles of the trees were free of branches up to 25 or 30 feet. A sample tree contained a total of 27.9 cubic feet of which heartwood formed 7.8, or 28 per cent; sapwood, 17.9, or 64 per cent. bark, 2.2, or 8 per cent. The equivalent volume of converted material per acre, on the basis of the battens, scantlings and boards actually sawed from a sample tree, was 4,082 cubic feet.

Irish Forestry Society: Rules and By-laws. Dublin. 1913. Pp. 12.

The objects of the society are the advancement in Ireland of scientific and practical forestry, the dissemination of knowledge of such branches of science and arts as are connected with forestry, and the diffusion of information as to the benefits to be derived by the Nation by the science of arboriculture properly understood and applied. The society was organized in 1900.

Irish Forestry Society: Transactions and Statement of Accounts for the Year ended 31st December, 1912. Dublin. 1913. Pp. 18.

"Ireland of old was famous as a land filled with .... sublimity, that of woods and forest grandeurs; we could be as cheaply poetic over woods as over bare flint, and Ireland would be the happier and every way the better; .... we are the least wooded country of the temperate zone, and every other country is working might and main, men and money, and method to increase its forests. We have of late a small nucleus of effort; the lost idea begins to come forward again; but progress is slow. .. All that bare area, those vast acres of nothingness, would, in well governed countries be clothed still with the secular woods, and immeasurable source of work and of national wealth, to say nothing of the good that follows to climate and to the beauty of the country or of the exceptional good there is in the very nature of forestry, and of the trades it brings about, as healthy and happy occupations for the people .... far more manly and moralising than the work of the factory." Quotation from the Freeman's Journal in Appendix.

Physikalische und chemische Eigenschaften der zur Holzkonservierung angewandten Teere und Teerderivate. Von Dr. Friedrich Moll. Sonderabdruck aus der "Zeitschrift für angewandte Chemie," Jahrg. 26, Nr. 101, 1913, Seite 792 ff.

Der künstliche Schutz des Holzes durch ätzsublimat (Kyanisierung). Von Dr. Friedrich Moll. Sonderabdruck aus der "Zeitschrift für angewandte Chemie." Jahrgang 26, Nr. 67, 1913, Seite 459 ff.

Beitrag zur Beurteilung der hölzernen Gestänge zir Telegraphen und Fernsprechlinien. Von Dr. Friedrich Moll. Archiv für Post und Telegraphie, Nr. 8, 1913, Pp. 229 ff.

Skogvaesenets Historie. I. Del Historik. II. Del Statistik. Kristiana, 1909. Pp. 292 and 181 respectively.

Gives a history of the Forest Service of Norway for fifty years, 1857-1907.

Indberetning om det Norske Skogvaesen for Kalander-aaret 1912. Kristiana, 1913. Pp. 152.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forest Evolution in Switzerland.

An article by Barbey summarizes the development of forest practice in Switzerland. After explaining that forestry was not originally homogeneous on account of Switzerland being divided into twenty-two federations, he shows that the birth of real forestry in Switzerland was in the eighteenth century when the first silviculturists were trained at Tharandt. Under the influence of this training, an attempt was made to adopt clear cutting methods, to regularize the forests and simplify management, but after a half century of practice the results of clear cutting in the Alps and in the Jura were far from satisfactory. Consequently, the selection method of felling has now been almost uniformly adopted, especially through the teaching of Professor Engler. The type of selection cutting is what the writer calls a system of concentrated selection fellings with a long period for regeneration either by single trees or by groups, with a cutting cycle of ten years. In Canton of Vaud, for example, it is interesting to learn that even in an ordinary high forest if a private owner wishes to cut more than twenty cubic meters of wood, he must be authorized by a representative of the state. In protection forests not a single tree can be cut without the approval of federal officials. By a law passed in 1914, except under the most unusual circumstances, clear cutting in protection forests is absolutely forbidden.

T. S. W., Jr.

Revue des Eaux et Forêts, January 1, 1914, pp. 32-36.

Forests of Russian Turkestan.

Moussetafine presents data on the forests of Turkestan which are divided into three characteristic types; (1) mountain forests, (2) river and valley forests, (3) plateau forests. The forests of Turkestan are described as having enormous importance from the standpoint of soil protection, water conservation, and protection against moving sand; and as having great economic importance since they are the sole source of fuel and building material. The important species are listed and their distribution described.

T. S. W., Jr.

Revue des Eaux et Forêts, January 1, 1914, pp. 105-109.

Forests of Spain. LeBressan generalizes on the impoverished condition of Spanish forests. After commenting on the varying acreage as reported by different writers, he reviews the damage which has resulted from overcutting and overgrazing. Most of this damage seems to have resulted from the substitution of goats for sheep.

J. S. W., Jr.

Bulletin Société Forestiére de Franche—Comté & Belfort, March, 1914, pp. 312-315.

SOIL, WATER AND CLIMATE.

Soil Physiology. The depth to which the soil is open enough to allow the penetration of tree roots does not always determine the distance the roots descend. In other words, the absolute soil depth and the physiologic soil depth are not necessarily equal. It is only the moist, crumbled, well aerated soil which contains a high percentage of the organic matter that supports root growth. A compact, sticky soil and a too open sandy soil without humus alike prevent root growth.

The distribution of the soil water is a most important factor. Trees require a large amount of water, but also the drainage must be good. In fact, xerophytic plant formations are found on sandy soils under which the water table is high because it is only the top layer of soil which is well enough aerated, and that drys out rapidly on account of its sandy character.

The following table shows the relation of soil depth to site quality for pine:

Quality.	*Depth.*	*Geometric mean.*
Site II	28"—120"	85"
III	35"— 85"	55"
IV	25"— 60"	40"
V	25"— 65"	35"
Stunted	5"— 40"	20"

The problem of improving forest soils cannot be solved by fertilization. That is too expensive. Much can, however, be done by cheaper methods of cultivation prior to reproduction; providing there is a proper mixture of deep and shallow rooted species, so as to completely utilize the soil and prevent its deterioration through weed growth, excessive light, and loss of humus. In the application of such methods the three main objects to be attained are drainage, complete aeration and the maximum humus content.

The following table shows the comparative cost of different methods of cultivation prior to securing natural regeneration or planting:

Ridge cultivation, (especially applicable to swampy soils and sandy soils with a high water table,	$20 an acre
Deep plowing (over 12 inches), ...	$8-10 an acre
Shallow plowing, ...	$4 an acre
Dynamiting, ...	$16 an acre

K. W. W.

Beiträge zur Physiologie des Badens. Forstwissenschaftliches Centralblatt, January, 1914, pp. 26-44.

Soil Preparation for Natural Regeneration.

It is a common practice of the profession in Germany to have excursions which visit points of interest and take up, under the guidance of the responsible officials the problems of management which the forest visited presents. While it will be several generations before we can show the results of long time management, the excursion idea is a good one. It profits both the visitor and the visited.

The most interesting points about the Langenbrand Forest in southwest Germany is the method of soil preparation employed to secure natural regeneration. The forest now has the following composition: Fir, 63%; Spruce, 14%; Pine, 17%; Hardwoods, 60%, (mostly beech). The problem is to secure natural regeneration of the desirable softwoods without opening up the stand too much, drying out the soil and encouraging weed growth. Still the thinning must be severe enough to afford the relatively intolerant spruce and pine an advantage over the tolerant beech and fir. Good results have been obtained over 280 acres in the period 1907-1913 by digging up the ground to a depth of 15 inches in spots about 2 feet square. The moss and weeds are entirely removed in these spots and the mineral soil thereby exposed. Success was attained over 93% of the area regenerated in the period from 1905-1913.

Another interesting point in the management of this forest is the recent reduction of the rotation from 120 to 100 years. This has resulted in an increased total yield with a smaller percentage of thinnings. The present yield is about 10 cu. ft. per acre, 25% of which comes from thinnings.

At this time the distribution of age classes is as follows:

1-20 years	11%
21-40 years	20%
41-60 years	11%
61-80 years	13%
81-100 years	29%
Over 100 years	16%

K. W. W.

Bericht über den Waldbaukurs in Langenbrand im Sept., 1913. Forstwissenschaftliches Centralblatt, February, 1914, pp. 87-97.

Interception Crowns In Pine Forest.

The author, S. Okliabin, describes the results of his observations conducted at one of the forest experiment stations in Russia (in the province of Samara) upon the amount of precipitation that penetrates through the crowns of a pine forest from 80 to 100 years old and having a density of from 0.6 to 0.7.

Twelve rain gauges were installed on an area of about 1,000 square meters under the crowns of the trees and in the spaces between the tree crowns. In addition to these rain gauges there were three other rain gauges, of which one was placed under the crowns of the trees on a tower, another in a small opening, and a third under the crowns. Measurements of rainfall by means of all these rain gauges were carried on from December 15, 1904, until October 1, 1909.

The most essential results obtained by the author are as follows:

(1) Precipitation in the form of rain is intercepted by the crowns of trees to a larger extent than in the form of snow. In the case of rain the average amount intercepted is 28 per cent., in the case of snow 12 per cent.

(2) The lighter the precipitation the more of it remains on the crowns. Thus the amount intercepted, on an average, in the case of rains from 0.1 to 1.9 mm is 41 per cent; 2.1 to 4. 9 mm is 36 per cent; 5.0 to 9.9 mm is 19 per cent.

In the case of snowfall a similar dependence is observed, but it is less pronounced, since the snow intercepted by the branches is gradually blown down into the rain gauges.

R. Z.

Lesnoy Journal, 1913, No. 5.

Water Lost by Pine Trees and Evaporometers.

In order to establish a relation between the evaporation that takes place from an evaporometer and the loss of water by a three-year-old Scotch pine, parallel observations were conducted by A. P. Tolsky during the summer of 1911 at the Forest Experiment Station in the Province of Samara, at 7 a. m., 1 p. m. and 9 p. m. The pine was planted the year before in a zinc vessel with soil. The loss of water was determined by weighing. The amount of water lost was replenished by means of a tube that reached through the lid covering the vessel to the bottom. The lid closed the vessel hermetically and had in addition to the opening through which the tube was inserted only one other opening for the stem of the pine. By watering, the level of the water in the soil was maintained at the same level throughout the entire experiment. From the results of these observations the author came to the conclusion that the loss of water by pine:

(1) Depends, just as in the case of the evaporometer, upon the temperature, solar radiation, humidity of the air, and the velocity

of the wind. It was impossible to establish this relation during the entire vegetative period, since, in order to do that, much shorter intervals were required.

(2) During the period of development of young shoots, the loss of water in the pine does not go on parallel with the loss of water from the evaporometer, especially in May and June. This would indicate that physiological processes have more to do with the loss of water from plants than meterological conditions.

(3) During the day, the greatest loss of water by the pine was observed in the morning and the forenoon hours. The evaporometer lost most water in the afternoon hours.

(4) The ratio between the loss of water by the pine and that by the evaporometer is especially great during the months of May and June. This period coincides with the vigorous growth of young shoots and needles.

(5) By comparing the loss of water from the pine with that from the evaporometer for definite periods of time, it is possible to determine converting co-efficients by means of which the intensity of physiological activity of plants for different periods of their development can be ascertained from the records of the evaporometer.

R. Z.

Transactions of the Forest Experiment Stations, Vol. XLVII, 1913, St. Petersburg.

Effect of Cover Upon Soil Moisture.

Prof. Albert, of Eberswalde, states that artificial fertilizers in pine forest did not prove successful in Germany, while attempts to substitute cultivation of forest soil by covering with different vegetable refuse, such as lupine straw, tops of potato plants, pine needles, gave favorable results. He describes the results of moisture determination in the soil during the summer of 1911 in a poor forest stand near Eberswalde on alluvial sand on three sample plots: (1) which was not cultivated at all; (2) cultivated in the spring and sown to lupine, which, however, entirely disappeared; and (3) covered with pine litter.

Moisture determinations at a depth of 20 and 40 centimeters clearly showed the effect of covering upon the greater humidity of the soil during the entire year.

Without cover, the soil at times lost its entire moisture available for plant growth. Albert sees the effect of the cover not only upon the moisture contents of the soil, but also upon a number of other factors and, for this reason, he believes that by covering the ground it will become possible to eliminate the failures in the reforestation work in sandy soils. R. Z.

Mitteilungen der Deutschen Landwirtschaftlichen Gesellschaft, 1912, No. 3.

SILVICULTURE, PROTECTION AND EXTENSION.

Thinnings in Beech and Pine.

Wimmenauer presents the results of certain investigations conducted by the Hessian Forest Experiment Station. The object of these investigations was to compare the financial advantages of various methods of thinnings, to wit: (1) thinnings from above, (2) thinnings from below, and (3) selection thinnings. The results show that the first two yield approximately equal money returns, whereas the last named lags far behind. The volume increment is greatest with (1), least with (2), and intermediate with (3).

Many interesting figures are developed, in tabular form, and the author reaches the justifiable conclusion that the static (comparison of values) of thinnings requires just as exact a division into grades of timber secured as does that of the final yield.

A. B. R.

Durchforstungsversuche in Buchen- und Kiefernbeständen. Allgemeine Forst- und Jadg- Zeitung, March, 1914, pp. 84-90.

Grades of Thinning in Scotch Pine.

Weber briefs an interesting investigation of the Royal Saxon Experiment Station at Tharandt dealing with the influence of various grades of thinnings on the increment of Scotch pine stands. The investigation was made on the State Forest of Kunersdorf near Schandau. It was begun in 1862 when the stand was 20 years old and was ended in 1912, when the stand was 70 years old. During these 50 years three comparative areas were thinned ten times, to wit: in the years

1862, 1869, 1874, 1879, 1883, 1889, 1894, 1900, 1905 and 1912, one area always with a light (A-grade) thinning, another with a moderate (B-grade) thinning, and the third with a heavy (C-grade) thinning.

The results show that the heavy thinning in no way retards the height growth, that it, in fact, reacts favorably thereon. Most interesting is the comparison of the volume increment of the three areas.

Total final yields of A grade thinning=7,693 cu. ft. per acre.
Total final yields of B grade thinning=8,165 cu. ft. per acre.
Total final yields of C grade thinning=9,438 cu. ft. per acre
or an increase of 22.7% over A grade and 15.6% over the B grade area.

Another important result is that the heavy thinning does not bring about a lessened clear-length (lower crowns) but, on the contrary, an increased clear-length commensurate with the greater height growth.

Regarding the form of the bole, Dr. Kunze, the investigator, himself says: "The experiments by no means justify the assumption that heavy thinning of Scotch pine means poor form of the stems."

The volume increment is greatly stimulated by the heavy thinning; the exact figures are not given in Dr. Weber's review. (The results are published by Paul Parey, Berlin and sold at 38c a copy.)

All in all, concludes the reviewer, these results coincide with similar experiments elsewhere and are an additional argument in favor of heavier thinnings. A. B. R.

Mitteilungen aus der Kgl. Sächsischen forstlichen Versuchsanstalt zu Tharandt. Allgemeine Forst- und Jagd- Zeitung, March, 1914, pp. 93-95.

Influence of Source of Seed.

Weber reviews the latest bulletin of the Swiss Experiment Station on the Influence of the Source of Seed upon the Character of Forest Growth. Readers of the QUARTERLY, however, need no extract of Weber's article, since an excellent brief of the bulletin itself is given in a review thereof by Director Toumey in the "Proceedings of the Society of American Foresters," Vol. IX, No. 1, 1914, pp. 107-113.

Such studies as these of the Swiss Experiment Station deserve to be read widely. A. B. R.

Mitteilungen der Schweizerischen Zentralanstalt für das forstliche Versuchswesen. Vol. X, No. 3, 1913, Zürich. Allgemeine Forst- und Jagd-Zeitung, January, 1914, pp. 18-24.

Volume Production of Pure and Mixed Stands.

Wimmenauer, with characteristic modesty, contributes some interesting data on this question. In mixed stands of beech and oak in Hesse, where the beech occupied from 88 to 35% of the total basal area of the stems and the oak from 12 to 65%, investigation showed that such mixed stands yield more volume than pure stands, when the proportion of oak is 20% and over.

In mixed stands of beech and Scotch pine in the Odenwald, where the beech occupied from 63 to 15% of the total basal area of the stems and the pine from 37 to 85%, investigation showed that such mixed stands yield more volume than pure stands by 19% and may run as high as 34% and 37% greater volume. This advantage in volume accrues when the proportion of pine is 50% and over. A. B. R.

Zur Frage der Mischebestände. Allgemeine Forst- und Jagd- Zeitung, March, 1914, pp. 90-93 (see also p. 109).

Damage by Tar.

Forstmeister von Gabnay brings together the latest information regarding the influence of asphalt or other tar coverings on trees. He first points out that the tarring of trees against insects produces the death of the cambium layer and, if the bark has been removed near to the wood, of several layers of sap wood, which may afterward be overgrown, but leave a defect that can never be cured.

A number of Frenchmen were first in the field investigating the influence of asphalting roads, but the most extensive investigation is that of Professor P. Claussen, who reports in the Proceedings of the Imperial Biological Institute for Agriculture and Forestry (Vienna). These investigations show that there is a great deal of difference in the tar used, some of the manufactures being poisonous and others not. The vapors arising from asphalting during the operation are found to be damaging the foliage, some plants suffering more than others, the degree of damage depending in the first place on temperature; when this exceeds 25° C the damage is insignificant, but when it is raised to 40-45° C the damage increases rapidly, so that even woody plants succumb. The dust arising from tar coverings is also damaging, especially on young leaves. Some plants lose their foliage, in others the leaves remain small, become red, or red spots develop, or they even develop specially protective tissue.

The author recommends to be careful in the choice of tars, not to tar the road in its entire breadth, but leave a strip along the row of trees, so as to keep bole and root system free, and to choose trees which are more resistant to this kind of damage.

Uber die pflanzenschädliche Wirkung des Teers. Centralblatt f. d. g. Forstwesen, November, 1913, pp. 497-504.

Tree Diseases in Southern Appalachians.

A. H. Graves discusses diseases of the Scrub pine (*Pinus virginiana*) and in addition to the writer's observations presents a comprehensive outline of the pathological data concerning this species. The tree was found to be subject to the attack of a variety of insects, which cause locally considerable damage. Of the fungous diseases, the most important is the "burl disease" caused by *Cronartium quercus*. It is also occasionally affected with heart rot produced by *Trametes pini,* and to a lesser degree by a rust, *Gallowaya pini*, causing a "leaf cast." Among injuries due to inorganic agencies are mentioned, windthrow under certain conditions, and occasional damage from ice and snow. In spite of the loss from these causes the writer states that "the species considered as a whole may be looked upon as being, in general, in a thrifty condition."

Phytopathology, 1914, IV, No. 1, pp. 5-10.

Bark Disease of White Pine.

This new disease has been causing local damage in various plantations near New Haven and elsewhere in the state of Connecticut. Its exact nature is not known, states A. H. Graves. The first indication is a slight yellowish cast to the foliage, readily noticeable at considerable distance. Examination of the trunk near the ground line reveals a canker covered with minute black pustules of some fungus. Sometimes the trees are entirely girdled, the lesions extending 3 or 4 inches from the ground in some cases. Nine fungi have been isolated from the bark of dying trees and several more from the bark of dead trees, the one of constant occurrence being a species of *Fusicoccum*. Pure cultures have been made of all the fungi found on the dying trees, and inoculations with these species on healthy trees in the greenhouse are now in progress. The results of these together with a more detailed account of the disease will be published later.

Owners of white pine plantations are advised to be on the watch for this trouble which is quite probably of parasitic nature and liable to spread disastrously. Where found, it is advisable to remove all diseased trees, or at least the portion of the stem affected, and burn them.

Mycologia, Vol. VI, No. 2, 1914, pp. 84-87.

Cambium Miner in River Birch.

C. T. Greene describes *Agromyza pruinosa*, a dipterous insect, the larva of which mines in the cambium of living trees. These mines or tunnels heal over but leave scars known as pith-flecks in the wood. The pith-flecks in birch were carefully studied, and it was decided that the species in question is at least one of the insects that produce pith-flecks, and it is possibly the only one. This is claimed to be the first recorded instance in America of the production of flecks in birch by a definitely known species.

Journal of Agricultural Research, Vol 1, No 6, 1914, pp. 471-474.

MENSURATION, FINANCE AND MANAGEMENT.

Weather and Height Growth.

Investigations carried on by A. P. Tolsky at the forest experiment station in the Province of Samara upon the progress of the development of plantations and their growth in height led him to the following conclusions:

(1) The growth in height of young shoots of Scotch pine in southeastern European Russia takes place during the months of May and June; the growth of the pine needles in July and August. This phenomenon has been annually confirmed by observations extended for four years, between 1908 and 1912.

(2) There is no gradual, uniform development of the shoots. The growth of the shoots varies in accordance with the condition of the weather. During cold nights in May the growth often stops entirely. In June, because of the warmer weather, the growth during the night exceeds that during the day, whereas in May the growth during the day is greater than that during the night.

(3) The length of the annual shoots is influenced by the weather conditions of the year before, especially during July and August, when buds are formed. If the weather during these months is warm and humid, the growth of the next year is much greater than if the weather was cold and dry. These observations confirm the investigations conducted by Professor Cieslar in Austria and by Forester Turmer in Russia upon the growth of spruce.

(4) Unfavorable weather conditions during early spring, i. e. in April and May, for instance, low temperature, late disappearance of snow and a large number of late frosts—or the reverse, abnormally high temperature during the spring—may affect more or less considerably the growth of the year.

(5) Weather conditions during the further growth of the young shoots influence directly only the degree of development of the needles. The latter, just as in other herbaceous vegetation, depends most intimately upon the actual condition of the weather, that is, upon temperature and humidity. Moderate temperature and humid weather increase the length of the needles. Reverse conditions decrease it. The weather conditions, however, during the growth of the young shoots have only a secondary effect as compared with the influence which the weather of the previous year has upon them. R. Z.

Transactions of the Forest Experiment Stations, Vol. XLVII, 1913, St. Petersburg.

Reserve Funds.

The 21st annual meeting of the German "Forstwirtschaftrat" in Trier in 1913 discussed, among other vital matters, the policy of money reserve funds in forest management. Dr. Endres of the University of Munich pointed out that such funds, designed to tide over years of low income or heavy expense in the forests, are really necessary only in small countries, so as to secure a truly sustained annual (money) yield and to avoid unsilvicultural cuttings—e.g. where low prices for wood might otherwise necessitate an increased annual cut.

Dr. Speidel of Stuttgart considered that such funds could best be created by setting apart a portion of the income from the sale of excess growing stock or of enforced cuttings (storm, fire, etc.). The general discussion seemed to favor *timber* reserve funds rather than *money* reserve funds.

A. B. R.

Die XXI Tagung des Deutschen Forstwirtschaftsrates in Trier, 1913. Allgemeine Forst und Jagd- Zeitung, January, 1914, pp. 35-39.

Increment in Yield Regulation.

Oberförster Fischer reviews a dissertation by Gustav Baader on methods of determining increment for purposes of forest organization. After reviewing the ways and means of increment determination in the working plan instructions of the various States of Germany, the author adds his own suggestions: for example, that in forests managed under the shelterwood system with a long period of regeneration (*Femelschlagbetrieb*), the yield as figured for a certain stand should be increased, for site qualities II to IV, by 25% where the period of regeneration is 20 years; by 35% where the period of regeneration is 30 years; the normal growing stock in reproduction fellings=(initial growing stock+final growing stock)×half the regeneration period×.5 to .6 (according to density).

The reviewer is reminded of Strazeleckis' proposal* to calculate the normal growing stock by the formula: $nV=\frac{r}{2}\left(V_{\frac{r}{2}}+\frac{1}{2}V_r\right)$

where r=rotation age; $V_{\frac{r}{2}}$=volume at ½ the rotation age; Vr=volume at the rotation age.

Baader would regulate the yield, both final and intermediate, by increment alone but this, the reviewer contends, is an insufficient basis: first, because of a lack of exact data—especially in the case of intermediate yield (thinnings); secondly, because values as well as volumes enter into yield determination; finally be-

*Allgemeine Forst- und Jagd- Zeitung, 1884, p. 88, p. 316.

cause these are always conditions of ownership and utilization which make a mere determination by volume based on increment inexpedient. For all these reasons area as well as volume must continue to play an important role in yield determination, especially in all intermediate yields.

The reviewer concludes that the proposal to abandon all area control is rather previous and would increase the cost of control and administration without any corresponding advantages over present methods. He, however, commends Baader's dissertation as clarifying the subject of increment determination and as stimulating more exact work along these lines.

A. B. R.

Die Veranschlagung des Zuwachses bei Waldertragsregelungen. Allgemeine Forst- und Jagd- Zeitung, March, 1914, pp. 100-102.

Evaluating Damage from Drought.

A unique and extensive detailed report is furnished by Oberforstrat Reus on the damage occasioned by the drought of 1911 over the entire forest property of the Dukedom of Anhalt, comprising around 75,000 acres in very varied condition. In the year 1911, precipitation was deficient by about 37 per cent. of the normal; this, after a year, of ten per cent. below normal. The total loss in money is figured at around $100,000, or $1.35 per acre of the total area. In this calculation, there is included a reduction in value on the forced cut which was found to be on the average 2/3 cent per cubic foot, a reduction in the productivity of stands due to the killing of timber of $30,000 and in the cost value of destroyed cultures and young stands of $65,000. To recover the damage in the plantations, some $35,000 will be required. The total cut of dead material necessitated by this drought was 840,000 cubic feet timberwood, or something like 12 cubic feet timberwood per acre.

The territory of the Harz Mountains suffered the most. Here the cut was nearly 30 cubic feet per acre. The acreage of young stands under 20 years which was entirely destroyed was around 1,250 acres, or about 2½ per cent. of the total forest area.

Among the observations of the difference of damage under different conditions the following are of interest. Of pine plantations, 20 per cent. were lost, while of pine sowings 40 per cent. were killed, showing the plantations to have borne the drought better than the sowings, made in both cases in furrows. In the oak cultures, sowings showed very little loss; plantings of small stock 12 per cent.; plantings of saplings 30 per cent. Here, however, the good sites involved explain the small loss in the sowings. In pine stands underplanted with spruce, 50 per cent. were lost. The underplanted spruce in oak, beech and larch in the Harz Mountains was entirely lost. Beech of natural regeneration was lost to the extent of 22 per cent.; but stands over 20 years of age did not suffer much. On grassy soils the cultures suffered considerably more than on open soil, even in sandy situations. As regards mixed stands, spruce in the Harz Mountains suffered more in the mixed than in pure stands, especially in the deciduous mixture. Spruce with oak suffered more than with beech, the lower stem classes particularly. When mixed in single individuals the loss was less than when in groups. Evidently the shallow-rooted spruce could secure less moisture from the soil than the deeper-rooted deciduous trees. In mixed stands of pine with beech and oak no difference appeared, when compared with pure stands.

The resistance to drought of different species was found on the whole to depend upon the depth of root system. The series being beech, pine, oak, alder, birch and aspen, spruce. In cultures, however, the series is somewhat different, namely oak, spruce, pine, birch and alder.

As regards the influence of depth of soil, even the young stands suffered less on deep soil than on the shallower soils. As regards exposure, apparently not much difference was found, the loss on the plateau being 5 per cent., north and south exposures 9 per cent., south and west exposures 8 per cent. As regards site classes, the better the more resistant were the stands shown to be. As regards age classes, naturally the younger stands showed the largest loss, the 1-20 age class showing a loss of 8½ per cent., the age classes from 21 to 80 years between one and 1.1 to 1½ per cent., the older age classes showing a slight fraction.

As a consequence of the larger amount of dead material, insect pests began to develop rapidly, but the immediate utilization of the dead material and pulling out of the young damaged growth, and other thorough methods of combating the pests have prevented additional loss. It was found that a dry rot as a secondary result had attacked to a large extent the roots of spruce and deciduous trees, but the fear that this would lead to a considerable further loss seems so far not to have been realized.

It is supposed that such a drought had not occurred within the last 150 years, and therefore the damage is considered most unusual.

Die Dürresschäden von 1911 in den Anhaltischen Staatsforsten. Zeitschrift für Forst- und Jagdwesen, February, 1914, pp. 70-82.

Forest Fire Insurance.

Fire insurance associations which insure against forest fires alone exist in France. Denmark and Norway. In the latter country a mutual fire insurance company was organized in 1911, to which we referred in volume XI, p. 525. There is now the first report of this society at hand.

Norway possesses about 23,000 square miles of productive forest area, of which something over 61 per cent. is coniferous. Of this 85 per cent. is owned privately. The total forest value is estimated at 160 million dollars, or about $12.50 per acre. There are strict laws and for most districts good organization to combat forest fires, with all modern methods of look-out stations, telephones, telescopes, maps, etc.

During the extraordinarily dry year of 1911, after a number of disastrous conflagrations, 50 of the largest private forest owners, owning altogether nearly 500,000 acres, of the value of around 5 million dollars, associated themselves for mutual protection, and by September, 1913, 1,372,000 acres, or 10 per cent. of the forest area in the districts, valued at $9,000,000 were insured, with the expectation of bringing up the insured values to $20,000,000 by the end of the year. The premium paid on acreage to the end of September was over $16,000 or 1.3 per cent. of the insured values or 12 cents per acre. Only $72 damage were paid out, and it was therefore possible to place $112,000 in reserve.

The insurance is made only on young plantations and on the forest soil, which are representing the most vulnerable part, since matured stands suffer little, and since these are relatively high in value and the premiums which would have to be paid would be relatively disadvantageous. The owner himself is obliged to state the value of his forest, as well as of the damage, if any, the association reserving the right to review both. The association pays all damage, no matter what the cause of the fire. Usually the insured has to insure his entire property, and the agreement is made for at least five years. No damage is paid unless at least 2½ acres are involved. Premiums are paid for the year in advance, and an additional premium up to treble the original may, if necessary, be levied. At present forests in the districts with satisfactory laws against forest fires are taxed 1¼ per cent., unless the forest is located in a zone of special danger (*e. g.* in the neighborhood of towns), when 1¾ per cent. is levied, the same as in other districts not well provided against fire. No special consideration is made as regards railroads passing through forest country, since the railroad companies are liable. It is expected that as the number of insured grows smaller premiums will suffice.

Die Waldversicherung in Norwegen. Schweizerische Zeitschrift für Forstwesen, January, 1914, pp. 21-24.

UTILIZATION, MARKET AND TECHNOLOGY.

Failure of Wood in Compression.

Professor Jaccard has published the results of his investigations into the character of the failure in compression parallel to the grain. His first studies were with specimens ruptured in a testing machine; later he included natural failures such as are found at the base of limbs, in crotches, and other places on trees where as a result of growth the fibers were subjected to stress great enough to cause failure.

He finds that there does not exist a specific type of rupture, i. e. one that is characteristic of every ligneous species, and that test blocks taken from the same kind of wood or even from the same log, may show on their homologous faces lines of rupture of little similarity. On the other hand when the test blocks are taken from woods that are of similar structure though of different species the lines of rupture of homologous faces may exhibit great resemblance. This is due to the fact that the resistance of the fibers is influenced in an analogous manner by the size, number and distribution of the vessels which accompany them, or in the case of the conifers by the particular structure of the early wood of the growth rings; in other words by the distribution of the elements of unequal resistance in the body of the wood.

The shortening of a block in compression is obtained either by the transverse bending of the fibers with a formation of a swelling of rupture, or by curvature of the fibers with the bulging of one or more of the faces of the test block. Among conifers and in a general way among the ligneous species with a fine texture and homogeneous structure the first type is commonly met with.

In addition to the anatomical structure the degree of humidity of the wood has an influence on the mode of rupture, fresh or green wood behaving quite differently from that which is air-seasoned or kiln-dried. The author refers to the experiments made by the U. S. Forest Service as recorded in the appendix of bulletin 70 and states that his own observations are in complete accord with Tiemann's.

It is Jaccard's contention that the direction of rupture is not influenced by the distribution of the medullary rays, which simply curve with the bundles of fibers to which they are attached. When the compression is continued until failure results, the rupture is in the form of longitudinal rents through the fibrous mass affecting equally the rays, the elements of which break in the median plane and not along the plane of attachment to the wood fibers. In fact it is very rare to observe a true detachment of the walls along the middle lamella.

The folding of the fibers or of the tracheids is accompanied by characteristic alterations of their walls. The latter seem to split into thin lamellae or sheets. Under high magnification the walls of the tracheids cut longitudinally present a fibrile or thread-like structure without definite arrangement, while on cross section numerous concentric strata are visible. The author concludes that the successive strata of growth of the fiber wall alternate with planes of less cohesion which under the compressive stress separate by shear or cleavage.

As previously shown by Tiemann the folding of the tracheids may be materially influenced by the bordered pits which form weak places in the wall. Sometimes the pit is crushed and again only deformed.

In test blocks of certain broad leaf species such as *Platanus* and *Gleditsia* longitudinal rents often appear and separate bundles of fibers. These splits do not occur along the rays nor even along the large vessels which run through the mass of the wood, but within the bundles of wood fibers themselves. The rays in the course of the rents are torn like the other elements, but those imprisoned in the interior of the bundles are merely bent. Except in the case of complete failure the lumen of the folded elements usually remains open, not only in the case of ligneous fibers with thick walls, but also in the vessels.

The author's studies of the natural failure of wood bears out his conclusions from the test specimens. His main point is that the distribution of the rays has little effect upon the mode of failure. This is not in accord with the findings of M. Thil who says:

The sides of the medullary rays sometimes produce planes of least resistance varying in size with the height of the rays. The rays assume a direction more or less parallel to the lumen of the cells on which they border, the latter curving to the right or left to make room for the ray and then closing again beyond it. If the stress acts parallel to the axis of growth, the tracheids are more likely to be displaced if the marginal ray cells are weak-walled. It is on that account that on a radial section of the test block the plane of rupture passes in a direction nearly that of a ray, whereas on a tangential section the direction of the plane of rupture is oblique, but with an obliquity varying with the species and determined by the inclination of the spirals on which the rays are distributed in the stem.—*Constitution anatomique du bois,* pp. 140-141.

S. J. R.

Etude anatomique de bois comprimés. Mitteilungen der Schweizerischen Centralanstalt für Forstliche Versuchswesen. Band X., Heft I., Zurich, 1910, pp. 53-101.

Termites Resisting Timbers.

Kanehira of Formosa, Japan, after a personal investigation and after correspondence with seventeen different countries, gives a list of tree species which resist termites or white ants, and which may be termed termite-proof trees. He summarizes the reasons for this quality in the wood as follows: (a) presence in the wood of some substance which has a strong smell or taste which the insects do not like; (b) presence of some substance which is poisonous to insects; (c) extreme hardness of the wood, rendering it difficult to attack. Appended to the article is a note by a research officer of Dehra Dun, India, who holds that the data thus far are not conclusive.

T. S. W., Jr.

Indian Forester, January, 1914, pp. 23-42.

STATISTICS AND HISTORY.

Early Administration in India.

Early reports on forest administration in the northwest province and in Oudh throw an interesting light upon the crudity of the administration as it then was. An officer in charge of an important forest wrote in 1872 that he had spent $10 in protecting his forest from fire, without avail. A novel method of sale was then in force, namely, to charge $1.00 to $1.60 per month per cart rather than a rate per unit of product.

Students of forest history should not fail to read this article.

T. S. W., Jr.

Indian Forester, March, 1914, pp. 75-94.

Swiss Statistics.

In connection with the expected revision of import tariffs, a very careful investigation into forest supply conditions of Switzerland is being made by a special commission, of which Professor Decoppet is chairman. Switzerland comprises 16,000 square miles, with a population of 3,-750,000. Its forest area is 2,141,000 acres. The Commission finds the total production of wood as 95 million cubic feet, 44 per cent. of which is workwood, and 56 per cent. fuelwood. The consumption, however, is 120 million cubic feet, distributed between workwood and fuelwood in equal proportion, 90 per cent. of the workwood being coniferous. The total value of the manufactured lumber reaches $11,000,000, at 23.8 cents per cubic foot, which makes the value per M feet B. M. in the neighborhood of $20.

In the 26 years from 1885 to 1912, a very considerable increase in quantities and values of imports has taken place, the importation in quantity having trebled. in value quadrupled. While as to values, wood importations as a whole have increased 170 per cent. that of workwood alone has increased 500 per cent., lumber in particular 328 per cent. and woodenware 200 per cent. While Germany in 1885 furnished 66 per cent. of the total wood import (2.4 million dollars), in 1911 it had dropped to 33 per cent. On the other hand, Austria rose from 8 per cent to 44 per cent. with $4,000,000. France's contribution rose from $600,000 to $1,000,000. Scandinavia, Russia, and America, which in 1885 were almost not at all represented, have risen to 1.4 million dollars. Exports, while during this period falling in quantity to one-half, in value remained about equal.

Striking a balance, in production and consumption it is found that the deficit which in 1885 was $200,000, in 1911 had risen to $8,200,000.

The conclusion is reached that it would be undesirable to have a tariff for protective purposes, on fuelwood. If the tariff on fuelwood were increased, prices would rise for the moment, but would soon go back to their former level, as the consumption of wood would decrease. As regards the deficit of 22,000,000 cubic feet of workwood (230 million feet B. M.), it is pointed out that the attitude of the tariff should be to encourage the importation of unmanufactured material, and discourage that of lumber. The importation of raw material increased during the 26-year period by 500 per cent. Experience has shown that the tariff for lumber should be at least 6 times that for round material, the difference representing the loss in labor value.

We may only add the conclusions, regarding the tariff question. "Duties on wood permit an equalization between domestic and foreign production, which latter often works more cheaply, and may be able to calculate with lower transportation costs, but the net yield of the forest is not influenced to the extent, which it is often assumed, by import duties, for wood prices depend on other factors which exercise greater influence than tariffs. Indeed, the increase in duties in the years 1885, 1898, and 1906, did not have as a result a decrease of imports, but a very lively market shortly before the new tariff came into action, then was followed by a reduction in imports during the using up of the accumulated stores, and then the importation continued in the even increase of the former time. The yearly natural differences in imports are often larger than those occasioned by new tariffs. The periods of increased importation are, as a rule, also periods of increased market for the producer. Increase in population and general prosperity occasion the increased use and increased importation.

Die Vorarbeiten zur Erneurung der Zolltarife und Handelsverträge. Kategorie Holz . Schweizerische Zeitschrift für Forstwesen, February, March, 1914, pp. 36-45, 71-83.

Baden Statistics.

The recently published Baden, official forest statistics for the management year 1911 are reviewed by Eberhard. They show that on January 1, 1912, the total area of state forests comprised 1, 449, 310 acres. Since 1878 the annual cut has increased from 45 cubic feet per acre to 107 cubic feet per acre in 1911. This rise is due in part, to increased accessibility and better markets, but also to frequent revisions of the working plans which showed a larger growing stock and increment. Furthermore, the change from pure beech stands to mixed stands and the afforestation with spruce and fir has brought about an increased yield. Finally the increase is due, in no small measure, to a more intensive silviculture.

The net yield in 1911 was $8.14 per acre. In the 33 years since 1878 the income from thinnings has been between 20 cents and 35 cents per acre for the total area. The cost of planting, in 1911, was twenty-two and two-fifth cents per acre; the cost of road building fifty and two-fifth cents per acre.

A. B. R.

Statistische Nachweisungen aus der Forstverwaltung des Grossherzogtums Baden für das Jahr 1911. Allgemeine Forst- und Jagd- Zeitung, January, 1913, p. 27.

POLITICS, EDUCATION AND LEGISLATION.

Taxation of Forests.

The French parliament is now discussing the present manifestly unfair taxation ot forests in France, on the basis that the forest is of public interest and essential to public health; that it possesses an indispensable influence on climate, on water, on erosion; and that the crop is not annual. It is suggested by Chancerel that taxation should be regulated by the following principles: (a) It should be based on the net annual production with a reduction for the cost of maintenance, management and reforestation; (b) The revenue should be calculated by the average per cent. returned by average soils in the locality; (c) Areas recently stocked or reforested should be free of tax during 30 years. As yet final legislation has not been secured. T. S. W., Jr.

Revue des Eaux et Forêts, March 1, 1914, pp. 167-170.

Forests and Warfare.

A reprint from a report by Louis Marin (Deputy) reviews the advantages of forests for warfare. He argues that the advantages of maintaining forests along the frontier have now been increased by the use of aeroplanes for scoutng purposes, since the forests form a cover for the movement of troops. T. S. W., Jr.

Bulletin Société Forestière De Franche—Comté & Belfort. March, 1914, pp. 310-312.

Commercial Training of Foresters.

An unsigned article advocates commercial training for foresters. The writer admits, of course, the necessity for sound silvicultural training, but argues that since forestry has become such a commercial business, it is logical to insist on training such as ordinary commerce would require. Unless this training is required, "there is no possibility of our collecting the forest revenue that we have a right to expect, with the results that the development and improvement of our forest assets are being and must be greatly retarded." T. S. W., Jr.

Indian Forester, February, 1914, pp. 63-70.

Oxford Course of Forestry.

A summary of the entrance requirements, courses, training, and methods of teaching used in the two-year Oxford course of forestry is syllabused in the January Indian Forester. The list of subjects, with a brief outline of what is included in each course, will be of particular interest to those engaged in teaching.

T. S. W., Jr.

Indian Forester, March, 1914.

Promotion System in France.

The recent election of advancement and discipline committees for the French Forest Service calls to mind this interesting procedure. Under present policy, district foresters (there are 32) and the directors of schools with the rank of district foresters, inspectors, assistant inspectors, and forest assistants elect (for each grade), have representatives who shall sit in secret session to determine the advancements in each class and also questions of discipline.

T. S. W., Jr.

Revue des Eaux et Forêts, January 1, 1914, pp. 32-36.

MISCELLANEOUS.

German Forestry Congress.

In 1913 the annual meeting was held in Trier, August 23-28. In accordance with the usual custom, the executive committee met in advance and prepared the program for the session of the Congress.

The first business of the general meeting was the presentation of a paper on "Border cuttings," by Doctor Wagner of Tübingen. No important points not already covered by previous reviews were brought out in the paper or the discussion that followed, so that a mere allusion is sufficient.

The findings of the Committee on Pine Seed may be summarized in the injunction to use only local seed from the best individuals of the species, and in the recommendation to insure seed inspection.

The committee which investigated timber trade conditions reported the need of securing greater publicity in timber sales, in order to obtain better prices. Some regular method was recommended for this kind of advertising, and also for the dissemination among the profession of information in regard to the prices being secured, which must be accurate and timely to be of value.

Tariff conditions were the subject of a report by a special committee, and also worked considerable discussion in the general sessions of the Congress. Agreement was finally reached on several fundamental principles and desirable points for legislation. Since the Congress was unanimously in favor of protection for the business of timber raising, these recommendations covered merely the ways in which protection should be given. In general, the purpose was to protect the lower grades of wood products from competition, because of the necessity of furnishing a local market for such material. The tropical hardwoods and other species which supply needs not to be filled by native woods would require no tariff. In the case of pine cones to be used for seed extraction, it was recommended that the import duties be made prohibitive, in order to insure the use of local seeds for reforestation.

The Committee on propaganda recommended activity along the following lines: Co-operation between state and national forestry associations; collection of economic and technical data; student trips through the forests; press notices; local meetings.

The question of reserve funds was discussed at length apropos of the recent legislation in Württemburg. While a small forest unit needs to make no distinction in the distribution of such funds, the large state forests require separate funds for cutting, improvements, and to produce normal stocking. The cutting fund provides for carrying on the harvesting operations. The second division covers the cost of road building, telephones, and buildings. The fund for stocking is a form of insurance against the accidents, like windfall and insects, which disturb the normal condition of a forest.

K. W. W.

Die XXI Tagung des Deutschen Forstwirtschaftsrates; Die XIV Hauptvorsammlung des Deutschen Forstvereins in Trier. Forstwissenschaftliches Centralblatt, January, February, 1914, pp. 44-54, 97-116.

OTHER PERIODICAL LITERATURE.

American Forestry, XX, 1914,—

The Panama Canal and the Lumber Trade. Pp. 81-91.

The Torrey Pine. Pp. 92-100.

The Sprag Industry of Eastern Pennsylvania. Pp. 142-145.

The Ohio Naturalist, XIV, 1914,—

Transpiration in Relation to Growth and to the Successional and Geographic Distribution of Plants. Pp. 241-251.

Soil Bacteria. Pp. 273-278.

Pomona College Journal of Economic Botany, III, 1914,—

The Palms Indigenous to Cuba III. Pp. 391-417.
Third and concluding instalment of the monograph.

Pulp and Paper Magazine of Canada, XII, 1914,—

Forestry and Pulp Industry. Pp. 178-180.

The Journal of the Board of Agriculture, XX, 1913-14,—

Some Douglas Fir Plantations. Pp. 402-416; 499-503; 690-696; 865-875; 1079-1088.

Poisoning by Conifers. Pp. 994.

The Indian Forester, XL, 1914,—

The Oxford Course of Forestry. Pp. 1-22.
Detailed outline of the training.

The Technical Training and the Work of the Forest Department from a Commercial Point of View. Pp. 63-70.
Relates to preceding article.

Timbers which Resist Termites. Pp. 23-42.

Bulletin de la Societe Dendrologique de France, No. 31, 1914,—

Graines et Plantules des Angiospermes. Pp. 31-37.
Conclusion of the series.

Monthly Bulletin of Agricultural Intelligence and Plant Diseases, V, 1914,—

Recent Experience and Progress in Moor Cultivation in Germany. Pp. 313-316.

Zeitschrift fur Forst- u. Jagdwesen, 1913,—

Neue Wege der Forsteinrichtung. Pp. 447-454.

Untersuchungen über den Wertzuwachs von Kiefer und Fichte. Pp. 502.

Der Blendersaumschlag und sein System. Pp. 727-41.

Einfluss hoher Essen auf die Verbreitung der Rauchschäden. Pp. 782-90.

Schweizerische Zeitschrift fur Forstwesen, 1913,—

Reisenotizen aus Skandinavien. Schweden und seine Holzausfuhr. Pp. 105-113; 145-55; 185-95.

Centralblatt fur das gesamte Forstwesen, 1913,—

Zur Praxis der Waldwertsberechnung. Pp. 1-11; 49-60.

Der Voranschlag für die verschiedenen Zweige des staatlichen Forstdienstes und für die Staatsforste und Domänen insbesondere für das Jahr 1913. Pp. 35-39.

Schweizerische Forststatistik (Literarische Berichte). Pp.77-80.

Ein altbekanntes Kinderspielzeug als Lehrbehelf für die Forstwirtschaft im allgemeinen und den Waldbau insbesondere. Pp. 327-32.

Studien über die Anwendung der Stereophotogrammetrie zu forstlichgeodätischen Zwecken. Pp. 484-497.
This is a very full explanation of the use of photography in surveying.

Allgemeine Forst- und Jagd- Zeitung, 1913,—

Die Sonnenenergie im Walde. Pp. 185-200.

NEWS AND NOTES.

The Forestry Branch of the Canadian Pacific Railway has assigned three men to handle fire inspection work for the Company on its lines in British Columbia, and three additional men on its Eastern lines, in Ontario, Quebec, Maine and New Brunswick. These men not only investigate fires which may occur, for the purpose of collecting information to be used in claims cases, but, what is more important, they help to prevent the occurrence and spread of fire by personally meeting section-men and other regular employees of the Company and making sure that the men are fully informed regarding the very strict instructions issued by the General Manager relative to the reporting and extinguishing, by railway employees, of fires occurring along rights of way. These inspectors also assist the Operating Department in securing efficient action in connection with the requirements of the Railway Commission relative to the maintenance of special patrols in forest sections, and the removal of inflammable debris from the Company's right of way. Under this method of organization, much better results are to be anticipated than was previously the case.

The spread of the co-operative idea in forest fire protection is evidenced by the recent organization of the Lower Ottawa Forest Protective Association, Ltd. This Association represents nearly 10,000 square miles or over six and a quarter million acres of timber lands on the watersheds of the Gatineau, Lievre, Rouge, Coulonge, Nation and Devils rivers in the province of Quebec. The staff will comprise a manager, three inspectors and about 50 rangers. The headquarters of the Association will be at Ottawa. In order to co-ordinate the efforts of all the agencies interested in protecting this region from fire, the manager of the Association has been appointed an officer of the Forest Protection Branch of Quebec, as well as of the Fire Inspection Department of the Dominion Railway Commission. A close co-operation with the settlers and with the railways operating in this territory is also proposed, in order to reduce the fire hazard as much as possible.

The latest Canadian railway to organize especially for the more efficient handling of fire protection work is the Algoma Central and Hudson Bay Railway. This line taps a heavily timbered section in Central Ontario, extending north from Sault Ste. Marie. D. C. A. Galarneau has been appointed forester to the Company, with duties which will include supervision of railway fire protection.

The lowest level of forest fire loss on record in Canada was reached this year on Dominion Forest Reserves in Western Canada. On the reserves in British Columbia, not a single fire succeeded in spreading over a larger area than 10 acres. The records are not yet complete for Saskatchewan and Manitoba, but the available figures compare favorably with those for the reserves farther West. All the figures compare favorably with corresponding ones for the National Forests of the United States where the area burned in 1913, although the smallest in recent years, was somewhat over 0.03 per cent. of the total reserved area.

In the Fire Districts on Dominion Crown Lands in the west patrolled by Dominion fire rangers the loss occasioned by forest fires last season is also remarkably small, not due entirely to the large amount of rain which fell last summer in the West. In the Coast Fire Ranging District, B. C., which being situated in the Railway Belt is administered by the Dominion Forestry Branch, during June, July and August no less than 110 fires occurred, yet all of these fires were extinguished by the fire-rangers before any standing timber was destroyed.

That the fire loss in the West has been so remarkably small is due in large measure to the fact that the Government rangers unceasingly sought, and obtained, the co-operation of all with whom they came in contact, whether settler, Indian, hunter, tourist or packer.

During 1913 the forces on the National Forests fought 4,520 fires or nearly twice as many as started in 1912. In both years, practically 50 per cent. of all fires were detected and extinguished before they burned over a quarter of an acre, and 25 per cent. were put out before they covered 10 acres. In only 25 fires did the damage amount to $1,000. The aggregate loss in timber and the damage to young growth and forage is estimated at about $192,000, the timber loss, nearly 59 million board feet, being valued at $82,000. About 18 per cent. of this total loss was incurred on private lands, within forests where 16 per cent. of the fires had their origin.

Reports for the winter fire season in the southern Appalachians, from southern Virginia to northern Georgia, covering the months of January and February, just received by the Forest Service show that the winter was dry and that fires have occurred on land which the Government is acquiring under the provisions of the Weeks Law. While these two months are normally not so dry as the fall or the spring fire season, serious fires may occur in an open winter, though they are not usual.

During January there were 9 fires, 5 of which covered more than 10 acres each. In February there were 10, of which only two spread over more than 10 acres. All of these fires occurred during the latter part of January and the first of February when the weather was unusually dry.

According to a press bulletin of the Forest Service, lightning next to railroads is the most frequent source of forest fires and the most numerous species in any locality is the one most likely to suffer. It is probable that most of the fires from lightning start in the duff at the foot of the tree. Especially in the Southwest, it is stated, "dry thunder storms" increase the danger.

The Commissioner of Dominion Parks Branch furnishes an innovation of fire notices by printing them on enameled tin sheets, which are practically indestructible. An exceedingly clear imprint is possible. The cost may be considerably more than linen, but the durability and consequent saving in renewals may offset this greater initial cost.

During the first three years of its administration, from 1905-7, the problem of the U. S. Forest Service was to take care of areas which had been badly overgrazed, and a material reduction had to be made in the number of stock grazed before the damage could be stopped. From the very beginning, the Forest Service invited the co-operation of the stockmen, and consulted with them regarding the practicability of the plans which were to be adopted. This co-operation was secured through the various stockgrowers' associations, and it has proved so successful that similar associations have grown up among other users of the National Forests.

Before range control was put into effect, the feed belonged to the man who got his stock on the land first, though there was no way by which he could hold it except by physical force. Such a system proclaimed that might was right, and led to controversies, and later to range wars. Under the present control, right prevails, and such an achievement alone would have made the work worth while.

The systematic use of the ranges has stopped loss of forage, and feed formerly wasted has been putting the stock in better condition.

Experiments of the Government in artificially reseeding the grazing areas to cultivated grasses show that in some cases the forage crop has been increased as much as 400 per cent., but this method is both slow and expensive, and it has been found that a great part of the range lands must be improved by protection and natural reseeding, for the next 20 years at least. Investigations have established beyond a doubt that natural reseeding can be accomplished best by a rotation system of grazing, based upon the simple principle that grazing aids in scattering and planting the seed after the seed has been given an opportunity to mature. Reports show that areas protected until after seed maturity and then grazed, as compared with areas absolutely protected for the whole year against grazing, are approximately 50 per cent. better, and probably 200 per cent. better than range which has not been protected at all. This means that ranges can be improved faster in use than they can be in idleness, and this principle is being adopted on many of the Forests.

In the "free for all' period of early days, the most palatable forage plants were so closely cropped that they were unable to develop the necessary plant food, and so literally starved. Also, the roots were frequently injured by trampling, or killed by exposure. As a result, the best kinds of vegetation grew weaker from season to season, and where the practice of early and close grazing was continued, the range at last became practically denuded.

The remedy suggested for range deterioration is a system of deferred grazing. Under such a plan, an overgrazed portion of the range, sufficiently large to supply the forage from the time of seed maturity until the end of the grazing season, is protected from stock until the seed crop has matured. Upon maturity of the seed crop the forage is grazed during the first season, but not to the extent of injuring seed plants. The same area is protected in the same way during subsequent seasons until the new plants have been securely established. When the area has been thoroughly reseeded it can be again grazed early in the season, and a second area is protected until the forage is mature.

By this method of alternating late grazing from one area to another, weakened vegetation can recover its vitality without the need of having the land closed to grazing the entire year.

The new open system of handling sheep, which is quieter herding during the day and bedding the sheep where night overtakes them, is in contrast to the old plan of herding them close by the use of dogs and returning them each night to a fixed bed ground, an improvement. The old plan, of course, rendered certain areas absolutely bare and the going from and returning to the bed grounds trampled a great deal of forage. He estimates that an increase of 10 to 25 per cent. has been added to the carrying capacity of the ranges and that 5 pounds weight has been added per lamb, because they have not been harassed by herding or forced to trail long distances to and from bed grounds.

One objection to the new method of handling sheep brought up by many owners has been that the herders who were used to the close system would not adopt the new one, for herders naturally take a pride in having their sheep look well, and, since they are coming to realize that open herding means better sheep, they voluntarily adopt it.

Grazing permits on the National Forests have been issued for nearly 11 million animals, including nearly 2 million head of cattle and horses, nearly 9 million head of sheep and goats, and about 65 thousand hogs. This means an increase for the current year of about 38 thousand more cattle and horses, and 347 thousand more sheep and goats, although the gross area of the National Forests at the beginning of 1914 is almost a million acres less than at the beginning of 1913.

During 1913, according to the reports just compiled, more than 27 thousand stockmen paid the government for grazing permits on the National Forests.

For several years past the carrying capacity of the National Forest ranges has been slowly rising, which, forest officers say, indicates an improvement in general grazing conditions and a better utilization of the forage resources. They claim that this is due mainly to the enforcement of better methods of distributing and handling stock.

On the lands recently acquired by the federal government within the Appalachian region of the East, regulated grazing has also been introduced this year on six distinct areas.

The next Canadian Forestry Convention will be held at Halifax, N. S., September 1 to 4, 1914. This will be the first Canadian forestry convention ever held in Nova Scotia.

On May 15 a large audience assembled at Cornell University to celebrate the opening of the Forestry Building of the New York State College of Agriculture. Three sessions were held with addresses by prominent men interested in the forestry movement, the afternoon being specially devoted to forecasts of progress for the next decade. The evening session had to be adjourned to the large Auditorium to accommodate the crowd who had come to listen to the poetic effusion of former Director L. H. Bailey and to Mr. Gifford Pinchot's address on the movement for conservation.

The following morning the Society of American Foresters held its first open meeting outside of Washington, and both the attendance and spirit of the meeting fully justified this departure. Besides some 30 active members of the Society, a large contingent of associate members and of forestry students filled the hall. The latter came from various forest schools as delegates of their forest clubs with a view of forming an association of these clubs, which was effected.

The open meeting was preceded by an executive meeting to discuss action on the questions lately submitted to the membership by letter ballot and on other questions.

The following resolution, offered by W. B. Greeley, was adopted:

That the Society of American Foresters shall investigate scientific problems through its own membership and resources, or in collaboration with other agencies.

That the results of such investigations shall be placed before the entire membership of the Society by publication in its Proceedings, or otherwise; and a ballot obtained thereon when advisable in the judgment of the officers or committees in charge of the investigations.

That the results of investigations may be published for general distribution, in the discretion of the officers or committees in charge of them, either as the conclusions of the members or committees conducting the investigations, or with a statement of the vote of the Society thereon when deemed advisable.

That the Society shall not officially endorse conclusions as to scientific facts; but may, with the concurrence of two-thirds of the members balloting, take an official position upon matters of policy.

The policy of holding at least one meeting annually outside of Washington was endorsed.

Efforts shall be made to organize local sections and to affiliate local organizations with the Society.

Committees shall be appointed to take up questions of nomenclature and terminology, the standardization of scientific methods, and the bringing together of information regarding investigative projects.

Among the speakers at the open meeting Mr. Gaskill outlined the effort which should be made in the next decade in State Forestry in the East; Prof. Roth presented his views on the outlook in State Forestry in the West; and Dr. Fernow, as President of the Society, developed his views on the needs of the Society. The most notable contribution in the program of the preceding day was the address of Mr. Greeley on National Forestry.

At the forest products exposition in Chicago and New York the Forest Service exhibited two models to show proper methods of logging. The models were supplemented by a graphic chart, which shows the increase of timber sales on the national forests from 1905 to 1913, inclusive. In 1905, the timber sold from the national forests aggregated 96,000,000 board feet, which brought the government not more than $85,000. Three years later the amount of timber sold increased to nearly 390,000,000 board feet, and the money received rose to $735,000. In 1911, 830,000,000 board feet sold for more than $2,000,000, and in 1913 more than 2,000,000,000 feet brought in contracts amounting to $4,500,000 Not all this money was received in any one year, because national forest timber is sold on contracts which range from one to 25 years, and it is paid for as cut.

Dr. B. E. Fernow, dean of the forest school of the University of Toronto, and Bristow Adams, of the U. S. Forest Service, have been elected President and Secretary, respectively, of the Society of American Foresters, one of the two organizations of professional foresters of the western hemisphere, the other being the Canadian Society of Forest Engineers, of which Dr. Fernow is also President.

The Seventh Congress of the International Union of Experimental Forest Institutes will be held in Budapest, Hungary, from the 7th to 17th September inclusive. Excursions will be made to Szabadka, Palics, Királyhalom, Horgosi-Királyhalom, Szeged, Temésvar, Karasjeszenö, Vadászerdoö, Gödöllö, Garamberzence, Selmecbánya, Besztercebánya, Fenyöháza, Likava, Csorbató, and Tàtralomnic.

The sale of one billion feet of western yellow pine timber from the Kaibab National Forest in northern Arizona was approved by the Secretary of Agriculture. In order to get this timber out it will be necessary to build a railroad approximately 200 miles long. Such a railroad will connect Colorado and Utah with the world-famous Grand Canyon of the Colorado, which hitherto has been accessible only from the south.

For several years the construction of such a railroad has been considered by various capitalists, but it has been stated that the lack of assured immediate traffic was an effectual barrier. It is pointed out, however, that a contract for a billion feet of timber will overcome this difficulty by providing a commodity for transportation which, together with tourist and local traffic, will place the project on a paying basis practically from the outset.

The U. S. Forester says, however, that the Kaibab Forest is one of the most beautiful in America, and gives assurance that the marketing of the mature crop of timber will not be allowed to mar the scenic beauty of the region.

The investment necessary to make this timber accessible will amount to more than $3,000,000. By placing this quantity of timber before the lumbermen of the country Forest Service officials believe that development in other directions may be looked for, the necessary railway making accessible heretofore undeveloped resources. The whole region is rich in agricultural land, in cattle and sheep range, and in coal and copper deposits, as well as in timber.

Bids for the timber will be received up to the middle of June, 1914, and three years will be allowed for the building of the railroad and mills, and 25 years for the cutting of the timber. The stumpage rates, however, will be readjusted at the end of each five-year period of the contract, the readjustments being based on the then current lumber prices. The annual cut will be not less than 40 million feet, most of which will be readily sold in the large consuming lumber markets of Utah and Colorado.

The Kaibab forest is one of the most heavily timbered in the southwest, the stand of timber being broken only occasionally by beautiful meadows or openings locally known as parks. Lumbermen who have visited it consider the country ideally adapted to logging. There are, altogether, two billion feet of timber, of which more than one billion feet are mature and ready for cutting.

Arrangements have just been made for the sale of 40 million feet of timber on the Tongass National Forest in Alaska. This forest is cut up by bays and inlets, some of which give an opportunity for taking the timber from the mill to the decks of ocean-going steamers. The Tongass forest is now self-supporting its lumber product being used largely in local industries, much going into boxes for canned salmon.

The Secretary of Agriculture has designated a new area in the southern Appalachians in which he thinks that lands should be purchased by the Government for forest purposes in accordance with the provisions of the Weeks law. This area is in northwestern Alabama, and includes 152,960 acres at the headwaters of the Warrior River in Lawrence and Winston counties. For a number of years extensive improvements by the Government have been under construction on the Tombigbee and the Warrior rivers, and a system of locks and dams to provide for 360 miles of navigable stream is now near completion.

The presence of a forest cover to protect the headwaters of the streams and to help equalize their flow being considered extremely important, the location of a government forest area in the region is found advisable.

This new area, in which purchases will be made, is at the extreme southern portion of the Appalachian region, about 150 miles from the nearest lands which the Government has purchased hitherto. The new area is almost completely covered with forest; 92 per cent. of it has never been cleared, and of the 8 per cent. upon which clearing has been attempted 3 per cent. has been abandoned and is reverting to forest growth. There is a merchantable stand of hardwood and pine timber, but there has been no great amount of lumbering because the locality has been too far from transportation facilities.

One striking thing about the region is that, although it has been settled for more than 100 years, a part of the land is still public domain, fully 9,000 acres never having been taken up by private owners under the various land laws. These lands have now been withdrawn from settlement, and request has been made that they be set aside as a nucleus for the proposed National Forest, the purchase of private lands being also undertaken, that another Forest of sufficient size for economical protection and administration may be built up.

The Government of the United States has just offered for sale two tracts of timber on Lolo Creek within the Clearwater National Forest, Idaho, aggregating 600 million feet of saw timber and 350 thousand cedar poles, together with a considerable amount of material for piling, shingles, and posts. The prices, which represent the lowest rates which will be considered for the saw timber, range from $3.50 for Green White Pine to 50 cents a thousand for Douglas Fir, Western Larch, and cedar. The prices of poles range from 5 cents to $2.40 apiece, depending upon the size.

The readjustment of boundaries has resulted in a total reduction of gross area on the Paulina and Deschutes National Forests, Oregon, of about 400,000 acres. The lands eliminated are located in the east-central part of the State, a considerable portion being on pumice lands of low fertility and little value for present or future forest purposes. A portion is located near the Deschutes River, and already comprises a large percentage of private lands, and includes two towns. These eliminations are a part of the work of boundary examinations initiated 5 or 6 years ago, which is resulting in fixing, after careful survey, the definite boundaries of those lands which should remain permanently in forests.

Foresters and lumbermen see a strong argument for forestry in the following decision of the Treasury Department, namely that " the gain from the cutting and disposal of stumpage is realized in the year during which the timber is cut and disposed of, and that the amount received in excess of the cost of such timber is profit, and should be so accounted for as income for that year." According to their interpretation, this decision means that no timberlands shall be subject to the tax until the timber is cut and marketed and that then only the profit will be subject to an income tax assessment. In other words, all costs will be deducted before the tax is levied, and these will cover the cost of growing the timber, including the cost of planting where necessary and of protecting the growing crop from fire and other depredation.

Nearly 17,000 acres have just been added by act of Congress to the Caribou National Forest, Idaho. This is one of the first of such additions through congressional action, instead of presidential proclamation under the law of 1907, and is the largest so far made by direct legislation.

The addition was made upon the petition of residents of the city of Montpelier, Idaho, the area included being the watershed of the stream which furnishes the city's water supply.

Direct seeding of Lodgepole Pine has been successful without exception on the Arapaho National Forest, Colorado. Several of the areas sown two and three years ago show from 5,000 to 10,000 seedlings per acre.

Western Yellow Pine cones, to the amount of 6,377 bushels, obtained on the Bitterroot National Forest, Montana, yielded 9,482 pounds of seed. The average cost of the extracted seed was 41 cents per pound.

New grazing regulations for the Dominion Forest Reserves, similar to those in operation on the National Forest of the United States, permit the keeping of a much larger number of stock by a much greater number of stock-owners, and also make available to the Dominion Forest Service a source of revenue second only to that derived from the management of the timber on these reserves. Unfortunately, due to the clamor of the cattle interest, the regulations have been suspended in British Columbia.

Foresters who have just returned from winter work in the White Mountains of New Hampshire report that, while some hardship is entailed, as much can be accomplished in the dead of winter as in summer.

During the past winter two camps of men have been estimating and valuing the forests which the Government contemplates purchasing on the slopes of the White Mountains. Because of the softness of the constantly falling snow, the work was done mainly on snowshoes. At times the temperature has been around 20 degrees below zero for considerable periods, and at times nearly 40 degrees below. The crews were housed in winter camps like those of the lumberjacks, and during the short winter days they were out by daylight and did not return until dark. The work of the crews required continuous walking. Diameters of trees were measured and the number of logs estimated in all merchantable trees growing on parallel strips 4 yards wide and 40 rods apart. From these estimates the full amount of timber was calculated, especially stormy days being used to work up data.

During the whole winter it was noted that stormy days caused no more loss of time than in summer, and the health of the men in the party was as a rule better than in hot weather.

In replacing a railroad trestle, recently burned, along the north shore of Great Salt Lake, engineers have just found that the piles are still perfectly sound after 43 years of service. Looking for the cause, since these were only of local pine and fir, they found the timbers were impregnated throughout with salt from the lake.

The first transcontinental telegraph line was transferred, when the railroad was built, to follow its right of way, and the old telegraph poles were sawed off at the ground. Upon recent examination the butts left in the ground in the salt desert have been found, although 50 years have passed since the poles were cut off, to be perfectly sound.

Experts in the U. S. Forest Service who have been investigating the preservative treatment of timber offer the suggestion that ties and poles which have been immersed for some time in the waters of the lake, which, being so much saltier than that of the ocean, is practically a saturate solution, ought to be impervious to decay if the salt is not leached out by the action of the elements. It has been suggested that this can be guarded against by painting the butt of the pole with a coat of creosote, which will keep out the moisture and keep in the salt.

California State inspectors at San Francisco have found a new canker disease on chestnut trees recently imported from Japan. According to Dr. Haven Metcalf, the government's expert on such diseases, this appears to be of the same type as the chestnut blight which is ravaging the forests of the eastern United States, and it is possible that the new disease would be equally as destructive if it became established in this country.

At the polls next November the people of Minnesota are to vote on an amendment to the constitution for the establishment of State Forests. The State Forestry Association started the campaign for this object at its 38th annual meeting at St. Paul on March 24.

It is pointed out that Minnesota has 15 million acres of non-agricultural soil which should come under forest management.

Nearly 4,000 acres were reforested by the Forest Service in Montana and northern Idaho during 1913, at an average cost of $7.50 an acre.

The U. S. Forest Service issues a note on the use of the Monterey Pine in New Zealand. The writer of the note refers to the name used, "Remarkable Pine," as given by the New Zealanders on account of its rapid growth, without realizing that this is simply the translation of its species name *insignis!*

The tree is remarkable, indeed, by its small range of distribution in spite of its evident adaptability to untoward conditions.

In New Zealand, as well as in South Australia, in the semi-arid country, plantations of this pine have been made 30 to 40 years ago, which furnish now considerable material for fruit boxes especially, making 75 to 100 M board feet of inferior stuff in 30 years. An individual tree is reported as containing 6,000 feet at 46 years of age, rivaling the Eucalypts. The character of the material is, to be sure, inferior.

The forestry division of the geological and economic survey of North Carolina issues separate reports of the forest resources of each county in the State, each report being a concise statement occupying less than four printed pages. It is intended by the survey that these reports of individual counties may be reprinted by the local newspapers, because in that way the specific local information will be given to the people in the cheapest and most direct way.

The Chinese national conservation bureau is considering reforestation at the headwaters of the Yellow River. The Government report shows that this will ameliorate the torrents and cause a more regular flow from the now denuded uplands. It is acknowledged, however, that this reforestation may not have an appreciable effect within the life-time of the present generation

The imports of matches into China greatly exceed in value any other wood product. Most of the matches come in from Japan.

A novel course is to be instituted at Harvard University next session, the Graduate School of Business Administration and the Forestry School co-operating. Ostensibly this course is instituted to furnish "scientific knowledge of the business of manufacturing and marketing lumber," with the expectation that improvements may be introduced by which loss under present methods may be turned into profits. Mr. John M. Gries, of the United States Bureau of Corporations, who made the investigation into the timber trust, is to carry on this course. This course is to cover two years, and is made up of a combination of parts of suitable courses already given in the Business School, together with some work in the forestry school for those who have had no previous training in forestry. The first year will include, besides new courses on the manufacture of lumber and on general lumbering to be given by Mr. Gries, certain Business School courses on accounting, marketing, factory management, business statistics and investments. In the second year the Business School courses will be three; in industrial accounting, including cost accounting; corporation finance and an advanced course on manufacturing made up of parts of two existing courses. Lumbering occupies the whole of the second half year, which will be devoted to special investigations in the field, each student being given a large problem in the lumbering business on which he will write his graduation thesis.

Besides this, there is also needed a kind of forestry research not hitherto available, to which the Harvard School of Forestry will now devote itself, turning over the subject of lumbering to the Business School. Within the accepted field of forestry there are several lines that give ample room for the training of the specialist.

Allied with the business of lumbering, as well as with forestry, are studies in wood technology,—research to discover, for instance, what new sources of supply there are for wood pulp, which is a pressing economic problem; what uses can be found for small trees, below accepted lumber sizes; what are the most practicable methods of reproducing forests; what processes of preservative or other chemical treatment will bring into use woods not suited to existing needs; and how diseases and insect pests can be controlled. Such things involve advanced technical research closely linked with economic conditions; and in this direction it is expected that the Forestry School will contribute to the broadening of the business side of lumbering as presented in the Business School.

The legislature of North Dakota has instituted a State School of Forestry at Bottineau. From the circular issued by its president, Fred. W. Smith, who is at the same time State Forester, it would appear that its function is not to educate foresters, but to educate the public and mainly in tree planting, the school distributing plant material and information as to its use free of charge.

Undoubtedly the Nestor of our profession, the Oberforstinspektor of the Swiss Federation, Dr. J. Coaz, retired from active service on April 30 of this year, at the ripe age of over 90 years. A service of 63 years, in various capacities, lies behind him, 40 years of which (since 1874) he has been the head of the Swiss forest service. More than that! He has been the cr-organizer of that service from its beginning, and was the foremost propagandist in securing its inauguration—the federal supervision of all forest services of Switzerland.

In an endeavor to get the public interested in the preservation of our native forests, as far as can be done without loss to the owners, and the establishment of forest plantings on all land that is not suitable for successful farming, the State Board of Forestry of Minnesota has this year and last year offered to public school pupils money prizes for essays on forest influences, the following being the order required: Relation to rainfall, to temperature, to animal life, to industries, and to sanitation.

Mr. John S. Bates, B. A., B. Sc., one of the foremost authorities on wood pulp manufacture in America, has been appointed Superintendent of the Forest Products Laboratories, McGill University, Montreal.

Mr. John Appleton, Yale '04, died on April 2, at Bangor, Me. Mr. Appleton was two years in the U. S. Forest Service, after which he began private practice as a consulting forest engineer at Bangor, being associated with Mr. B. S. Viles, and later with Mr. J. W. Sewall. Besides mapping and estimating large areas of timberland, he organized a tree surgery department with headquarters later in New York. The work on the Yale and Bowdoin campus was done under his direction.

CONTENTS.

Volume XII No. 3

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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.

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1914.**

ERRATA

By a peculiar accident Mr. Korstian's article was printed twice, namely, on pages 177 to 192 and pages 408 to 424. The first printing contained a few typographical errors, which do not occur in the second printing.

In the article by Mr. Haasis a few errors occurred, which do not influence the sense, or else correct themselves.

p. 312 read Apr. 6 a. m. 5
Mar. 6 a. m. 8
Dec. 9 a. m. 2.5

p. 318 shift exposure headings one place to the left, leaving out o, and inserting 1 hour before 2 hours.

In the article by Mr. Upson, change in table on p. 324: in 5th column 365 to 385; in table on p. 326: headings should read

D.B.H Inches	Feet B.M	Ties No.	Lineal Feet	Aver. Ht. Feet	Feet B.M.	Ties No.	Lineal Feet	Aver. Ht. Feet

FORESTRY QUARTERLY

VOL. XII.] SEPTEMBER, 1914. [NO. 3.

RESULTS OF AN EXPERIMENT ON THE EFFECT OF DRYING OF THE ROOTS OF SEEDLINGS OF RED AND WHITE PINE.

BY FERDINAND W. HAASIS.

The following experiment was conducted on the lands of the Northeastern Forestry Company at Cheshire, Connecticut. It was made possible through the kindness of the Superintendent, Mr. F. S. Baker, in supplying material and ground.

The object was to determine to what extent seedlings would recover after having had the roots exposed to sun and wind. A slight amount of exposure is inevitable in the lifting, bundling, packing and transplanting. The question was: will the plants recover after exposure for hours, or is exposure for minutes fatal?

The chief factors influencing the result, are:

1. The sun's altitude.
2. The latitude.
3. The absolute and relative altitudes and the locality.
4. The time of day.
5. The cloudiness and place of exposure.
6. The temperature.
7. The humidity.
8. The precipitation.
9. The direction and velocity of the wind.
10. The treatment after exposure.
11. The species.
12. The age and character of the material.
13. The soil in which planted after exposure.
14. The weather after transplanting.

As to the sun's altitude, only one experiment was conducted, beginning on April 19th the following table (taken from P. N.

Hasluck, Book of Photography, 1905, p. 88, having been prepared by Prof. A. Scott) shows the actinic (not thermal) ratios for the various months and hours for latitude north 40°.

a.m.	*p.m.*	*June*	*May July*	*Apr. Aug.*	*Mar. Sept.*	*Feb. Oct.*	*Jan. Nov.*	*Dec.*
12 m.		1	1	1	1	1.25	1.5	2
11	1	1	1	1	1.25	1.25	1.5	2
10	2	1	1	1.25	1.25	1.5	1.75	2.5
9	3	1.25	1.25	1.25	1.5	2	2.5	3.5
8	4	1.5	1.5	1.75	2.25	2.75	4	8
7	5	2	2.5	2.75	4	7		
6	6	3.5	5	8				
5	7	9						

The present experiment was, however, started at about the height of the shipping season, so that, from the standpoint of present commercial practice, this variable may be ignored.

The nursery is in about 41° 30′ N. Lat., 15 miles from salt water (New Haven Harbor), at an altitude of about 200 ft. above mean sea level, on level ground.

The sun's heat evidently varies in intensity from hour to hour, and a series of hourly exposures might be made through the day, but it was desired to try prolonged exposures as well, and these, as, for instance, a 10-hour exposure, are evidently rather limited as to time of day. A series of exposures varying from one another in duration by ten minutes was, however, conducted about noon.

It is obvious that a cloudy day would be less harmful than a brilliantly clear day. The day chosen happened to be clear though not brilliant (see Table 1), probably as nearly average a day as obtainable. In the nursery practice much of the work is done under shelter of some kind. Stringing the plants in the transplanting boards is done under the shelter of burlap shanties which give considerable protection from wind and perhaps half protection from sun. Some of the counting and bundling is done here, also. The greater part of this, however, as well as all the packing, is done in the counting and packing sheds which afford complete sun protection and nearly complete wind protection, and it was only in the packing shed that the shade exposures were made.

The temperature, the humidity, and the precipitation do not need comment, though perhaps the significance of the humidity is at times overlooked. The drier the air, the more rapid the evaporation.

As to the wind, it is an elementary principle of physics that rate of evaporation is increased by increased movement of air over the body from which the evaporation occurs. The influence of wind direction would probably be included under other factors. It might influence humidity, temperature, precipitation, velocity. In the present instance, the south wind is apt to be warm, and perhaps, moist, though not markedly so.

The exposures were made on pine planks. This is probably a severer test than it would be to leave them on the ground as would probably happen in practice.

As suggested above, the plants may be either replanted or packed for shipment after exposure. In some cases the roots are puddled whether for shipment or transplanting. In the present experiment all the exposures in a series were started at the same time the successive lots being stopped at different times and placed with the roots in wet sphagnum in the packing shed until evening, when all were planted after sunset. It has been suggested that perhaps the wet moss had a tendency to revive the exposed plants, but it is the treatment they would receive if shipped to a customer. From the standpoint of immediate transplanting it might have been better to start the exposures at different times, and stop them all at once, transplanting immediately. It was, however, desired to plant after sunset to reduce, as much as possible, untimed harmful exposure, and to use the method suggested would have involved continuing the exposure for a time (an hour or two or half an hour, perhaps) after the sun at least, and possibly the wind had considerably declined in destructive effects. True, commercially, plants would never be planted at night, but it is believed the treatment adopted eliminated some variables difficult to determine.

To avoid having so many plants that the handling would lack precision because of mere numbers, but two species (*Pinus strobus* and *Pinus resinosa*) were used, and only three year seedlings of these, two of each kind to each set. Even so the results show a considerable variation. The individuals used were not chosen, but taken as they came from the bed.

The place in which the plants are planted would undoubtedly have a determining influence in the case of weakened plants, as would also the weather conditions after planting but a consideration of these is scarcely within the province of the present investigations. As variables they may both be ignored in the present instance.

It is realized that these investigations are by no means complete. From the scientific standpoint it was an error not to have unexposed checks given otherwise the same treatment as the exposed plants, though from the commercial standpoint it is significant that some of the plants lived even after an exposure of several hours. Merely two plants for each variable allowed for, time of day, species, place of exposure, length of exposure, is a small number but the reason has, it is believed, been satisfactorily stated above. A recent article in "Forestry Quarterly" (vol 12, p. 31) is based upon experiments along similar lines started April 29th and kept under observation until the beginning of August. Such extended study is desirable, but was impracticable in the present instance. Exposure immediately upon lifting might work for more accurate results than the method used (see *infra.*)

The conduct of the experiment was as follows:

The approximate number of plants of each species needed was counted roughly in the bed and a double quantity dug, after sunset, with the earth adhering to the roots, like a sod. These sods were heeled in over night in the packing shed. The next morning the requisite number of plants was taken, the original earth shaken from the roots, and the exposures begun, the plants being exposed on pine boards and held down against the wind by a narrow strip of wood laid across the root collars and weighted with rocks in such a way that no shade was cast upon the roots. (A transplanting board might be more satisfactory, though it would probably be more difficult to remove a few plants at a time than in the case here described.) As before stated, the plants were taken as they came, except that care was exercised to use the ones near the center of the clump, and dead ones were discarded. The exposures were thus begun, the Red pine being started at 6.40, the White at 6.45. One group was left on the bench in the packing shed; the other was placed in the full sun and wind.

At one-hour intervals (approximately the table [1] shows the time to the nearest five minutes) two Red pines and two White pines from the sun and from the shed were labeled with the time and character of the exposure, and the roots packed in wet sphagnum.

A similar series was begun at 11.45. The interval being 10 minutes*, and completed at 12.45.

The exposures, with an hourly interval were completed at 4.40 p. m.

All were planted about 7 o'clock in the evening, care being taken to expose the roots as little as possible, the label being removed from the bundle and fastened to one Red pine before the roots were uncovered, the four being then planted in a trench in regular order, and with the sets in a regular order, as rapidly as possible. The spacing was 1.5 inches on an average.

Table I gives a correlation of the periods of exposure with the meteorological data. These latter were supplied by the Observer of the United States Weather Bureau at New Haven, Conn., 15 miles south of the nursery.

After planting the weather was rather favorable. The first rain occurred on the 20th. The plants were not watered during the progress of the experiment. Weeds were pulled occasionally. Observations were made at weekly intervals beginning with the fourteenth day after planting. The results are shown in tables II and III. The final observations are given in table III which shows the condition of the plants in each case about two months after transplanting. Owing to the small number of plants used it is hardly practicable to give percentage results. It can be seen, however, that some of the plants which had been exposed several hours were still living at the end of two months. It is perhaps safe to say that an exposure of two hours in the sun and perhaps more in the shade is not necessarily fatal (though of course this exposure was in the earlier part of the day.) The Red pine seems to have been affected to a greater extent than the White, but it is here that the lack of an

*Sun exposure for this series was 2 min. in shed, the rest (8, 18, etc.) in full sun.

unexposed check is especially felt. Another unexpected result is the large number of Red pines dying after exposure in the shade.

Table I showing the Hourly Weather Conditions, April 19, 1914.

Time.	Temperature ° F at end of hour.	Precipitation Inches.	Relative Humidity at end of hour %	Sunshine Hours.	Wind Movement Miles.	Wind Direction.
5— 6 a. m.	46	0		0.88	5	S
6— 7	47	0		1.0	5	S
7— 8	51	0	81	1.0	6	S
8— 9	54	0		1.0	6	S
9—10	55	0		1.0	7	SE
10—11	68	0		1.0	11	S
11—12	66	0		1.0	12	S
12— 1 p. m.	67	0		1.0	9	S
1— 2	72	0		1.0	13	S
2— 3	70	0		1.0	15	S
3— 4	68	0		1.0	18	S
4— 5	63	0		0.4	20	S
5— 6	60	0		0.0	24	S
6— 7	59	0		0.0	24	S
7— 8	58	0	74	0.0	27	SW

After sunset.
Meteorological data taken from the U. S. Weather Bureau's Local Record at New Haven, Conn.

PERIODS OF EXPOSURE.

Duration.	Time of Day.
10 min. [3]	11.45 a. m.—11.55 a. m.
20	11.45 —12.05 p. m.
30	11.45 —12.15
40	11.45 —12.25
50	11.45 —12.35
60	11.45 —12.45
1 hr. [4]	6.40 — 7.40 a. m.
2	6.40 — 8.40
3	6.40 — 9.40
4	6.40 —10.45
5	6.40 —11.45
6	6.40 —12.55
7	6.40 — 1.30
8	6.40 — 2.45
9	6.40 — 3.40
10	6.40 — 4.40

[3] Sun exposure for 10 minute series was 2 min. in shade, the rest (8, 18 etc.) in full sun.

[4] All Red pine started at 6.40, White pine at 6.45 a. m. All planted about 7 p. m.

TABLE II

Showing number of plants living from week to week after different exposures.

Exposure. Time	Place on	Red Pines Living. May 3 14 days after	May 10 21	May 17 28	May 24 35	June 1 43	June 7 49	June 14 56	June 20 62 days	White Pines Living. May 3 14da.	May 10 21	May 17 28	May 24 35	June 1 43	June 7 49	June 14 56	June 20 62 days
10 min.	shade	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20 min.	shade	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30 min.	shade	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	sun	2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2
40 min.	shade	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
50 min.	shade	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2
	sun	2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2
60 min.	shade	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1 hr.	shade	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2 hr.	shade	2	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3 hr.	shade	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2
4 hr.	shade	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
	sun	1	1	1	1	1	1	0	0	2	2	2	1	1	1	1	1
5 hr.	shade	2	2	2	2	1	1	0	1	2	2	2	2	2	2	2	2
	sun	2	2	2	1	1	1	1	a	2	2	2	2	1	1	1	a
6 hr.	shade	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	a
	sun	1	1	1	1	1	1	0	0	2	2	2	2	1	1	1	a
7 hr.	shade	1	1	0	0	0	0	0	0	2	2	2	2	2	2	2	2
	sun	2	2	2	2	2	1	0	0	2	2	2	2	2	2	2	1
8 hr.	shade	2	2	2	1	1	1	1	0	2	2	2	2	2	2	1	1
	sun	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2
9 hr.	shade	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	1
	sun	2	2	2	2	2	0	0	0	2	2	2	2	2	2	2	2
10 hr.	shade	1	1	1	1	1	0	0	0	2	2	2	2	2	2	2	2
	sun	2	2	2	1	0	0	0	0	2	2	2	2	2	2	2	2

a Missing.

TABLE III.

Showing condition of the transplants at the conclusion of the experiment, June 20th, 1914 (62 days after the exposures).

			Minutes.							Hours.								
		Exposure:	0	10	20	30	40	50	60	2	3	4	5	6	7	8	9	10
Red Pine	Shade	Thriving	1	1	2	2	1	2	2	1	1	1	1	1				
		Existing												1				
		Dead	1	1			1			1	1	1	1		2	2	1	2
		Remarks																
	Sun	Thriving	2	1		1	1	1		1								
		Existing		1	1	1		1	2	1	1					1		
		Dead			1		1				1	2		2	2	1	2	2
		Remarks											a					
White Pine	Shade	Thriving	2	2	2	2	2	2	2	2	2	1	2	1	2		1	
		Existing										1				1	1	2
		Dead														1		
		Remarks												b				
	Sun	Thriving	2	2	2	2	2	1	1	1				1				
		Existing						1	1	1	2	1			1	2	2	1
		Dead										1	1		1			1
		Remarks											b	b				

a 2. Missing; b 1. Missing. (1 "Thriving" white pine found cut off by cultivator.)

"Thriving" indicates plants that are putting out new leaves and seem firmly established.

"Existing" indicates plants that are not putting out new leaves and seem unlikely to recover.

The missing plants were chiefly cut off by the wheel cultivator knives.

VOLUME TABLE FOR LODGEPOLE PINE.

By Arthur T. Upson.

General experience has shown that timber sale and intensive reconnaissance estimates demand the use of reliable volume tables for different classes of forest stands. By no other means can results be obtained with certainty and as little expense. Besides the elements of accuracy and uniformity, a table must involve those of simplicity and ease of application. The Lodgepole pine stands found growing in the Colorado Rockies are homogeneous only in composition and age and vary in their physical development as a result of the fertility of the soil and the relative altitude, which conditions give rise to three site qualities. The deep, moist soil at the low altitudes represents conditions for the optimum development of the species and consequently forms the zone occupied by quality I, pine; the second quality occurs under the conditions represented by the thinner, drier soils of the middle slopes; and the upper slopes and ridges present the conditions of soil and relative altitude which induce the poorest development of pine, and fix the zone occupied by site quality III. The amount of ground cover beneath the stand is a fair indicator of the fertility of the soil, and consequently of the quality of the site, for in I it is usually abundant and in III almost lacking. Volume tables for Lodgepole pine in this region then, should be divided into three site qualities.

Such a site-quality volume table may assist in the preparation of a site-quality map.

The writer has had the opportunity during the past year to gather volume data on 2015 Lodgepole pine trees on the Arapaho Forest, Colorado, and to compile a volume table which gives volumes of sawtimber and linear feet of props for each D. B. H. class by three site qualities. The data were gathered in stands in which cutting and logging were in progress, the measurements on the entire trees just as they lay after felling and bucking into logs and props, and before the swampers had an opportunity to disturb the top or before the skidders removed any of the logs. The usual procedure in measuring was followed.

Since in the Rocky Mountain region the smallest piece which can profitably be sawed into lumber is six inches at the small end, and since the Forest Service timber sale contracts in this region usually specify that all material down to six inches in the top will be scaled by the Scribner Rule, Decimal C, a volume table which gives accurate results must include scaled material to this minimum size. All log scales were read from an ordinary 30″ Forest Service Scribner Rule scale stick, after the average diameter had been secured, and the scale was recorded in one of the extra columns, headed "Scrib. Dec. C." If the log was defective, proper deduction was made and the resulting scale recorded in the column, "Defect Scale," which therefore, signifies the scale after the defect, if any, has been deducted from the gross scale.

In this region mine props are utilized to a minimum diameter limit of 5 inches inside bark, and this was usually adhered to in the operations on which the present data were gathered. The length of the top above the 6-inch point was measured to the nearest foot and recorded as the next section after the last sawlog. The amount of material in the top which was 5″ or more in diameter inside bark, was measured and recorded in feet in an extra column, headed "Linear Feet," and on the same line as the total length of the top.

Under "Remarks" in the right-hand column, notes on the amount of character of any defect or on utilization were entered. Under "Remarks" at the bottom were placed the estimate of the site quality and utilization notes. In volume measurements the "Age" column and the reverse side of the form were not used. A brief and concise forest description was written for each set of measurements collected in a given stand and designated so as to apply to certain tree numbers. An endeavor was made to select trees which were fairly representative of that particular stand. However, it was necessary that measurements be taken in very good and very bad stands as well as in average ones, in order that the entire range of merchantable Lodgepole pine might be represented by the data.

The "Used Length" is that portion of the tree between the stump and the 6-inch point which has been utilized. The "Mer. (merchantable) Length" is the entire length between these points and may be greater or the same as the "Used Length." The "Clear

Length" is seldom entered as it is of no special importance since Lodgepole pine is seldom capable of yielding clear lumber.

Data for Sawlog-Tie-Prop Table.

In securing measurements on trees cut into ties, the record is modified so as to present the use of the data for both a sawlog-prop table and a sawlog-tie-prop or simply tie-prop volume table providing a column for "No. Ties" and a double set of "Totals."

The bole of 11" to 15" trees to a point approximately 10" in diameter, is usually cut wholly into ties, and above that point to a 5" minimum diameter, into prop material. From trees 16" to 20" D. B. H., one or more sawlogs are butted off until tie diameters are reached, when the remaining portion of the bole is cut into ties and prop material.

In measuring trees cut wholly into ties and props, the figures as mentioned above are so recorded as to furnish data for both kinds of volume tables. Each tie is recorded as an 8.0' log, the d. i. b. and d. o. b. determined as with logs and actually scaled, gross and defect, and the log is also tallied as one tie. Beyond approximately 10", the point where props begin, the pieces down to 6" are entered only as logs. From 6" to 5" the regular prop is entered in the "Linear feet" column opposite "Top." Two lines of totals are computed for all columns except "Length." The upper line of totals furnishes data for the tie-prop table; the lower line for sawlog-prop table.

In measuring trees cut into logs, ties and props, the manner of recording the data is simply a combination of that usual for logs and that for ties and props.

Although in this method of double recording a slight inaccuracy occurs in that no overrun of length is allowed in the ties and large props, nevertheless, this seldom makes a total difference of more than 1.5 feet in the total height of the tree and is more than offset by the fact that data for two different tables are combined in one set of measurements and recorded on a single tally sheet.

Determination of Site Qualities.

The simplest and probably the most accurate method of determining the site qualities of stand is that of Bauer, who uses the total yield in cubic feet, as related to age, as the criterion of quality.* Another method is to use heights instead of volumes. This method is based on the experience that the height of an even-aged stand is a reliable index of the quality of site and it has been proved that the classification of sample plots by this method and by that of total volume leads to practically the same results.

Since Lodgepole pine in this region occurs in remarkably pure and nearly even-aged stands of fairly uniform density, it was safe and a reasonable assumption that, in determining the site quality of stands in which the measured trees grew, the D. B. H. in inches of the individual tree could be substituted for the average age of the stand; the total height of the individual tree could be substituted for the average height of the stand. This allows the site qualities to be determined by the use of curves plotted on D. B. H. in inches and the total height of the tree in feet in the following manner:

All measurements were tabulated by inch diameter classes and two-foot height classes in a semi-final table, to determine the number of trees of each class.

The diameters were then plotted as abscissae on a rectangular system of co-ordinates and the height in feet as ordinates. Beside each point plotted the number of trees of that class was noted. The comet-shaped band of plotted points was carefully scrutinized and those which represented abnormally high or unusually low trees for a specified diameter class were thrown out. Then a curve was carefully drawn through the average maximum points, which represented the maximum heights for all diameters of trees of site quality I, and a curve through the minimum points represented the minimum heights for each diameter of site quality III trees. Then the ordinates, on each vertical diameter line, were divided into three equal parts and curves drawn through the two points of division. These curves, therefore, bounded the data for each site and indicated the maximum and minimum heights for the three site qualities. Curves were finally drawn through the centers of each of the three bands and the average heights for each were read off and tabulated in the volume table.

*Graves' "Forest Mensuration," pp. 325-326.
Schenck's "Forest Mensuration," pp. 60-61.
Schenck's "Forest Management," pp. 16-17.
Schlich, Volume III, pp. 102-104.

After the maximum and minimum heights for each site quality and D. B. H. class were determined, the tree measurements were gone over again, and the volumes in feet B. M. and the number of linear feet of props were grouped by diameters and site qualities, totalled, averaged, and expressed in a semi-final table of the following character:

TABLE 1—SITE 1.

D B H	No. of	Volume Ft. B. M. Decimal C.		Linear feet		Height in feet from curves		
Inches	Trees	Total	Aver.	Total	Aver.	Max.	Min.	Aver.
6	7	0	0	150	21.4	57	46	52
7	11	31	2.8	116	10.5	64	53	59
etc.	etc.							

Tables 2 and 3 were similar to Table 1 except they showed data for sites II and III respectively. In these operations the gross scales instead of the "Defect Scales" were used, since a table compiled from measurements of perfect trees is more valuable than one which includes the local average defect. In securing the original data, defect deductions were only made to ascertain how defective were the local Lodgepole pine stands.

The method described above was employed in compiling the semi-final tables for the tie measurements except that only trees 11" to 20" in diameter were used, and the results recorded in a semi-final table of the following character:

TABLE 4—SITE 1.

D B H	No. of	Vol. Feet	No. of stand. Ties	No. of lin. ft. to 5"	Hts. in ft. from curves.		
Inches	Trees	B M Aver.	Aver.	Aver.	Max.	Min.	Aver.
11 etc. to 15"	10	0	2.66	34	88	74	81
16 etc. to 20"	10	138	4.40	23	102	89	96

Tables 5 and 6 were similar to Table 4 except they represented data for sites II and III respectively.

These six tables were made a permanent record, for by so doing it will, with little office work, be easily possible to add data on additional trees at a future date without tearing apart or reworking the present data.

Compilation of Final Volume Tables.

In order to round off and harmonize the values given in the fourth column of Tables 1 to 3, the average volumes for each diameter class were plotted in the usual manner, and curves were drawn for each Site Quality, due weight being given to

LODGEPOLE PINE.

Site Quality Volume Table.

ARAPAHO NATIONAL FOREST, COLORADO

COMPUTED FROM ACTUAL SCALE OF LOGS AND PROPS: SCRIBNER RULE, DECIMAL C.

Values read from curves—Basis 2015 trees.

	Site Quality I			Site Quality II			Site Quality III		
D. B. H. In.	Feet B M	Lin. Ft. Props	Aver. Total Ht. Ft.	Ft. B M	Lin. Ft. Props	Aver. Total Ht. Ft.	Feet B M	Lin. Ft. Props	Aver. Total Ht. Ft.
6	0	20	52	0	18	40	0	15	30
7	25	10	59	20	10	47	15	10	35
8	45	10	65	35	10	53	30	10	40
9	65	10	71	55	10	58	45	10	45
10	90	10	76	75	10	63	60	10	49
11	120	8	81	100	8	67	80	7	53
12	150	8	85	125	8	71	100	7	56
13	185	8	88	150	8	74	125	7	59
14	220	8	91	180	8	77	150	7	62
15	260	8	94	215	8	80	175	7	65
16	300	7	96	250	7	82	200	6	68
17	340	7	97	280	7	84	225	6	70
18	380	7	98	315	7	85	250	6	72
19	420	7	99	350	7	86	280	6	73
20	460	7	99	365	7	86	310	6	74
21	500	7	100	420	6	87			
22	540	7	100	460	6	87			
*23	585	7	101						
24	630	7	101						

STUMP height equals 1 foot. Volumes in feet, B. M. include all material down to the 6-inch diameter in the top; linear feet from this point to a minimum of 5 inches. This table is built from perfect trees, therefore, does *not* allow for defect.

those points which represented the largest number of trees These three curves each showed uniform increases of volume with diameter, but did not always show uniform progression for the same diameters in different sites. Theoretically this latter uniformity could have been obtained by again plotting the values from the first set of curves for each diameter class in the three sites, but since for each diameter class there would have been but three points, it was found difficult to draw uniform average curves. Consequently, a uniform progression of values in the horizontal columns was secured mathematically.*

The same general method of harmonizing the values in columns 3 and 4 of Tables 4, 5 and 6 was used.

It was impossible to harmonize the linear foot values from

LODGEPOLE PINE.

Site Quality Volume Table.

ARAPAHO NATIONAL FOREST, COLORADO

BASED ON STUMP DIAMETER OUTSIDE BARK FOR USE IN TRESPASS CASES.

Computed by conversion of D. B. H. Table and stump measurements of 2015 trees. Values read from curves.

	Site Quality I			Site Quality II			Site Quality III		
D. O. B. Stump	Feet B M	Lin. Ft. Props	Aver. Total Ht. Ft.	Ft. B M	Lin. Ft. Props	Aver. Total Ht. Ft.	Feet B M	Lin. Ft. Props	Aver. Total Ht. Ft.
7	0	20	52	0	18	40	0	15	30
8	25	10	58	20	10	46	15	10	35
9	40	10	64	35	10	52	30	10	40
10	60	10	70	50	10	57	45	10	44
11	85	10	75	70	10	62	60	10	48
12	110	8	79	90	8	66	75	7	51
13	135	8	83	110	8	69	95	7	54
14	165	8	87	135	8	72	105	7	57
15	195	8	90	160	8	75	125	7	60
16	225	8	93	185	8	78	145	7	63
17	255	8	95	210	8	80	165	7	65
18	290	7	96	235	7	82	185	6	67
19	325	7	97	265	7	83	205	6	69
20	360	7	98	295	7	84	230	6	70
21	395	7	99	325	7	85	255	6	71
22	430	7	99	360	7	85	285	6	71
23	465	7	100	395	6	86	315	6	72
24	505	7	100	430	6	87			
25	545	7	101	465	6	87			
26	585	7	101						

FOOT note same as in regular D. B. H. Volume Table.

columns 6 of Tables 1, 2 and 3 by a series of curves since little apparent relationship seemed to exist. The method which was employed in determining the linear foot values for the different site qualities and diameter classes was similar to the Arbitrary Group Method of computing volumes of woods. As 6″ trees yield only prop material, the linear foot values assigned to them were almost identical with the true average secured by the

*Schenck's "Forest Mensuration," pp. 58-59.

actual field measurements. The remaining diameters were arbitrarily grouped into the following:

Pole Group .... 7″ to 10″ D. B. H.
Tie Group, ...11″ to 15″ D. B. H.
Sawlog-Tie Group, ..15″ to 20″ D. B. H.
Sawlog Group, ...20″ to 24″ D. B. H.

The arithmetical mean number of linear feet of props was then computed from the averages secured by actual measurements for each group in each site quality, and the result used

LODGEPOLE PINE.

Site Quality Volume Table.

ARAPAHO NATIONAL FOREST, COLORADO

FROM ACTUAL SCALE AND COUNT OF LOGS, TIES AND PROPS; SCRIBNER RULE, DEC. C.

Values read from curves and harmonized with those of regular Vol. table. Basis, 206 trees.

	Site Quality I				Site Quality III			
D. B. H.	Feet	Lin. Ft.	Aver. Ft.	Lin. Ft.	Aver.	Feet	Lin. Ft.	Aver.
Inches	B. M.	Ties	Feet	Ht. Feet	B. M.	Ties	Feet	Ht. Ft.
11	0	2.70	32	81	0	2.00	26	67
12	0	3.55	29	85	0	2.80	24	71
13	0	4.35	26	88	0	3.45	22	74
14	0	5.00	24	91	0	4.00	20	77
15	0	5.60	23	94	0	4.45	20	80
16	140	4.20	23	96	120	3.55	20	82
17	155	4.00	22	97	130	3.30	20	84
18	190	3.70	22	98	160	2.95	20	85
19	245	3.20	21	99	205	2.45	19	86
20	320	2.50	21	99	270	1.80	19	86

Site Quality III

11	0	1.25	20	53
12	0	2.00	19	56
13	0	2.55	18	59
14	0	3.05	18	62
15	0	3.40	18	65
16	100	2.90	18	68
17	105	2.60	18	70
18	130	2.20	18	72
19	165	1.70	17	73
20	220	1.10	17	74

Trees smaller than 11″ yield only small sawlogs and props. From trees 16″ to 20″, one or more sawlogs are butted off before ties are made. Trees over 20″ usually made wholly into sawlogs and props. Props include all material from last tie to 5″ point. No allowance made here for defect.
Stump height=1 foot.

in the final volume table. A similar method was used in the sawlog-tie-prop table.

In addition to the general table, a volume table which can be used in working up trespass estimates, etc., was constructed based on stump diameters outside bark and site qualities, after the following manner:

All stump diameters outside bark for each D. B. H. class were tabulated and the average secured, (e. g., the stump d. o. b. of a 11.0" D. B. H. tree was found to be 12.4"). Then on a system of rectangular co-ordinates the average stump diameters outside bark were plotted as abscissae and the volumes in feet B. M. for their corresponding D. B. H. (taken from the regular volume table based on D. B. H. and site qualities) were plotted as ordinates. The values for the final stump d. o. b. table were secured by reading from the curves, the volumes for the even stump diameters. This gave immediately uniform progression of values in both the vertical and in the horizontal columns.

Conclusions.

There are two ways of applying a site-quality volume table, one of which may be used to check the other. The inexperienced estimator by use of a hypsometer may take the total heights of ten to twelve trees and by comparison with the average heights given in the table for each diameter, determine the quality of site. Should very accurate results be desired, interpolation between the values for two site qualities may be made. The experienced man may judge site qualities by careful observation of the stand, taking into account the height of the trees, the character of the soil, the relative altitude, and the nature of the ground cover. Since the determining factors of site quality of pine stands are fertility, depth and moisture content of the soil, and since the characteristics of the soil vary almost directly with the relative altitude above the valley bottom, and since the density of the ground cover is an index of the fertility of the soil, this means of determining the quality is reliable and at the same time simple. This makes the work progress rapidly in spite of the fact that to apply this table it is necessary to make a site-quality map. As mentioned before, this map is extremely valuable in reconnaissance; and the same is true in timber sale work, for when a site map is included the usefulness of the timber sale map does not cease with the completion of the sale.

One of the good points of a site-quality volume table for Lodgepole pine based on d. o. b. on the stump instead of D. B. H. is the ease with which it can be applied in computing the volume of timber cut in trespass. Trespass usually occurs in good stands which yield much brush and under which abundant advance growth is found. These conditions necessitate, in logging, heavy swamping which causes the removal or misplacement of the tree tops, the only indicators of the total or merchantable heights of the trees. For these reasons other forms of volume tables cannot be used with as great accuracy as the site volume table, for in the latter the estimates may be secured by the use of the soil factors as means of determining the height of the trees.

Sawlog-tie-prop tables of any form are valuable only as indicators of how certain pine stands will run in sawlogs, ties and props. As a rule accurate estimates of these classes of material on specific operations cannot be secured for the following reasons: A tie table can only give results for ties of certain specifications (7"x7" in this case), while on the other hand, railroad tie contracts call for ties varying from 6" to 10" faces, and their tie inspectors are not uniformly rigid in their inspections, often allowing undersized ties to be "run through." Moreover, the degree of utilization of trees practiced by the tie choppers varies. Some will cut and others will not cut into ties, large tie-sized trees, small tie-sized trees, trees swelled at the base, and limby-boled trees. These variable factors make it undesirable to spend too much time and money in the preparation of tables which give results in feet B. M., number of ties and linear feet of props; for that reason the site-quality, sawlog-tie-prop table given in this article is based on but 206 trees, and yet it serves the purpose for which it was intended.

Since this volume table is probably the first of its kind for Lodgepole pine, a good deal of comment has been made in regard to its accuracy and its applicability to all Lodgepole pine stands.

The table can, of course, only be used for large averages, like any other volume tables it does not give correct answer for individual trees. Check tests on 62 trees, taken at random, gave for 30 trees higher scale than the table, for 20 trees lower and for 12 trees the same volume; the differences altogether averaged 2.18 ft. B. M. per tree, or 1.2% for stands higher than the detail scale.

In using the volume table on any specific work of estimating, it must be kept in mind that this table gives the contents of the bole in feet B. M. to a point 6″ in diameter. In the event that this minimum limit is raised, as may be the case in sales where the operator can satisfactorily show that he cannot dispose of the smaller material, the results given by this table must necessarily be reduced to allow for this portion of the bole between 8″ and 6″ which is not utilized.

THE RELATION OF CROWN SPACE TO THE VOLUME OF PRESENT AND FUTURE STANDS OF WESTERN YELLOW PINE.

By George A. Bright.

The most striking feature of a stand of Western Yellow pine is its open character. This peculiarity is the first thing which strikes any one looking upon such a forest for the first time. Even growing on the best soils and under favorable climatic conditions, it would be difficult, if not quite impossible, to find a full or normal stand of Yellow pine over an area of forty or even ten acres. There appear openings even where the very best conditions for the growth of this tree occur, as well as in localities where conditions are less favorable.

This peculiarity of Yellow pine stands is due to five primary causes, as follows: (1) fire, (2) insect infestation, (3) windfall, (4) root competition and (5) light competition.

(1) In stands of Lodgepole or Engelmann spruce a fire will kill most of the trees that it touches and the ground is practically cleared for an entirely new stand, which generally comes in quickly and evenly, the light seeds of these species being blown for considerable distances. In the case of Yellow pine, on the other hand, comparatively few trees are killed by a single fire. Openings are only made here and there in the crown cover by the destruction of one or a few trees at best.

On deep, moist soils the damage done by fire is less than on dry soils or where the soil is shallow; also reproduction is here far less precarious. For these causes primarily the openings on dry soils are apt to be large and more frequent, although the trees, once having obtained a start, make good growth. In a report by Mr. Munger he discusses the damage done to Yellow pine by surface fires. A table taken from this report follows:

TABLE I.

Showing for the average acre, on three representative areas, after surface fires, the number of trees per acre of Yellow pine and their proportions in the total stand, in four classes, according to the damage which they sustained in the fire.

	Burned to Death		Felled by Fire		Scarred by Fire		O. K.		Total	
	No. Trees per Acre.	% of Total Stand	No. Trees per Acre.	% of Total Stand	No. Trees per Acre.	% of Total Stand	No. Trees per Acre.	% of Total Stand	No. Trees per Acre.	% of Total Stand
Wallowa N. F. Average 70 Acres.	1.21	5.12			7.70	32.59	8.92	37.75	17.83	75.46
Wallowa N. F. Average 30 Acres.			.60	2.12	8.70	30.90	9.27	32.92	18.57	65.94
Wallowa N. F. Average 30 Acres.	.50	1.52	.43	1.31	8.34	25.23	9.02	27.24	18.29	55.30

It will be seen from this table that surface fires in Yellow pine have a decided tendency to thin out the trees, especially if the fires are repeated many times during the life of a stand. But, if the damage to the large trees is considerable, the damage to the seedlings, saplings, and poles is very much greater. Indeed it seems almost certain that in times gone by, when the Indians were in the habit of setting great numbers of fires to drive game, very few seedlings were able to reach maturity solely because of the frequent fires.

(2) Insects, especially bark beetles, have also had a strong tendency to thin out forests of Yellow pine. The most destructive of the bark beetles working in Yellow pine is the Dendroctonus species, of which there are a considerable number of varieties. These beetles work in colonies, flying from one group of trees to another and killing each group in succession, thus opening up spaces of considerable size in the forest.

The injury wrought by these beetles is usually more severe than the injury done by fire, and beetles are harder to subdue than fire. They are probably present in all Yellow pine forests in Washington and Oregon. In the Black Hills, a few years ago, it often happened that every tree over large areas was killed by them.

(3) Windfall is not a serious menace in a Yellow pine stand, even where through any one of the various causes the stand may have been considerably thinned. It rarely causes large openings, picking out a tree only here and there. In future stands it will be possible still further to minimize the loss by wind by cutting out the weak and top heavy trees.

(4) Root competition may exert a slight influence toward keeping a stand of Yellow pine open, but it is believed that this is by no means a very important factor. It would, however, exert a very important influence on the character of a stand, were it not for the fact that Yellow pine is most intolerant, so that the trees, in order to obtain the amount of light which they require for their best development, must be separated by a distance sufficiently great to preclude root competition.

The roots of Yellow pine rarely extend farther out from the tree than the limbs of the crown in normal trees growing on good soils. This was observed by measurements taken, from time to time, on a great many trees which had been recently toppled over by the wind. This estimate should be conservative, as the trees which are most readily thrown by the wind are those whose root systems are superficial and accordingly broad. The area of the crown of a Yellow pine forms, therefore, a good working index of the area of its root system.

Rain falling upon the earth soaks, for the greater part, straight down with very little lateral spreading, at least until it has sunk below the level where it will be available for the roots of trees. Rain, therefore, which falls beyond the immediate reach of the roots is, for the most part, lost, as far as the trees are concerned.

That root competition is not very severe, even directly beneath the crowns of large Yellow pines, is shown by the fact that seedlings often spring up and make good growth in such places. In a Forest Service Bulletin discussing reproduction of Western Yellow pine in the Southwest, the author of that publication shows it to be a fact that reproduction is more prolific under the partial shade of the old trees than it is out in the open. The seedlings derive more benefit from the partial shade than harm from root competition. In other words, the shutting off of part of the sun's rays by the foliage of the big trees and the attendant decrease in evaporation from the soil more than offsets the moisture absorbed by the large trees, and reproduction is consequently here able to get a start, which would not have been possible for it in the open.

It has been frequently noticed in dense thickets of Lodgepole pine where a few very large old larch were still left standing, that the Lodgepole reproduction was very much thinner, or entirely absent within 15 or 20 feet of the trunk of the larch. This circumstance was undoubtedly due to the fact that the large trees absorbed so much of the moisture that none or little was left for reproduction. Light did not enter into the matter to a sufficient degree to account for the phenomenon, as very little shade is cast by such trees. It must have been root competition. However, as it would be impossible to grow Yellow pine of the size of these larch within a distance of 40 or 50 feet of one another because of the light requirements of the species, there is no fear of root competition taking place to any serious extent.

Were no other factor involved, it would be possible to judge the correct spacing of Yellow pine according to the area occupied by the roots as judged by the crowns, and the approximate number of dominant trees that could stand on an acre could be found by dividing the area of the crowns in square feet into the area of an acre in square feet. But the light requirements of the species compel a wider spacing of the trees than is demanded for the development of the roots.

(5) This extreme demand of Yellow pine for light, or intolerance of shade, has played its part along with the other factors already mentioned, in keeping the forests composed of this species open. It will always necessitate that the trees be spaced well apart. The crowns require light from the side as well as from the top, in order that the tree may thrive and make good growth. The large, irregular spaces primarily due to the ravages of fire, insects, and wind are, however, entirely unnecessary and represent only so much waste ground from the standpoint of timber production. Moisture, which might be available for tree growth in these openings is now lost through evaporation due to the unbroken rays of the sun and drying effects of

the wind, whose movement is unchecked by the obstacle which might be afforded by the trunks and foliage of trees. In other parts of the forest, the trees are usually so crowded together that many are suppressed to such a point that, if not eventually killed, their growth is very nearly nil, and they serve only to absorb moisture and nutriment from the soil, that had much better go to the dominant trees standing in the light. By proper spacing it will be possible in future stands to avoid root competition and allow the proper amount of light to reach each plant, for its best growth and development.

On good, average soils supporting average stands of pure Yellow pine, containing no large openings, it was found that on ten different sample plots comprising in all 60 acres, there was an average of 33 trees per acre, nearly half being either suppressed or intermediate, as a result of their persistingly growing in groups. The suppression, however, was evidently not primarily due to root competition but to light competition, because no matter how closely together the trees stood, none appeared sickly until they were over-topped by some of their associates, and the light shut off. As soon as this occurred, they rapidly lost ground, and many perished. If the suppressed and intermediate trees occurring in these plots had been distributed evenly through the open places in the stand, none would have been suppressed, as each tree large and small over 12" D. B. H. would have been supplied with a crown space of 1320 square feet, which is greater than is demanded by any but the very largest of pines, as we later will show.

By observing single acres, it will be found that more than 33 trees can stand within the limits of an acre and thrive, and there should accordingly be no reason why the number of trees over large tracts, where the essential conditions are the same as on the single acre, should not be equally large except as the openings are caused by accident.

By the suppression of fire and insects, and care to guard against conditions resulting in windfall, forests can be put in a position to return the maximum yields of which they are capable. Fires and windfall are comparatively easy to control. Beetles, it is feared, however, will always prove to be a serious problem.

It is a characteristic of Yellow pine to fill quickly with reproduction gaps caused by the death of old trees through one of the above mentioned causes. In this respect, Yellow pine behaves in a manner just the reverse of fruit trees which do not thrive well where another tree, especially of the same species, has recently stood. Old cut-over areas of Yellow pine frequently have growing on them a fine stand of reproduction, while the surrounding area which had never supported trees is still bare, although the conditions for tree growth appear practically identical. This has been noted frequently on small patches of timber cut on the lower units of tree growth, where climatic conditions are more or less severe.

In times gone by the frequent fires killed out the patches of reproduction about as soon as they occurred, but since the fires have been in large measure stopped, reproduction has come in very thickly in most Yellow pine forests, and its abundance points to a heavier future stand than the existing stand. This abundance is decidedly out of proportion to the comparatively small number of old trees in most Yellow pine forests which make up the present stand.

Just how much the forest can be made to yield after the injuries resulting from fire, insects, and wind have been reduced to a minimum, will depend on the number of dominant trees of merchantable size which it will be possible to grow on an acre without crowding. This number will depend on the amount of space required by each tree, and for this purpose it was necessary to find the actual average area occupied by the crowns of Yellow pine of various diameters, and to add to this area the proper allowance of space around the periphery of the crowns which would admit the sufficient amount of side light.

For this purpose the actual areas of the crowns of 113 Yellow pines of diameters ranging from 12 to 42 inches D. B. H. were measured and the results of this study are shown in the following table and curve.

The crowns were measured by standing immediately under the periphery in five or six different places and measuring from each place the distance in. to the center of the tree. These distances were then plotted on a conveniently large scale, the shape of the crown drawn in, and the area determined by a planimeter. These results were finally evened off on a curve. There appears a very distinct relation between the diameter of the tree and the size of the crown. The crowns of only normal, dominant trees were chosen for this table.

It was observed that the crowns of Yellow pines whose D. B. H.

TABLE II.

Showing the relation between the diameter b. h. and the diameter and area of the crowns of dominant, normal, Western Yellow pine in Oregon.

D. B. H. Inches	Basis Number of Trees	Average Area of Crowns Not Evened on Curve Sq. Ft.	Average Area of Crowns Evened on Curve Sq. Ft.	Average Diameter of Crowns Ft.
12	2	100	100	11
14	5	190	160	14
16	6	195	210	16
18	4	235	250	17
20	10	260	285	19
22	14	330	325	20
24	12	375	360	21
26	16	400	390	22
28	17	410	420	23
30	3	400	455	24
32	11	555	500	25
34	3	440	550	26
36	5	620	605	27
38	3	525	665	29
40	0	0	735	30
42	1	795	820	31

TABLE III.

Showing, for various diameter classes, the distance at which Western Yellow pine must be spaced in pure stands in order that all trees will be dominant.

D. B. H. INCHES.	Actual Diameter of Crowns from Table II. FEET.	Distance apart Trees should stand, allowing for space beyond Periphery of Crowns. FEET.
12	11	16
16	16	22
20	19	27
24	21	31
28	23	35
32	25	40
36	27	44
40	30	50

are from 12 to 20 inches are not suppressed by the crowns of other trees of the same species and of similar size, if the edges of the crowns are separated by a space of from 5 to 10 feet. In the same way trees having a D. B. H. of from 22 to 32 inches require a space of 10 to 15 feet between the edges of their crowns, and, for trees 34 inches D. B. H. and over, a proportionately larger space, say of 15 to 20 feet is required.

This extra distance between the crowns should then be added to the diameter of the crowns shown in Table II, to obtain the total distance at which the trees should be separated from one another.

The crowns of trees are in reality circular, but for the sake of insuring a conservative estimate, they will be considered as square. Thus the number of dominant trees of any D. B. H. class which it will be possible to grow on an acre can be determined by squaring the figures given in Table III representing the distances at which the trees are spaced, and dividing the resultant product into 43,560, which is the number of square feet in an acre. From these calculations the table IV could be constructed, adding ages and volumes from other compilations in the District office.

TABLE IV.

WESTERN YELLOW PINE.

Relation of Crown Space, Number of Trees and Volume.

Age of Trees Years.	D. B. H. Inches.	Actual Area Occupied by Crown Square Feet.	Total Area Allotted to Crown. Square Feet.	Number of Dominant Trees per Acre.	Total Area on an Acre Covered by Crowns. Square Feet.	Density of Crown Cover	Total Volume in Board Feet.
75	12	100	256	168	16,800	.39	16,800
100	16	210	484	90	18,900	.43	22,000
133	20	285	629	60	17,100	.39	28,000
183	24	360	961	45	16,200	.37	37,000
262	28	420	1225	36	15,120	.35	46,000
348	32	500	1600	27	13,500	.31	51,000
425	36	605	1936	22	13,310	.31	57,800
495	40	735	2500	17	12,495	.30	56,700

This table shows that the density for all diameter classes is less than .5 and that it decreases as the diameter increases. This compensates for the greater intolerance of old trees as compared with young trees, and for the greater shade cast by tall trees as compared with short trees.

The volume which an even aged stand of Yellow pine may be expected to produce in a certain time, having a normal number of dominant trees per acre as permitted by the crown space requirements of the trees, is also shown.

In order to compare the results of this table with conditions as they actually exist in the wild state, ten sample plots comprising altogether 60 acres and composed of pure Yellow pine were chosen. A summary of these plots is given in Table V which follows:

TABLE V.

Showing summary of 10 sample plote taken in pure stands of Yellow pine in Oregon.

Locality of Plot	Size of Plot Acres.	Total No. Trees on Plot.	Average No. of Trees per Acre above 12″ D. B. H.	Average D. B. H. of Trees above 12″ Inches
Palmer Jct.	5	170	34	21
Palmer Jct.	5	190	38	23
Palmer Jct.	4	119	30	19
Palmer Jct.	4	176	44	19
Palmer Jct.	6	159	26	21
Whitney	20	669	33	21
Whitney	10	301	30	22
Austin	4	124	31	22
Spray	1	30	30	21
Prineville	1	33	33	24

These sample plots were taken in stands where no large openings occurred, the endeavor being to find as even a crown cover as possible. They do not by any means represent maximum yields, however. It is noticed in these plots that the average number of trees per acre falls below the figures given in Table IV. The average diameter for the different plots varies between 19 and 24 inches. According to Table IV the number of trees per acre of 19″ trees should be about 68, and for 24″ trees, 45. On the sample plots respectively but 44 and 33 trees were growing on an average acre. It was very evident that these plots were by no means fully stocked. Their average density hovered around two-tenths and was generally less.

The last two sample plots of one acre each were studied more intensively than the other plots. The acres of the crowns were carefully measured and plotted on maps where the irregularity and broken character of the forest cover, which was of pure Yellow pine, is strikingly illustrated. Especially is this noticeable in the one case, where many of the trees are so crowded together as to be very much suppressed, while if distributed at regular intervals over the plot, there would have been ample space and to spare, for every tree to have reached its best development. Probably these clumps of mature trees are the survivors of a dense thicket of seedlings such as are seen everywhere throughout the Yellow pine forests. If root competition for water were an especially important factor in keeping Yellow pine forest as open as they are characteristically found, it does not seem likely that the species should be so often found crowded together in

TABLE VI.

A summary of two 1-acre sample plots taken in stands of Western Yellow pine in Oregon.

Plot	Total. No. Trees on each Plot.	Total. Volume of Plot.—B. F.	Density of Crown Cover.	D. B. H. of Average Tree. Inches.	TREE CLASS Dominant Number.	Intermediate Number.	Intermediate Suppressed No.	Suppressed Number.
A.	30	16,600	.19	21	17	6	3	4
B.	33	31,000	.23	24	19	7	2	5

groups. Large spaces do not occur around single trees, as a rule, but around groups of trees. It seems probable that the crowding together of the species rather affords a measure of protection by shading the ground and thus lessening evaporation. When the trees grow into poles and veterans, the competition for light is the factor which thins out their numbers more especially than the competition for moisture.

In the second case the stand is more uniform than in the first, but the same grouping of the trees is still evident enough. In the first case the average tree is 21 inches D. B. H., the volume, therefore, should approach 31 M., and in the second case where the D. B. H. of the average tree is 24″ the volume should approach 37 M. As a matter of fact, the volumes on these two acres are respectively only 16,600 and 31,000 B. M.

Probably many years will be required before it will be possible, in this country, to obtain very extensive normal forests of Yellow pine. Trees will be spaced, not usually by planting as is the case in most of the German forests, but they will be spaced by means of the axe. That is, the stands will be thinned out, as the increasing size of the trees require, and the spacing will consequently be more or less rough. On very dry soils it will be necessary to make the spacing greater than on moist, for the reason that on a moist soil a tree can put up with a greater degree of shade. The shade is compensated for by the increased allowance of moisture. It has been the endeavor in this report to deal exclusively with average conditions of soil and climate as they exist. Extreme conditions of soil and climate will always require special treatment.

In conclusion, it may be said that possibly various statements in this report may lend themselves to criticism as not being sufficiently backed up by evidence. It was necessary to make this study entirely a side-issue along with more immediately imperative work of another sort, so that the procuring of much field data was impossible. It is felt, however, that the subject treated is an important one, and, before concluding, it is desired to call attention once more to the method described earlier in this report, of measuring the areas occupied by the crowns of Yellow pine, which, it is thought, yielded very satisfactory results.

The importance of knowing the crown area of trees of all species, for different diameter classes will become increasingly important as it becomes more and more possible and necessary to practice intensive forestry in this country. In planting and thinning, it will be of value in determining the most advantageous spacing of the young trees. In forest management, it will assist in estimating the probable future yield of stands.

By means of sample plots, the various habits and peculiarities of the different species can be graphically shown and compared in a most instructive manner.

NOTES ON STRIP MAPPING FOR INTENSIVE RECONNAISSANCE.

By A. F. Kerr.

The objects of intensive reconnaissance are to secure: 1st an accurate map, 2nd an estimate of the timber, and 3rd other data necessary for the proper management of the Forest—all at a reasonable cost.

The strip survey has been generally adopted as the best system for securing this information, for the following reasons:—The gridiron arrangement of the strips permits of the simplest and most effective methods of control, and the most accurate location of details in mapping, and it fits well into the rectangular scheme of the Land Office Survey. The gross estimates are practically reduced to a mathematical basis, and may be worked up for conveniently sized, legal subdivisions. The application of correction factors for defect, etc., require judgment, but the bulk of the estimating can be done by inexperienced and, consequently, low-salaried men.

The question of control is an extensive one in itself and, for that reason, will not be considered here.

In general the location of data on the strip map depends upon pacing for distances and the aneroid barometer or Abney hand level for elevations. Topography is shown by contours or form lines drawn as the mapper proceeds along the compass course.

This system is usually applied in one of two ways. Since the Abney level is merely a substitute for the barometer in either plan it need not be considered separately.

By the one method which was commonly used, "form lines" are drawn on each strip in accordance with the barometer readings, and entirely independent of the form lines on adjacent strips. That is, the form lines of adjoining strips are not connected in the field but simply serve to indicate the direction that the contours will take on the finished map. These form lines are drawn on the map as final contours, in the office, in accordance with the "corrected" barometer readings.

By the other method actual contours are drawn, and are connected as far as possible in the field. They are based, not upon barometer readings alone but, upon differences in elevation determined by the barometer and checked by judgment and by angle and distance. In other words this map is completed in the field, and is dependent to a certain extent upon the judgment of the topographer. Barometer and time readings are recorded upon the field map at regular intervals as in the first case, but are disregarded until the map is turned in for final adjustment.

The important difference between these two methods is, that in the first case form lines *are not* connected in the field while in the second case form lines *are* connected in the field.

It is for the purpose of discussing the relative merits of these methods that this paper is written.

The barometer and a reasonable ability to pace constitute the new topographer's chief assets, and perhaps because of the relative accuracy of the barometer, he is inclined to place unlimited confidence in it.

Considering now the method first described:—the topographer starts from a control stake of known elevation and when the barometer shows a change equal to the contour interval to be used he unquestioningly indicates it by a line drawn across the strip, showing the general direction of a contour at that point. Other form lines, at irregular intervals, are drawn to indicate minor changes in slope. He proceeds along the compass course concentrating his attention upon the mechanical factors, his pacing and the barometer. Important topographic features will be noted superficially, but the business of properly indicating barometer form lines on the strip occupies his mind. He misses the general scheme of things entirely.

Succeeding strips will be done in the same manner. Each strip is a unit in itself, since no individual contour, and therefore no particular land form of one strip is actually connected with the complementary elements of the same land form on adjoining strips. It is seldom that an important topographic feature is complete in a single strip, and if the portion on each strip is sketched as a detached fragment the feature as a whole is lost.

No matter how careful the topographer may be, work done in this manner will become mechanical and the form lines across the strip will be simply a graphic representation of the barometer readings taken.

It is a fact, that should require no argument, that a map made in this manner can be no more accurate than the topographer's mental conception of it. If he does not connect his lines on the sheet and thus develop a complete and tangible representation of succeeding impressions he can not retain a clear idea of the country over which he passes. A given land form seen from one strip may have a decidedly different appearance when seen from the next strip, and the form lines representing it may be entirely unconformable. In the office a case of this kind can be settled only by guess work.

Following such a method the mapper will perhaps develop speed and, to some extent at least, his sketching ability, but his judgment of perspective, of topographic forms, and of the interrelation of physical features will certainly remain latent.

The stock argument in favor of this method is that "owing to atmospheric changes which can not be allowed for in the field the topographer is liable to connect form lines of different elevations." Such an argument is in itself an admission that the work is being done mechanically. It says in effect that the barometer readings must stand, and that the topographer may not use his judgment as to whether or not the reading is correct. It is based on the assumption that a topographic map depends for its value upon the exact location of certain contours, rather than on the proper relationship of the contours to each other.

If it were possible to locate contours accurately throughout their entire length, and at close enough intervals, the resulting map would necessarily be a correct representation of the topography. But with reconnaissance work in rough country and heavy timber it is only possible to *approximate* their locations, at points from an eighth to a quarter of a mile apart, and usually at vertical intervals of 100 feet. It is evident that under such circumstances the exact location alone of a few points will not give a very reliable map.

To produce a reasonably accurate map under the conditions which ordinarily obtain, requires an understanding of physiographic features, of the interrelation of land forms, of perspective, and more than this it requires topographic sense and imagination.

To concentrate attention on the strip line and to locate contours by arbitrary barometer readings is to develope only the mechanical ability of the mapper, and to positively weaken his topographic sense. A completed field sketch made in such a manner will show scarcely a single definite feature. The lines on it merely suggest the form which the draftsman is supposed to develope. It is practically unintelligible until it has been thoroughly worked over. In this process it usually loses whatever character it may originally have had, and takes on the wooden appearance of the conventional map, with long regular curves, contours uniformly spaced and streams all traced in the same pattern.

Whatever the method of securing the data, the purpose of a finished, contour map is to convey to the user a correct and definite impression of the topography of the country which it covers. It is obvious that no contour can be accurately drawn on the map until it is first developed in the mind of the topographer. Therefore, anything which will give him a better grasp of the details or a more thorough knowledge of their arrangement, will tend toward the production of a better map.

If the mapper can be made to actually see and appreciate the controlling topographic features of an area, the problem of representing them on the map sheet will offer little difficulty.

The plan of connecting in the field, contours of approximate elevation, is a means toward this end. It is simply the application to strip mapping, of a principle of extensive reconnaissance in which large areas must be mapped from a few points. In such work it is impossible to depend altogether on artificial means for the location of contours, and the topographer is forced to rely to a certain extent upon his eye and his judgment. Applied to strip mapping it does away with the purely mechanical use of the barometer and with the idea that "the draftsman can distribute the error," and it places the responsibility for the accuracy of the map squarely upon the topographer. The barometer is used as far as it can be relied upon, but the actual location of many of the contours on the ground is largely a matter of judgment.

The fact that the contours of separate strips must be connected makes it essential that special thought be given to every feature. The lines can not be drawn carelessly, merely as a suggestion to the draftsman of the probable direction of the final contour. They are, in the best judgment of the topographer, the final contours themselves. Intermediate form lines to show minor changes are used only in exceptional cases, as their presence confuses the map and there is little advantage in putting indefinite data on the field sketch which will be eliminated from the final map.

It may be argued that, since only a limited portion of the area he is covering is visible to the mapper, he should not attempt to sketch in those portions which can not be seen. There is no reason however to suppose that this part of the map can be supplied any more accuately in the office. The details are in the field, and there the topographer has the advantage of being able to see at least a part of the feature he wishes to represent, and from this can make a reasonably good estimate of the unseen portion. In the office it is a sheer guess.

In order that the field sketch may be retained exactly as it is turned in, a carbon copy is made and the corrected barometer readings placed on it. The necessary adjustments are then made on the copy. Such adjustments usually consist in a slight shifting of some portions of the map in order to correct for errors in bearing and distance, and to check up the contours with the corrected elevations. It is very seldom that any change in the relative positions of the contours is required, and the finished map loses none of the character of the original sketch.

To sum up:—the first method encourages the use of the barometer as a crutch, and bases its claim for accuracy chiefly upon the accuracy of the barometer readings.

Nothing definite, in the manner of representing topographic data on the field sketch is required, and nothing definite is obtained.

Since it is the mechanical element that is emphasized, rather than the personal there is little improvement in the quality of the maps produced.

By the second method the location of the contours is based to some extent upon the topographer's judgment. The barometer readings are used especially in making the final adjustments, that is, backed by the best judgment of the topographer, as well as by the barometer.

Every feature must be shown on the field sketch in a complete and definite form. No gaps are left to be filled in by a draftsman.

The map is a direct expression of the topographer's personality, and will improve in quality as the topographer gains in experience.

The first method is unsatisfactory in many respects, under conditions such as those found on the west side Forests. The second method is suggested as a possible improvement.

The foregoing observations are based on a thorough trial of both methods, covering areas aggregating over 50,000 acres on the west slope of the Cascades, and on the opinions of several topographers whose combined experience covers at least six season's work.

[The experience of the Forest Service corroborates the conclusions of the writer, and the Service's instructions for 1913 definitely provided for the use of the second method only. Ed.]

OBTAINING VERTICAL CONTROL OF PRACTICAL VALUE WITH THE ABNEY HAND LEVEL.

By William J. Paeth.

Method and system become of more and more importance as the work of Reconnaissance is done on a more intensive scale. The object of the survey is to obtain, at all times, as much data of standard value as possible, in a given time, and with the amount of money allowed for the work. In order to approach this ideal, the method and system of doing the work must be adapted to the conditions encountered while doing each portion of the work. Any one system will not result in this maximum efficiency, at all times, and under all circumstances.

Understanding, however, the nature and effect of the local conditions under which the work is being performed, the method and system can be chosen scientifically to meet the peculiar demands of the situation, and this method and system should be changed at will as soon as changing factors and influences warrant the use of another method.

The maps obtained by cruising methods now employed vary greatly in character and accuracy, depending upon the degree of intensiveness with which the work is done. However, maps of the greatest practical value and efficiency must be consistently accurate within the limits of accuracy determined upon for the type of map being made. To be consistently accurate the vertical control and the horizontal control must be obtained with equal degrees of precision. It would be out of place to obtain the horizontal control accurately and to plot the vertical control from less accurate vertical location. A practically accurate forest map is not always obtained unless all the factors affecting the accuracy of the methods used are considered and understood.

As stated before, methods must be chosen to fit local needs. Circumstances may affect the balance in accuracy between vertical and horizontal control and in order to make the map consistently accurate new methods of obtaining either the horizontal or vertical control must be adopted. To illustrate; the compass man may be able to work within the prescribed limits of error imposed upon his work in horizontal location, at the same time however, local factors may so influence his work in obtaining elevations with an aneroid that the vertical location will be decidedly less accurate than his horizontal location. As a consequence a large error is introduced into the horizontal location of the contour.

The importance of the accurate horizontal location of contours is apt to be overlooked when only the representation of the general character of the topography is desired in the topographic map. Maps prepared by extensive methods, on a scale of one or two inches to the mile, will be of this kind, and these extensive maps will be consistently accurate because the horizontal control and the vertical control are obtained with relatively equal accuracy. If however, a map is prepared by supposedly intensive methods the resulting map is more than a general representation of the ground and in order to give this technical character to the topographic map prepared by intensive methods the compassman must appreciate the necessity for preserving the balance between accuracy in vertical and accuracy in horizontal location.

The accurate horizontal location of a contour is perhaps of greatest importance to the timber appraiser, the logger, and the trail and road builder. The minimum grade of a haul is determined by the difference in elevation between two points and the horizontal distance between these two points. A topographic map having this quality of consistent accuracy will show the timber appraiser, logger and road builder a fairly accurate approximation of the grades within the limits of accuracy of the map. An inconsistently accurate map will not, because the horizontal location of the contour is not reliable.

As a rule, in the construction of forest maps it is more difficult to get accurate results in the vertical location than in the horizontal. The error in horizontal location can be corrected and distributed between stations along the strip line so that the final results will be well within the standard limits of accuracy. Experience has demonstrated, however, that corrected aneroid elevations, under some conditions, still exhibit an error in vertical location, when compared with bench marks, out of all proportion to the error in horizontal location. Under favorable circumstances, on the other hand, the elevations secured with the aneroid compare favorably with bench marks and the resultant accuracy is well within the limits of the precision of the horizontal control.

In order to secure a consistently accurate topographic map of greatest practical value to the timber appraiser, logger, trail and road builder, and forester, the conditions affecting the work with the aneroid should be studied, with the end in view, that some other method of obtaining vertical control may be substituted at the time when local factors affect the work with the aneroid so unfavorably as to destroy the value of the results for the construction of the type of forest map desired.

The Aneroid Barometer.

The aneroid is not always an accurate instrument and the errors encountered in working with the aneroid can hardly be controlled by the man in the field. The elevations are not secured by geometric principles. The levels are determined by an intricate mechanism which measures the weight of the column of air pressing upon the top of a shallow cylindrical box. The top is composed of corrugated metal so elastic as to respond to changes in pressure. The interior of the box is in vacuum. When the atmospheric pressure decreases the elasticity of the corrugated top presses it outward, and when the atmospheric pressure increases the top is pressed inwards. This movement of the corrugated top is communicated to an indexed dial by means of a complex system of multiplying levers, chains, and springs. The possibilities for error in the mechanism of such an instrument are apparent. No system of office corrections will compensate for them. The errors caused by the daily and hourly changes in atmospheric pressure can be eliminated by determining these changes with a stationary barometer in camp and correcting the elevations taken during the day in the field. This, however, can only be done with an accurate camp barometer, preferably a mercurial barometer. Two aneroids read in camp will often vary considerably even if not moved and it can not be determined which is the more accurate. The errors peculiar to each instrument in the field however, can not be detected and remain undiscovered. Errors in the aneroid readings often become obvious to the compassman and he has no means of accurately correcting them.

The instrumental errors of the aneroid are outlined as follows in Wilson's book on Topographic Surveying:—

1. The elasticity of the corrugated top of the vacuum chamber is affected by rapid changes in pressure.
2. The readings are affected by changes in temperature which it is impossible to readily compensate.
3. The different spaces on the scale are seldom correct relatively one to the other, but the scale of pressure in inches is more accurate than the scale of feet since the latter contains the error due to the formulae by which it was graduated.
4. The weight of the instrument affects its indications, its readings differing in accordance with the position in which it is held.
5. It lacks in sensitiveness frequently not responding quickly to changes in altitude.
6. The chains and levers sometimes fail to quickly respond to the movement required of them.
7. Because of its containing so many mechanical parts these are subject to shifting or jarring by movement made in transporting it, the only remedy for which is frequent comparison with known altitudes or a mercurial barometer."

It is readily understood that most of these errors are different for each instrument in the field and that no office correction can eliminate them. No corrections based on camp readings can remove the errors in the field barometers caused by other factors than atmospheric changes. The only possible method of correcting or eliminating these other errors of the aneroid is in the field by the compassman. The compassman must study the cause of these errors and must not rely too much upon the camp corrections applied by the camp draftsman.

In order to get the best results with the aneroid the instrument must be handled carefully and intelligently. The errors introduced by changes of conditions must be recognized by the compassman and topographer. Ignorance of all the factors influencing the accuracy of the results of the use of the aneroid will depreciate the value of the map, and this depreciation will not be due to any defect of the instrument itself. Understanding clearly the cause and nature of the errors encountered it is possible to draw some conclusions as to the conditions under which the aneroid is most favorably used and to determine approximately under what conditions the aneroid is an unsuitable instrument.

Conditions Favorable to the Use of the Aneroid.

1. The change in slope or topography must be gradual. Ab-

rupt and steep slopes are unfavorable because it has been found that the aneroid is most liable to show instrumental error when there is a sudden change in pressure under which conditions the aneroid is not able to respond as quickly as is required. If there are abrupt changes in elevation and slope the aneroid will act sluggishly and the first reading will not be accurate. The compassman must wait a few minutes and allow the instrument to settle. Where these abrupt descents and ascents are made frequently much time will be lost in waiting for the aneroid to read correctly. Herein lies the objection to the use of the aneroid in rough and rugged country. Where the change in elevation is gradual the instrument adjusts itself to the change in atmospheric pressure while the compassman paces along the line. No time is lost then in waiting for the aneroid to read correctly and large instrumental errors are not so apt to occur. This is the case in uniformly sloping country where the slopes are rounded and the grades are not changed abruptly at definite points. Such country is most favorably adapted to the use of the aneroid.

2. In country where the strips can be run with some speed and where it is possible for the compassman to finish the mile between base line benchmarks within a comparatively short time the aneroid can be used satisfactorily. Frequent comparisons with known elevations will thus compensate the errors in the readings of the aneroid. Wilson on this point says:—"Where the changes in slope are not great and the journey is made with considerable speed and when the time consumed in travel is comparatively short, the aneroid may safely be used for distances as great as three to five miles though in such cases the aneroid may not check out within a contour interval on the next comparison." In smoothly sloping country where the topography is not broken the compassman can work with greater speed than where the topography is rough and rugged. As a consequence he will be able to compare his aneroid readings with base line benchmarks within short intervals of time.

However, the speed with which the compassman can run the strip is not the only factor in determining the working speed of the crew. Topography will influence the speed of the compassman, and timber cover will determine the speed of the estimator. Where there are many species the estimator will work slowly. Where there are only a few species or only one the estimator will work fast. Thus where both topography and timber cover conditions favor speed in the work of the reconnaissance crew as is the case in uniformly sloping Yellow pine country, conditions are very suitable for the use of the aneroid. The strips can be run with speed and frequent comparison with known elevations will correct the errors in the elevations taken along the strip.

3. Weather conditions must be favorable to the use of the aneroid. Wilson states:—"It frequently happens as on the approach of a storm or change from stormy to clear weather that atmospheric pressure will change in a few hours by over an inch. This means an apparent change in elevation at one place of over 1000 feet or more." In winter cruising on the Crater National Forest the corrections of the great aneroid variations caused by the unsettled weather conditions will introduce errors of over 300 feet in the final corrected results. It has been found almost impossible to correct these big errors caused by the daily weather variation in the winter time. The aneroid is most suitable only when the weather conditions are settled.

The Abney Hand Level.

Realizing that the aneroid is liable to introduce errors in the horizontal location of contours when that instrument is used under unfavorable circumstances, the following methods have been outlined in order to substitute a geometric system of obtaining vertical control. It should be borne in mind, however, that the trigonometric methods here mentioned should not be used with the object of doing work of high precision. The sole aim of the use of these methods is to bring the work of obtaining vertical control within the proper limits of accuracy which limits can not be attained with the aneroid under prevailing unfavorable conditions. If these methods of using the Abney are used with a clear conception of the degree of precision to be attained the mapper will not waste time in attempting to do work of too great refinement.

The work in vertical location along the strip is valuable only to guide the office man in the positioning of the contours upon the form line field sketch turned in by the compassman. Consequently if the field man preserves the general profile of the strip the elevations secured along his line will be accurate enough for all practical purposes of the work. The precise elevations of particular points along the line are of no moment. The relative value of the slopes the one to the other along the line are of intense practical value to the man in the office when plotting the final map. Errors in absolute elevation along the strip line are controlled by the precise elevations of the base line stakes at each end of the strip line.

In order to handle the Abney intelligently the compassman must clearly understand the theory of the Abney level and its practical application in obtaining elevations along the line on a strip survey. The geometric principle is readily understood; the slope is measured either in degrees or per cents of slope; the tangent of the vertical angle represents the per cent of slope; the two are synonymous; in descending a slope of two per cent the compassman drops two feet in elevation in every 100 feet of horizontal distance.

The real difficulties in the use of the Abney are encountered in its practical application. The compassman is too apt to be confused by every little irregularity of the ground. Before attempting work with the Abney the compassman must understand that the object of his work is to obtain a general profile of the ground along the strip. The final map is drawn on a scale of four inches to the mile. The small irregularities which attract the attention of the compassman are lost sight of in the preparation of the final map. The accurate approximation of the per cents of the slopes along the strip becomes the guide of the office draftsman when he expresses the character of the various slopes by contour lines. Then the value of the slope data becomes most apparent and the desire for the representation of the minor points of relief is recognized as impractical and unnecessary.

The compass man need not sight upon any definite object. His sight must be largely influenced by judgment and this judgment can be practiced so that the compass man will be able to approximate the slope of the ground accurately without having definite points of sight. The final resulting profile by this method of sighting will be sufficiently accurate to be of real practical value in plotting the final map.

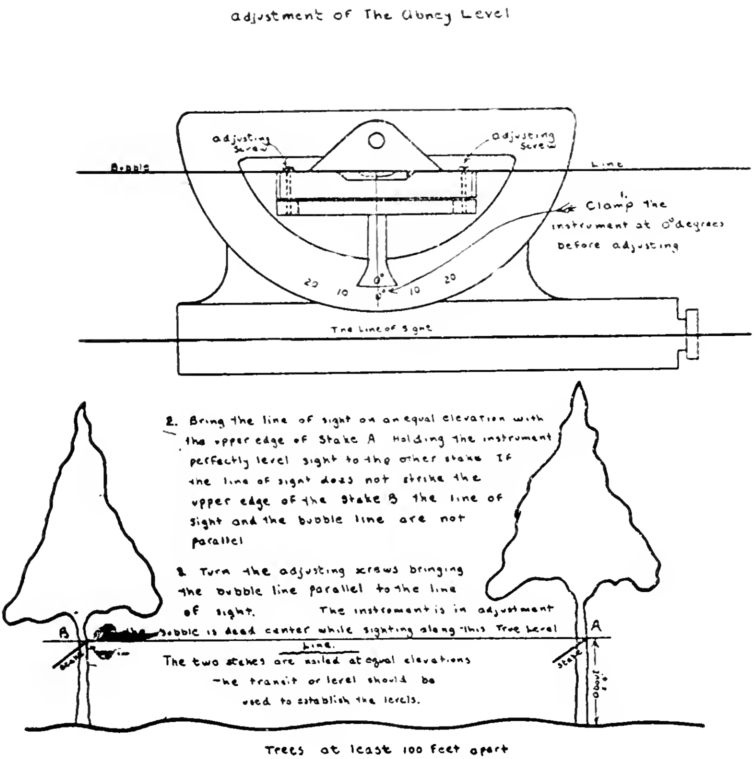
The errors in profile by this method will never be too large to destroy the value of the work. A profile drawn from elevations taken with an aneroid would at times show glaring errors in slope which errors would be detected at once in the field by the compassman with an instrument based upon a geometric principle such as the Abney. Aneroid reading frequently will show errors of fifty feet in descending an abrupt slope of 200 feet in less than five chains. The compassman must make an all too apparent error with the Abney in order to introduce this same error into his profile. Yet the aneroid reading stands and the error remains uncorrected by the office corrections applied to remove the errors caused by weather and temperature changes.

The compassman will usually be able to take the sights illustrated. Snags and trees are usually found in bodies of dense brush. Furthermore the compassman can obtain the heights of the snags and low trees sighted upon with sufficient accuracy by guess alone. If the situation calls for greater accuracy in the determination of the height of the tree or snag the compassman can obtain the height of the snag or tree using the Abney as a hypsometer.

The compassman should always bear in mind that he is not required to do work of precision. He is asked to exercise accuracy in judgment and to cultivate obtaining practical accuracy in results without paying attention to distracting details. Always bearing in mind the nature of the final map the compassman will be able to recognize the important topographic features and he will lose sight of the insignificant points of relief. Then in taking his sight he will be able to sight parallel to the general slope of the ground or avail himself of other means of sighting as trees, shrubs, etc., to obtain the slope profile. His judgment and ingenuity will improve and speed will come with practice.

In order to do accurate work the adjustment of the instrument must be checked before using it. Simple diagrams and instructions are shown in figures 1 and 2 explaining how to check the adjustment of the level and how to adjust the instrument when the same has been found to be out of adjustment. Two methods are illustrated. The first method is the best when it is possible to place two boards or stakes at equal elevations with a

Figure One

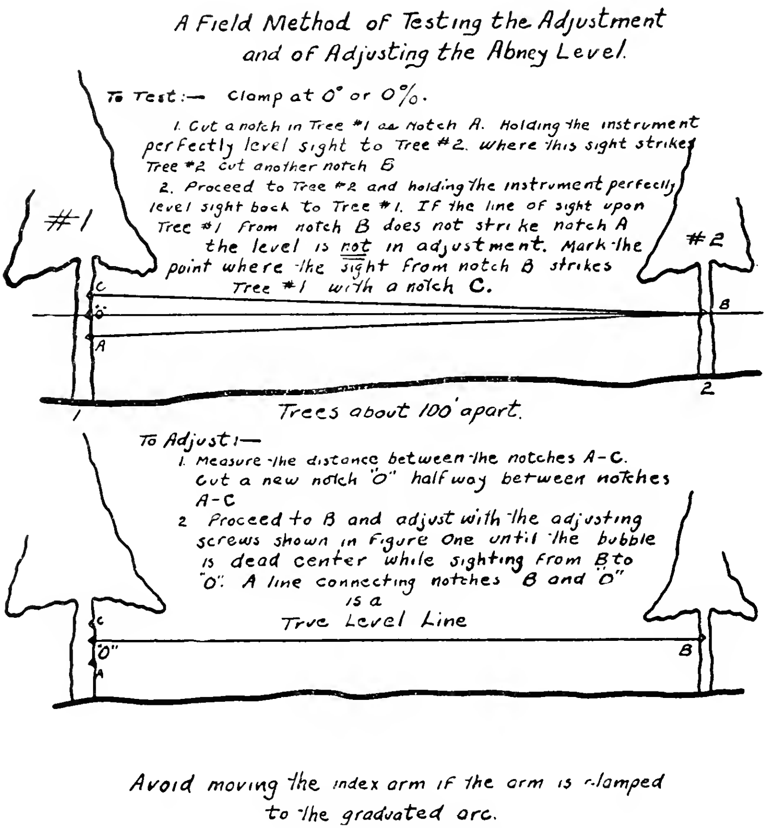


level or a transit. These adjustments can be made in the main camp at the beginning of the years' work, and with care the hand level will remain in adjustment for a long time. If through accident the level is thrown out of adjustment and the crews are in sidecamp where a level or a transit is not available, Method 2 will answer the purpose.

A Simple Method of Working with the Abney Hand Level.

This method of keeping field notes is proposed in order to simplify and shorten the work of the compassman. It is recognized that one of the chief objections to the use of the hand level in reconnaissance is in the matter of speed. However, this objection can be removed if the compassman avoids doing work

Figure Two.



unnecessary for the purposes of sketching topography. It must be strictly understood by the compassman that his absolute elevation along the strip line is of no consequence in making his form line field sketch. He must work with speed and he has not the time to perform the numerous arithmetical calculations accurately to determine his absolute elevation on the line.

Running the strip, the compassman enters the precise elevations of the base line stake on the map sheet; he determines the line of the strip with the compass; he then sights *parallel* to the *slope* of the ground along the compass line with the Abney and enters the reading on the map sheet. He paces along the line until a change of slope is encountered. He marks this position on the map sheet where the change in slope occurs. The slope reading now applies to the horizontal distance along the line between the point of the first reading and the position where the change in slope occurred. Having marked the point on the line where there is a change in slope the compassman takes another sight parallel to the slope of the ground along the compass line and proceeds as before. It is desirable to take several readings at different points along the same degree of slope, in order to get better average approximation of the slope.

The compassman does not attempt to run a line of levels; the object of the field work is not to establish a set of absolute elevations along the strip line, but in most cases the compassman is working between two base line stakes having precise elevations, and if he preserves the relative value of the slopes in per cents or degrees along his lines between these two bench marks at each end of his line the office draftsman can determine the absolute elevations of the slope station in the office. The field man however does not, attempt to perform this unnecessary work. These datas are as valuable as a set of absolute elevations.

The compassman sketches the topography passed over along the strip. The guess of the man in the field as to the form of the country is better than the guess of the man in the office. The field man draws fine form lines following points of equal elevation. He does not attempt to draw these form lines separated by known contour intervals. The man in the field is not drawing contours but sketch lines. These sketch lines are supposed to show the man in the office that the points on the sketch line to one side of the strip are of the same elevation as the point of intersection of the line of strip and the sketch or form line. By clamping the Abney at O degrees or per cent the form line can be traced to some distance on each side of the line.

It is an established rule to sketch only the country already passed over and lieing behind the compassman.

The direction of sketch lines is governed by streams and valley lines, peaks and ridge lines. These points of topographic control are of great assistance to the man in the office when plotting the map; hence the field data obtained with the Abney include the profile of streams and valley lines expressed in degrees or per cents of slope.

When the line crosses a stream the compassman plots the direction of the stream upon his map sheet. If he carries an aneroid alone the office man gets only an idea of the horizontal location of the stream. The compassman equipped with the Abney hand level after having plotted the stream on the map sheet, takes a sight straight down stream and up stream. He then enters upon his map sheet the gradient of the stream, valley or draw. From this data the office man can calculate the drop of the stream or valley in feet and he can plot the exact location of the contours crossing the stream bed. The final map will show the true character of the stream, valley or draw with more accuracy than a map prepared from less detailed vertical control data with the aneroid.

The compassman also notes the difference in elevation between a ridge, peak, lake, etc. and the point of observation on the line.

Often low leaks, lakes and spurs or ridges lie to one side of the line. The compassman sights to the top of the peak or point of the ridge, and obtains the vertical angle or per cent of the slope to that point with his Abney. The point is located horizontally by intersection. The absolute elevation of the point is not necessary to the man in the field. The field man only determines the *difference in elevation* between his *position on the line* and the *point sighted at.* The sight is plotted so that the man in the office will know from what position on the line the sight was taken.

In the same manner, the difference in elevation between lakes, valleys, draws, etc., and the position on the line can be determined. The sights are all plotted on the map and the difference in elevation in feet entered on the line indicating the sight as either a plus or minus difference. The man in the office, when he calculates the elevation of the point, of observation on the strip, then adds this difference of elevation to secure the absolute elevation of the point sighted at.

It can not be too often repeated that the field man does not need absolute elevations to draw sketch or form lines. The difference in elevation between his position and the points to one side of his line are sufficient to guide him in drawing his sketch form lines.

Passing Obstacles Encountered Along the Line.

When obstacles are met with along the line, making an offset necessary, the work of the compassman can often be simplified and much sighting with the Abney avoided if the compassman practices a little ingenuity in meeting the peculiar needs of the situation with original methods and application of the Abney principle. A few special cases are cited for example.

1. *Cliffs.* Assuming that the strip ends on the edge of a steep cliff. The compassman marks his position with a stone, a cut branch, etc., and, having plotted the edge of the cliff on his strip, he can make the offset without further sighting. Having made the descent the compassman offsets back again to the line and marks his position on the strip. From this new position on the line he can sight back upon his former position on the cliff, and knowing the horizontal distance between his first position on the cliff, and his present location on the line, he can obtain the difference in elevation between these two points. Drawing a heavy line to indicate the sight, he enters upon the map sheet, between the two points of sight, the *difference in elevation* in feet and the degree of per cent of slope. He then proceeds along the line as before, entering upon his map sheet only the per cent or degree of slope of his line.

2. *Dense Bodies of Brush where no offset can be made.* Assuming that a dense body of underbrush separates two open spaces. The compassman may find it convenient to sight upon the tip of a tree on or adjacent to the line, on the opposite side of the brush. Marking the point of sight on his line, he proceeds through the dense brush without further sighting until he emerges from the brush, coming opposite the tree sighted upon along his line, he marks the position. Having determined the horizontal distance between his point of sight and the tip of the tree, he calculates the difference in elevation of his point of sight and the tip of the tree. Quickly pacing out from the tree he obtains the height of the tree, and adds this height to the difference in elevation. He has now obtained the *difference in elevation* between his point of sight on the opposite side of the brush and

the point on the line at the *base* of the tree, the tip of which was sighted upon.

3. *Crossing Exceptionally Steep Ravines.* When crossing very steep ravines, one accurate sight to the bottom, going down, and one to the top, going up, will suffice, although the form of the sides will suggest changing degrees of slope. On very steep slopes the horizontal distance between contour intervals on the map does not differ much for a change of 5% in slope or more. It will be sufficient under the circumstances mentioned to show upon the map sheet only the *difference in elevation* between the two edges and the bottom. At the bottom of the ravine the compassman should indicate the grade of the ravine by sighting straight down the water course. He enters this reading as a per cent or degree of slope upon the stream or valley line.

4. *Lakes and Marshes.* When offsetting to pass lakes or marshes, the compassman can do away with sighting for obvious reasons. With judgment he can ascertain the point on the line at the opposite side of the marsh or lake which has the same elevation as the point where the offset was made.

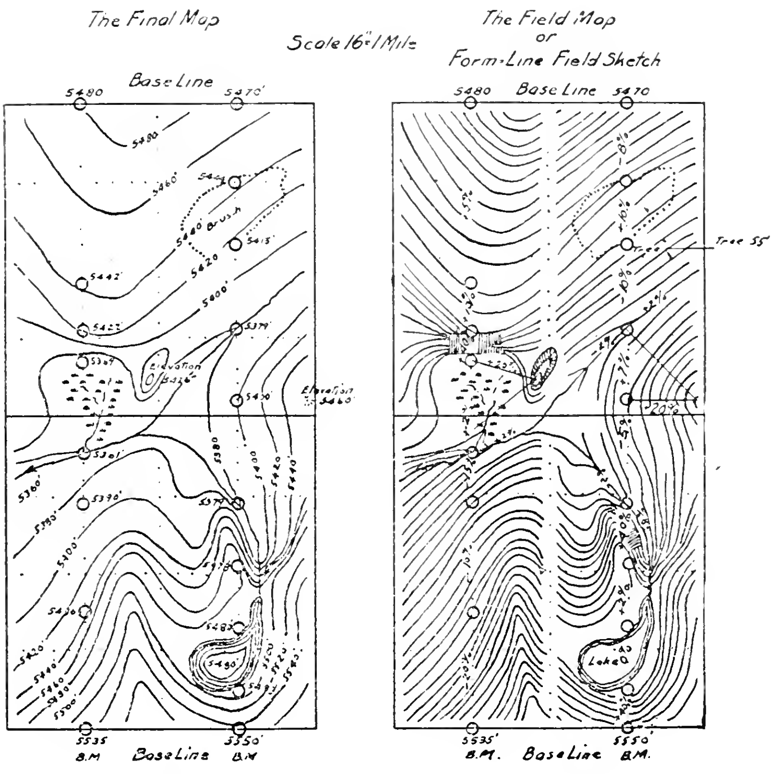
5. *Sighting in Dense Brush.* Sometimes the compassman will find it convenient to sight upon the tops of dead snags or stumps, etc., on his line ahead of him. Taking a sight upon a snag or stump in the brush ahead of him, he proceeds without further sighting until within a few chains of the stump or snag. A sight from this point on the line will give him data for a sufficiently accurate approximation of the height of the stump or snag. Then the compassman can calculate the *difference in elevation* between the point of his first sight and the point on the line opposite the stump or snag. In brushy areas the compassman will frequently find such opportunities to do accurate sighting. The error in elevation introduced by error in pacing will be corrected when the horizontal distance between the two points is corrected by the office man, or the camp draftsman.

For sights taken parallel to the compass line, the angle or per cent as well as the difference in elevation should be entered upon the map sheet, the angle or per cent being placed on one side of the line, indicating the sight, and the difference in elevation between the two points on the other side of the line, indicating the sight.

Tying in.

At the end of the strip the compassman enters the precise elevations of the base line stake (if attainable) on his map sheet. Thus his line begins with a precise elevation and closes in on a precise elevation.

Figure Four



A sample map is shown in Figure 4 to illustrate the field work of the compassman using the Abney hand level. Such field notes will furnish the officeman with a greater wealth of detail than is furnished by a set of aneroid elevations taken along the strip. Furthermore, this detail is all of practical value to the logger, trail builder, herder and all practical woodsmen.

The final map will express the true character of all the running streams. The gradient of mountain streams does not vary uniformly. There are frequent narrow inaccessible gorges where the streams become rapids, and again the stream will flow upon an underlying shelf of harder rock for some distance on a smooth grade. The compassman can indicate very approximately the changing character of the stream as he encounters it on his strips without an Abney hand level, but when the field man gathers all this data, not haphazardly and by guess alone, but with good judgment aided by a practical instrument, the value of this data is greatly enhanced.

The logger is interested in the character of the draws, ravines and gullies, and even a rough map should give the logger an approximate idea of his logging chance.

The draftsman can express the true nature of all the draws and ravines on the final map with the field data furnished by these methods. The inaccessibility or accessibility of timber, from the logger's point of view can be determined approximately from such a map, and the closer examination of the ground can then be made more intelligently.

The collection of these data may introduce a greater cost on an area basis, but the total cost on a basis of the relative value of the final map will be much lower.

Office Work in Plotting The Final Map.

With such field data the camp draftsman is called upon to do much of the work usually done by the man in the field. In order to shorten the increased work of the office man as much as possible a profiling scale has been designed as illustrated in Figure 5. This rule is to answer the purpose both of obtaining the elevations of the slope stations on the strip line and of interpolating the contours.*

The profile in Figure 4 was drawn from the field data on the sample strip shown in the same figure. This profile has been prepared in order to illustrate the character of the data and to make the work of the office man more easily understood.

1. *Horizontal Closure.* The error of horizontal closure is corrected first and this error of closure is distributed along the line between the slope stations pro ratio to the distance between stations. The greater part of the error is thrown between stations

*See also the following article.

having the greatest horizontal distance between them. Having corrected the area of line and pacing, the draftsman proceeds to correct the vertical control obtained from the field data.

2. *Vertical Closure.* Beginning with the precise elevation on the base line stake, the draftsman works across the strip obtaining the elevations of all slope stations. These operations are very simple and can be performed with speed. At the end of the strip the draftsman compares his calculated elevations with the base line stake elevation. If there is a sufficiently large error to correct, this error is distributed along the line, pro ratio to the difference in elevation between the slope stations. A large part of the error is thrown between stations having a large difference in elevation than between slope stations having small difference in elevation regardless of the horizontal distance between slope stations. It is imperative that the draftsman calculates the elevations of the slope stations only after he has corrected their position horizontally on the strip line. The error due to pacing will affect the vertical control unless the horizontal control is corrected first.

Having corrected the errors of horizontal and vertical closure the next operation is the location of the contours upon the form line field sketch turned in by the field man.

The Location of Contours on the Form Line Sketch.

The form lines are an absolute index to the direction of the contour crossing the strip line and the office man is not to interfere with the field sketch. The man in the field was on the ground when the form lines were drawn and his guess in the field is more valuable than the guess of the man in the office who may be unacquainted with the country being mapped.

This form line as drawn by the man in the field is the guide line for the contour. A contour drawn at an acute angle to a form line would be revealed as an obvious error to the office man were he at the spot in the field to compare his contour as drawn with the actual topography. In plotting these Abney field notes the draftsman should conform strictly to the form lines drawn by the man in field, having first corrected their horizontal location if an error in horizontal closure has been made by the man in the field. The contours will then represent the true character of the topography of the country mapped. The finished map will have a real practical value instead of merely having the appearance of a topographic map.

The draftsman can locate his contours on the strip by drawing a profile for each strip and then projecting the contours on the strip as shown in figure 4. This method is simple and easily understood but it has the disadvantage of being a very slow method. The plan here proposed is an adaptation of a practical method used by Professor H. H. Chapman of the Yale Forest School for locating contours with an Abney.

Chapman's Method.

The draftsman has the following data: the angle or per cent of slope; and the horizontal distance to which this slope applies.

Tables can be prepared showing the number of contour intervals in a given horizontal distance for each degree or per cent of slope. Thus, on a 15% slope there will be a fifty foot contour interval every five chains, approximately. If this slope applies to 18 chains of the strip the draftsman has 3 3-5 contour intervals. Assuming that the base line stake has an elevation of 5810 feet, the first 50 foot contour will be located about four chains from the base stake, the second contour nine chains distant, the third fourteen chains, and there will be a remainder of 3-5 of a contour interval to apply to the next degree of slope.

When sketching contours in the field, and the field man has time to perform these mental calculations, the above method is easily used. In the office where the calculations must be made with speed, a mechanical device will be of value. The profiling rule designed is based upon the same principle as the above method. This scale automatically divides the strip into contour intervals and locates the contour on the strip. This scale can be graduated for either per cents of slope or degrees of slope. The graduations of figure 5 are based on a horizontal scale of 16 inches to the mile.

For each degree of slope or per cent of slope there is a fixed horizontal distance between contours. By graduating this horizontal distance between contours, plotted on a field scale of 16 inches to the mile, *into drop in feet* the rule will show the *drop*

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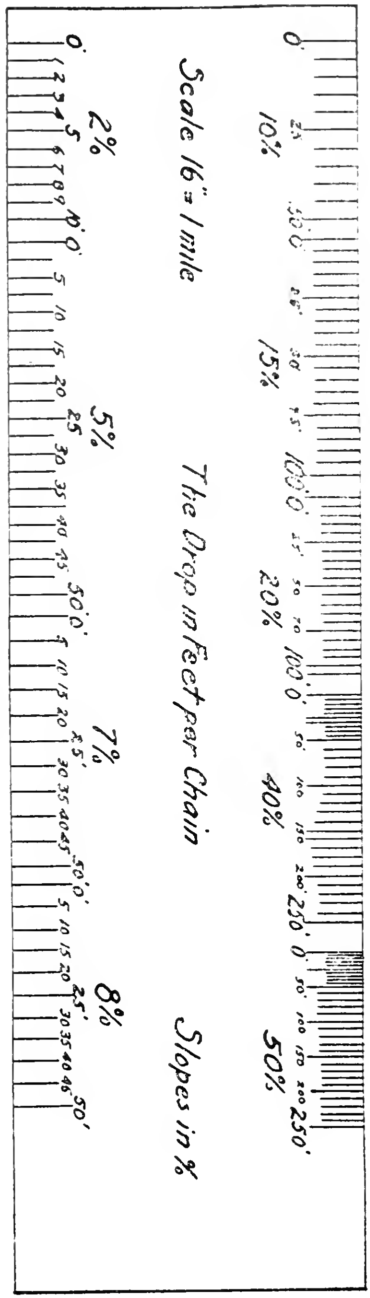
*See next article.

or *rise* per chain or unit of horizontal distance along the slope of the given degree or per cent. on the map sheet.

Thus the draftsman does not have to calculate the distance to the position of the contours. He scales the distance directly with this rule and the whole operation is performed with speed and precision. The camp draughtsman is not called upon to do much arithmetical work. The office work is done by graphic methods and speed will become a matter of practice. Arithmetical calculations are tedious and speed is very much influenced by mental fatigue. Using this rule the elevations of the slope stations can be obtained by reading the drop in feet from the rule and adding or subtracting the difference in elevation to the elevation of the preceding slope station. The position of the contour can be read directly from the rule.

In order to explain the character of this rule and its application the whole operation is here explained in full; applying to the strips shown in Figure 4.



· PROFILING · RULE ·

Figure five

Obtaining the Elevations of Slope Stations with the Profiling Rule.

1. The elevation of the base line stake is 5535 feet. The strip is being run due north. From slope station No. 1 on the base line to slope station No. 2 on the slope reading is—20%. Taking the rule and applying the graduations for the 20% slope:—place the O point of the scale on the base line station. Read to slope station No. 2. The drop is found to be 99 feet. Subtracting 99 feet from the elevation of the base line stake gives the elevation of slope station No. 2 as 5436 feet.

2. The elevation of the base line stake is 5470 feet. The strip is being run due south. From the base line stake south the first slope reading is 8%. Taking the graduations for 8 per cent the drop is found to be 26 feet. Subtracting 26 feet from the elevation of the base line stake 5470 feet gives the elevation of the slope station as 5444 feet. The slope station is on the edge of a dense body of brush.

3. The compass man has sighted upon the tip of a tree on or adjacent to the line, on the opposite side of the body of brush or in the brush as the case may be. The slope reading to the tip of the tree is *plus* 10%. Applying the 10% graduation the drop in this case will be a rise. The rule gives a 26 feet rise. Adding this elevation to the elevation of the slope station, 5444, gives the tip of the tree an elevation of 5470 feet. The compassman has obtained the height of the tree and has entered on his map sheet the height as 55 feet. Subtracting 55 feet from 5470 feet gives the elevation of the Slope Station at or near the base of the tree sighted upon as 5415 feet.

4. On the strip starting from base line stake 5535, in the swamp from slope station 5361 and from 5369 the compassman has intersected the small knob to the right of the line. From slope station 5369 the slope reading is *plus* 20 %. The rule gives a 57 foot rise to the tip of the knob. Adding 57 feet to the elevation of slope station 5369 gives the elevation of the knob as 5426 feet.

Locating the Contours Between Slope Stations on the Strip.

1. On the strip ending with Station 5480:—

The last slope reading is 5%. The elevation of the last slope station is 5480 feet. Taking the rule graduation for the 5% slope the graduation representing O feet is placed upon the station 5480. This station is on the contour. Reading to the 20 foot graduation the first contour 5460 is found to be about 6 chains from station 5480.

2. On the strip ending with station 5470, the last slope reading is 8%. The elevation of the last station is 5470, ten feet above the 5460 contour. Taking the rule graduations for the 8% slope the 10 foot graduation is placed upon the station 5470. Reading to the 20 foot graduation the next 20 foot contour 5460 is found to be about two chains from the slope station 5470.

Observe that this system is identical with Chapman's method; the only difference being that this adaptation is a mechanical solution of every problem, and that the office man can perform the work with speed.

A thorough study of figure 4 will explain the character of this rule. The graduations represent the *drop* or *rise* in feet per chain for each degree or per cent of slope. This rule is based on per cents of slope on a scale of 16 inches to the mile which scale is to be preferred to a smaller scale in intensive mapping.

Summary of Office Work.

A brief resume of the draftsman's work is as follows:—

1. *Correction for horizontal closure.* 2. *Graphic calculation of the elevation of slope stations and correction for vertical closure.* 3. *Obtaining elevations to one side of the line.* 4. *Drawing contours in strict conformity with the form lines of the field sketch.*

These operations are all simple, and easily understood. Speed will become largely a matter of practice. The correction of aneroid elevations takes considerable time and value of the final result is not always satisfactory. The draftsman can perform all his office work using this rule described as quickly as preparing a creditable map from aneroid data. In thus using graphic methods almost entirely one of the chief objections to the use of the Abney is removed and the draftsman will be able to meet all demands for speed made upon him in his work.

The greater wealth of detail furnished by these Abney field notes may call for more work in plotting the data supplied. The practical uses however, to which a map can be put should be the real index of its value and the cost of a map on an area basis alone is not a fair measure of the efficiency of the methods used in the preparation of the map.

Experimental mapping with the Aneroid Barometer and the Abney Level.

Under certain conditions the use of the aneroid is accompanied with so many objections that the choice of another instrument would be decided upon provided the new method was of proven value. However, if such methods deserve any attention at all they ought to be given a thorough trial experimentally first.

The experimenter has in mind the following sets of conditions:

1. There are two broad types of topography. The first type is the uniformly sloping type where the slopes are not very steep. The second type is the broken and rugged type.

2. Further there are two kinds of timber cover. Where the trees are mostly of one species the estimator will work fast. Where there are many species the estimator will work slowly.

3. There are two kinds of weather conditions, the settled, and the unsettled.

All of these three factors will enter into the experiment. Each of these factors influences the accuracy of the work done with the aneroid or else have such an influence that the compass man may have spare time to use slower but more accurate methods than the method with the aneroid.

The degree of accuracy to be attained in the work is fixed and uniform. The object of the experiment shall be to determine with what instrument and with what method can we secure this degree of accuracy at the lowest cost, under the conditions existing at the time the work is being done.

In this problem it is understood that the aneroid is incapable of recording changes in elevation of less than 25 feet accurately, Country so flat as to fall within that class is not considered in this connection.

Experiments could be made as follows:—

1. A section, 640 acres, is selected to represent a type.

2. Base lines are established for this section of land to be used for this experiment. Let us assume that the north and south

section lines are supplied with good vertical and horizontal control stakes providing for the double running of the forty.

3. These sections of land are mapped as carefully as possible by three crews of equal efficiency.

a. The first crew will make as careful a map as possible using the aneroid.

b. The second crew will make as careful a map as possible using the Abney.

c. The third crew will make an absolutely accurate map using the transit.

Each strip crew will use the same primary control and this control will cost the same for each method.

4. Careful cost figures will be kept of the work done by each method.

5. The final maps will be plotted and tracings made of each map. The tracing of the aneroid map will now be laid over the tracing of the transit map and the degree of error absolutely determined. The tracing of the Abney map is then laid over the transit map and the error determined. The cost figures kept will give the total cost of the final map by each method. The experimenter will now have absolute knowledge of the relative accuracy and cost of each instrument and method for each type of topography, timber cover, and weather condition.

The choice of instrument and method can now be made intelligently in order to obtain the most valuable results, Such a scientific choice of methods by the reconnaissance party chief will result in the obtaining of maps of equal value although the separate portions of the work were done under widely different conditions. The aim always should be to maintain the standard set for the type of map being made.

In the use of a new instrument and new methods there is introduced a loss of time and efficiency which will disappear with practice. This point should be borne in mind when studying the practical value of the method for the use of the Abney Hand Level here proposed.

THE USE OF THE ABNEY HAND LEVEL.

By M. L. Erickson.

For two winters I have experimented with the use of the Abney level in timber reconnaissance with the view of using it as a substitute for the aneroid barometer. For winter use the aneroid barometer has proven very unsatisfactory. Probably the main reason for this is the constant great change in atmospheric pressure distributed over small areas. The atmospheric changes apparently vary and change greatly in areas as small as a square mile. It was found that careful camp aneroid readings taken hourly failed to provide the desired corrections of the field readings, for even after these corrections were made it was nothing uncommon to still find an error of 200 to 300 feet. Perhaps, the aneroids we used were not sufficiently high class to register true atmospheric pressure. At any rate, I have found it necessary to abandon, for the most part, the use of the aneroid barometer in winter cruising and I think, the Abney level should be substituted for the aneroid in summer work also.

The use of the Abney hand level was found to work satisfactorily practically in all forest conditions. The greatest objection to it at first was the amount of computation necessary to determine elevations. It involved long office work and I did not care to employ the Abney so long as its use seriously increased the cost of the work. This winter, however, I have prepared a table by which all office computation is eliminated, and the elevations can be carried in the field and noted on the field sketch. Mr. W. J. Paeth has devised a scheme by which the office computation due to the use of the Abney is very materially lessened, and I think his plan is practicable and cheap enough where a draughtsman is employed steadily in the office. But I was not satisfied until all office computation was eliminated and also the added expense of a camp draughtsman. This winter's experience has demonstrated that the office computation is not necessary and the use of the Abney was found to be entirely practicable.

The table used is based on readings in per cent, but similar tables can readily be prepared for Abney levels graduated in degrees based on horizontal distances expressed in paces, chains, or any other equivalent. For our use I prefer the Abney level graduated in per cents and prefer to express distances in double paces

TABLE FOR USE OF ABNEY LEVEL.

Slope in %	*Distance in Paces (5.28′)*																	
	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
2	0	0	5	5	5	5	5	5	5	5	5	5	10	10	10	10	10	10
4	5	5	5	5	5	10	10	10	10	10	15	15	15	15	20	20	20	20
6	5	5	10	10	10	10	15	15	15	20	20	20	25	25	25	25	30	30
8	5	10	10	10	15	15	20	20	20	25	30	30	30	30	35	35	40	40
10	10	10	15	15	20	20	25	25	30	30	35	35	40	40	45	45	50	50
12	10	10	15	20	20	25	30	30	35	35	40	45	45	50	50	55	60	60
14	10	15	20	25	25	30	35	35	40	45	50	50	55	60	65	65	70	75
16	10	15	20	25	30	30	35	40	45	50	55	60	60	65	70	70	75	85
18	15	20	25	30	35	40	45	50	50	55	60	65	70	75	80	85	90	95
20	15	20	25	30	35	45	50	55	60	65	70	75	80	85	90	95	100	105
22	20	25	30	35	40	45	50	55	60	70	75	85	85	90	100	105	110	115
24	20	25	30	40	45	50	55	65	70	75	80	90	95	105	110	115	120	125
26	20	25	30	40	50	55	60	65	75	80	90	95	100	105	115	120	125	135
28	20	30	35	45	50	60	65	75	80	90	95	105	110	115	125	130	140	145
30	25	30	40	50	55	65	70	80	85	95	100	110	115	125	130	140	150	155
32	25	35	45	50	60	65	75	85	90	100	110	115	125	130	140	150	155	165
34	25	35	45	55	60	70	80	90	100	105	115	125	130	140	150	160	165	180
36	30	35	45	55	65	75	85	90	100	110	120	130	140	150	155	165	175	185
38	30	40	50	60	70	80	90	100	110	120	130	140	150	160	165	175	185	195
40	30	45	55	65	75	85	95	105	115	125	135	145	155	165	175	185	195	205
42	35	45	55	65	75	85	100	110	120	130	140	150	160	170	180	195	205	215
44	35	45	55	70	80	95	105	115	125	135	150	160	170	180	195	205	216	230
46	35	50	60	75	85	95	110	120	130	145	155	165	180	190	205	215	225	240
48	35	50	65	75	85	100	110	125	135	150	160	175	185	200	210	220	235	250
50	40	55	65	80	90	105	115	130	145	155	165	180	190	205	220	230	245	260
52	40	65	70	80	95	110	125	140	150	165	180	190	205	220	235	245	260	275
54	45	55	70	85	100	110	130	145	155	170	185	200	215	225	245	255	270	285
56	45	60	75	90	105	115	135	150	160	175	195	205	220	235	250	260	280	295
58	45	60	75	95	110	120	140	155	170	185	200	215	230	245	260	275	290	305
60	50	65	80	95	110	125	140	160	175	190	210	220	240	250	270	285	300	315
64	50	70	85	100	110	135	150	170	185	200	220	235	250	270	290	305	320	335
68	55	70	90	110	125	140	160	180	195	215	235	250	270	285	305	325	340	360
72	60	75	95	115	135	150	175	190	210	225	250	265	285	300	325	340	360	380
76	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	350	380	405
80	65	85	105	130	150	170	190	210	230	250	275	295	315	335	360	385	400	425
84	65	90	110	135	155	175	195	220	245	265	290	310	330	340	380	400	420	445
88	70	90	115	140	160	185	205	235	255	275	305	325	345	370	395	420	440	465
90	70	95	115	145	165	190	210	240	260	285	310	335	355	380	405	425	450	475

(equal to 5.28 feet). It will be noticed that the elevation table gives the reading in the nearest 5 feet, which was found to be sufficiently accurate for all practical purposes. Thus using the multiple of 5 for elevations, makes mental calculation easy. Any error introduced by reading the elevation closer than 5 feet is very small, for all such errors are compensating. The per cent indicated in the table is given in the nearest 2 per cent. Ordinarily, it adds nothing to the practical accuracy of the work to read the Abney closer. When long sights are taken the exact per cent can be read and the elevation determined a little closer by interpolation. The paces, too, are indicated in the table to the nearest 5. It seems to add nothing to the practical accuracy of the work to indicate this more closely.

The use of the table is very simple.

The compassman first sets up his compass, secures an alignment, and then sights with the Abney level at some object along the compass course at approximately the height of his eye. The slope (plus or minus) is then noted on the field map, as indicated in the accompanying sketch. The compassman then paces to the object sighted at, which is usually a point where the slope cnanges. He then refers to the table already prepared and pasted on the front cover of his tatum holder and directly determines the rise or fall in elevation. He adds or subtracts this to the elevation previously established at the starting point. This takes but a moment's calculation and usually it is a mental one. The true elevation as determined is noted on the map to the left of the strip line. The station indicated in paces is set down on the map at the right of the strip line. He then draws a form line contour through the station and proceeds with his observation for the next station.

It is always best to sight at some object approximately the height of the eye, but this is not at all necessary, especially when long sights are taken. For distances over 75 double paces the difference in per cent by sighting at an object several feet above or below the height of the eye is so small that it can not be read on the Abney scale. It is not advisable to take observations for distances much over 200 paces unless the object sighted at is very distinct. Because the table does not give direct differences in elevation for horizontal distances greater than 100 double paces it should not be assumed that this difference in elevation can not be obtained. For distances over 100 double paces note the reading for 100 double paces and then add to it the reading for the additional distance. The sum of the readings gives the difference in elevation between the two points.

In cruising the most economical crew is 2 men. The compassman takes the course with a compass and the grade readings with an Abney and carries his horizontal distance by pacing.

There are numerous practices in the field that the topographer soon learns to employ.

1. Sight a definite object on ground. Determine elevation at that object and then add 5 feet for distance ground to eye.

2. Sight at peculiar markings on trunk of tree (black knots, scars, wood-pecker holes, etc.). Add or subtract difference in feet above or below approximate height of eye.

3. Sight at peculiar definite limbs in tree. Make approximate allowance for distance above eye.

4. Sight at top of a tree or snag. Determine height of tree by any of the simple methods and add this to elevation determined for the top of the tree.

A great help in plotting the contours between strip lines when the course follows steep side hills is to note with the Abney the slope up or down by plus or minus; the direction of slope being indicated by arrows.

The exact location and elevation of points of ridges or other topographic relief not directly on line with the compass course can be determined. The location is determined by bearings from two stations taken with the compass, and the vertical angle is taken from one of these stations with the Abney level. Knowing the distance and the vertical angle, the elevation of the object can be easily computed.

The Abney is a great aid in checking one's own work in the field. Often observation from stations along the strip line to tops of peaks, ridges, cabins, ponds or other objects already located will give a check on the elevation previously determined.

Incidentally the tallyman need depend on no other instrument for determining the number of logs or height of trees.

On very steep hillsides, through dense brush, or across difficult obstructions it is often unsatisfactory to pace the distance. The Abney level can be used to determine the horizontal distance as well as the vertical difference in elevation.

Example: The crew arrive at the brink of a very deep canyon with precipitous walls. The compassman determines an object on the opposite bank for his course, then with the Abney level takes readings at the base and the top of a tree on the opposite bank. The first reading at the base of tree is 2%, the reading at top of tree is 20%. The vertical angle then is 18%. Arriving at the opposite side the height of the tree is measured and found to be 150 feet high. For every 100 feet of horizontal distance there is a vertical distance of 18 feet, therefore $\frac{150}{18} \times 100 = 833$, distance across the canyon.

The difference of elevation between the two banks is .02 x 833 or 16.6, or 15 feet expressed to the nearest five feet. Since the observation was taken at the base of tree 5 feet (height of eye above ground) should be added to this reading.

The above method of determining distance was employed many times last winter and it works out beautifully.

While aneroid barometers with the most careful use and careful corrections were daily giving us errors of 100 to 200 feet, our results from the use of the Abney level were checking within 5 and 10 feet. Occasionally, one makes an error of 20 feet in a two-mile strip. The greatest error made was 35 feet in running a distance of 2½ miles. Such small errors are easily distributed.

Every individual would not be adapted to use the Abney hand level with practical success. Curious as it may seem, those that are inclined to be too precise and fussy often make the biggest errors. The compassman using the Abney must keep ahead of the cruiser; he can not take time to make a second observation, he can not afford to lose his object sighted at, he can not consume extra time in making more close computations than are necessary, and he must learn what features of topography to omit. Numerous short sights requiring reference to the table frequently should be avoided. One learns to estimate small differences in elevation to the nearest 5 feet and it does not add to the accuracy of the work to take observations for short distances involving small differences of elevation.

In going through patches of dense, tall reproduction where long sights can not be secured one learns to estimate the difference in elevation as he goes along and checks this by estimating the average per cent of slope. After a few days' practice it is surprising how close one checks up on this work.

Often just before reaching a big patch of brush or reproduction a sight can be secured on a tree or snag at the further edge of the patch. This should always be done when possible to avoid estimating the difference in elevation as the course is projected through the brush.

Just as big a day's work should ordinarily be accomplished by a two-man crew using the Abney as with the aneroid barometer. We could double run eight forties a day in rather difficult going, and that is certainly satisfactory.

In our work last winter we ran a transit level through approximately the middle of the area covered by reconnaissance. Absolute bench marks were established at section line intersections and at other points where necessary. From these bench marks, base lines usually 2 miles apart were run with the Abney hand level. In establishing base lines, especially long ones, with the Abney a little more accurate computation is employed than for regular strip cruise work. Distance was measured with a chain and elevations were computed to the nearest foot. Our base line surveys with the Abney proved very satisfactory. A two-man crew can run and blaze about 2½ miles of base line per day.

T 31 S, R 3 E, within the Crater National Forest, was covered last winter in this kind of a reconnaissance survey, and it is the only large area on the Forest mapped with a high degree of accuracy.

One valuable feature in using the Abney is the fact that a contour map of any fineness desired can be secured with scarcely any additional work or increased cost. Ten-foot contour intervals can be sketched in on the field map as easily as 25 or 50-foot contours.

The Abney hand level has undoubtedly come to stay as an instrument useful in reconnaissance work and if the right men are secured to use it, it will supplant the aneroid barometer.

Some improvements in the Abney hand level should be made to make it more convenient and less liable to get out of adjustment. The graduated arc should have about twice as great a radius. It should be graduated in both degrees and per cent. The tangent graduation should extend to 200 per cent, and the case for it should be arranged so as to carry on the belt instead of over the shoulder.

STUMPAGE APPRAISAL FORMULAE.

By Donald Bruce.

While there are a number of different formulae in common use at the present time in appraising stumpage, they may be classified into two distinct types. The first is based on the principle of allowing a certain percentage of the operating cost as profit and considering the difference between the selling value and this cost plus this profit as the stumpage value. The second allows as profit a per annum percentage on the invested capital. The most common example of the first class is what is generally known as the Forester's formula, expressed mathematically as follows:

$$X = S - O - .op\ (O + X)$$

or simplified

$$X = \frac{S}{1.op} - O$$

Where S=selling value; O=operating cost, including depreciation, interest on fixed investment, etc.; p=per cent profit allowed; and X=stumpage.

It will be noted that in this particular formula, interest on the fixed investment is included as an operating cost. This is not, however, an essential characteristic of this type of formula. The characteristic formula of the second type is as follows:

$$X = S - O - \frac{.op\ C}{A}$$

Where C=average capital invested, and A the average annual output of the operation; the other letters retaining their above defined meanings.

The main complication in this case is involved in the determination of the average investment and the method of charging off depreciation and profit. Several quite complicated formulae have been devised for this purpose, of which the most accurate but perhaps the most intricate is what is known as Hunter's formula.

There are advantages inherent in each formula. The operating cost method is simpler to apply while the other is considered to be more accurate though possibly more difficult of application. It is, however, an error to claim that either formula is universal in its application. It can be shown that cases are possible where each gives ridiculous results unless the profit percentages are varied through an extreme range. To thus vary these percentages widely almost nullifies the value of the formula since it places the final decision squarely back on the judgment of the appraiser. The customary percentages with the Forester's formula are from 15 to 20 per cent. and for the investment formula from 10 to 15 per cent. The following examples will show cases in which widely different figures must be used. While these cases are hypothetical, the figures used are typical of logging chances in western Montana and northern Idaho. The conditions are extreme, but yet are actually met.

Case I. An easy logging chance of about 22,500 M. B. M. to be handled at the rate of 7,500,000 a year; largely direct skidding to the river bank where the logs can be sold in the deck.

Estimated cost of logging, ...	$3.00 per M.
Estimated cost of improvements and equipment (including interest)	.45
Total cost of operation, ...	$3.45
Average sale value of logs, ...	6.50
Margin for profit and interest, ...	3.05
Average investment, improvements, ..	$1,000.00
Average investment, equipment, ...	4,000.00
Average working capital, ...	5,000.00
Total average investment, ...	$10,000.00

By the investment method: allowing 15 per cent. per annum profit on the average investment gives as total profit, $1500 on 7,500 M. B. M.; profit per M. 20c; stumpage ($3.05—20c)= $2.85. It is obvious that this profit of 20c, while a fair return on the invested capital, is a ridiculously small margin over the estimated operating cost and one which would not justify a logger in undertaking the job. By the Forester's formula, on the other hand; allowing 20 per cent profit, the stumpage amounts to $1.95, and $1.10 is allowed for profit. ($1.95=$6.50—$3.45—20%×($3.45

+\$1.05) (approx.). This figure is quite consistent with the actual stumpage values current in the sales of this character. The profit allowed on this basis would, however, be 82.5 per cent. return on the invested capital. Obviously this is a case where the investment method is practically valueless.

Case 2. A railroad chance of 400,000 M. B. M. to be handled at the rate of 20,000,000 a year; expensive construction involved, but otherwise cheap logging.

Estimated cost of logging, ...	\$4.00 per M.
Estimated cost of improvements and equipments (including interest).....	3.00 per M.
Total cost of operation, ...	\$7.00 per M.
Stumpage, ...	.50 per M.
Profit, ...	1.50 per M.
Value of logs, ...	\$9.00 per M.

The stumpage and profit above given are determined by the Forester's formula allowing 20 per cent. profit. (\$.50=\$9.00—\$7.00—20%×(\$7.00+\$.50). Checking this by the investment method we find the following results:

Average investment for improvements, ...	\$300,000
Average investment for equipment, ...	80,000
Working capital, ...	100,000
Total average investment, ...	\$480,000

\$1.50 profit per M. on 20,000 equals \$30,000 per annum, which is 6¼ per cent return on \$480,000. In this case, then, the results of the Forester's formula are shown to be ridiculously low when checked by the investment method. On the other hand, a 15 per cent. profit on the investment would equal \$3.60 per M., or over 50 per cent. of the operating cost. This, however, is so high a profit that the stumpage is more than wiped out, indicating that in this present case the chance cannot be handled at a reasonable profit. The case, however, is distinctly one where an operating cost formula is of little or no value.

Under certain conditions then, each formula is useless unless checked by the other. When analyzed the reason for this is that the prospective purchaser demands, and justly, assurance of two things, first, that he will obtain a reasonable return on his invested capital and second, that he has a reasonably wide margin over the cost of operation as an insurance against the many minor hazards inherent in the logging business. In the first case above described the return on the capital was ample, but the margin over the operating costs was so ridiculously small that no sane logger would attempt the job since the least accident such as a period of bad weather might easily wipe out all profits. In the second case the margin on the operating cost was ample but the return on the money invested was insufficient to interest capital. Obviously both demands must be met. Neither formula alone can measure both. The investment method, of course, defines absolutely the return to the invested capital, while the operating cost method is an excellent measure of the margin necessary above the cost of operation. Therefore, both should be used, constituting a double minimum. Thus used, the range of percentages in each may be kept reasonably low. With the percentages standardized, the formula which gives the lower profit must govern.

This simultaneous use of the two methods brings in question at once the advisability of including interest as a cost in the operating cost method. This practice, which has become almost universal since its adoption in the Forester's formula, has something in its favor where the investment method is not used as a check. To include interest makes a formula which is in a sense a hybrid between the two methods. Extra profit is allowed in the form of interest for extra invested capital not fairly represented in the operating cost. This compensation is, however, only partial since the interest rate is invariably (and necessarily) low, say 6 per cent, as compared with the profit rate. Further, its inclusion tends to confuse the results. Neither the margin over the real operating costs nor the return on the investment is shown.

The profit allowed consists of three factors: 1. A percent on the operating costs (which may be earned several times a year). 2. A per cent. per annum of a part of the invested capital, (usually only the fixed investment), and, 3. A per cent (profit) on this last percentage since the latter is carried as a cost item. And these three factors are so confused that analysis is difficult.

When both formulae are used, the interest charge should unquestionably, in the opinion of the writer, be omitted. The necessary return on the capital is obviously shown by the investment method, and, as previously suggested, the straight operating cost method is an admirable measure of the margin necessary. The $6.00 logging job involves roughly twice the chance of unforeseen costs as does a $3.00 job, and demands approximately twice the margin. This is not true, however, where interest on invested capital is added as a cost. The same logging chance handled by a railroad instead of by driving may well involve less operating cost but greater invested capital. It is obviously, however, a more stable proposition and can be handled on a lower margin. The decreased operating costs and the correspondingly lower margin necessary should be reflected by the operating cost formulae while the increased capital invested can better be expressed and handled by the investment method.

While, in general, both formulae are necessary, in certain specific cases it can be seen from inspection that one or the other will give the lower stumpage rate and hence govern. Small sales similar in character to that first described ordinarily involve such a small investment that the operating cost method can safely be applied without check. This is a great advantage to the seller of stumpage since appraisal of these small chances must usually be made by men of narrow experience who, while thoroughly competent to estimate logging costs, are somewhat at sea on questions of invested capital.

To summarize, it is felt that (1) if stumpage is to be appraised by formulae, both the operating cost and the investment methods must be used and the lower stumpage indicated adopted, and (2) that interest on fixed capital invested should not be included as an operating cost.

STANDARDIZATION OF FIRE PLANS, ORGANIZATION, EQUIPMENT AND METHODS IN DISTRICT III.

By John D. Guthrie.

An interesting and productive conference was held at the District Forester's offices in Albuquerque, N. M. in March, 1914. The Supervisors of the Datil, Coconino, Sitgreaves, Gila, Apache, Pecos and Jemez Forests, with certain of the District officers, acting as a committee, considered the standardization of fire plans, organization, methods and equipment. The desire of the committee was to find out how far the District should go in making the features of the present annual fire plan standard, with the idea of making all instructions of the plan, upon which the committee agreed, as mandatory hereafter for the entire district.

It was realized that local conditions had to be considered in any attempt at standardization, yet it was felt that certain provisions of the fire plan and certain methods and equipment could well be made uniform for all forests in Arizona and New Mexico.

This committee went on record as adopting the following:

Discovery of Fires and Method of Reporting.

As standard the triangulation system of detection, from primary lookout stations, to be supplemented by riding patrol only on those portions of a forest which cannot be covered from lookout stations.

On forests having adequate telephone communication fires will be reported to both the supervisor and district ranger or fire chief.

Rank of Officers.

It was decided that ordinarily the primary lookout man will rank next in authority to the district ranger or fire chief. No objections, however, will be made if the fire organization is such that patrolmen should outrank lookout men. The important consideration is that instructions to lookout men and patrolmen must be definite in this matter of rank in order to fix responsibility for action. In the ideal fire organization, patrolmen will be essentially fire fighters. Under this heading there was considerable discussion regarding the giving of an appointment as forest guard to lookout men and patrolmen, who might in many cases be excellent men for these positions yet who were not ranger material, and in a way were performing the work of day laborers. Some of the committee held very strongly that no new men should be given a guard's appointment who would not possibly later develop into ranger material, and that all lookout men and patrolmen should be day laborers. As opposed to this view it was pointed out that the Forest Service has emphasized very strongly that every member of the forest force whether he be supervisor, deputy, forest assistant, ranger or guard is an integral part of the fire organization, and each man must realize a sense of responsibility if results are to be expected, also that there is no more important position in the fire organization than that of lookout man, that the qualifications for the duties required were peculiarly exacting. In view of these facts the point was made that it did not look consistent to consider the lookout man as a mere day laborer, that it could not be expected that his sense of responsibility would be aroused or that he would feel that he was part of the fire organization if he were a day laborer, paid so much per day, and liable to be dropped any day, that by giving him an appointment it would in itself be impressed upon him that he was a forest officer and a part of the fire organization, and that he had certain responsibilities and duties.

The statement has been made frequently that the Forest Service should not give guards' appointments to all men used temporarily on the forests; that a forest guard should be an assistant to a ranger; that the Service should reserve this title for men who have decided to enter the Service work to become eventually rangers, and that it is not desirable to give men serving in such capacities the power to arrest. It is extremely seldom that the actual power to make arrests is made use of by any forest officer—there is no need of it—and therefore it is not felt that

that question in itself is worth considering. There are certain men on almost any Forest, who by reason of several summers' experience as guards and of their intimate knowledge of the country and local conditions, make the very best possible guard material. These very often are men who do not intend to become rangers, who own ranches and who could not pass the ranger examination if they took it, and others in exactly the same class who are too old to take the ranger examination. These men are glad of the opportunity to earn some money during the summer, make excellent guards, but would not be willing to work as day laborers at all.

The solution of this matter is that there should be special positions of lookout man and patrolman, to be appointed as such. Surely every field forest officer realizes that there is no more responsible nor important position than that of lookout man—then why not recognize it by making a special appointment?

Divorcing Protection From Administration.

Until protection can be absolutely divorced from administration, fire plans cannot be considered perfect. On those forests where the administrative work during the fire season is of such a character that it can either be neglected entirely or handled by the district rangers without interference with their protective duties it may be said that the two are now already divorced.

On large forests containing extensive stands of timber, the first step to be taken toward divorcing protection from administration is the establishment of fire units, with the assignment of a fire chief in charge of each unit. Such units will be made without regard to the boundaries of administrative districts. If two or three administrative districts are included in whole or in part in a fire unit, their respective rangers in charge will continue the administrative work and will be called on only in the event they are needed for actual supervision of fire fighting. Under this system, the organization for fire protection is separate from the administrative organization until there is a large fire or a number of small fires. This means that a district ranger in charge of an administrative district will not be called upon until the need for his services has been indicated by the fire chief or supervisor.

Rate of Wages.

The maximum wage for inexperienced men as either lookout man or patrolman will not exceed $60.00 per month, together with subsistence, which will not cost over $15 per month; this subsistence to be furnished by the Forest Service. Inexperienced patrolmen who will be so situated that there is no necessity for the Service to furnish subsistence will be paid not to exceed $75 per month. Experienced lookout men and patrolmen (those who have rendered one years' service or more and whose services because of their detailed knowledge of local conditions, are invaluable so that they could not be replaced), may, in the discretion of the supervisor, be recommended for a wage greater than $60. The District Forester will be informed of the facts in such cases, and his approval secured in advance.

Instructions to Protective Force.

Either the supervisor or a competent member of his force specifically designated will, in advance of the fire season, or as soon as the special protective force is on the ground, personally instruct each man as to his duties. This will not take the place of written instructions. This field inspection will give the opportunity to orient protractors. The importance of impressing upon each officer the necessity of discipline must not be overlooked. It should be made clear to a lookout man that he must remain at his post until permission for leaving is secured from either the supervisor or the fire chief or district ranger, as the case may be. To relieve the monotony of a lookout man's duties, if it can be arranged without detriment, he can be allowed to exchange positions with a patrolman for a week or more; this is to be done only after specific authority has been given.

Co-operation.

Inter-forest boundaries will be practically disregarded in considering protection against and fighting of fires.

On those forests which adjoin Indian Reservations, supervisors will personally take up the matter of co-operative fire protection to ascertain if mutual arrangements can be made. If such arrangements can not be made, the District Forester will, after being duly informed of the facts, take the matter up with the Forester. The idea, as indicated, will be to work from the bottom up rather than vice versa.

Supervisors will write to local postmasters calling to their attention the matter of co-operation, as indicated in an Order issued by the Postmaster General in 1913.

Before the beginning of the fire season a circular letter should be sent to each permittee; the letter will be in the nature of an appeal—instructions and commands must be avoided. Cards or posters containing the Six Rules will be given as wide distribution as possible; fire signs and notices are to be posted in well chosen location, avoiding the "bunching" of them. Large painted fire signs (2x3 or 4 ft.) well placed at the entrance to a Forest or occasionally along a well travelled road should possibly be of greater benefit than a larger number of ordinary signs posted indiscriminately.

The fire campaign must at all times be an active one; in so far as possible—following up circulars with personal talks, and preparing fire news items for local papers whenever there is a "lead" for a story.

Per Diem Guards.

Per diem guards will be appointed on every Forest where the class of men suitable for this position can be secured. They will be considered as a part of the fire organization. Such appointments are conducive to responsibility and quick action in time of fire, where no other forest officer happens to be in the immediate vicinity. The appointment of per diem guards at the rate of $.35 per hour for time actually worked in fighting fire together with the fact that rangers can now act as notaries in administering oaths, should remove any possible objections to the plan. The rates of pay for fire fighters are to be: Laborers, $.25 per hour—maximum; Cooks (regular experienced) $.35 per hour—maximum; Foremen, $.35 per hour—maximum.

Instructions in the time book (form 875), which was sent out in 1913, will be followed in determining the time of fire fighters. Ordinarily the officer in charge of a fire will keep the time of fire fighters.

Studying the Efficiency of Lookout Stations.

One very important feature of the 1914 fire plan will be the thorough study by the supervisor or a competent forest officer whom he may designate, of the efficiency of lookout points, before new points are selected and towers erected. Generally it may be said that every forest has a few prominent peaks and they have been selected as lookout stations as a rule. What is wanted is to know accurately whether these points already selected really cover the areas they are supposed to. To determine this, go to a lookout point and take bearings on all prominent points in the area covered by the lookout, as well as bearings in canyons and on natural boundary features, making an estimate of the distance to all such points and plot them on the map so that a meander line can be drawn around the "seen" area. Where nearby ridges or other small peaks are so located as to interfere with fires on their far sides being readily discovered, special note should be made of these conditions, so that they can be checked from other lookout points. If after checking the area of efficiency of all lookout points, it is found that there are certain areas that can not be seen from any of them, the advisability of establishing another primary lookout or, if none is available, the location of a patrolman's route will be in order.

Fire Maps.

The present fire map, a sample of which was sent out in the spring of 1912, has been adopted as the standard fire protection map for the district. This means the adoption of all the information as given on that map. When there is a riding patrol the routes of patrol will be indicated. The organization diagram will be placed on the map. The protractor should be drawn directly on the tracing at each primary lookout point. On the forests where the tri-colored base map is now in use or where there is any reason for not placing the protractor on the tracing, the transparent protractor will be pasted on the map. Where there are inter-forest primary lookout points, a double arc, with the projected bearings from the lookout point of an adjoining forest marked on each arc, should be on the border of the map, so that a correct bearing may be had from the lookout point of such adjoining Forest. In order to get this it will be necessary to give each Forest its proper location with regard to adjoining forest maps and strike a circle with a radius long enough to reach from the exact location of the lookout point to the border of the map. Maps of inter-forest areas comprising a fire protection unit will be prepared as rapidly as possible.

Report Forms—Equipment and Supplies.

A blank form to be used by lookout and patrolmen as a daily report was adopted for general use; likewise a blank report form to be used by the supervisor, fire chief or district ranger in recording the daily reports from the lookout and patrolman was adopted. On Forests inadequately provided with telephone communication, where the so-called mail box system is used for checking the work of patrolmen, a suitable galvanized iron box was adopted, as well as a blank form for the purpose of recording the visits of lookout men.

Standard supply lists will be left with each store-keeper living in or near the Forest and necessary arrangements made so that he can send immediately when requested the supplies specified in the list. The standardization of subsistence supplies for fire fighters was thoroughly considered, but no list adopted, due apparently to the great variation in local conditions.

With the intent of avoiding possible criticism or comparisons between adjacent Forests, the following list of food supplies, when supplied by the Forest Service to lookout or patrolmen was adopted as standard:

Beans	Fresh meat
Flour	Coffee
Baking soda	Lard
Dried fruit	Tea
Pepper	Salt
Canned milk	Bacon
Canned tomatoes	Sugar and syrup or jam
Canned corn or peas	Macaroni and rice
Baking powder	Potatoes

It was felt that the above list gives sufficient opportunity for selecting a diet that can be relished by the most fastidious employee. The total cost of supplies that may be purchased from this list for one man for one month will not exceed $15.00.

The following equipment for a lookout station was made standard: The fire maps; A metal protractor 14 inches in diameter; A metal sight alidade 14 inches long, with a pointer on one end, and hole in center to fasten in center of protractor. The sights will be at least 6 inches high.

Where needed a lookout watch-box, or shelter, is to be constructed. The telephone installed on the tower, and if possible a second one installed on the ground or in the lookout's cabin, which must be as near as possible and convenient to the lookout point or tower.

The tools will be a rake, axe, shovel, and saw.

In reference to the type of telephone to be used in enclosed towers of lookout shelters, considerable discussion did not result in standardization. Some favored the adoption of desk sets or regular wall sets, while others believed the use of the metal box telephones should be continued.

Standard equipment for a patrolman will be as follows: 1 axe; 1 shovel, hoe or rake, with handle; Emergency rations; Instructions in writing; Forest Service key, at the discretion of the supervisor.

An upright galvanized metal tool box was adopted. This box is very stoutly made, knock-down style, 27 inches wide and 30 inches deep and 8 feet tall. The door is 4 feet 10 inches tall by 2 feet 4 inches wide, and the bottom of the door is 16 inches from the base of the box. There are two racks inside on the back wall for holding rakes, shovels, axes, etc., and on each side a shelf for storing canteens, water bags, etc. The space in the bottom will hold food supplies, pack outfits and other fire box equipment. The box is water and rodent proof. On the inside of the door of the box will be posted a list of the tools in it—a duplicate of this list will be kept in the ranger's office, and also in the supervisor's office, if desired. A standard list of tools for boxes was considered, but not deemed advisable.

There should be a rodent-proof box at all places where a reserve food supply is kept. This should be made of galvanized metal similar to the tool box.

Pack train outfits will be kept at strategic points for the purpose of bringing in supplies to fire fighters, if in the judgment of the supervisor such outfits are needed for efficient protection. Before purchasing burros, mules or horses for this purpose the approval of the District Forester is necessary.

Use of Improvement Crews.

Wherever it is possible to do so, improvement crews during the fire season should be placed on work where they can be available for fire fighting, thus giving an additional reserve supply of fighters in case they are needed. The foreman will have a wagon and team, or some other means of transportation, and will be equipped with a portable telephone and enough emergency wire to conveniently reach the telephone system. In case of fire he will be called on to go to it immediately, with his crew if necessary.

Awards.

The committee decided that the plan of making awards should be tried out this season. These are to be given to Forests having at the end of the fire season the best record in fire protection. A first and second prize will be given. The award will consist of a framed official letter for posting at the Forest headquarters, designating the winning Forest, together with a list of the entire Forest personnel, copies of the letter being sent to each member of the Forest force as well. The first prize will be designated by a blue ribbon attached to the letter; the second by a red ribbon. The awards will be determined on: 1. highest percentage of class A fires; (2) smallest average acreage per fire, including all classes of fires; (3) inspection reports

Inspection.

The committee went on record to the effect that it is of the first importance for the supervisor himself to personally inspect the workings of the protective plans in the field. Monthly field plans for the supervisor's office force must provide for this during the fire season and will be scrutinized by members of the District Office with this end in view.

The committee fully discussed the following, but did not feel at that time that standardization was practicable; pack saddles and outfits; nested cooking equipment; water packing outfits for use on pack animals; electric storage battery; lanterns for tool boxes.

A COMPARATIVE STUDY OF TWO LOG RULES, AS APPLIED TO TIMBER IN CENTRAL NEW YORK.

By John Bentley, Jr.

It is a well known fact that there are a great many log rules in use in different parts of the country, and that the values given in these rules vary within wide limits even for logs of the same size. Differences of 25% or more are not uncommon in logs of the smaller diameters, and while the *relative* differences in logs of large diameter are not so great, the *absolute* differences are sufficient to cause one to marvel that the same log could by any chance yield such uncertain quantities of lumber. The factors influencing the board foot contents of logs are, of course, numerous; but with sound logs and a definite allowance for saw-kerf, it seems that any log rule constructed on sound principles should be able to stand comparison with the actual mill cut of a number of representative logs. That the same log, when scaled by the Doyle rule should yield only 16 board feet, and when scaled by the Scribner rule should yield 32 board feet seems absurd, and yet these are the figures assigned by these two rules for a log sixteen feet long and 8 inches in diameter. If the differences were fairly constant, one might feel inclined to excuse such discrepancies on the ground that saw-kerf and slabs were allowed for in different degrees; but when one follows these same two rules to a log 48 inches in diameter, and finds the relative positions just reversed,—that by the Doyle rule the log contains 1936 board feet, and by the Scribner rule 1728 board feet, it then becomes obvious that the rules can not *both* of them be constructed on sound principles. What are we to do? What, in particular, is the man to do who is not familiar with the inconsistencies of log rules? Some people may even be buying by one rule and selling by another rule, ignorant of the fact that there may be a difference of from 10 to 20 per cent.

It has long been the desire of the writer to test the accuracy of the "Universal" Log Rule, devised by Prof A. L. Daniels, of the University of Vermont, and published by him in Bulletin No. 102 of the Vermont Agricultural Experiment Station, in

1903.* This rule appeared to be based on principles entirely sound; and when compared with other rules, it seemed to have escaped the errors which are often so noticeable. It was decided, therefore, to test the "Universal" Rule in a way which would prove its accuracy when applied to logs of various dimensions, and afford a comparison with some other rule in common use.

The opportunity came when a small portable mill was found in operation not far from Ithaca. Three students* were assigned to a study involving a test of the "Universal" Rule and the Scribner Rule. The method consisted in scaling numbered sound logs of different sizes by both log rules, and then comparing these results with the actual product of those same logs, when measured as lumber. In this way it was possible to discover whether the differences were constant, and if so in what degree, so that some definite conclusions could be drawn as to the relative accuracy of the rules when compared with the mill-cut. While it might be argued by some that a portable saw-mill hardly affords ideal conditions under which to study a problem of this nature, let it be said that the logs that are bought and sold in New York state to-day are more likely to be sawed at a portable mill than at a large stationary mill. The day of big lumbering operations in New York, except for a few in the Adirondack Mountains, is past. A great deal of work in other sections of the state, where woodlots rather than large forests are the rule, is done by portable saw-mills. And they are operating in some remarkably good pieces of timber, woodlots that have been protected and preserved for two generations or more, where stands of 25,000 feet, B. M., per acre are occasionally met with.*

In the case now under consideration, the mill was a small one, with a 52-inch rotary saw cutting a kerf of ¼ inch. The logs were mostly White Pine and Hemlock, although a few hardwoods were also included. The logs were sawed into inch-boards or two-inch planks, the proportion of the latter being ap-

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* See also FORESTRY QUARTERLY, Vol. III, p. 339.

*Messrs. H. B. Steer, C. S. Hahn and P. C. King.

*The stand per acre in the present instance averaged 25,000 bd. ft. The writer knows of one acre of nearly pure pine in New York State, that was cut a few years ago, yielding 50,000 bd. ft.

proximately 30%. While leaving some things to be desired in the way of equipment and efficiency, the operation was typical of much of the work being done by the portable saw-mills in the state.

The number of logs scaled and measured was 62, of which 34 were White Pine, 21 Hemlock, and 7 hardwoods. They ranged in size from 8 to 16 feet in length, and from 6 to 28 inches in diameter. The smallest log scaled and sawed was 8 feet long and 6 inches in diameter. The largest log scaled and sawed was 10 feet long and 28 inches in diameter. Each log was scaled by both the "Universal" Rule and the Scribner Rule, and a tally kept of the actual product, measured as it came from the saw. The logs were divided into seven groups, based on the amount of lumber indicated in the scale, as follows: Group I, included all logs scaling from 1 to 50 board feet; Group II, included all logs scaling from 51 to 100 board feet; Group III, included all logs scaling from 101 to 150 board feet; and so on, Group VII, including all logs scaling more than 300 board feet. (Table 2 shows the number of logs in each group.)

Table 1 is a summary of the results, showing only the amount of the over-run in board feet, and expressed as a percentage. This table shows the "Universal" rule to approach quite closely to the actual mill cut. Table 2 shows in more detail, just how the over-run was distributed, according to the size of the log. This Table is very instructive in respect to the fact that the greatest percentage of over-run, in both rules, occurs in the logs of small diameters. This would indicate that the rules are inaccurate for the very small logs, and since in any "run" of logs there must always be more small ones than large ones, this tendency of log rules to undervalue the small logs should be remembered. In the larger sizes, particularly from 16 inches in diameter to 26 inches in diameter, the differences noted are not so great. In this connection, it is interesting to note that a sound log 10 feet long, and 28 inches in diameter, scaled 364 board feet by the "Universal" Rule, 360 board feet by the Scribner Rule, and the measured lumber from this log amounted to just 364 board feet. It would seem, therefore, that our log rules, —most of them—are not liberal enough with the small logs, and in these days of close utilization, the small logs may often count for a good deal, in the aggregate.

Table 3, showing the *mean* over-run in board feet for logs of the several groups, discloses the fact that the Scribner rule is less reliable than the "Universal." The mean over-run for the Scribner is about double that of the "Universal" in all groups excepting Groups V and VII. This confirms the figures shown in Table 1, where the percentage of over-run on all logs is nearly in the same proportion for the two rules.

It is acknowledged that in a study of this kind there is some opportunity for the lack of skill on the part of the scaler in discounting for defects to affect the figures to such an extent that no definite conclusions could be reached. If the full scale were allowed on defective logs, then the mill-cut would be quite likely to fall short of the scale, and conversely, if too liberal a discount were made the mill-cut would greatly exceed the scale. In the present instance the conditions were favorable to a high degree of accuracy, because the logs were most of them sound, and the task of scaling called for the exercise of judgment chiefly in the matter of determining the average diameter, and proper allowances for slight crooks in the logs.

The general conclusions reached in this comparative study of the two log rules may be stated as follows:

(1) Both the Scribner and the "Universal" Rules give a sound log less than can be produced from it under favorable conditions.

(2) Both rules fall short by larger percentages in the small logs than in the large logs. The scales apply with the greatest accuracy in logs of medium size, that is, from 16 to 26 inches in diameter.

(3) With sound logs, the mill-cut may be expected to over-run the Scribner scale by about 10% and to over-run the "Universal" scale by about 5%.

(4) All things considered, the "Universal" Rule will give better results than the Scribner Rule, but both run low for the logs of small diameters.

NOTE.—The "International" Rule, as printed by Dr. J. F. Clark in "Forestry Quarterly," Vol. IV, page 79, may be adapted to allow for a saw kerf of ¼ inch by applying a reducing factor of 9.5%. This was done, and the logs by this scale would yield a total of 7,435 board feet, or only 2½% less than the actual mill cut. It may be said, therefore, that the "International" Rule, when adjusted to allow the proper amount for saw-kerf, will undoubtedly give very good results.

TABLE I.

SUMMARY OF RESULTS.

Total No. of Logs.	How scaled.	Total Scale (board feet)	Over-run (board feet)	Percent of Overrun.
62	By Scribner Rule	6.847	778	10.1%
	By "Universal" Rule	7.194	431	5.6%
	By measurement of sawed lumber	7.625	....	......

TABLE 2.

DISTRIBUTION OF OVER-RUN.

No. of Group.	Daniels "Universal" Rule Net Amount of Over-run.	Per-cent. of Over-run.	Scribner Rule. Net Amount of Over-run.	Per-cent. of Over-run.
I. (1— 50 bd. ft.)	145 bd. ft.	21.7%	221 bd. ft.	27.9%
II. (51—100 bd. ft.)	93	10.3	169	17.4
III. (101—150 bd. ft.)	22	2.0	111	9.4
IV. (151—200 bd. ft.)	36	3.9	71	9.3
V. (201—250 bd. ft.)	129	6.0	143	5.9
VI. (251—300 bd. ft.)	—34*	—4.5	23	7.7
VII. (300+ bd. ft.)	40	3.9	40	3.8
		(Average)		(Average)
Total, ...	431	5.6%	778	10.1%

*Under-run.

TABLE 3.

MEAN OVER-RUN, FOR LOGS OF DIFFERENT SIZES.

No. of Group.	Mean Over-run, Board Feet. Daniels' "Universal" Rule.	Scribner Rule.
I. (1— 50 bd. feet)	6.6	9.2
II. (51—100 bd. feet)	8.5	16.9
III. (101—150 bd. feet)	2.4	12.3
IV. (151—200 bd. feet)	7.2	17.7
V. (201—250 bd. feet)	14.3	13.0
VI. (251—300 bd. feet)	11.3	23.0
VII. (301+ bd. feet)	13.3	13.3

THE YOUNGLOVE LOG RULE.

By Wm. W. W. Colton.

The Younglove Log Rule is mentioned in the Woodsman Handbook and also in Graves' Forest Mensuration, but the author states that he was unable to obtain the rule and could find out very little about it. Consequently, when a few months ago I was looking in a local hardware store for a caliper to measure logs with, I was rather surprised to find that the only one in stock was a Younglove Scale Caliper.

Upon making inquiries, I discovered that the Younglove Rule had at one time been the only one in use in this section of the State (Fitchburg, Mass.) and that even up to the present time saw mill owners and people selling logs throughout this locality claim that the Younglove Rule is the only one to be used. As there was so little known about this rule, I thought it might be of interest to others to learn more about it and I have therefore sought out the following information.

The Younglove Rule was originated by Tyler Younglove, who was born in Fitchburg about 1812. He was a carpenter by trade and worked for many years in a local saw mill and lumber yard. About 1840 he worked out this rule and in later years, together with his son, manufactured calipers and sticks for measuring sawed lumber. After his death, his son conducted the business enlarging it to some extent and made scale sticks and calipers of all kinds. He died a few years ago, and with him died the secret of his log rule. A grandson of Tyler Younglove, Mr. Wm. K. Younglove, is now a captain in the Fire Department in Fitchburg, and through his courtesy I was allowed to look over the papers and other effects of his late father and grandfather. Among these, I ran across one copy of the mill table for log measure which is in my possession. No record, however, could be found of the principle upon which the scale was made. I have talked with a number of old residents who knew the old gentlemen in life, and the general opinion is that the table was constructed from diagrams and from actual measurements of logs at the mill. In comparing it with the other tables given in the Woodsman Handbook, I find it corresponds very closely to the Baxter Rule. For logs over 20″ in diameter, the contents of logs given is slightly less than in the Baxter Rule. By applying Prof. Daniel's Method given on page 34 of Graves' Forest Mensuration, we find the formulae for this table to be $V = \frac{5}{8} D^2 + 9/20\ D - 7$.

According to Mr. Wm. Younglove, his father would never impart the secret of making this to anyone, and often boasted that it would die with him. Since his death, there have been no more Younglove Calipers made, and I believe at the present time I have in my possession the last one ever placed on the market for sale. From those who have used this rule, I find that the best results are obtained from taking the diameter outside the bark at the small end of the log. I have used the caliper myself this year in measuring logs, cut from a small woodlot near by, and have taken measurements both at the small end, and one third of the way from the small end. These logs have been marked and I hope to follow them through the mill at some later date to see which measurements tally up the best.

It would seem that the table would give very fair results for the measurement of small diameters but runs rather low for diameters above 24 inches.

(The logscale itself was submitted, but is not printed for lack of practical interest.—Ed.)

PROGRESS OF THE U. S. FOREST SERVICE AS REFLECTED IN THE FORESTER'S REPORTS FOR 1911, 1912, 1913.

By Alexander J. Jaenicke.

Any one familiar with these annual reports will realize that it is impossible to adequately give an idea of their contents in a brief abstract such as this purports to be. An annual report concerns itself with the activity and the plans of the U. S. Forest Service, and this is discussed in an exceedingly concise and not at all detailed manner. An abstract, therefore, must necessarily omit much that is exceedingly important; in fact, nothing but a general idea of the contents can be given.

The report for 1911 is really Mr. Graves' first report, the 1910 Report being the last one of Mr. Pinchot's administration. In abstracting Mr. Graves' reports for 1911, 1912 and 1913, it was thought best to consider them *together* rather than separately in order that the growth and progress of the Forest Service during these three years could more easily be traced. In the following pages, when the year 1911 is mentioned, this will mean the fiscal year 1911, or the period between July 1, 1910 and June 30, 1911 and similarly for the other years. All three reports are much alike as regards the order in which the various topics are taken up, and this sequence will be followed in this brief, the main topics being indicated by headings.

Classification of Expenditures and Receipts.

For the years 1911, 1912 and 1913, the annual expenditures of the Forest Service have been between $5,000,000 and $6,000,000. Thus these years have seen no marked rise in the annual appropriations. Under the heading of salaries and general expenses, over 90% of the annual appropriation was used each year, less than 10% being used for the permanent improvement of the National Forests. Consequently the administration and protection of the National Forests has cost an annual average of 2½ cents per acre while the improvements have amounted to less than 2½ mills per annum.

The receipts of the Forest Service can be classified under the following three heads:

1. Timber.
2. Grazing.
3. Special uses.

In 1911, the total of these receipts amounted to slightly over $2,000,000. In 1912, there was an increase of $100,000 and by 1913 the total annual receipts were practically $2,500,000. The average distribution of these receipts is roughly about as follows:

Timber—55%—$1,350,000.
Grazing—40%—$1,000,000.
Special uses—5%—$150,000.

In the future, there is no doubt but what the receipts from timber will show the greatest increase, although steady gains in grazing and special use receipts can be confidently looked for.

Organization and Personnel.

Perhaps the most noteworthy of mention here is the tendency toward the reduction of supervisory officers in Washington and in the districts. The officers in Washington were decreased by placing increased responsibility upon the district officers, and these in turn were reduced in number by gradually increasing the responsibilities of the supervisors.

In addition, during Mr. Graves' regime, there has been much attention paid to the organization of the protective force and the investigative work. There has been a marked increase in efficiency in both as a result of this re-organization.

The classification of the forest force at end of the year 1912 was as follows:

Supervisors,	147
Deputy supervisors,	92
Rangers,	1393
Guards,	780
Forest examiners and forest assistants,	156
Clerks,	171
Miscellaneous lumber men, experts, hunters, etc.,	156
Total,	2895

The previous year the Forest Service numbered 2624 men. These figures are indicative of the very gradual increase which may be expected in the future, in contrast to the rapid increases in the earlier history of the Service.

Area and Boundaries of the National Forests.

During the past three fiscal years, the area of the National Forests has remained practically the same, amounting to approximately 187,500,000 acres at end of the fiscal year 1912, inclusive of Alaska. Exclusive of Alaska and Porto Rico, the National Forests at the end of 1912 included roughly 160,600,000 acres. This area is distributed in approximately 160 National Forests, a National Forest thus averaging slightly over one million acres. Exclusive of the acquisitions under the Weeks Bill, National Forests exist in 20 states, California leads in the area of National Forests within its borders with almost 28,000,000 acres. Idaho and Montana follow closely with almost 20,000,000 acres in each of these two states.

The policy which has governed recommendations for additions and eliminations since the fiscal year 1911, may be briefed as follows:

Lands to be retained within the National Forests:

1. Lands wholly or partly covered with brush which are valuable for watershed protection, or open land on which trees may be grown, unless their permanent value is greater for cultivation than for protection.

2. Lands wholly or partly covered with timber and undergrowth which are more valuable for growing of trees than for agriculture.

3. Lands not possessing timber or brush which should be included in National Forests for administrative reasons.

Lands to be eliminated from National Forests:

1. Lands not wholly or partly covered with timber or undergrowth upon which it is not expected to grow trees.

Claims and Settlements on the National Forests.

The claims on the National Forests may be divided into two large classes: 1. Homestead claims. 2. Mining claims.

Claims within the National Forests are constantly the source of much annoyance and trouble because of the frequent attempts at fraud.

During the fiscal year 1913, 1,690 individual tracts of land in the National Forests passed into private ownership through the patenting of claims. These included:

Homestead claims,	977
Desert land claims,	6
Timber, stone claims,	35
Mineral claims,	639
Coal claims,	24
Miscellaneous claims,	5

In 1911, this total was almost 3000, while in 1912, it had dropped to 1500. There are several reasons for this, but they cannot be discussed here. Suffice it to say, that the criticism that the Forest Service hinders homesteading and prospecting is unjust, and not substantiated by facts. Those who have been foiled in attempts to patent fraudulent claims have naturally been the chief opponents of the present "claim policy" on the National Forests.

Land Classification.

This work was seriously inaugurated in 1909, but the work has seen its greatest development since the fiscal year 1912, because of previous experience gained, and the increased appropriations. The purpose of the work in Mr. Graves' own words is "to segregate and make available for the establishment and development of homes, all National Forest land which will serve its best purpose by being brought under cultivation."

In general the work includes the following:

1. Classification of areas where the amount of land chiefly valuable for agriculture warrants large eliminations.

2. Detailed classification of considerable areas.

3. Examination and classification of single scattered tracts for which prospective settlers make application.

Timber Sales.

The total stand of timber on the National Forests inclusive of Alaska is approximately 600,000,000,000 board feet. Of this about 350 billion feet is overmature and mature. The annual yield is roughly estimated at slightly over 6 billion feet. With the proper deduction for local requirements near the various National Forests, over 5½ billion feet are available for timber sales to supply the general market.

Timber sales are rapidly increasing. Comparison of the fiscal years 1912 and 1913 brings this out clearly:

Year.	Total sales (ft. b. m.)	Stumpage Value
1912,	800,000,000	$1,600,000
1913,	2,000,000,000	$4,500,000

The aims of the National Forest Timber policy may be summarized as follows:—

1. Prevent losses by fire.
2. Utilize ripe timber in such a manner as to insure restocking of the land and continuance of production.
3. Sell timber at the proper price.
4. Sell ripe timber so as to prevent speculation.
5. Prevent monopoly of public timber and maintain competitive conditions in the lumber industry by its sale.
6. Provide for requirements of local communities and settlers.
7. Make timbered lands of agricultural value available for proper settlement and use.
8. Make the National Forests self-sustaining, and yield revenue to the various states to offset loss in taxes.

The most important factors influencing the sale of timber are:

1. Distance of larger bodies of N. F. timber from markets and transportation facilities.
2. Condition of the lumber markets.
3. Difficulties in logging—topography exceedingly rough on many portions of the National Forests.
4. Presence of privately owned timber tributary to same markets as National Forest timber.

The relative importance of these four factors vary from year to year, and their fluctuation results in corresponding changes in timber sale receipts.

A brief classification of the timber sales by years will clearly show their rapid growth in total values:—

VALUE.

Year	Less than $100	$100-$500	$500-$1000	$1000-$5000	Over $5000	Total.
1911	5144	327	70	73	39	5653
1912	5279	378	78	92	45	5772
1913	5696	209	73	142	62	6182

Protection.

Fire losses are reported by calendar years, and not by fiscal years. The calendar year 1910 was an exceptional one for severity, and especially to be regretted is the large loss of life which took place in the fight against the fires.

The following summary will give a general idea of the acreage burned over on the National Forests during the past three years for which figures are available:

Calendar Year.	Timbered Area per 1000 Acres.
1910	19.90
1911	1.78
1912	0.91

Lightning, railroads and campers cause almost two-thirds of the fires which occur. Half of the discovered fires burned over much less than an acre, 25% burn over between 0.25-10 acres, and the remaining 25% burn over more than 10 acres. About 3000 fires are annually fought on the National Forests. It is difficult to get at the exact cost of fighting these fires, since the time spent on them by regular forest officers is not considered in the annual reports.

The present efficiency in the protective work of the Forest Service is due to:

1. The rapid development of permanent improvements such as telephones, look-out stations, etc.
2. Preparation of detailed fire-protection plans on a large number of forests and their rigid execution.
3. Co-operation of private owners and railroads.

Aside from protection from fire—there are also the following phases of the protection problem:

1. Protection against pollution of streams.
2. Prevention of insect depredations.
3. Control of forest-tree diseases.

Reforestation.

It is estimated that there are 7,500,000 acres on the National Forests which must be reforested by artificial means. In addition to this, the natural regeneration on 1,000,000 acres cut over annually by timber sales must be taken care of.

A great deal of the work of reforestation is still in the experimental stage, and hence in many sections of the country, extensive and expensive plantations are not yet justifiable—district 3 and district 5 are examples of this.

In 1912, the following tentative distribution among the districts of the area to be reforested annually was agreed upon:—

District	Acreage
1	9000
2	6000
3	500
4	6000
5	500
6	9000

Direct seeding, under which the tree seed, is sown upon the ground with or without simple forms of cultivation, and the growing of seedlings in nurseries under ideal conditions to be transported into the field when of suitable size—these are the two general methods used in reforestation work in the Forest Service.

In the matter of direct seeding, three problems are confronted, i. e.: 1. Seed supply. 2. Rodent injury. 3. Cheap cultivation.

In 1913, the reforestation work covered approximately 30,000 acres. About 24,000 acres was sown at an average cost of $4 per acre—6000 acres planted at $11 per acre.

Most of the seed used was collected by Forest officers. In 1913, 40,000 lbs. of coniferous seed was collected at an average cost of $.78 per lb.

The nursery stock used was obtained from the various forest nurseries on the National Forests. The cost of seedlings in 1913 was $3 per 1000, and $5 for transplants. These figures will undoubtedly be materially reduced in the future.

Of the 30,000 acres reforested in 1913, the following is the species distribution:

Species	Acreage
Douglas fir,	10,000
Western Yellow pine,	7,000
Western White pine,	7,000
Lodgepole,	2,000
Miscellaneous,	4,000
	30,000 acres.

The most notable thing in connection with the reforestation work, is the rapid decrease of per acre costs from year to year, and the increasing success of the work. The experimental work in connection with reforestation is still, however, of first importance.

Range Management.

Over 20,000,000 head of stock are partially dependent on the National Forests for forage. The system of range control devised and placed in operation by the Forest Service has won the approval of the vast majority of the western stock growers. To further increase the efficiency of this system, the following studies are under way:—

1. Exact character and condition of all forest lands.
2. Distribution and economic importance of all the herbaceous plants.
3. Natural, artificial methods of reseeding valuable herbaceous plants.
4. Most efficient methods of handling live stock to conserve the range.
5. Character and extent of damage by stock to forests, watersheds, and methods of minimizing these injuries.

A study of the number of stock grazed under permit, shows a gradual increase in the carrying capacity of many forests. This is due to:—

1. Increased forage production.
2. Better knowledge of the ranges.

3. Improvements in handling stock.
4. Better distribution of stock.
5. Gradual substitution of shipping by railroad for trailing.

Some of the notable things which indirectly contribute to the success of the present grazing policy of the Forest Service include:—

1. Protection against disease.
2. Protection against wild animals.
3. Prairie dog extermination.
4. Protection against poisonous plants.
5. Co-operation of Forest Service with live-stock associations.

Water-power Development.

In spite of the fact that the regulations make it impossible to grant permits for a term of years, power development on the National Forests is rapidly increasing. It is estimated that at least 12,000,000 horse power can be developed on the National Forests from natural stream flow. This can of course be greatly increased by storage reservoirs. To again quote Mr. Graves, "The purpose of the administration of the water power sites on the National Forests is to encourage power development in every way possible, while safeguarding the interests of the using public."

Since water-power development in the National Forests has aroused so much discussion recently, it may be well to summarize the main features of the Forest Service policy with respect to this development:—

1. The speculative holding of the power sites is prevented.
2. Provision is made for complete and prompt development together with continuous operation.
3. A return is secured for the power site privilege.
4. Permittees are required to abide by certain regulations.
5. The capitalization of the value of the privileges conferred by the permit is prohibited.
6. Sufficient power is retained by the Forest Service so that the placing of unjust burden on the consuming public is prevented.

Permanent Improvements.

The chief improvements carried on by the Forest Service on the National Forests include roads, fire lines, telephone lines, trails, bridges, fences and buildings. By the end of the fiscal year 1913, these improvements had a value of almost $3,500,000.

Ten per cent of the receipts of the National Forests are devoted to the building of roads primarily for the benefit of the public. In addition to this, 25 per cent of the gross receipts of the National Forests reverts to the states for the benefit of county schools and roads. In the fiscal years 1913 and 1914, the ten per cent item will have amounted to considerably over $200,000 per annum, while the 25% item will mean an annual $500,000 for the present fiscal year.

Acquisition of Lands Under the Week's Bill.

Up to the end of the fiscal year 1913, the National Forest Reservation Commission approved for purchase a total of slightly over 700,000 acres. These lands are located in 14 purchase areas in the Southern Appalachians and White Mountains. The states in which these lands are located are: Maine, New Hampshire, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Tennessee and Georgia.

The work of the Forest Service in fire protection in these purchase areas has already resulted in a great improvement in the local sentiment on the forest fire question. Improvement work on these lands has already been begun.

Most of the land which has been bought is in a cut-over or culled condition and in many cases only the inferior species are left. Plans have already been made for the management of these areas, especial attention having been given to the grazing business and special permits, as well as to the timber sale business and the proper restoration of the areas.

Co-operation With States.

The Weeks Law which began its operation on March 1, 1911 with an original appropriation of $200,000 to be expended in the various states with a limit of $10,000 in any one state in any one year has been productive of much good. Among the benefits which have resulted because of this co-operation are:—

1. The shaping of forest policies and forest legislation in various states.

2. Increased activity of the public and the legislatures in the forestry movement.
3. Increased efficiency in all lines of forestry work in the various states because of the interchange of ideas on effective methods of State organization and fire control.

National Forest Investigations.

At present there are nine forest experiment stations. Reforestation problems are given the most attention. The following phases of reforestation are given the greatest attention:—

1. Methods of seed extraction.
2. Methods of direct seeding.
3. Nursery work.
4. Methods of field planting.
5. Studies in the breeding.
6. Factors governing production fertility of tree seed.

In addition, mensuration studies, thinning experiments, studies in forest management, forest influences, efforts of grazing, are only a few of the things to which the experiment stations devote their attention.

Silvicultural and dendrological studies are carried on by the Washington investigative force.

Other studies given consideration by the Forest Service are those that deal directly with forest products. Among these studies are:—

1. Utilization of National Forest timber.
2. Wood preservation.
3. Wood chemistry and distillation.
4. Timber physics.
5. Pulp and paper investigations.
6. Industrial investigations.

Conclusion.

In this abstract, as little attention as possible has been given to mere figures and statistics. It was deemed far more important by the writer to outline the scope of the work of the Forest Service, and to give briefly the policies which govern this work. Much that is essential and important had to be omitted in order to give this digest the brevity that is demanded of it.

EXPLOITATION OF CROSSTIES IN NORTHERN NEW MEXICO.*

By Clarence F. Korstian.

The following data on the various operations in the exploitation of crossties is based on the methods employed by a company which has been operating for the past six years in Northern New Mexico. The area which is now being exploited lies on the west slope of the Sangre de Christo Range, at elevations of 8,000 to 11,000 feet above sea level. The lower slopes of these mountains merge into rolling hills and gently sloping mesas. The upper portion of this area is quite rugged, consisting of deep canyons which have steep slopes. Mostly the timber is found on the mesas, slopes and ridges. The soil is usually of sufficient depth to cover the underlying rock so that it does not interfere with logging to any great extent.

Hewn Ties—Woods to River.

The following species suitable for hewn ties are found in this locality: Western Yellow pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga taxifolia*), White fir (*Abies concolor*), Englemann spruce (*Picea engelmanni*), Alpine fir (*Abies lasiocarpa*), and Limber pine (*Pinus flexilis*). Western yellow pine, Douglas fir, and white fir are the most important species on the area now being cut.

The following defects were found common to Western Yellow pine: stump and heart rot, cat-faces, mistletoe and injury caused by the pine bark-beetle. The cat-faces were caused by fires, occurring from 25 to as much as 100 years ago, and by removal of the inner bark for food by Indians, a custom which has been discontinued but which seems to have been prevalent 25 to 50 years ago. Trees having stump rot and cat-faces require long-butting which not only increases the waste but results in a lower grade of ties. Mistletoe and the bark-beetle cause the trees to

* The writer is indebted to Assistant Forest Ranger Wayne Russel for assistance in collecting the data contained in this article.

become pitchy and burly, which renders them difficult to work. Generally, however, Western Yellow pine is not difficult to work but is heavy to haul. Douglas fir is usually sound, being the least defective of the species used for ties. It makes the most desirable ties because of its durability and lightness, but is not liked by the majority of tie makers because of its hardness. White fir is very soft and easy to work, and for this reason is preferred by any of the tie makers. It is often seriously infected with stump and heart rot. The policy of seldom marking White fir above 18 to 20 inches D. B. H. has been adopted for this locality, because trees above this diameter usually show considerable rot, White fir makes the least desirable tie because the wood is soft, brittle, and does not hold the spikes firmly. When creosoted it makes a fairly satisfactory tie as evidenced by the fact that the railroad company, in this section of the country, accepts white fir ties together with those of the other species without discrimination.

Trees from 10 to 16 inches D. B. H. are suitable for hewn ties, although the tie makers prefer those from 11 to 13 inches D. B. H. At the lower elevations where cutting is now in progress the trees average 2.7 ties per tree. This figure is kept rather low, due to the marking for cutting of all suppressed and defective trees, from which at least one tie can be made, and the short-boled timber toward the lower limit of the Yellow pine type.

Three classes of hewn ties are made; squares, firsts, and seconds. The butts of large trees are made into square ties, which are not less than 10 inches on the face, and do not exceed 8 inches in thickness and 8 feet long. First class ties are 8 inches wide, 7 inches thick, and 8 feet long. Only one inch increase is allowed in thickness or length. Second class ties must be 7 inches thick, so long as the log is large enough to permit, and under no circumstances less than 6 inches thick and 6 inches wide. No ties under 6 inches by 6 inches, or over 11 inches by 8 inches, are accepted by the tie inspector.

The company's agreements with all of their tie makers contain a stipulation which states that all timber of the proper size for hewn ties must be cut and if sound shall be made into ties. It not sound, it must be cut into every four feet sufficiently to show the defect. All ties must be smooth and of uniform width and thickness. The specifications further state that all ties must be free from shake, loose knots, rot, score hacks, and bark.

The per cent of the different classes, according to the past season's cut, is approximately as follows:—

Class	Per Cent
Squares,	8.3
Firsts,	35.8
Seconds,	52.7
Drys (made from dead timber),	.6
Culls,	2.6
Total	100.0

Making.

Areas are allotted to the contractors who in turn subdivide them, alloting small areas to subcontractors who are held responsible for the proper utilization on their area. A full crew usually consists of three contractors, about 40 subcontractors, and approximately 100 laborers, most of whom are Mexicans who make their homes in Northern New Mexico. From one-third to one-fourth of the laborers are from the State of Chihuahua, Mexico. These are the most efficient and rapid tie makers, each man averaging about 25 ties per day, while the natives average only 18. A few Picuris Indians have worked at intervals but can not be depended upon for steady labor. An unskilled laborer in this locality receives $1.50 per ten-hour day, without board.

The subcontractor organizes his gang, consisting of from two to five men, and pitches his tent or some simple shelter close to water which may be near his area. The matter of available water has a great bearing on the desirability of any area. It is difficult to get men to make ties in timber that is more than a mile from a spring or stream.

The tie makers or, as they are commonly called, "tie hackers" use the following tools and equipment; one 4 to 4½ pound double-bitted axe and one 12 inch broad-axe to each man, and one 5 to 6 foot cross-cut saw, one steel wedge, one light sledge hammer, one 8-foot measuring pole and a bottle of kerosene (to cut the pitch from the saw) to every two men. These are furnished by the tie makers themselves.

Enough trees for the day's cut are notched by the men, working singly, in such a manner that when they are felled any crooks the trees may contain will be perpendicular to the ground. The object of this is to face the tie so that when finished it will lie flat on the ground. Care is also taken with small trees that their greatest diameter is perpendicular to the ground. This gives the ties the widest possible face and necessitates less scoring. After the trees are notched two men fall them with a cross-cut saw.

Two methods of scoring are employed. In the more prevalent method followed by the native Mexicans the chopper stands on the fallen tree and with the axe cuts into its side at an angle of about 45 degrees at intervals of about six inches. The Chihuahuans, in scoring, stand at the side of the fallen tree and split large slabs from its side until it is nearly the desired size. This method requires more skill on the part of the chopper but is more rapid and leaves no possibility of the score hacks showing after the tie has been faced. The limbs are chopped off as they are reached in scoring.

In facing, the maker stands on top of the tree in all cases and with the broadaxe works the two faces to their desired size and smoothness. The "cant" or faced tree is then bucked into 8-foot lengths with the crosscut saw. The unfaced sides of the larger ties are hewn until they become rectangular, making them into squares. The bark is then peeled from the unfaced sides of the remaining smaller ties. As this requires no skill it is often done by boys or apprentices.

The following prices are paid for making the ties:—

Squares,	$0.14
Drys,	0.12
Firsts,	0.10
Seconds,	0.08

The average price, including the culls for which nothing is paid, is $0.09 per tie. The contractors sublet the making at practically the same prices, expecting to make their profit on the haul from the woods to the river.

In timber averaging three ties per tree, two men, making 40 ties in a ten-hour day, will spend 1¼ hours felling, 3½ hours limbing and scoring, 3 hours facing, 1 hour bucking, 1¼ hours peeling. At this rate the average cost of each operation is as follows:—

Felling, ...	$0.011	per tie
Limbing and Scoring, ...	.032	" "
Facing, ...	.027	" "
Bucking, ...	.009	" "
Peeling, ...	.011	" "
Total, ...	$0.09	" "

One man making 20 ties per day of the average grades earns $1.83 per day. However, loss of time due to getting supplies and inspections and the wear and tear on tools reduces their daily wage to approximately $1.50 per day.

The season in which most of the hewn ties are made is between May first and October first. While the better tie makers prefer to work during the summer, some of the less skillful prefer to work during the winter, because the frozen timber is less liable to sliver, rendering it easier for the less skillful man to make a smooth face on a crooked-grained or knotty tie.

Brush Disposal.

All limbs are lopped from tops which are left in the woods. Large limbs are cut up so that when piled the piles are about four feet high and eight feet across. The piles are placed from ten to fifteen feet from the nearest top, tree, reproduction or other inflammable material, except in extreme cases which would work a hardship on the operators. Such cases are left to the discretion of the Forest Officer in charge of the sale. As a rule each tie maker piles his own brush for which the operators pay him $0.03 per tree, or approximately $0.011 per tie.

Skidding, Hauling and Yarding.

The contractors are desirous of allowing a month or two to elapse between the time the ties are made and the time they are hauled in order to take advantage of the weight lost in drying. In some cases it is possible for the haulers to drive to where the ties lie in the woods and load them directly on their wagons. Where this is impossible skidding is necessary. Skidding is usually done by a man and one horse. A chain about six feet long having three or four grabs about 18 inches apart is used. The grabs are driven into one of the faces near the end of the tie. Two to four ties are skidded at each trip. Where more ties are skidded at one time an extra chain is needed. With the use of an extra chain three ties are skidded in front and two or more trailers are hooked to the rear of these. The number of ties skidded in a day by one man and horse varies greatly with the distance which they are skidded and obstructions, such as underbrush, rocks, steep slopes, and arroyos. A man and horse can skid 500 ties in a ten-hour day on the mesas, which are comparatively level and free from underbrush, or where the skidding distance is short. In the canyons and on the brushy slopes of the Douglas fir type, or where the ties must be skidded 200 yards or more or where they are scattered, one man and a horse can skid but from 150 to 200 ties per day.

The ties are loaded on wagons which have been lengthened enough to permit two tiers of ties to be piled end to end. An average load for a team of the small native horses is about 25 ties. Ordinarily each man requires about one-half hour to load the ties and bind them on the wagon with a chain.

The average haul from the areas at present allotted the contractors to the yards at the river is about two miles, all of which is down grade over comparatively good roads. For this haul they receive $0.09 per tie for all classes. Subcontracts are let at different prices, varying according to the distance the ties must be hauled and the accessibility of the areas. The haulers receive from $0.05 for the shorter hauls to $0.10 for the longer and more difficult ones, with an average of about $0.065 per tie. The haulers are required to construct all but the main trunk roads, many of which are county roads. The number of trips a man and team can make in one day varies from two on the longer hauls, or where skidding is difficult, to four trips on the shorter hauls or where skidding is easy or unnecessary. One man and team can skid and haul an average of 75 ties per day. At this rate he earns about $4.86 per day actual time, but considerable time is lost due to breakdowns and inclement weather which considerably reduces the haulers' average wage.

About fifteen minutes are required for the hauler to unload and pile his load in the yard. In piling, two ties are laid on the ground about five feet apart. About eight ties are placed across these forming the first tier. Other tiers are then laid upon these, the ties of each tier being at right angles to those of the tier below. The piles contain about fifty ties each and are placed two feet apart. The piles are placed as close to the edge of the water as possible, and not more than five piles back from the river, to prevent carrying the ties considerable distances when they are put in the river in the spring.

Each contractor furnishes or rents his own yard. One contractor yarding about 50,000 ties this year paid $50.00 yard rent, or $0.001 per tie. However, as the majority of this year's ties are yarded on rich agricultural land which is under irrigation, this is believed to be slightly above the average annual cost of yarding.

Sawn Ties—Woods to River.

Sawn ties, at present, are being made only from Western Yellow pine and Douglas fir. The entire operation from the felling of the timber to the delivering of the tie at the river is covered by contract with one contractor, who in turn lets subcontracts for the cutting and hauling of the saw-logs to the mill and the hauling of the ties from the mill to the river.

Logging.

The logging does not differ from that of any other small operation in Northern New Mexico.

Felling, Limbing, and Bucking.

These operations are usually covered by a single contract. Only 16-foot logs are cut for which the choppers receive $0.75 per M. feet, Doyle scale.

Skidding and Hauling.

Skidding and hauling are included in one contract. On some of the steep slopes it is necessary to skid as much as an eighth of a mile. The length of haul varies from one-fourth of a mile to three miles. The average haul is about one and one-half miles, for which $3.00 is the average price paid.

Milling Equipment.

The contractor uses a portable mill having a daily capacity of about 10 M. feet B. M. The mill is composed of one 45-horsepower boiler, one 35-horsepower engine (which runs the circular saw, feed and edger), one 6-horse power engine (which runs the cut-off saw), friction feed with cable, edger, and cut-off saw. The cost of this mill is approximately as follows:

Boiler and 2 engines, second hand, ...	$650.00
Mandrel, husk, feed works, carriage and track, new, ...	300.00
Two 60-inch circular saws, new at $100 each,	200.00
One edger, new, ...	250.00
One 30 inch cut-off saw, with attachments, .	35.00
Freight and hauling, ...	100.00
Total, ...	$1,535.00

The mill has been used in this condition for five years, and, with considerable repairing, can probably be used for about five years longer.

Moving Mill.

The mill was moved a distance of six miles and set up in the winter on a trestle work about eight feet above the ground. The rollway is also on trestle work, and because of the small space available for the mill site, contains an angle of nearly 45 degrees. When the ground thawed in the spring the foundation settled, making re-inforcement of the foundation and realignment of the machinery necessary. The water supply failed with the approach of the dry season. In addition to a delay of about a month this necessitated an additional expenditure of about $100.00 for water development.

The angle in the rollway requires the services of an extra man for turning logs, and even then often causes delays. The banking ground for logs is inadequate and it has been necessary to stop logging at times because of the lack of space. The edger is on the opposite side of the carriage track from the saw. The logs used in the trestle work and rollway contain about 20 M. feet, B. M. The trestle work rendered flooring of the mill necessary, and this required 2 M. feet of lumber which would not otherwise have been needed. About 3.5 M. feet B. M. were used in roofing.

The cost of moving and setting up the mill under consideration is estimated at about $600.00, but for the reasons given above, this cost is considered excessive. Another mill of about the same capacity was moved the same distance and set up in this locality for less than $200.00. The contractor expects to be able to cut 4,000 M feet B. M. at this set. This gives a cost of $0.15 per M. feet.

Sawing.

The mill, when running at full capacity employs, in addition to the contractor who is foreman and filer, the following crew:

1 Sawyer,	$4.50 per day
1 Fireman,	2.50 per day
1 Man tailing down	1.75 per day
1 Log turner,	1.75 per day
1 Ratchet setter,	2.25 per day
1 Off-bearer,	1.50 per day
1 Edgeman,	2.00 per day
1 Cut-off man	2.00 per day
1 Roller man	1.50 per day
1 Lumber piler	1.50 per day
1 Man wheeling sawdust	1.50 per day
Total daily wage,	$22.75
Allowing contractor's wages,	4.50
Total pay roll,	$27.25 per day

With an average cut of 10 M. feet per day, the average cost of sawing is $2.72 per M. feet.

Depreciation of Plant.

As it is estimated that the mill will have no wrecking value at the end of five years, it is now worth about one-half of its original cost, or $767.50. An annual cut of 2,000 M. feet would require $153.50 to be charged off annually, or $0.077 per M. feet.

Interest on Investment.

The present value of the mill and the value of tools, belting and equipment aggregates $1,000.00. With an annual cut as above, the interest at 6% would be $60.00, or $0.03 per M. feet.

Taxes, Repairs and Maintenance.

The mill was assessed at $400 or approximately one-third of its valuation by the County Assessor. The taxes at $0.04 per dollar amounted to $16.00 for the year 1912. The outlay for taxes, repairs, files and oil aggregate about $250.00 per year, or $0.13 per M. feet.

Grades and Prices.

At the present time the mill-run averages about 60% ties and 40% side lumber. Side lumber is produced incidental to the squaring of a tie cant and the sawing of ties from the heart-wood. The percentage of ties is low, due to the fact that the company does not accept sawn ties showing any defect or wane.

The lumber is graded in but two arbitrary grades which run 85% No. 1 and 15% shipping culls. The contractor receives $7.50 per M. feet for both grades of sawed lumber piled at the mill. The company is able to dispose of a limited amount of lumber for local consumption at $15.00 per M. feet, B. M., for No. 1 and $8.00 per M. feet for the shipping culls. The remainder will have to be hauled 30 miles over rough roads to the railroad at a cost of $6.50 per M. No further consideration will be made of the side lumber since no data is available as to amount that will be disposed of locally and the amount to be hauled to the railroad, but it is thought that the company makes very little profit on the side lumber.

About 65% of the ties are cut 7 inches by 9 inches, 8 feet long; 25% 7 inches by 8 inches, 8 feet long; 10% 6 inches by 8 inches, 8 feet long. With the above percentages and allowing 24 7x9's, 27 7x8's and 32 6x8's per M. feet, B. M., the average is 25 ties per M. feet. The contractor receives $6.00 per M. feet, B. M. for the ties at the mill, or 24 cents per tie.

The average price received by the contractor for the mill run is:

Side lumber at $7.50 per M. ft, B. M.,	40%,	$3.00
Ties at $6.00 per M. feet, B. M., ...	60%,	3.60
Total, ...		$6.60

Summary of Logging and Milling Costs.

	Costs per M. ft., B. M.
Felling, Limbing and Bucking,	$0.75
Skidding and Hauling,	3.00
Gross Logging Cost,	$3.75
Net Logging Cost, allowing 25% overrun, Doyle scale,	$3.00
Moving Mill,	0.15
Sawing,	2.72
Depreciation on Plant,	0.077
Interest on Investment,	0.03
Taxes, Repairs and Maintenance,	0.13
Total Logging and Milling Cost,	$6.11
Profit,	0.49
Average mill run price received,	$6.60
Per cent of profit,	8.00

Hauling Ties to River.

The contractor is relieved of the side lumber at the mill, but is required to deliver the ties in the yard at the river. For this he receives $0.05 per tie. He sublets the contract to two men at $0.04, making a profit of $0.01 per tie or $0.25 per M. feet, B. M. The haul is all down hill a distance of two miles. The haulers average about three trips per day and haul about 30 ties at each trip. At this rate their wages average $3.60 per day. The men hauling sawn ties earn smaller wages than those hauling hewn ties, but have steady employment.

Hewn and Sawn Ties—Yards to Cars.

Placing in River.

The ties are placed in the river when the spring freshet is at its height. About 200 men were employed for common labor at \$1.50 per day without board, while 30 Mexican patrons received from \$1.75 to \$2.50 per day without board, and 10 Americans received from \$2.50 to \$3.00 per day with board. The head foreman received \$4.50 per day with board.

Forty men with a payroll of \$70.00 placed 22,000 ties in the river in one day. This gives an average of \$0.003 per tie. However, when all things are considered, such as isolated yards, distance of piles from river, depth of water, and current at point where thrown in, it is believed that on the average this cost will be approximately \$0.005 per tie.

Driving.

About \$4,000.00 is spent annually in clearing out the rivers in preparation for the season's drive. Some piles were so placed that the spring freshet carried them away before the drive started. Many of these ties became water-logged and interfered with the driving, causing trouble enough to more than offset what the cost of placing them in the river would have been. The drive proper is quite similar to a log drive in the northeast. On the smaller streams the camp or wongan is moved every few days with a wagon, but on the larger river it follows the men in boats. A few men were put on the drive as soon as the ties were started. The drive proper started with about 150 men and ended with about 15 men, with an average of approximately 65 men, most of whom received their board. About 80 days were required, from the time the ties were first placed in the river until the rear of the drive reached the boom, covered a distance of about 90 miles. This time was required to break jams, keep the ties moving, place stranded ties in the stream, take out dead heads and remove boulders loosened by the ties.

About 6,000 ties became stranded and water-logged but will be picked up next year. A like number of last year's ties were picked up in their place. The following data is based on a drive of 300,000 ties, as the company considers this an average economical drive. Approximately 3,000 ties were broken in the jams and by dynamiting. It is believed that these ties cost the company \$0.28 each at the time they were broken, making a total cost of about \$840.00. During the drive damages caused to ditches and land adjacent to the rivers, for which the company is held responsible, amount to about \$600.00.

The cost of driving may be summarized as follows:

Clearing river,	$4,000.00
10 Americans at $3.00 per day, 80 days,	2,400.00
65 Mexicans at $1.75 per day, 80 days,	7,700.00
Board, 50 men at $0.50 per day, 80 days,	2,000.00
3,000 broken ties at $0.28,	840.00
Damages,	600.00
Dynamite and pike poles,	100.00
Camp equipment,	250.00
Total,	$17,890.00

This makes the average cost of driving $0.06 per tie.

Booming.

The boom is about 800 feet long and is composed of 92 thirty-foot yellow pine logs from 18 to 30 inches in diameter, with an average diameter of about 22 inches. In the case of small logs they are often placed two deep. Two logs are fastened side by side with pieces of cull ties.

Often cull ties are spiked on top of the logs. The pairs of logs are fastened together, end to end about 18 inches apart with large chains passed through the ends of the logs. The logs were hauled by wagon a distance of 10 to 15 miles at a cost of $2.00 per log. The boom is taken out of the river every summer at the close of the loading operations. With such care the boom is replaced about every six years.

Sixteen square cribs hold the boom in place diagonally across the river. Each crib is constructed of about 6 tiers of 16-foot logs about 6 inches in diameter. These are filled with rocks. The construction of each crib required the services of 6 men for about 4 days.

The improvements to be charged off in six years are as follows:

Boom—	
60 M. feet logs at $1.00 per M,	$60.00
Hauling at $2.00 per log,	185.00
Boom chains, 100 at $1.50,	150.00
Cribs	
Logs and hauling,	100.00
Building 16 cribs, 6 men 4 days at $1.75	672.00
Total,	$1,167.00

This makes a charge of about $0.001 per tie on the 1,800,000 ties exploited in the six years.

A canal was dug to a pond about a quarter of a mile below the boom. This provided for the storage of the ties until they could be loaded. The digging of this canal required the work of 20 men for about 25 days, for which they received an average of $1.75 per day, which totaled, ...	$875.00
A levee was built along the canal and around the pond to keep the ties from escaping in case of an overflow, at a cost of	$3,500.00
The construction of an office, bunk house, sheds and other outbuildings aggregated	$3,000.00
Total improvements to be charged off during life of operation, 20 years, ...	$7,375.00

On 6,000,000 ties to be exploited in the 20 years, this gives a per tie cost of about $0.001.

The annual recurring booming charges are as follows:

The services of 10 men and teams for 10 days are required to put the boom into the river at $3.00 per day for team and driver this cost is, ...	$300.00
The cost of pulling the boom out each year with teams aggregates, ...	$400.00
A care-taker is kept at the boom camp the entire year, whose salary is about	$480.00
An average of 5,000 ties pass the boom each year and must be picked up along the river below the boom and hauled to the railroad at a cost of $0.10 per tie, aggregating, ...	$500.00
Total, ...	$1,680.00

This, together with the improvement charges, aggregates $0.008 per tie.

Loading on Cars.

The loading is done with the aid of three endless chain conveyors. A six or seven horsepower gas engine furnishes the power for one, while the other two are run by a 15-horsepower upright boiler and engine. Each conveyor is composed of two endless chains about 50 feet long fastened together 3 feet apart with pieces of 4-inch strap iron.

The following crew, not including men along the canal and on the pond, is used for each conveyor:

Four men in car, one engineer or leverman, 1-2 tie inspectors, four men in water at foot of conveyor.

In a 10-hour day 150 men can load 40 cars. As gondolas are used they hold about 300 firsts or, as they are more commonly loaded, 425 firsts and seconds. Each car contains an average of 190 firsts and 235 seconds. About thirty days are required to load the ties working continually, but a longer time is required as the ties arrive at the boom irregularly. About 7 tons of coal and 200 gallons of fuel oil are reported to run the engines. The value of the loading equipment is so small that the charge per tie is almost negligible.

The loading charges may be summarized as follows:

			Per Tie.
Labor			
150 men at $2.00, loading 17,000 ties			$0.018
Fuel and Oil			
7 tons coal at $6.00, ...	$42.00		
200 gals. fuel oil at $0.15,..	30.00		
		$72.00	
Oil, 10 gals. at $0.40, ...		4.00	
Total, ...		$76.00	0.001
Total Loading Charges			$0.019

It is believed that loss of time and shortage of cars increase this cost to $0.02 per tie.

Supervision.

The woods administrative force consists of one superintendent, one bookkeeper, and one tie inspector, whose salaries aggregate about $5,000.00. Since a part of their duties is to administer the grazing of 1,200 cattle and horses and 4,000 sheep and goats on the company's holdings, as well as to supervise the commissaries operated by the company, all of this sum should not be charged against the company's tie operations. A small ranch is also operated on which a portion of their forage and provisions is grown. For the above reasons it is believed that of the $5,000.00 but $4,000.00 should be directly chargeable to the tie operations.

The expenses of the main office, such as salaries of bookkeeper and stenographer's, stationery and supplies, and office rent amount to $9,000.00. The total annual charges against supervision aggregate $13,000.00, or $0.043 per tie.

Interest on Capital Involved.

The entire 300,000 ties have, at this point, cost the company about $0.33 per average tie. The cost of the annual output is invested for at least six months. The interest on $99,000.00 at 6% for six months is $2,970 or approximately $0.01 per tie.

Stumpage.

The timber from which the hewn ties are made is valued at $2.50 per M. feet B. M. The original agreement between the U. S. Forest Service and the company under which the timber is being cut contained the following clause:

> "Hewn railroad ties without disqualifying defects whose widest diameter inside the bark at the small end exceeds 12 inches will be scaled."

In actual practice it was found that this would not work out satisfactorily to all parties concerned. In the first place it was impossible for the Forest Officer to be on the ground when all ties over 11 inches by 8 inches were squared to these dimensions. The Forest Officer had no way of knowing from what sized log the tie was made. Secondly, such a clause worked a hardship on the company by causing them to pay for material which they could not use. It was more satisfactory to count all ties in number equivalent to 1,000 feet board measure according to size. The squares and faced ties whose largest diameter at the small end was more than 12 inches were counted at 28 per M feet, B. M., while the other faced ties were counted at 32 per M. feet B. M. 3.5 per cent of the faced ties were over 12 inches, and were counted by the Forest Officer at 28 per M. This amount is too small to have any appreciable effect on the stumpage value per tie. At 28 per M. feet B. M., each tie is worth $0.089, while those counted at 32 per M. are valued at $0.078 per tie.

SUMMARY

Cost per Tie F. O. B. Cars at Boom

	HEWN TIES				SAWN TIES*
	Squares	Drys	Firsts	Seconds	
Marking	$0.140	$0.120	$0.100	$0.080	$0.240
Brush Disposal	0.011	0.011	0.011	0.011	.....*
Hauling & Yarding	0.090	0.090	0.090	0.090	0.050
Placing in River	0.005	0.005	0.005	0.005	0.005
Driving	0.060	0.060	0.060	0.060	0.060
Booming	0.008	0.008	0.008	0.008	0.008
Loading on Cars	0.020	0.020	0.020	0.020	0.020
Supervision	0.043	0.043	0.043	0.043	0.043
Interest on Capital	0.010	0.010	0.010	0.010	0.010
Total	$0.387	$0.367	$0.347	$0.327	$0.436
Stumpage	0.089	0.078	0.078	0.078	.....*
Grand Total	$0.476	$0.445	$0.425	$0.405	.....*

Total cost of average hewn tie $0.415.

*Cut on Company's own holdings where they make no disposal of brush and no data is available on stumpage.

FOREST TYPE: A DEFENSE OF LOOSE USAGE.

By E. H. Frothingham.

Almost from the beginning of forestry in America the expression "forest type" has been used by writers in this field, each using it in his own way, and apparently to his own and his readers' perfect satisfaction. This happy state of affairs was not of long life. Questions as to the precise meaning of the term were raised by cautious critics, and strenuous attempts were made to fix a standard definition for "forest type." In consequence, those who have been addicted to the lavish use of the word can hardly avoid a feeling of uncertainty, as of confidence misplaced.

In the "Symposium"* recently conducted by the Society of American Foresters the attempt was apparently made to clear up the existing confusion as to the meaning of "forest type," and to arrive at some standard definition or definitions. Whatever its object, the "Symposium" has not clarified the situation; it might, indeed, be said to have left "confusion worse confounded." When ideas clash, words are often to blame. It is possible, then, that a glance at the word "type" in its ordinary usage will reveal the source of the trouble.

Before proceeding, however, it would be well to review the qualifications that a word must have for technical use. In his comments on "Terms Used in Forestry and Logging,"* Dr. Fernow has proposed a number of standards by which to test the situation of technical terms. All of these apply to the case in hand; but one in particular is of interest here:

> b. Words which are current with well established meanings should not be employed as terms in another sense, especially where it is likely that ambiguity would be introduced by the simultaneous use of the ordinary sense and the term meaning.

Are we not committing this very error when we borrow the word "type" from recognized usage and impress it for service,

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*Proceedings, Society of American Forresters, Vol. VIII, No. 1, pp. 61-104.

*Forestry Quarterly, Vol. 3, No. 3, pp. 255-268.

not in one, but in several different new senses, thus inevitably introducing the ambiguity referred to?

The New Standard Dictionary publishes 13 distinct definitions of "type," of which the following have a direct or remote bearing upon the various uses in forestry which have been proposed for the word:

> Type, n.—3. One of a class or group of objects that embodies the characteristics of the group or class; an example, model, representative, or pattern, as of an age, a school, or a stage of civilization; also a characteristic style or kind; as the blond "*type*" of beauty. 4. *Biol.* (1) Plan of structure; a fundamental structure common to a number of individuals; as, the vertebrate *type.* (2) The ideal representation combining essential characteristics, as of a species, genus, or family; an organism exhibiting the essential characteristics of its group. .... 8. A plan to which proposed work or action should conform; guiding style; specif., in the fine arts, an original object or conception as the subject of copy.

The first of these definitions is one which a person unfamiliar with forest terms would be apt to understand by "forest type," since it is in the sense of "a characteristic style or kind" that the word is most commonly heard in general usage. But the authors of the "Symposium" have used the word in all three of these senses: (1) in the sense of "a characteristic style or kind," to denote a "kind of forest," designated either by the principal species which compose it or by the character of the land it occupies; (2) in the biological sense of "the ideal representation combining essential characteristics," referring not to the essential characteristics of individual trees as "types" of species or genera, but, strangely, *to those of the soil and climate;* and (3) in the sense of a "plan to which proposed work or action should conform," to designate a kind of forest which it is believed desirable to produce.

There are here three distinct meanings of the expression "forest type"—and there are possibly others. To assume that a single technical term can be applied satisfactorily to ideas so distinct and at the same time so closely associated within the bounds of a single science is, of course, absurd. Furthermore, its specific application to anyone of them invalidates it for either of the others; but all of the ideas must find expression, and all involve, in one sense or another, the notion of "type." The solution seems, therefore, to lie in the substitution for the word "forest" of some more specific term, designating the category to which the type belongs.

This has already been done. The three terms *cover type*, *physical type*, and *management type* have recently been proposed, to denote what are in effect the three ideas above mentioned. Of course, however, only one—*cover type*—actually refers to the *existing forest* itself. The others relate to (1) *locality*, and not *existing forest;* (2) *future forest*, and not *existing forest.* It seems clear, therefore, that the expression "forest type" has one and only one logical application, and that in the sense of a "characteristic style or kind" of existing forest. The basis on which the distinction between forest types should rest can not be constant any more than if the words "style" or "kind" were substituted for "type." The term is extremely elastic. It varies with the purpose of the author, but in spite of this, it *can not mislead*, since we expect nothing more from the word "type" than is specifically provided by the author's definition. A "hardwood type" may be, by this definition, nothing more than a kind of forest consisting of hardwoods, but it may also, of course, represent a definite relation of forest and environmental factors if the author makes clear that he is giving it this meaning; similarly, a birch-beech-maple type may be merely a kind of forest consisting of birch, beech and maple, or it may be a climax forest for definite physical conditions. Except for the different degrees of intensity which individual authors may, by definition, give the term, the meaning of "forest type," as of "kind" or "sort" can not be limited without a sacrifice of consistency and precision.

In papers dealing with forestry from the ecological standpoint, it would often be better, therefore, to employ the terms used in ecology. Among ecologists, a forest considered with relation to its total environmental factors would be called a "formation," and as this term is without an equivalent in American forestry there is no reason why it should not be adopted. For use in a general scheme of forest classification it would be most serviceable.

Used to designate "locality" the term "forest type" is totally inconsistent, as has been shown by Barrington Moore.* Mr. Moore's point is that "physical factors are the cause of forest types; hence can not be forest types in themselves."

The "aggregate of physical factors" is often implied in the words "locality" or "site." Like "type," "locality" and "site" should be used in harmony with their common usage, and their intelligibility should not be endangered by special technical meanings. To classify aggregates of physical factors, it would, of course, be perfectly proper to use either "locality" or "site" in connection with "type," just as "forest" is used with "type" to designate kinds of forest. "Habitat" differs from these in that it denotes all environmental factors, both physical and physiological. Compounded either as "habitat type" or "locality type," there would be no danger of confusion with "forest type," and the terms would be self-explanatory.

The above discussion has attempted to show that the term "forest type" is exceedingly useful in silviculture and forest description, so long as it is allowed perfect freedom; that it is elastic and adaptable to modification by different writers to serve any specific purpose, provided this is done in the sense of "kind" or "style" of forest and not otherwise; but that as a general expression in forest terminology any attempt to limit its meaning to a restricted technical sense can result only in ambiguity and destroy to that degree its usefulness.

It may be said in dispute of these points that they amount to a distinction without a difference. If the author may define "type" to suit himself, why may not the profession at large agree on a rigid definition? The answer to this, like the ancient receipt for rabbit stew, is "first catch your agreement." If perfect agreement can be secured, the demands of intelligibility will, of course, be satisfied. Until this is accomplished, however, the word "type," in true proletarian fashion, will refuse to work at the expense of liberty.

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*Proceedings, Soc. of Amer. Foresters, Vol. VIII, No. 1, pp. 73-75.

THE SCOPE OF DENDROLOGY—SOME CORRECTIONS.

By H. de Forest.

A careful consideration of my paper on "The Scope of Dendrology in Forest Botany" appearing in the June number of the Quarterly will not support the conclusion of Dr. Howe that I hold the subject of silvics to be a study of associations of trees alone. The paper states definitely that I consider silvics to cover all ecological investigations of forests, that such investigation is pursued by means of plant-geography and plant-ecology, one part of the latter dealing with the ecological significance of the morphological and physiological characteristics of the plants of a locality, (the part Dr. Howe says I exclude from silvics), and the other part dealing with the local minutiae of vegetation.

Dendrology, I believe, deals with facts concerning the individual tree species that go to make up the forest. Dr. Howe in his appended comment says that this "would include the study of the biological relationships of single trees." It is undoubtedly and obviously true that the facts mentioned are deduced from the study of the biologic relationships of trees. It is not, however, necessarily true that dendrology itself should include this study. In systematic dendrology, for example, students learn certain facts, certain "ear marks" of tree species Dr. Howe calls them, in order to be able to identify species, but they do not in that subject go into the problems of how and why these "ear marks" occur. The latter is recognized as belonging to another part of botany. The case between dendrology and silvics is somewhat similar. Dendrology has arisen in response to needs. The need so far as biologic dendrology is concerned may be stated as the necessity in educating foresters for giving to them early in their course of training a systematized collection of facts concerning the chief biologic characteristics of important species. It is especially needful in forestry education to learn what may be termed metaphorically the numbers and numeration of the subject before engaging in its mathematical processes. Silvics embraces, so to speak, the problems and runs into the higher mathematics.

I must protest against the statement that I have said forest-ecology stops the moment practical considerations enter and silvics begins only when practical considerations are in hand. I stated that "the point of view of silvics is different (from that of forest-ecology) because of its different object. The forest-ecology of the botanists is concerned with adding to the sum total of botanical knowledge. Silvics of the foresters, on the other hand, is concerned with . . . all forest investigations . . . that bear in any way upon the practical questions of forest production." The well known fact that botanical research has the high purpose of adding to the sum total of botanical knowledge while forestry research has the high purpose of furthering the interests of forest production as their main objects is obviously not exclusive of practical activity on the part of botanists, nor entirely, I hope, of activity purely for the sake of knowledge on the part of foresters.

A botanist does, of course, distinguish herbaceous plants in the field by certain "ear marks." In other words he uses a method somewhat similar to that used by foresters with trees and shrubs. Botanists, however, have not as yet developed their "ear marks" for herbs into the definite form that foresters have developed theirs for trees and shrubs. It is a noteworthy fact that leading taxonomists among botanists protest frequently to-day against the unnecessarily difficult taxonomic schemes given in many manuals schemes derived mainly from herbarium specimens rather than fresh material, and often involving characters that appear in nature only several months apart. The "complete taxonomic scheme" of botany mentioned in my paper involves, it is well known, the recognition of the different orders found along the three main lines of advancement from primitive to highly specialized characters, with the various families belonging to each, the connecting thread to-day being genetic relationship. Further, the characters there considered are largely floral. As much of this as the prospective forestry student needs belongs, I think, to his botanical study proper. Systematic dendrology, as my paper states, does not deal with most of this material but only with such characteristics as are of service in field identification. I fail to see why the recognition of the difference between this important work of botanical taxonomy and the work of systematic dendrology, serving two different purposes, constitutes a hair-splitting between the "scientific" and the "practical."

The expression "sister sciences of plant-geography and plant-ecology," used in my paper was employed in the sense common throughout English literature as a metaphorical equivalent for "closely related." It indicates no exact family relationship.

I do not believe Dr. Howe's remarks on plant-geography and plant-ecology are abreast with the best later developments of these subjects. As certain botanical journals have expressed an intention to review this aspect of the paper discussion here is unnecessary.

Since its publication the paper has been read at my request by several American botanists who tell me, without exception that they not only find it clear but also do not get from it any such impression as Dr. Howe appears to have been given.

[The Editor has reluctantly given additional space to this academic discussion in order to satisfy the author's sense of injury by Dr. Howe's criticism. He must, however, protest that there is still perversion in the definitions of the author, if the originators of terms have any right to give them their meaning.

The combination "biological dendrology" was for the first time used by the Editor (so far as he knows) in making out a curriculum for the forestry courses at Cornell University, and he knew perfectly well what he meant, namely, *not* "the chief biologic characteristics of important species" as the author proposes to define, but a statement of the general biological laws to which trees of any species are submitted in their development. On the other hand, it was Dr. Gifford as Assistant Professor at Cornell, who invented the term silvics, really as a mere shortening of the phrase "silvicultural characteristics (i. e. part of the biology) of important species,"—precisely what the author proposes to make the definition of the broader subject of biological dendrology.

As this definition suggests, silvics has, indeed, a practical object —silviculture—in view. It does not, however, deal with problems but with facts or observations. The problems begin only when silviculture is to be practised, namely, how to apply these observations or facts.

This much was needful to add in view of the committee work on terminology by the Society of American Foresters.]

COST OF GROWING TIMBER ON THE PACIFIC COAST.

By H. R. McMillan.

Professor Kirkland of the University of Washington Forest School addressed the British Columbia Forest Club on the cost of growing timber in the Pacific North West. The discussion was based on the crop which can be produced on second quality soil, valued at not more than $5.00 per acre. It is estimated that there are 10,000,000 to 15,000,000 acres at least of this soil type in the Vancouver and Vancouver Island Forest Districts.

The yield according to Munger's yield tables is estimated to be 100,000 feet per acre in 100 years on Site 1; 65,000 feet per acre in one hundred years on Site 2; 35,000 feet per acre in one hundred years on Site 3.

The costs which will enter into the production of timber are:—

1. The interest on the cost of land—This cost would not be felt directly by the Government of the Province or State, but would bear heavily on the private owner who has purchased land.

2. Cost of reforestation—This will vary from zero (?) to $12.00 per acre. The average for the regions discussed was considered to be $5.00.

3. Interest compounded on cost of reforestation.

4. Cost of administration at 20 cents per acre per year. This cost appears high, the United States Forest Service is calculated as spending 2 cents per acre per year. But it must be remembered that in this calculation barren areas are eliminated. The cost of administration on the National Forests now is about 10 cents per acre for the forest areas actually effected by administration.

5. Compound interest on the cost of administration.

6. Taxes.

7. Interest compounded on taxes.

On this type of soil at the end of sixty years it is estimated that the yield in Douglas Fir will be 52 M feet per acre.

The cost per M feet of growing it under a sixty year rotation is:—

1. At 3%, the Federal Government Interest rate $3.54
2. " 4%, the Provincial or State Government rate 6.16
3. " 4½%, the Municipality rate 8.42
4. " 5%, the interest rate paid by the large owner 9.37
5. " 6%, the interest rate paid by the moderate sized corporation 15.21
6. " 7%, the interest rate paid by small corporation or individual 25.77

The deduction to be made from this table is that the growing of timber is a function to be performed by Federal, Provincial or State Governments and Municipalities. The policy of Canadian Governments in reserving timber lands is thus economically sound.

The interest rates quoted are interest rates ruling in the Northwestern States. There is not in Canada the same difference in interest rates paid by Dominion and Provincial Governments as exists between rates paid by the Federal and State Governments in the States. The Province will not be at such a disadvantage in growing timber as appears in the comparison quoted.

The large owner is not entirely out of court. Stumpage value of White pine is now over $16.00 per M in Eastern Canada. It is reasonable to expect that stumpage in the West will eventually reach this point. The large owner who can borrow money at 5% will then be able to grow timber at a profit.

Another interesting deduction is the effect of taxation on forestry by private owners. Professor Kirkland pointed out that the taxation rate is now claimed to be the chief obstacle to the growing of timber by private owners. He disagreed with this objection, holding that the interest rate paid by private owners was an even greater obstacle.

Where the rate of interest is 5%, and taxes the present average in the Pacific Northwest, 1½ cents per thousand feet annually, the tax, with interest on taxes, is only 15 per cent of the cost of growing timber on a rotation of sixty years, while other interest charges are 75 per cent of the total cost. Where the interest rate is 6 per cent the proportions become 11 per cent and 81 per cent respectively, and where the interest rate is 7 per cent the proportions are 9 per cent and 86 per cent. Clearly the rate of interest is a much more important factor than is taxation in determining whether the Government or the individual will grow the forests.

The argument outlined above does not apply to the woodlot owner as it does to the private owner of large tracts of timber land. The woodlot owner is freed from considering many costs which vitally affect large owners, labor, interest in the land cost, cost of restocking, and frequently taxes.

COST OF GROWING TIMBER ON QUALITY II FOREST SOIL.

Items	Federal Govt.	State	Municipality	Large Owner	Moderate Sized Corporation	Small Corporation & Individual
Estimated interest rate........	3%	4%	4½%	5%	6%	7%
Compound interest on soil value 60 years....................	$24.46	$47.50	$69.64	$93.39	$159.95	$289.24
Cost of stocking with young trees	5.00	5.00	5.00	5.00	5.00	5.00
Compound interest on cost of stocking	24.46	47.50	69.64	93.39	159.95	289.24
Sum of annual charges for administration and protection for 60 yrs.	12.00	12.00	12.00	12.00	12.00	12.00
Compound interest on all amounts spent on administration and protection from the time incurred to the time of cutting	20.61	35.60	45.90	58.71	94.62	150.71
Taxes under general property tax				28.66	28.66	28.66
Interest on taxes..............				45.42	53.23	76.52
Yield tax 25%................	26.64	49.34	67.39			
Total per acre................	113.17	196.95	269.57	336.57	513.41	851.37
Total per M on basis of 52M per acre in 60 years.........	3.54	6.16	8.42	9.37	15.21	25.77

CURRENT LITERATURE.

The Trent Watershed Survey. By C. D. Howe and J. H. White, with introductory discussion by B. E. Fernow. Commission of Conservation. Ottawa 1913. P. 156.

This report issued by the Canadian Commission on Conservation after a careful field study of a mismanaged forest area in Ontario is quite the most valuable publication on forestry which has yet appeared in Canada.

It throws the spotlight on the results inevitably following the mismanagement of forests in Eastern Canada.

The area described is typical of the greatest forest region of Canada, the Archaean formation characteristic of the permanent timberlands throughout Canada east of Lake Winnipeg, and even west of Lake Winnipeg, north of the prairies. What is true of the 2100 square miles of the Trent valley in Old Ontario is true of hundreds of thousands of square miles in New Ontario, Quebec, New Brunswick and Nova Scotia where the forest, the only possible crop, has been left to manage itself.

The Trent Valley was originally heavily forested, two-thirds pine, chiefly white, and one-third hardwoods, beech and maple. Lumbering under the licence system began in 1840, reached the maximum cut of 160 million feet per year in 1872 and dwindled to 18,000,000 feet pine, 24,000,000 feet hardwoods in 1911. The pine will be cut out in five years.

The forest was milked. The total cut of timber and total revenue received is not shown; whatever the revenue may have been none of it was used to perpetuate the forest. No expenditure was made, no care was taken to protect logged over lands from fire or to encourage another crop of timber, even though the Government was informed that the land was non-agricultural. The results of this policy as already apparent, are shown in the report, both generally for the region and in detail for each township. A similar policy of destructive lumbering and neglect of logged over lands by governments is still in force in many extensive regions in Canada; therefore the conditions disclosed by this survey merit special study.

The whole pinery has been burned over once and in many places several times. Where originally one million acres of pine stood there are now 560,000 acres of poplar and birch, 300,000 acres of cordwood and 90,000 acres of moderately culled timber. There has not been, and is not now any fire protection except in the few square miles of remaining licenses and there is no attempt to encourage and protect the natural reproduction of the extremely valuable White pine. On the average 14,000 acres are burned over annually. Fires in 1913, since the completion of the survey covered 175,000 acres and did damage estimated at $300,000. When it escapes fire White pine reproduces readily and vigorously except in repeatedly burned areas. In this district $12,000,000 worth of White pine reproduction has been destroyed by fire. The destruction goes on at the rate of $250,000 per year and not one attempt is made to prevent it.

A most important feature of this report, especially for Ontario, is the clear manner in which the value of White pine reproduction is shown.

Another serious loss to the Province has been the expensive agricultural experiment carried on, an expense which can be measured only in human blood and tears. The logged over lands though known to be non-agricultural were opened to settlement fifty years ago, and settled by the same hardy timber following folk who settled the most of Eastern Canada. The report deals exhaustively with subsequent conditions. The thin soil scattered amongst boulders and rock ridges has refused to raise any crop but timber. In half a century ten per cent of the area has been cleared and the population of 2100 square miles has risen to 15,000 people. Only about two per cent of the whole area is cultivated. The settlers now in the country realize that the land was never meant for agriculture. The population has declined fifteen per cent in ten years; in 1912, 194 farms were to be sold for taxes averaging 18c per acre. Social conditions are unsatisfactory.

Recommendations for the future management of the territory are included in the report. The district though now unproductive because of lack of fire protection, is estimated to be capable of producing 100 million feet of timber and pulpwood annually, equal to an annual business of $5,000,000 to $6,000,000. With this timber yield will come new industries and the area now in waste, may be made to produce by fire protection alone $2.00 per acre per year in perpetuity. There is now sufficient merchantable timber on the ground to meet the cost of administration.

This report reduces to definite terms the condition which is known by foresters to be true now, or becoming true, throughout extensive forest regions in Canada. It could not be more clearly shown that the failure of the Canadian people to protect forest lands from fire, to restrict agricultural settlements to agricultural lands, is leading in a large degree to the destruction of our forest resource and the reduction of our agricultural resource.

The chief cause of delay in organizing fully equipped forest services in Eastern Canada may be the fear that such services will cost money which is needed for other apparently more pressing government expenditures. This study shows how a great forest reserve will quickly pay for itself by the protection of valuable young stands from fire, by the encouragement of new industries in now barren districts, by the protection of the public timber from trespass and the collection of the full public revenue.

H. R. McM.

Woodlot Forestry. By R. Rosenbluth. Conservation Commission. State of New York, 1913. 104 pp.

The literature devoted to the woodlot laid down in the great mass of articles, bulletins and other published material has been exceptionally meager in application up to the present date.

The latest available statistics show that out of a total forest area of 545 million acres in this country at least 202 million are included in woodlots or in remaining portions of the original virgin forest which in character of ownership, products, etc. may be classed as such. Surely this is going to play an important part in the production of our future wood supplies, and therefore the proper care, maintenance and utilization of our woodlot areas are of great economic interest. It is therefore with pleasure that we welcome this latest contribution to the professional literature of the forestry profession. Many of our states have added valuable contributions to the only too limited knowledge of certain technical as well as general phases of forest distribution, growth, forest utilization and protection.

Mr. Rosenbluth's bulletin entitled woodlot forestry, admirably fills the need for a complete up-to-date manual as well as treatise for woodlot owners not only in New York State but in a good portion of the northeastern section of the country. It also serves as an excellent model for investigations of similar nature in the woodlot regions. Much of the subject is generally known and understood by foresters, it is intended presumably for the use of owners of woodlots, estates, and small timber tracts and is expressed in simple, direct and readily understood phraseology. And in this very particular lies the great strength, value and usefulness of the publication. Naturally very little claim may be laid to originality and investigative research. As stated in the acknowledgments much of the material has been suggested and contributed by others. However, Mr. Rosenbluth's extensive experience over the State of New York in various associated lines of work have been of great assistance to him in collecting and collaborating the material embodied in it.

On page 7 it is stated that there are over 4,436,000 acres in woodlots in the state and 2,750,000 acres of unimproved land. This latter, presumably may be classed as abandoned pastures, waste land, etc. and therefore belonging in the same class as the woodlot for general forestry purposes. It is unfortunate that the planting up of waste lands has not received more attention in the bulletin, in as much as according to these figures one-third of the farm areas are not used for purely agricultural purposes.

On the whole too much space is devoted to elaborating the principles involved in woodlot management and too little to the actual application of these principles. It is a well accepted fact that woodlot owners do not often get the full market value of their forest products and the bulletin would be of much greater usefulness had there been more discussion of the practicability and methods of utilizing the products of the woodlot both to assist in perpetuating the timber supply and to benefit the woodlot owners. The space given to utilization is excellent, however, as far as it goes inasmuch as it gives at least approximate prices paid for the principal woodlot products and shows how they can be marketed to advantage.

The illustrations and drawings are unusually well selected and convey at once to the layman reader their illustrative purpose.

Altogether it is a most commendable contribution to our literature and it has shown the results of painstaking effort on the part of one who has familiarized himself on the subject.

N. C. B.

Silvical Characteristics of Canadian Trees. Compiled by Foresters' Club, University of Toronto. 1914. P. 63.

The members of the classes of 1913 and 1914, Faculty of Forestry, University of Toronto, Canada, have recently put out a publication entitled, "Silvical Characteristics of Canadian Trees." Fifty-six species in all are discussed. The silvical characteristics taken up are the size, growth, root system, crown, tolerance, wood, reproduction, range, soil, and association of each species. In addition, under a heading entitled "General," the commercial importance, technical features, supply, common enemies, and management recommended, are given some attention. The silvical characteristics are first taken up by descriptive words, or short concrete expressions or sentences under each heading. Then on a table they are shown in a comparative form by giving to each silvical characteristic heading three grades represented by numbers. Thus under the heading "Growth" species of slow growth are designated by the figure 1, of medium growth by the figure 2, and of rapid growth by the figure 3. Under the heading "Tolerance," the same figures represent intolerant, medium, and tolerant trees respectively, etc.

The conception of the publication is good in that it attempts to bring together in concrete form for easy reference the main silvical facts in regard to these species. The publication is a compilation of data from various sources and similar to much other compilation work, it impresses the reader as not being entirely a finished product. This is without doubt due to a lack of knowledge of some of the species, to a lack of published knowledge of some of the others, but it appears to be due also almost unquestionably to not consulting carefully all available sources of data. Some contradictions appear in the publication and it is certain that a few of the statements will not stand the test of very careful weighing. Thus Elms in general are given as "tolerant" but each of the species as "intolerant."

Nevertheless, the faults do not destroy the value of the work as a whole and it is quite commendable for a students' publication.

C. R. T.

A Study of the Growth and Yield of Douglas Fir on Various Soil Qualities in Western Washington and Oregon. By E. J. Hanslick.

Mr. E. J. Hanzlik's manuscript report of 40 pages dated March 14, 1912, is of keen interest to all foresters, and hence receives here a very full review.

The report covers a series of seven studies:

(1) Yield tables for Douglas fir stands.
(2) Mean annual growth and the rotation.
(3) Site qualities of Washington and Oregon.
(4) Influence of aspect upon the density and growth of Douglas fir.
(5) Influence of density of stocking on growth and volume.
(6) Comparison of yield on bench and bottom lands.
(7) Methods of determining site qualities of Douglas fir stands.

1. *Yield Tables.* The study was carried on in about thirty-five different localities, west of the Cascade Mountains into the Coast Range in Oregon, from the Canadian Line on the north to Cottage Grove, Oregon, on the south. The altitude of the territory covered varies from about 200 feet along the coast to about 2500 feet in the Cascade Mountains.

This study aimed to include all types and qualities of stands of Douglas fir, providing they were even-aged, pure and fully stocked and under 140 years of age. Care was exercised especially in getting fully stocked stands, so as to obtain data which would approach closely to that which there is reason to believe will be obtained when Douglas fir is placed under a definite system of management. For that reason, the yield shown, in the tables is higher than is attained now in the average run of Douglas fir in its present state of growth.

The yield tables in this report indicate the average yield for each quality and not the maximum yield which can be obtained under very favorable conditions. Therefore these tables are very conservative on the whole and can be safely used after the conditions and quality of the site have been determined. In applying the tables, it is very important that the quality of site be known, and in many cases this is a difficult matter to decide easily. Therefore, in study No. 7 there is a discussion concerning the question as to the determining factors.

The data for these tables was secured by the method of stand measurements, consisting of ascertaining the size and number of trees per acre in even-aged stands of various ages. About sixty-one tracts, ranging in age from 24 to 137 years, were measured, in each of which from five to thirty-three sample plots, in size from one-sixteenth to one acre, aggregating 598 in all, were examined. The diameter of each tree on the plot and the heights of a few of them were measured and the data systematically tallied.

The tables were derived by applying volume tables found in Forest Service Circular 175 "The Growth and Management of Douglas Fir in the Pacific Northwest" by T. T. Munger, to the actual sample plots measured in stands of various ages, and the results read from evened-off curves. The yield in cubic feet includes the contents of the whole stem of all trees; that in board feet includes only the merchantable contents of the trees which are 12 inches or more in diameter breast high.

TABLE I.

Average Yield for Virgin Even-aged Stands of Douglas Fir on *Quality I* Soils.

Western Washington and Oregon.

Read from curves.

Based on 219.7 acres (205 sample plots).

Age	ALL TREES. Number of trees per acre	Basal area	D. B. H. of Average tree	Height of average tree	Yield per acre	Average Annual growth per acre in each decade	Mean annual growth per acre	MERCHANTABLE TREES (12 inches or more in D. B. H.) Number of trees per acre	Basal area	D.B.H. of average tree	Height of average tree	Yield per acre	Yield per acre	Average Annual growth per acre in each decade	Mean annual growth per acre	Age
Yrs.		Sq.Ft.	Inches	Feet	Cubic Feet				Sq.Ft.	Inches	Feet	Cu.Ft.	Feet B. M.			Yrs.
20	940	124	5.0	36.0	2,100		105									20
30	625	162	6.9	61.0	4,000	190	133	36	36	13.6	78.0	1,200				30
40	383	190	9.6	83.5	6,750	275	169	84	96	14.5	98.0	4,000	16,500		413	40
50	275	216	12.0	102.0	9,050	230	181	118	159	15.7	115.0	7,500	30,000	1,350	600	50
60	220	241	14.2	117.0	19,800	175	179	125	199	17.1	126.5	9,500	44,000	1,400	734	60
70	190	268	16.1	129.0	12,500	170	178	128	241	18.6	136.0	11,500	56,500	1,250	807	70
80	171	294	17.7	139.0	14,200	170	176	125	265	19.7	144.0	13,500	70,000	1,350	875	80
90	152	317	19.6	147.5	15,900	170	176	122	299	21.1	152.0	15,400	85,000	1,500	945	90
100	136	337	21.3	155.5	17,600	170	175	117	320	22.4	159.0	16,900	100,000	1,500	1,000	100
110	122	354	23.1	163.0	19,200	160	174	111	340	23.7	165.5	18,400	111,500	1,150	1,013	110
120	112	369	24.6	170.0	20,700	150	172	105	358	25.0	172.0	19,850	120,500	900	1,003	120
130	105	383	25.9	177.0	22,100	140	170	98	370	26.3	178.5	21,250	128,000	750	985	130
140	100	396	27.0	184.0	23,400	130	167	93	386	27.6	184.5	22,700	135,000	700	965	140

Note—Yield in cubic feet includes the contents of the whole stem of all the trees.

Yield in board feet includes only merchantable contents of trees 12 inches and more in D. B. H., taken to a top diameter of 8 inches inside the bark.

TABLE 2

Average Yield for Virgin Even-aged Stands of Douglas Fir on *Quality II* Soils.

Western Washington and Oregon

Read from curves.

Based on 125.6 acres (176 sample plots).

	ALL TREES.							MERCHANTABLE TREES (12 inches or more in D. B. H.)								
Age	Number of trees per acre	Basal area	D. B. H. of Average tree	Height of average tree	Yield per acre	Average Annual growth per acre in each decade	Mean annual growth per acre	No. of trees per acre	Basal area	D. B. H. of average tree	Height of average tree	Yield per acre	Yield per acre	Average Annual growth per acre in each decade	Mean annual growth per acre	Age
Yrs.		Sq.Ft.	Inches	Feet	Cubic Feet				Sq.Ft.	Inches	Feet	Cu.Ft.		Feet B. M.		Yrs.
20	940	94	4.3	31.0	1,730		87									20
30	625	132	6.3	54.5	3,230	150	118	24	22	12.9	78.0	600				30
40	425	163	8.4	76.5	5,450	222	136	88	89	13.5	96.0	3,350	12,000		300	40
50	312	190	10.6	90.5	7,370	192	147	110	134	14.8	107.0	5,550	21,500	950	430	50
60	250	213	12.5	100.0	8,850	148	147	120	169	16.2	115.0	7,350	32,000	1,150	534	60
70	223	235	13.9	108.0	10,000	115	143	122	197	17.5	122.0	8,850	41,500	950	593	70
80	210	256	15.0	114.0	11,150	115	139	118	221	18.6	129.0	10,200	50,000	850	625	80
90	203	276	15.8	120.0	12,250	110	136	117	242	19.6	135.0	11,450	58,000	800	640	90
100	198	292	16.4	126.0	13,400	115	134	116	260	20.3	141.5	12,600	66,000	800	660	100
110	196	305	16.9	132.0	14,500	115	132	115	278	21.0	148.5	13,650	74,000	800	673	110
120	194	316	17.3	137.5	15,650	110	130	114	292	21.7	155.0	14,500	81,000	700	673	120
130	192	325	17.6	143.0	16,650	100	128	113	307	22.3	161.0	15,300	86,500	550	665	130
140	190	334	18.0	148.0	17,500	85	125	112	322	23.0	166.0	16,100	91,500	500	653	140

Note—Yield in cubic feet includes the contents of the whole stem of all the trees.

Yield in board feet includes only merchantable contents of trees 12 inches and more in D. B. H., taken to a top diameter of 8 inches inside the bark.

TABLE 3

Average Yield for Virgin Even-aged Stan ds of Douglas Fir on *Quality III* Soils

Western Washington and Oregon

Read from curves.

Based on 100.0 acres (127 sample plots)

	ALL TREES.							MERCHANTABLE TREES (12 inches or more in D. B. H.)								
Age	Number of trees per acre	Basal area	D. B. H. of Average tree	Height of average tree	Yield per acre	Average Annual growth per acre in each decade	Mean annual growth per acre	No. of trees per acre	Basal area	D. B. H. of average tree	Height of average tree	Yield per acre	Yield per acre	Average Annual growth per acre in each decade	Mean annual growth per acre	Age
Yrs.		Sq.Ft.	Inches	Feet	Cubic Feet				Sq.Ft.	Inches	Feet	Cu.Ft.	Feet B. M.			Yrs.
20		79			1,320		66									20
30	1,630	109	3.5	44.0	2,500	118	83									30
40	775	134	5.6	59.0	4,200	170	105	14	12	12.5	85.0	350				40
50	515	157	7.5	70.0	5,650	145	113	65	63	13.5	94.0	2,500	9,500		190	50
60	362	178	9.5	79.0	6,700	105	112	93	108	15.0	103.5	4,350	16,500	700	275	60
70	286	196	11.1	86.0	7,650	95	109	96	144	16.6	112.0	6,000	25,500	900	364	70
80	253	211	12.4	92.5	8,570	92	109	98	171	17.9	120.0	7,400	34,000	850	425	80
90	238	225	13.2	99.0	9,520	95	106	100	196	19.0	128.0	8,600	42,000	800	467	90
100	233	237	13.6	105.0	10,350	83	103	101	213	19.8	135.0	9,600	49,000	700	490	100
110	228	246	14.0	111.0	11,100	75	101	100	226	20.4	140.0	10,500	55,500	650	505	110
120	224	254	14.4	116.5	11,750	65	98	99	236	20.9	148.0	11,250	60,500	500	504	120
130	219	261	14.8	122.0	12,250	50	94	97	244	21.4	154.0	11,950	64,500	400	496	130
140	214	267	15.1	127.5	12,700	45	92	96	251	21.8	159.0	12.600	67,500	300	482	142

Note—Yield in cubic feet includes the contents of the whole stem of all the trees.
Yield in board feet includes only merchantable contents of trees 12 inches and more in D. B. H., taken to a top diameter of 8 inches inside the bark.

TABLE 4.

Average Yield for Even-aged Stands of Douglas Fir on *all Quality* Soils,

For Western Washington and Oregon

Read from curves

Based on 445.3 acres (598 sample plots).

Age	Number of trees per acre	Total basal area	D. B. H. of average tree	Height of average tree	Yield per acre	Average annual growth per acre in each decade	Mean annual growth per acre	Yield per acre	Average annual growth per acre in each decade	Mean annual growth per acre	Age
Yrs.		Sq. Ft.	Inches	Feet	Cu. Ft.	Cu. Ft.	Cu. Ft.	Ft. B. M.	Ft. B. M.	Ft. B. M.	Yrs.
20	940	94	4.3	31.0	1,730		86				20
30	625	132	6.3	53.5	3,230	150	118				30
40	420	163	8.5	75.5	5,450	222	136	13,000		325	40
50	325	188	10.3	90.0	7,370	192	147	22,500	950	450	50
60	270	209	11.9	100.0	8,730	136	145	32,000	950	542	60
70	237	228	13.3	108.5	9,900	117	141	41,000	900	579	70
80	215	247	14.5	117.0	11,100	120	139	50,000	900	618	80
90	198	265	15.7	126.0	12,300	120	137	59,500	950	659	90
100	184	280	16.7	133.0	13,500	120	135	69,750	1,025	695	100
110	169	293	17.8	141.5	14,700	120	134	79,500	975	723	110
120	158	305	18.8	149.0	15,850	115	132	88,000	850	733	120
130	152	315	19.5	156.0	16,900	105	129	94,500	650	727	130
140	150	324	19.9	163.0	17,850	95	125	100,000	550	714	140

Note—Yield in cubic feet includes the contents of the whole stem of all the trees.

Yield in board feet includes only merchantable contents of trees 12 inches and more in D. B. H., taken to a top diameter of 8 inches inside the bark.

The following table (No. 5) gives the approximate time in years required to produce different wood crops according to the different qualities of site in western Washington and Oregon.

TABLE No. 5.

Approximate time required to produce different wood crops.

Site Quality	For all trees Posts Aver. Diam. 6″ Years	Pulp wood fuel, props average Diam. 8″ Years	Ties Aver. Diam. 11″ Years	For trees 12″ or more D. B. H. Poles & Pile Average Diameter 14″ Years	Saw Timber Average Diam. 18″ Years
I	25	35	45	60	65
II	30	40	55	70	75
III	40	50	70	110	85

Note—In the saw timber column the average diameter is taken as the diameter of the average tree of all the trees 12 inches or more in D. B. H.

2. *The Mean Annual Growth and the Rotation.* The mean annual growth of Douglas fir varies considerably for each quality.

On the Quality I sites, the mean annual growth ranges from 413 feet B. M. per acre at 40 years of age to 1,013 feet B. M. at 110 years of age. At this latter period the growth culminates, decreasing therefrom to 965 feet at 140 years.

In cubic volume, the maximum volume production is attained at the age of 50 years, at the rate of 181 cubic feet per year. The decline in the mean annual growth is very slow, decreasing only a few feet each year, so that at 100 years the rate of growth is only 6 cubic feet a year less than at 50 years. Therefore for a stand which is to be managed on a cubic volume rotation, such as for cordwood, pulp wood, etc., it is seen that a rotation of from 50 to 70 years might be best, depending much upon the quality of the product desired.

For Quality II soils, the mean annual growth in board measure varies from 300 feet per acre at 40 years to 673 feet at 110 and 120 years. After this period the growth decreases gradually to 653 feet at 140 years. For this quality, it is recommended that, silviculturally, a rotation of 110 years be used, with a mean annual growth of 673 board feet per acre, making a total stand per acre of 74,000 board feet.

For a cubic volume rotation, the culmination of the mean annual growth is at the age of 55 years, at which period the growth is 147 cubic feet a year. After this age, the decline is very gradual, allowing a rotation of from 50 to 60 or 70 years, according to the quality of the products desired.

On Quality III sites, the mean annual growth in board feet culminates at the age of 115 years, giving a growth of 505 board feet per year, making a stand per acre of 58,000 feet B. M. This period may be considered as the silvicultural rotation of Douglas fir stands on the poorest quality of soils.

Taking the cubic volume, the mean annual growth culminates at the age of 50 years, with a rate of growth of 113 cubic feet a year. The decrease is gradual from this period, making a rotation of from 50 to 60 or 70 years possible.

In the following table (No. 6) is given the length of rotation, the mean annual growth, the stand per acre, for the different soil qualities.

TABLE No. 6.

Table showing the silvicultural rotation for cubic volume and board volume production for three qualities.

	CUBIC VOLUME			BOARD VOLUME		
Quality	Rotation Years	Yield Cu. Ft.	Mean An. Growth Cu. Ft.	Rotation Years	Yield ft. B. M.	Mean An. Growth ft. B. M.
I	52	9,050	181	110	100M	1,000
II	55	8,110	147	110	74M	673
III	52	5,650	113	115	58M	505

3. *A Study of the Site Qualities of Washington and Oregon.* In this discussion an attempt is made to classify the soils of Oregon and Washington into different site qualities on the basis of the cubic volume of Douglas fir stands.

In summing up the question of sites, the following conclusions are reached:

1. In the State of Washington about one-half the Quality I sites will be placed under cultivation for agricultural crops; in Oregon much of this quality is absolute forest land.

2. The Quality III sites in both states will always remain as true forest land.

3. The Quality II sites both in Washington and Oregon will only in part be turned over to the raising of agricultural crops.

4. The better qualities are for the most part a medium to deep loamy soil, with a mixture of sand or gravel.

5. The poorer qualities occur upon soils, for the most part, either a shallow or very shallow sand with a rock subsoil, with much outcropping rock.

6. The best quality sites in Washington occur below 1000 feet elevation; in Oregon below 1700 feet; both in the region of greatest precipitation and most even temperature.

7. The poor quality sites occur above 1200 feet in Washington; in Oregon no doubt at much higher elevations.

8. The medium or second quality sites are found at intermediate elevations between the best and the poorest qualities.

9. Douglas fir is found mainly in pure stands either on bench or slope lands which are well drained, while the poorer drained bottom land stands contain a mixture of Hemlock and Cedar with the Fir.

4. *The Influence of Aspect upon the Density and Growth of Douglas Fir.* In general it has been noted that stands with certain aspects appear to be either more or less densely stocked than similar stands situated on different aspects. The study shows that this is actually the case, and not only is the density of the stand affected, but also that the cubic volume, the board-foot volume, the basal area, and the diameter growth are affected.

1. A south exposure bears the densest stocked stands; a north exposure bears the least densely stocked stands.

2. The trees on a north exposure have a greater diameter growth, and the growth in cubic feet and board foot volume exceeds that of other exposures.

3. The trees on a south slope, having a smaller diameter give a larger basal area in square feet than those on other exposures.

5. *Influence of Density of Stocking on Growth and Volume.* In order to attain the maximum yield in board measure, it is desirable to thin out most of the smaller, suppressed trees and thus give the larger ones a chance to attain the best development possible under the conditions.

Mr. Hanzlik illustrates this with two otherwise similar tracts located in the Coast Range. Both are on Quality I sites and show a maximum of cubic volume production. The tracts are, however, at different elevations. The Glenada tract contains a very dense stand of trees while the Saddle Mountain tract seems to be about normally stocked, though somewhat below the average stocking for that age. The figures shown are for the average of ten sample acre plots in each case.

TABLE No. 7.

Effect of Density on Yield.

Tract	FOR ALL TREES.				FOR TREES 12" OR MORE IN D. B. H.				
	Total Number of trees per acre	D. B. H. average tree	Total basal Area in sq. ft.	Total yield cubic feet	Number trees	D. B. H. of average tree	Basal area in square feet	Yield Cubic feet	Yield in board feet
Glenada 39 years.........	510	9.0	225.7	7503	75	13.7	76.9	2800	9,726
Saddle Mt. 38 years......	281	10.7	175.4	6477	90	14.7	106.0	3929	20,661

From this table it is evident that a densely stocked stand has a backward effect upon the growth of the individual tree, as there is no other factor which might have had influence upon the tree growth.

The most noticeable effect of the overstocking is that the Saddle tract with nearly 50% less trees per acre than Glenada nevertheless has a larger average D. B. H. and only 13.6% less yield in cubic feet. Still more favorable to Saddle is the comparison of trees 12 inches D. B. H. and over, for Saddle has 90 trees, Glenada only 75 and the cubic volume of these stems in Saddle is 29% greater than in Glenada; the board foot volume 42% higher. This is because on the Glenada tract only about 15% of the trees are 12 inches or over, D. B. H. while on the Saddle tract 32% are of merchantable size.

Accordingly, density is a prime factor in the development of Douglas fir stands, especially where the largest quantities of saw timber are desired at the earliest possible time.

In agreement with the Austrian experiments by Bohdannecky and Schiffel, and the Russian plantations of Douglas fir by Dr. Schwappach, Mr. Hanzlik reaches the following conclusions in regard to the present stocking of Douglas fir stands in western Washington and Oregon:—

1. The immature stands contain from 25-50% too many stems. Heavy thinnings are necessary for increased increment and will give a fairly good money return, at the same time benefiting the stand silviculturally. Stands on the better quality soils require very little thinning after 70 to 100 years of age.

2. Mature stands of the better qualities are probably very little overstocked; on the poorer qualities the stocking is too heavy due to an excessive number of trees under 12 inches D. B. H., which no doubt retards the growth of the larger trees.

3. In even-aged mature stands (over 100 years of age) of the first quality a stocking of about 100 trees per acre at maturity will produce the greatest yield in board measure as practically all the trees in the stand are of a merchantable size (12 inches or more in D. B. H.).

6. *Comparison of Yield on Bench and Bottom Land.* The conclusion is reached that land which is considered as first class agricultural soil will not always yield as large a forest crop as land which is classed as inferior for agricultural crops. Mr. Hanzlik also shows that Douglas fir makes its best growth on a slope rather than on level land and that one of its requirements is that the land be well drained.

7. *Methods of Determining Site Qualities of Douglas Fir Stands.* Mr. Hanzlik compares the four chief methods of determining site quality: 1) by optical inspection. 2) by the use of the height growth of the dominant trees, 3) by the growth of the stand in cubic volume, 4) by the density factor (based upon the assumption that the height, basal area and the age of a stand are related by a constant factor). Except for some slight discrepancies, this factor agrees with the site quality as determined by the growth of the stand in cubic volume. The factors are between 200 and 500; for division between Quality I and Quality II 400 is an appropriate number, while 300 separates the second quality from the third (on scale of five qualities II-III and III-V).

Dr. Adam Schwappach has briefed Mr. Hanzlik's report in the October, 1913, number of the Zeitschrift für Forst-und Jagdwesen* and has converted the yield tables into metric measure. He comments on the great height growth and comparatively poor volume production which these tables show. He calculates the stand-form-factor $\left(\frac{\text{volume in cubic feet}}{\text{height in feet x basal area}}\right)$ for all trees at 140 years of age and finds the factor to be .32, .35 and .37 for the three site qualities respectively, which is very low. This, Dr. Schwappach attributes to the volume tables; Mr. Hanzlik himself says that his volume figures are very conservative. Furthermore, as Dr. Schwappach points out, the tables are for final yield only and do not take into account the intermediate yield from thinnings which, in Norway spruce, aggregate about 50% of the total production. Even allowing 20% increase over Hanzlik's final yield figures to allow for trees dying out, the yield of the Douglas fir is only 20% greater than that of Dr. Schwappach's own figures for Norway spruce, Site Quality I, age, 120 years.

Comparing Hanzlik's figures with the latest Saxon yield table for spruce, printed in F. Q., Vol. XII, No. 1, p. 114, one finds at age 100 years for Site Quality I:—

Douglas fir, ...17,600 cubic feet per acre.
Norway spruce, ...14,915 " " " "

—an increase of only 17% over the Norway spruce.

Assuming the stand-form-factor to be the same at 120 years as that of Norway spruce—i. e. .44—and using the values for height and basal area as given in the table, the yield becomes for 120 years, 27,880 cubic feet as against 20,700 cubic feet per acre. "One sees, therefore," says Dr. Schwappach, "what an influence the method of volume determination has and how carefully the data must be analyzed before the American figures can be used as a comparison with the production of German species—in this case with the production of spruce and fir."

Dr. Schwappach concludes from Mr. Hanzlik's figures that the plantations of Douglas fir in Germany are yielding, at least in youth, just as much as similar stands do on their native sites.

A. B. R.

"Ertragstafeln für Pseudotsuga Douglasii," pp. 652-657.

Dry Rot in Factory Timbers. Inspection Department of the Associated Factory Mutual Fire Insurance Companies. 31 Milk St., Boston, Mass. 1913. Pp. 34. Illus.

A brief summary of the results of investigating several thousand beams in buildings, more than one hundred of which were "examined chemically and microscopically." The pamphlet deals exclusively with southern yellow pine timbers, since this wood is the only one now used to any extent in the East for heavy mill frames. Attention is called to the great confusion in the commercial names used to describe the southern yellow pines, and to the indefiniteness of some of the terms used in rules for the inspection of timbers. The difficulty of identifying the various southern yellow pines is also brought out.

After discussing briefly the various causes of dry rot and the influences which encourage it, the pamphlet mentions some of the preservatives which have been used to arrest decay.

The following observations are made:

1. "The percentage of resin in hard pine can be taken as an index of its power of resistance to dry rot.

2. "Hard pine lumber 12 inches square or larger is practically not obtainable with sufficient natural resistance to withstand fungus in a moist atmosphere.

3. "The non-resinous and sappy hard pine, which is obtainable is not safe to use for the important parts of a building without antiseptic treatment.

4. "Holes through columns, narrow spaces between beams and hollow spaces in floors or roofs are of no value in preventing dry rot, and serve to rapidly spread it to all susceptible material.

5. "Heating a new building to 115° F., for twenty-four hours, or more, several times has a value well worth its cost in preventing serious dry rot damage.

6. "Of the various antiseptic treatments in practical use at present, corrosive sublimate appears to be the best adapted to mill timber. Modification of the present process may be necessary when deeper penetration is required."

R. C. B.

Annual Fire Report, 1913. California State Board of Forestry. Sacramento, 1914. Pp. 94, illus.

This is a review of the forest fire situation in California during the past year.

The State Forester points out that his office must rely upon Federal Forest officials for reports on fires in the National Forests and upon 1,300 voluntary unpaid fire wardens for all reports of fires outside of the National Forests. The latter class of men fail to make reports, hence the statistics given probably do not come very near the actual truth so far as the whole State is concerned.

The year 1913 appears to have been more unfavorable than any for some time past, a total of 559,370 acres being burned over at a loss of $511,077. The reported acreage burned during 1912 was 156,241 acres with a loss of $31,906.

The most unfavorable months for fires are September, August, July and October.

Several pages are devoted to a description of a few average fires which occurred during the year 1913. This is followed by a discussion of protective associations operating within the State; the character of assistance rendered by the Federal Government and to proposed legislation.

An appendix contains a copy of the early and also the present forest laws of the State.

R. C. B.

Flumes and Fluming. By Eugene S. Bruce. Bulletin 87, Department of Agriculture, Washington, D. C., 1914.

Contains an analysis of the methods of constructing box and V-shaped flumes, cost of construction and upkeep. The bulletin is well illustrated and contains tables showing the amount of water required to fill flumes at the various depths with given grade percents, weight of water, velocity of water when filled to various depths at different grades, and estimates of material. Besides being of interest to the profession itself, the bulletin unquestionably contains material which would be of great value to lumbermen.

T. S. W., Jr.

A Naturalist in Western China. By E. H. Wilson. London, England. 1913. 2 volumes, pp. 251-229.

The writer of these two volumes has made four separate expeditions, covering nearly 11 years since 1899, into western China, for the purpose of collecting botanical specimens and plant introductions. The first two explorations were in the interest of the well-known house of Veitch, and the last two for the Arnold Arboretum.

An introduction by Professor Charles S. Sargent, of 37 pages, contrasts the forest flora of eastern continental Asia with that of eastern North America. According to this, in general, the American trees are larger and more valuable than the related Chinese species; while the shrubby members are less showy. The 129 natural families represented in the two regions are discussed in detail, and a very interesting comparison made as to representatives of each in the two areas. Reference may be made to the Coniferae, which is represented in China by 14, and in eastern North America by 9, genera. China lacks the Taxodium and Chamaecyparis of eastern North America, while the genera Libocedrus, Cupressus, Cunninghamia, Pseudolarix, Keteleeria, and Fokienia have no eastern American representative. In eastern North America 15 species of Pinus occur as contrasted with 8 in eastern Asia. In Picea and Abies, however, the advantage lies with China, with 20 and 9 species respectively, as against 3 and 2. The numerical representation in the remaining genera is approximately equal. Summing up, of the 129 families, 92 families are common to the two regions; 12 occur in eastern North America, not in eastern Asia; and 25 occur in eastern Asia not in eastern North America. Owing to the greater variety of topography the forest flora of China is richer in genera than that of eastern North America. Of the 692 woody genera in the two regions, 155 are common to both; 158 are found in eastern North America and not in eastern Asia, and 379 occur in eastern Asia and not in eastern North America. Of the tropical genera, 76 have reached Southern Florida, and 89 southeastern China. It is concluded that the number of species of trees and shrubs is probably nearly equal in the two regions.

The first volume is largely an account of the various journeys, with special reference to the manners and customs of the non-Chinese races inhabiting the China-Thibet region explored, but much botanical information accompanies the narrative.

The bulk of the material of botanical interest, however, is to be found in the second volume. The nature of this is indicated by the following headings: the flora of western China; the principal timber trees; fruits, wild and cultivated; Chinese materia medica; gardens and gardening; flowers cultivated; principal food-stuff crops; trees, shrubs and herbs of economic importance; tea and tea-yielding plants, and the tea industry.

J. H. W.

OTHER CURRENT LITERATURE.

Workmen's Compensation Laws of the U. S. and Foreign Countries. Bulletin of the U. S. Bureau of Labor Statistics. Whole No. 126. Washington, 1914. Pp. 477.

Hearings before the Committee on Agriculture, House of Representatives, 63rd Congress, 2d Session, on H. R. 13679—a bill making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1915, and report on the bill. Washington, Government Printing Office, 1914.

Statement of H. S. Graves, Chief Forester, Forest Service, is given on pp. 239-312 inclusive. Report on the Agriculture Appropriation Bill so far as it refers to the Forest Service is given on pp. 662 and 686-692 inclusive. The appropriation for 1915 is $5,399,679, an increase of $143,577 over 1914.

Grazing Homesteads and the Regulation of Grazing on the Public Lands. Hearing before the Commission on the Public Lands. March, 1914. Washington, 1914. Pp. 504.

The Lumber Industry and the Railroads. By John R. Walker. Published by the Southern Hardwood Traffic Bureau, Memphis, Tenn. Pp. 15.

A statement made on behalf of the Southern lumber interests in the general advance rate case before the Interstate Commerce Commission at Washington, D. C., February 20, 1914.

The article is a plea against the proposed 5 per cent advance in the freight rate on lumber in the territory east of the Mississippi river and north of the Ohio and Potomac rivers.

History of the Pacific Coast Shippers' Association, and organization of wholesalers and manufacturers of Pacific Coast forest products. Compiled and edited by F. D. Becker and S. B. Bellows. Published by the Association. Seattle, Washington. January 1, 1914. Pp. 80.

The Country's Forests. U. S. Department of Agriculture. Forest Service. Washington, 1914. Pp. 14.

Our Timber Supply. U. S. Department of Agriculture. Forest Service. Washington, 1914. Pp. 8.

Western Red Cedar in the Pacific Northwest. By J. B. Knapp and A. G. Jackson. Rep. from West Coast Lumberman, Seattle-Tacoma, February 1, 1914-March 1, 1914. U. S. Department of Agriculture. Forest Service. Pp. 24, illus.

Section I. Forest Characteristics of Western Red Cedar.

Section II. Utilization of Western Red Cedar.

Systematic Fire Protection in the California Forests. By Coert DuBois. For forest officers in District 5, U. S. Forest Service (not for public distribution). U. S. Department of Agriculture. Forest Service. Washington, May 29, 1914. Pp. 99, illus.

An excellent manual dealing with methods and means of fire prevention and control.

Suitability of Longleaf Pine for Paper Pulp. By H. E. Surface. Bulletin 72, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 26.

Rocky Mountain Mine Timbers. By N. De W. Betts. Bulletin 77, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 34.

Cost and Methods of Clearing Land in the Lake States. By H. Thompson. Bulletin 91, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 25.

New Facts concerning the White-Pine Blister Rust. By P. Spaulding. Bulletin 116, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 8.

Uses for Chestnut Timber Killed by the Bark Disease. By J. C. Nellis. Farmers' Bulletin 582, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 24.

Stock-watering Places on Western Grazing Lands. By W. C. Barnes. Farmers' Bulletin 592, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 27.

The Road Drag and How it is Used. Prepared by the Office of Public Roads. Farmers' Bulletin 597, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 15.

Proceedings of The Society of American Foresters. Volume IX, Number 2. Washington, D. C. 1914. Pp. 149-292.

Contains: Forest Administration for a State, by A. F. Hawes; Recent Ecological Investigations, by H. deForest; The Use of Yield Tables in Predicting Growth, by E. E. Carter; The Measurement of Increment on All-aged Stands, by H. H. Chapman; Determination of Stocking in Uneven-aged Stands by W. W. Ashe; Yield table Method for Arizona and New Mexico, by T. S. Woolsey, Jr.; Yield in Uneven-aged Stands, by B. Moore; Determination of Site Qualities for Even-aged Stands by Means of a Site Factor, by E. J. Hanzlik; Damage by Light Surface Fires in Western Yellow-pine Forests, by T. T. Munger; Fire Damage in Mature Timber, by J. A. Mitchell; Diseases of the Eastern Hemlock, by P. Spaulding; An Improved Method of Infiltrating Wood with Celloidin, by A. Koehler; The Application of Range Reconnaissance to the Southwestern Stock Ranges, A. D. Read; Damage to Reproduction by Snow, by R. H. Boerker; The Use of Wood in Gas Producers, by R. Thelen; The Distinguishing Features of the True Firs (Abies) of Western Washington and Oregon, by E. J. Hanzlik; Reviews.

A Classified List of American Literature on Forestry Subjects for General Reading and Reference. Timely helps for farmers. Vol. 7, No. 8. Orono, Me., 1914. Pp. 53-60.

The Brown-tail and Gypsy Moths and Parasites. Bulletin of the Department of Agriculture, Vol. xii, No. 4. Augusta, Me., 1913. Pp. 18.

The Fire Wardens' Manual. State of New Hampshire, Bulletin 5, Forestry Commission, 1914. Pp. 72.

"It is the special aim of this bulletin to instruct the wardens how they may perform their services easier by the use of systematic methods, and make their work more effective. The purpose is also to show how the warden service may benefit by the work of lookout watchmen, patrolmen and other employees, and how the wardens can assist and keep a check on the other kinds of work."

The Chestnut Bark Disease—Control: Utilization. New Hampshire Forestry Commission, Bulletin VI. Prepared in co-operation with the Bureau of Plant Industry and Forest Service. Concord, April, 1914. Pp. 40, illus.

Contains a summary of present knowledge on the spread of the disease in New Hampshire, and facts in regard to the utilization of chestnut wood.

Reforesting Waste and Cut-over Land. Bulletin IV, New Hampshire Forestry Commission. Concord, February, 1914. Pp. 27, illus.

Treats of the importance of reforestation both to landowners and the State; gives information on how trees for reforestation may be secured and how they should be planted.

Forestry in New Hampshire. Twelfth report of the Society for the protection of New Hampshire forests. N. p., 1914. Pp. 96. Illus. 1 map.

Third Annual Report of the New Hampshire State Tax Commission. Concord, N. H. 1914. Pp. 148.

Report of the Commission on the Taxation of Wild or Forest Sands. Boston, Mass. 1914. Pp. 97.

Massachusetts Forestry Association, Its Work and Character. Bulletin No. 109. N. p., 1914. Pp. 4.

What Does a Shade Tree Mean to You? Bulletin 110. Massachusetts Forestry Association. N. p., 1914. Pp. 4.

State Forests for Massachusetts. Massachusetts Forestry Association. Bulletin No. 111. N. p., 1914. Pp. 8.

Tenth Annual Report of the State Forester of Massachusetts, 1913. Boston, 1914. Pp. 114.

A Preliminary Working Plan for the Portland State Forest. By W. O. Filley and A. E. Moss. Seventh report of the State Forester. Forestry Pub. No. 10. Rep. from report of the Conn. Ag. Exp. Sta. Pp. 391-420. 2 maps.

Report of the Connecticut Agricultural Experiment Station. 1913: Part VI, Seventh Report of the State Forester. By W. O. Filley and A. E. Moss. New Haven, Conn. 1914. Pp. 391-419.

A Forestry Arithmetic for Vermont Schools. By A. F. Hawes, State Forester. Vermont For. Pub. No. 14. Burlington, April, 1914.

A unique forestry publication designed to create an interest in forestry in the common schools of the State. This bulletin is to be used as a supplement to the regular arithmetic text-book now used.

Forest Fires. Bulletin 10, New York Conservation Commission. By W. G. Howard. Albany, N. Y. 1914. Pp. 52.

Third Annual Report of the Conservation Commission, 1913: Divisions of Lands and Forests and Fish and Game. Albany, N. Y. Pp. 366.

Methods of Determining the Value of Timber in the Farm Woodlot. By J. Bentley, Jr. The Cornell Reading Courses, Volume III, Number 62. New York State College of Agriculture at Cornell University. Ithaca, N. Y. 1914. Pp. 133-164.

Rural and City Shade Tree Improvement. University Extension Service in Forestry, New York State College of Forestry. Syracuse, N. Y. 1914. Pp. 15.

Possibilities of Municipal Forestry in New York. By N. C. Brown. New York State College of Forestry. Syracuse, N. Y. 1914. Pp. 19.

The Lumber Industry. By R. S. Kellogg. Published by Alexander Hamilton Institute, New York. 1913. Pp. 104.

Ninth Annual Report of the Forest Park Reservation Commission of New Jersey, 1913. Union Hill N. J. Pp. 82.

Report of the Maryland State Board of Forestry for 1912 and 1913. Baltimore, Md. Pp. 56.

Contains a review of the work performed during the years 1912-1913. The chief features of note are the authorization given by the last legislature for the purchase of lands along the Patapsco river for a State Forest Reservation; an extension of the fire protection system; the completion of the forest survey of the State in 1912 which was begun in 1906; the examination of 6,000 acres of private land, chiefly woodlots; and the marked extension of forestry knowledge in the State through addresses and illustrated lectures.

Forest Laws of Maryland. Maryland State Board of Forestry. Forestry leaflet No. 15. Baltimore, Md., 1914. Pp. 8.

Timber Resources of Warren County. Press Bulletin 115 of Geological and Economic Survey. Chapel Hill, N. C. 1914. Pp. 4.

Timber Resources of Orange County. Press Bulletin 116 of Geological and Economic Survey. Chapel Hill, N. C. 1914. Pp. 4.

Forestry Report. State of Michigan, 1913. State Game, Fish and Forestry Warden. Lansing, Mich., 1914. Pp. 16.

Report of the Public Domain Commission, Jan. 1, 1911, to June 30, 1913. Lansing, Mich., 1914. Pp. 67.

The Control of damping-off Disease in Plant Beds. By J. Johnson. Wisconsin Agricultural Experiment Station. Research Bulletin 31. Madison, Wis., 1914. Pp. 59.

Third Annual Report of the State Forester. Minnesota Forestry Board. December 31, 1913. Pp. 147. Illus.

Illinois Arbor and Bird Days. Compiled by H. T. Swift. Springfield, Ill. 1914. Pp. 7.

The Ames Forester. Volume II. Published by The Forestry Club of Iowa State College. Ames, Iowa. 1914. Pp. 68.

Contains the following articles: Impressions of German Utilization; Red Pine on the Minnesota National Forest; A Lookout on the Sopris National Forest; Stumpage Appraisals Involving Use of a Railroad; Ex-12, Ex-Guard, Ex-Ranger; Grasses of the National Forests of the Rockies; The Manufacture of Walnut Gun Stocks in Iowa; A Summer Camp for Ames Foresters.

A Study of the Vegetation of the Sandhills of Nebraska. By R. J. Pool. Lincoln, Neb. 1913. Pp. 312; plates.

The University of Washington Forest Club Annual. Volume II. Seattle, Wash. 1914. Pp. 74.

Contains, in addition to a review of the year's club meetings, letters from the field and a roster of students, the following articles: Lumber Publicity; Overhead Systems of Logging in the Northwest; Forestry in the Philippines; The Panama-Canal and the Lumber Industry of the Northwest; The Elements of

Cost in Milling; Seattle's Municipally Owned and Operated Lumber Dock; Growth and Reproduction of Western Hemlock; Changes in the College of Forestry During the Year.

First Biennial Report, State Forester of Kentucky, 1913. Frankfort, Ky. Pp. 104.

Report of Conservation Commission of Louisiana, 1914. New Orleans, 1914. Pp. 136.

Third Annual Report of the State Forester. State of Oregon. Salem, 1914. Pp. 46.

The Forest Protection Problem in California. Circular No. 5, State Board of Forestry. 1914. Pp. 7.

Annual Fire Report, 1913. State Board of Forestry. California. Pp. 94.

Manitoba—A Forest Province. By R. H. Campbell. Circular 7, Forestry Branch. Ottawa, Canada. 1914. Pp. 16.

Chemical Methods for Utilizing Wood Wastes. By W. B. Campbell. Circular 9, Forestry Branch. Ottawa, Canada. 1914. Pp. 6.

The Care of the Woodlot. By B. R. Morton. Circular 10, Forestry Branch. Ottawa, Canada. 1914. Pp. 16.

Co-operative Forest Fire Protection. By G. E. Bothwell. Bulletin 42, Forestry Branch. Ottawa, Canada. Pp. 28.

Report of the Commissioner of Dominion Parks for the Year Ending March 31, 1913. Canada Department of the Interior. Ottawa, 1914. Pp. 96.

The Maple Sugar Industry in Canada. By J. B. Spencer. Bulletin No. 2B, Dominion of Canada, Department of Agriculture. Ottawa, 1913. Pp. 64. Illus.

This bulletin contains a brief historical review of the industry;

a statement of its present extent and importance; a discussion of sugar grove management; the sugar-making plant and its operation; marketing; the future of the industry; and the objects and aims of the Co-operative Maple Sugar Makers Association.

The Training of a Forester. By G. Pinchot. Philadelphia and London. 1914. Pp. 149.

A Critical Revision of the Genus Eucalyptus. Volume II, Part 10, and Volume III, Part 1. By J. H. Maiden. Sydney, N. S. W. 1914. Pp. 291-311, Pls. 85-88; and pp. 1-22, Pls. 89-92.

Annual Irrigation Revenue Report of the Government of Bengal, 1912-13. Calcutta, 1914. Pp. 60.

Annual Report of the Woods and Forests Department for the Year Ended 30th June, 1913. Perth, 1913. Pp. 9.

Boletin de la Sociedad Forestal Argentina, Ano I., 1913. Buenos Aires.

Forestry. Education Department, Victoria. Circular of Information No. 17. Melbourne, 1913. Pp. 16.

Identification of Timbers. By P. J. Drew. Department of Forestry, N. S. Wales. Bulletin No. 7. Sydney, 1914. Pp. 7.

Preservation of Outdoor Timber. London Board of Agriculture and Fisheries. Leaflet No. 284. London, 1914. Pp. 4.

Rapport du département fédéral de l'intérieur sur sa gestion en 1913. Bern, 1914. Pp. 16.

Amtliche Mitteilungen aus der Abteilung für Forsten des K. Preussischen Ministeriums für Landswirtschaft, Domänen und Forsten 1912. Berlin, 1914. Pp. 47.

Etat der schweizerischen Forstbeamtem mit wissenschaftlicher Bildung. Bern, 1914. Pp. 21.

Das Fachwerk und seine Beziehungen zum Waldbau. Von G. Baader. Giessen, 1914. Pp. 67.

Beiträge zur einheitlichen Ausgestaltung der Wald brandstatistik. Von Heinrich Gaertner, 1913. Kiel, Gartenstr. 4.

A Pamphlet written from the standpoint of the needs of forest fire insurance, giving plans of securing the necessary statistics for a rational insurance.

Grundzüge der Waldwerts berechnung auf volkswirtschaftlicher Grundlage. Von Offenberg. Berlin, Paul Parey, 1912.

Discusses the choice of interestrates for taxation purposes as differing from those for regulating purposes.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forests of Corsica.

Of the 368,000 acres of forest on the island over half is commercial, less than a fifth private forest, and 30 per cent is State Forest (French) and under good administration, accessible by excellent road systems constructed during the last 50 years. Neger enthuses particularly over the coniferous mountain forest. From the seashore to about 3000 feet the characteristic Mediterranean tree flora, called macchia, prevails, composed of a variety of broadleaf trees and shrubs of little economic value. This is followed by a narrow belt of open chestnut forest, *Castanca vesca*—the chestnut and olive being the most important food trees of the island, hence this region having the densest population—sometimes up to 4000 feet, old veterans of over 1000 years old being not rare. Above the chestnut zone, up to 4500 feet, the conifer forest extends, while strange to say the timberline is formed by a broadleaf forest, in which the beech (up to 100 feet high) is the dominant species and *Abies pectinata* its concomitant with *Betula verrncosa, Alnus cordata, Ilex aquifolium.* Neger explains this peculiar, unexpected distribution by the absence on the island of the northern timberline conifers, the coniferous forest below being made up of the Mediterranean species *Pinus pinaster* and *P. corsicana* with *Abics pectinata.* The pines show a magnificent development, diameters going sometimes up to 5 feet and heights to over 150 feet. The two pines are not easy to differentiate without cones except by habitus, the Corsican pine remaining pyramided to old age and presenting a clear bole, the Pinaster pine assuming a rounded crown and remaining branchy. Seed production is very plentiful hence natural regeneration easy. Although the stands appear a picture of health, fungi are not absent, and mistletoe is sometimes unusually developed.

Die Bergwalder Korsikas. Naturw Zeitschrift für Forst-und Landwirtschaft. April, 1914, pp. 153-161.

Forestry in the Balkans.

In the barren land of Herzegovina, efforts for some years have been directed to reforestation, in order to save the country from becoming a desert. The Venetians and Romans once drew supplies of timber from that region, but now there is little left. In many places bare mountains of stone occupy regions of former forests; but the people are planting trees and trying to make them grow. One of the common methods is to blast holes for the trees with dynamite and carry soil to fill the pit. Some places have become covered with green vegetation in two years. No grazing is permitted at first on newly planted mountain slopes. Sheep are the first animals to be admitted to these new pastures, the year following cattle are admitted, and finally goats when the shrubbery is high enough to care for itself. Parallel plots of these reserves are laid out over the province, so that when one plot is entirely reserved, the next plot is open to sheep, the third has sheep and cattle, and in the fourth, sheep, cattle and goats graze together.

Very strict forestry laws exist and violations are subject to imprisonment. Instead of jailing the men, however, they are used for forest work.

Hardwood Record.

South American Forests.

The great forest of the Amazon basin is 1100 miles long east and west by 750 miles north and south, an area of nearly a million square miles. The woods are tropical species; among which there are none that are suitable for construction purposes. Very little cutting has been done and that for the common woods of commerce, cedar, mahogany, rosewood, lignum-vitae, fustic and ironwood, and these cuttings extend only a few miles back from the coast, and the principal ports and rivers. Railroads charge exorbitant rates. There are no solid stands of single species, but instead there are hundreds of species growing thoroughly mixed and scattered. The wood of most species is so hard that a narrow-bitted ax specially formed is used.

American Lumberman, 1913.

Afforestation in Korea. About 47 per cent of the total area of Korea is still under forest, although reckless cutting has almost denuded the mountains, especially in the Southern part. The government has established nurseries with the idea of educating the people to the importance of tree planting. Several large firms have started reforestation and have plans for planting up areas varying from 4,000 to 30,000 acres, totaling more than 50,000 acres. The area of the whole country is about 60 million acres. The trees found in Northern Korea are Chamaecyparis, larch, fir, birch, pine and others; in the Southern part, oaks, walnuts and pines.

American Lumberman, February, 1913.

BOTANY AND ZOOLOGY.

Wood Identification. A few points in wood identification are brought out in an article, not signed but apparently from the Forest Service, in the Hardwood Record:

1. Hollywood—fibers are marked with spirals.
2. Cucumber—vessels with ladder-like or scalariform markings. Tulip poplar—vessels with ordinary bordered pits.
3. Birch—vessels with scalariform markings. Maple—vessels with ordinary pits.
4. Willow—marginal cells of pith rays irregular and different from the rest of the ray cells. Cotton-wood—ray cells all alike and elongated in one direction.
5. Hackberry—same as willow in (4). Elm—same as cottonwood in (4).

Parasites of Fungi. Analogous to the use of parasites in combating insect pests, a method which has been so successfully inaugurated by American entomologists, Dr. Tubeuf proposes to fight fungus pests through their parasites, and discusses as a first example the parasite of the *Peridermium strobi,* the white pine blister rust, which we are trying hard to keep out of the country. In the yellow aecidia of this rust there lives a lilac colored fungus, *Tuberculina maxima,* which spreads over the mycelium of the blister rust under the bark and forms conidia, which as the bark splits are dispersed over the blister rust aecidiae, suppress these and inhibit further spore formation, thus hindering the spread of the disease. It requires, however, experimentation to find out how far the effect of the parasite goes, to determine whether this biological method of fighting the disease may become practical.

Biologische Bekämpfung von Pilzkrankheiten der Pflanzen. Naturw. Zeitschrift für Forst-und Landwirtschaft. Jan., 1914, pp. 11-19.

SOIL, WATER AND CLIMATE.

Forest Influences.

Russian investigators are active in trying to establish the truth of the influences of forestcover. The forestal significance of the retention of precipitation of crowns is under discussion in the Journal of the St. Petersburg Foresters Society. Five year observations show that in a pine forest of .6 to .7 density 23% of the precipitation was retained by the crowns; of snow 12 to 15% was so retained. In the majority of cases (50% of the rainy days) from 26 to 50% remained in the crowns; the lighter rainfalls, which are more frequent, naturally are retained to a greater extent. With regard to snow the wind plays a role; the severer winds benefiting the soil by larger masses being deposited, while rain is more rapidly evaporated and lost to the vegetation.

A technical expertise regarding the devastating floods in Transcaucasia, especially on the southern slopes, which annually destroy millions of property with loss of life, states the affected water basins as 13142 square werst and estimates the needed preliminary expenses for reboisement work at over $800,000. Conditions are more difficult than in the French Mountains, since the streams rise at elevations of 8000 to 11000 feet, the slopes are steep, and the rocks easily disintegrating sandstone, with marl, clay and lime layers.

The forest region extends to 7000 feet; the forest area is partly in private hands, badly used and should be declared protection forest, and pasturing should be prohibited; in some districts natural regeneration will be successful, in others, planting is necessary.

Das V Heft des Lesnoj Journal, May, 1913. Zeitschrift für Forst-u. Jagdwesen. Jan., 1914, pp. 51-58.

SILVICULTURE, PROTECTION AND EXTENSION.

Natural Regeneration. In a thoughtful article, Forstmeister Lieber develops his ideas on natural regeneration, which he summarizes in the following rational prescriptions:

1. Preparation of stands for natural regeneration must be begun in early youth by means of thinnings in such a manner that a special preparatory felling is not required and so that richer or poorer seed years find a larger part of the stands ready for the reception of seed.

2. The decision whether regeneration is to be begun depends on whether sufficient desirable volunteer growth is at hand; and its development dictates the progress of fellings.

3. The fellings are to be conducted not only with reference to the needs of the young growth but with regard to the best utilization of the old growth. Both considerations have equal rights; the "ripeness" of the trees to be removed must be determined.

4. Keeping foremost in mind the object of the management to secure highest yield the desire to form a certain stand in form and kind must be kept in the background. Change in species and form one must not fear because of a preconceived plan.

5. It is equally justifiable to finish the regeneration in a short time as to extend it over a long time as considerations sub 3 indicate. The transition to a selection form or to the real selection forest may in some places satisfy the needs.

6. Consideration of yield regulation must not deter the choice of a method of silviculture which is difficult to regulate if better yields can thereby be secured. Yield regulation is a servant of

the management, it must not become the master and demand forms, because they are easier to obtain or to judge.

Ueber natürliche Verjüngung. Forstwissenschaftliches Centralblatt. Apr., 1914, pp. 181-195.

Natural Regeneration of Spruce.

Forstmeister Bauer (Bavaria), believing that the spruce is one of the species which is adapted to natural regeneration and has large areas under such management comes to the conclusion that only on I and II site is this method of regeneration technically and financially successful. On poorer sites, natural regeneration remains poor, so that, if no thinning is done (which is expensive) in 50 years only bean and hop poles are found, and at 30 years stands are hardly over man-height, while 10 year old plantations side by side have reached that height. He recites the disadvantages of natural regeneration on poor and medium sites; enormous loss in increment; loss through poorer values of the wood product; great cost of cultural measures to remedy these defects; more punky wood due to injuries received in gradual removal of timber and reduction of workwood per cent; execssive cost in moving material from seeding area which alone would pay for planting.

Technisches und finanzielles Versagen der Natur vrjüngung in reinen Fichtenbeständen auf Böden mittlerer. Bonität. Forstwissenschaftliches Centralblatt, Oct., Nov., 1914, pp. 520-522.

Production of Mixed Stands.

Dr. Wimmenauer compares the production of mixed stands of beech and pine, beech and oak, beech and larch by ascertaining the cross section area per cent in which each participates in the composition and compares their volume proportionately to what the normal yield tables for the single species calls for. He finds beech and oak produce more in pure stands if the participation of oak exceeds 2 per cent. In the mixture of pine and beech similarly an admixture of 50 per cent at least of the light needing species is desirable and favoring the same by reducing the beech.

Zur Frage der Mischbestände. Allgemeine Forst-und Jagdżeitung, March, 1914, pp. 90-93.

Influence of Degrees of Thinnings.

Dr. Kunze reports from the Saxon experiment station the results of 50 years of thinning experiments in a stand of Scotch pine, 20 years old at the start which on three sample plots was thinned ten times, lightly (*a*), moderately (*b*) and severely (*c*). The final measurements were made in 1912 when the stand was 70 years old, by the method of sample trees, due attention having been paid to stem classification. The results agree with what other investigators have found. Severe thinnings are most effective; they do not curtail the height growth, but on the contrary stimulate it more than the other two degrees. In total production the *c*-grade furnished 22.7% more than the *a*-area, and 15.6% more than the *b*-grade. It appears, however that the three areas were not equally stocked at the beginning, which vitiates the value of the figures. The severe thinning did not lengthen the crown but on the contrary shoved the crown up in proportion to the great height growth; the crown diameters also show great regularity in gradation, as appears from a comparison of branchwood to bole wood, the boles being also more cylindrical.

Mitteilungen aus der Kgl. Sächsischen forstlichen Versuchsanstalt zu Tharandt, Band I, Heft 2, 1913.

Exotics in Saxony.

The attempts at the introduction of exotics for forest purposes in Saxony dates back only ten years. The results are discussed by Neger. Expectations were in many cases not fulfilled. Causes of failure were mainly damage by game and misplaced expectations on the ability of exotics to thrive on untoward sites and especially to severe frost conditions which the clearing system followed to an extreme in Saxony has produced. *Abies concolor* has failed for both causes; *A Nordmanniana* is discarded; *Pseudotsuga,* the green form succumbs to frost, the blue form from Colorado is hardy, although relatively to the green slow, grows faster than spruce in some locations, the form from British Columbia has not thrived; in the hill country the green variety seems to hold its own. *Picea sitchensis* is only fit for the mildest locations; *Piccea pungens,* valueless. *Pinus banksiana (divaricata),* the same. *Pinus Strobus* suffers much from game, besides from Peridermium and *Lyda campestris,* but is resistant to drouth and frost and is soil improving. *Larix leptolepis* suffers from drouth more than the native, its resistance against the larch disease is its best recommendation. *Chamaecyparis lawsoniana* needs high degree of humidity and side protection, suffers from game and is given to form double leaders. The most successful species has been *Quercus rubra* on poorer soils than the native thriving and growing rapidly, also *Populus canadensis* in overflow lands.

Der Stand der Anbauversuche etc. Naturw. Zeitschrift für Forst-und Landwirtschaft. Jan., 1914, pp. 1-11.

Fighting White Pine Rust.

Dr. Tubeuf dismisses as unpractical the proposition of Eberts to spray the Ribes host of the White pine rust with Bordeaux mixture on account of the impossibility of protecting the underside of the leaves which is more liable to infection than the upper side.

Bekämpfung der Ribes-bewohnenden Generation des Weymouthskiefernblasenrostes. Naturw. Zeitschrift für Forst-und Landwirtschaft. March, 1914, pp. 187-189.

Novel Fire Protection.

M. Canon advocates fire lines planted to a shrub called "Mille pertuis," which is said to resist fire, to grow densely up to 18 inches in height, and to remain in foliage the entire year. Canon advocates the use of this shrub in central France for covering fire lines. This presents a new idea which might be applied on this continent.

T. S. W. JR.

Revue des Eaux et Forets, April 15, 1914, pp. 270-271.

Light Firing in British India.

Glover gives an interesting account of the progress which has been made in the Punjab toward light firing in Chir pine forests to prevent the excessive damage that occurs after a forest has been successfully protected from fire a number of years and then subjected to a general conflagration. The forest conference of last year resolves:

> That the principle of Departmental firing in Chir forests, coupled with the regular method of regeneration be accepted * * and that experiments regarding the feasibility of introducing a similar scheme into the Kangra Division be carried out.

Details of the methods followed are described. The firing is usually done during the winter months, the object being "to keep the fire line moving regularly and evenly down hill." The article concludes with an account of the damage to a tree crop, undergrowth and soil cover, and the writer summarizes the experiments as showing "most conclusively that, except in regeneration areas, woods can be fired on a larger scale without doing appreciable damage to the Chir." It is recommended, however, that the selection system be abandoned for these areas, and that a uniform system be adopted as being more suitable, since the regeneration could then be protected more systematically. It is argued that there is no reason why forests where trees are tapped for resin should not be similarly burned provided the bases of the tapped trees are first cleared of needles and grasses, as is now the practice on the Florida National Forest in the United States.

T. S. W., Jr.

Departmental Firing in Chir Forests in Punjab. Indian Forester, June, 1914, pp. 292-306.

Natural Regeneration of Deodar.

An anonymous writer describes the poor results which have followed the use of the selection system, the selection system in groups, and the group system in the deodar forests of the Himalaya Mountains in British India. A new method was proposed early in 1914 which bids fair to give success.

> The entire layer of decaying vegetable debris was dug up, raked together into heaps along with the larger refuse

in former exploitations and burned. The ashes were then scattered over the treated area, which was subsequently planted with deodar or a mixture of deodar and kil (Blue pine). Results have surpassed all expectations.
T. S. W., Jr.

Annual Regeneration of Deodar. Indian Forester, 1914, pp. 306-309.

MENSURATION, FINANCE AND MANAGEMENT.

New Method of Cubing Standing Timber

The Hungarian Forstrat Marton de Zsarolyan proposes a new way of estimating closely the bole contents of standing trees by the introduction of what he calls conus cubic numbers. He starts with the idea that the upper diameter of whatever log length is considered can be more readily and with less error estimated in tenths of the measured b. h. d than in inches. If V is the volume, D the b. h. d, d the upper diameter and l the log length, then $d=(o.x)D$ and

$$V = \left[\frac{D^2}{4} + o.x^2. \frac{D^2}{4}\right] pi \times \frac{l}{2} = \frac{D^2}{4}\left[\frac{1+o.x^2}{2}\right] pi\ l.$$

The figures $\frac{1+o.x^2}{2}$ calculated for various x are the conus cubic numbers. The formula can, however, be still further simplified into $V=\frac{D^2 pi}{8}(1+o.x)^2 l = D^2 0.3927(1+ox^2)l$, and having ascertained the values for $(1+ox^2)$ and carried out the multiplication with 0.3927, we get rounded off conus numbers

far x=	1	2	3	4	5	5	7	8	9
	40	40	45	45	50	55	60	65	70

This series easily memorized does away with the need of tables or cumbrous calculations: with the upper diameter estimated as .5D the conus number, with which D×l must be multiplied is also .5; for every additional tenth 5% is to be added, for every tenth below 5% to be deducted.

Neues Verfahren zur Bestimmung des Kubikinhaltes von stehenden Stämmen. Allgemeine Zeitschrift für Forst-u. Jagdwesen. March, 1914. pp. 113-114.

New Ideas on Forest Valuation.

Hans Hönlinger, who has written a book on "Practical Forest Valuation" (*Praktische Waldwertrechnung*) briefly answers his critic by showing that the difference between the soil rent theory and his own consists in that the former charges the expenditures entirely against the soil and none against the stock, which is the reason that negative soil values may be figured out, although the forest rent is positive. Hönlinger distributes the expenditures in the same ratio as the incomes against soil and stock.

Briefly the difference in the formula would be:

Soil rent: 1. Forest value $= \frac{Y^r - ra}{.op}$; 2. Soil value $= \frac{rY^r}{1.op^r - 1} - rA$; Stock value $= Y^r - \frac{rY^r}{1.op^r - 1}$. In formula 2 and 3 the forest income (from formula 1) appears distributed on stock and soil, but the forest expenditures charged entirely to soil; while in formula 3 no expenditures are charged. Hönlinger's formulae read: $F = \frac{Y^r - ra}{.op}$; $S = \frac{r\ (Y^r - ra)}{1.op^r - 1}$; $St = \frac{Y^r - ra}{.op} - \frac{r(Y^r - ra)}{1.op^r - 1}$

Centralblatt f. d. g. Forstwesen. Dec., 1913, p. 564.

Facts and Estimates in Increment.

Kirchgessner points out that while increment should be the basis of utilization, it is not easy to determine it, subjective elements affording much variation. Estimates move on a middle line; the better sites being underestimated the poorer faring better. He then proceeds to compare the actual yields during the last 70 years of management of ten communal forests of medium quality in Baden, some 2000 acres, with the latest estimates of increment.

The comparison is most flattering to the estimator, for while the ten positions figured on actual returns show on the average an increment of 58 cu ft. p. acre (varying from 49 to 71), the estimate averages 55 (varying from 50 to 64) cubic feet per acre.

To show how the calculation is made we translate the sums of the items:

Area, 2,070 acres; total cut in 70 years, 5,724,000 cubic feet (of which 25 per cent in thinnings); latest estimate of stock, 10,630,-000 cubic feet; stock estimate 70 years ago, 2,000,000 cubic feet; increment in 70 years by adding cut and present stock, and deducting previous stock, 14,354,000 cubic feet; from which increment per year and acre can be determined and compared with the increment estimate.

Zuwachsschätzung verglichen mit dem tatsächlichen Ertagsergebniss. Forstwissenschraftliches Centralblatt. March, 1914, pp. 149-150.

Financial Aspects of Thinnings

Professor Dr. Wimmenauer reports in great detail and with ample tabulations results of experimental thinning in the dominated stand at the station of Hesse, carried on within the last 25 years, some 17 areas for pine and beech on plots of two-thirds to two and a half acres being reported. The inquiry was directed not merely to volume but to value production. For the latter to overcome the difficulty of dividing into assortments a value meter (Wertmeter) calculation was introduced. For beech, where at the age of 79 years workwood is as yet not developed, the value meter was determined by assuming brushwood to be half in value of timberwood, hence if there were 60 *fm* of the latter and 40 *fm* of the former, this would give 80 *wm*, valuemeter. For pine the calculation was made differently. Since the relation of assortments in a stand is primarily dependent on the mean diameter of the stand, the assortments corresponding to each such diameter were ascertained and their values in the local market ascertained (since only relative values are to be determined), and then a quantity of wood of the value of 10 Mark was accepted as valuemeter. For illustration: to a 40 *cm* diameter corresponds 40% of sawtimber at 22.6 *mk*, 40% of building timber at 17.1 *mk* 10% fuel wood over 3 inch at 5.3 *mk* and 10% brushwood at 0.6 *mk*; this makes the average value 16.5 *mk*. Such a tree would then contain 1.65 value meters.

The results are somewhat unexpected and disappointing. The beech areas show that total volumes as well as increment per cents under *a*, *b*, and *c*, i. e. light, moderate, and severe thinnings in the understand (*par le bas*) vary irregularly and differ very little, while in *d* and *e*, i. e. thinnings in dominant and selection thinnings which were made in a few cases did not show much better.

The total average showed

Thinning degree	a	b	c	d	e
Valuemeters	100	98	102	106	92
Increment per cent	4.	4.1	4.5	4.5	4.9

The thinnings in the subordinate stand of pine showed also no tangible result, the increment per cent for *a*, *b*, and *c* thinnings being 4., 4.1, 4 respectively, the volumes 96, 100, 96.

A much more satisfactory experiment with different methods of calculation was carried on by the author independently in beech. The procedure started with the thought that a thinning produces two effects: an increase of increment on the remaining stand which is expressed by the difference of the increment per cent of the thinned stand (z) and that of the unthinned main stand (y); and on the other hand, an earlier money income which can earn interest (p) instead of the increment per cent (x) of the subdominant stand of the unthinned stand, so that, if the original dominant stand was H, the thinned stand D, a precise financial expression of a thinning would be: $\Delta = H(z - y) + D(p - x)$. In practice, recognizing five stem classes, the performance of each of them would have to be ascertained and the sum found.

The three experimental areas were thinned every 5 years, altogether 5 times (original ages 67, 67, 63), the first one, with thinnings in the subdominant, tree classes I-III; the second, by selection thinning, tree classes III-V; the third one by thinning in the dominant, tree classes II-IV. A fourth area lightly thinned was used to determine increment per cents y and x of the formula, while the increment per cent z of the thinned stands was for each stem class in each area calculated from the 20 year period. The following results appear.

Stem class	I	II	III	IV	V
x or y	.3	2.2	3.3	3.6	3.8
z in area 1	1.2	2.1	3.6	4.3	3.9
z in area 2	2.4	3.6	3.8	3.5	3.1
z in area 3	1.5	3.6	4.6	3.9	4.1

The different kinds of thinning exhibit characteristic results. After moderate thinning in the subordinate stand the stouter stem classes benefit generally more. In the selection thinning irregularity is striking. In the thinning *par le haut* the maximum increment comes to the middle class III. Nevertheless, the increment per cents of total volume are little different, as in the previous case, varying only as 3:3.7:3.4:3.6. Applying now the ascertained data to the formula and choosing p=3, the final result makes the three different kinds of thinning as 152.1: 75.2: 147.8. That is to say the selection thinning is financially only half as effective as the other two kinds, which are pretty nearly alike in their results. The second object of thinnings, the money interest instead of wood increment, is particularly advantageous in the thinning in the subdominant, not so in the thinning par le haut, and least in the selection thinning. The increase in increment on the main stand appears as 86: 113: 129 for the three kinds of thinning.

The author believes to have proved that in the statistics of thinning practice only exact calculations yield reliable results.

Durchforstungsversuche in Buchen-und Kiefernbeständen. Allgemeine Forst-u. Jagdzeitung. March, 1914, pp. 84-90.

Determining Value Increment

Künkele in a very elaborate article of 50 pages develops a method of evaluating the value increment per cent of standing trees, as well as stands, which should be sufficiently accurate and at the same time simple. The article is divided into five parts: Influences determining wood prices; mathematics of price curves; value increment of single trees; value increment of stands; helps and examples of the use of the new formulae. In the first part some interesting data are brought showing, that length of log influences the price only of small sized sticks essentially [masts? Ed.]; quality of wood influences price more than length, especially in pine and that increasingly with size; but by all odds the greatest influence on price is exercised by diameter, increasing up to a certain size which varies with species. A table giving prices for 24 species paid in the Baden State forests exhibits the precise variations. An idea of the relative value of species may be gained from the diameter which in different species command a price of 20 cents per cubic foot (cut logs): black locust 6 inch; ash, 10 inch; walnut, 11 inch; oak, 13 inch; basswood and maple, 15 inch; pine and larch, 16 inch; elm, 17 inch; beech, 24 inch. Translating the price per cubic meter into approximate values per M ft B. M. for 12-16 inch logs, cut in the woods the following prices are found: ash and walnut, $44; oak, $27; basswood and maple, $25; pine and larch, $22; elm, $20; poplar, $21; birch, $18; chestnut, $17; spruce and fir and beech, $16.

Different species show then, different price movement per unit. In oak, while length does not vary the price more than 15% at most, the diameter may vary it by 1700% over the smallest diameter (6 inch). Here fame plays a role, oak of the Spessart commands three times the price of logs in other forests. In beech the influence of diameter may increase price by 300%; in other broad leaf species by 400%, the rise beginning only with medium diameters. Spruce and fir show price increases for length in different size classes varying from 3 to 35%, for quality from 10 to 21%, but for size up to 200%. In pine the price rises with the diameter up to 500%, so that while the smallest logs bring 8 cents per cubic foot, the largest may bring 40 cents.

It is also interesting to note that the cost per cubic foot of making logs averages for all kinds and sizes just about 1 cent (about $1.25 per M ft. B. M.) which means 1 to 10% on the final value; and transportation from the woods to the woodyard averages for all German forest product 4 cents per cubic foot. This influences the prices in the forest by from 2 to 20%, and that all assortments alike.

Market price increments in the last decade for beech progressed regularly 1% annually, but oak 3 times as much and in some places over 4 per cent annually for medium sized logs (16-20 inch middle diameter). Oak has experienced such constant price increase in the last decade, especially in the Spessart mountains so that "the sum of all increments in spruce cannot measure up to the mere price increment of oak; in other words, the oak in the woodyard unused brings better interest than the spruce in the forest.

The mathematics of the price curve is then developed in great detail with the use of calculus, and after critical reference to other formulae (Schumacher's rule) the author's own formula is constructed, not quite so simply as the author promised. The upshot of it is that Schumacher's rule, "the values per unit rise with the diameters in arithmetic progression," is only partly true, the curve being represented by a number of straight line parts; which by shifting of the abscissae zero axis to a determinable degree can be made straight: the prices then are in direct proportion to the *changed* diameters. The amount of shifting (s) for different diameter classes (D to d) is capable of mathematical expression; being for straight lines $s = P\frac{D-d}{P-p} - D$ when P and p are the prices for the two diameters; and for curved parts, — $s = y\frac{\Delta x}{\Delta y} - x$.

To determine the price increment per cent, Pressler's well known diameter increment per cent formula, somewhat modified, namely $Pd = \frac{200b}{D+nb}$, in which n=number of years for which the investigation is made, and b=average periodic ring width, during n years, is modified to $\frac{200b}{D+nb+s}$. This holds if the measurement is made in the middle of the log length, for measurement at other places, the coefficient 200 must be varied; if breast high, to 240 or 300 for .8 and .9 density (change of form factor!), and if measured at Pressler's "increment middle" to 160 and 130 respectively for the two densities.

Going into the discussion of the value increment of a tree, the author reviews the various methods hitherto employed, and then develops his own formula starting from the conception that this increment is composed of the increment 1. of the log volume (v^1) times unit price (q^1), 2. of volume of other wood (v^2) times its unit price (q^2), 3. of the participation of the log volume in the total volume (x) or in the total value (z) in hundreds of the unit. The final result of the consideration of these factors yields the formula of value increment percent: $\text{pval} = \frac{200bz}{D+nb+s}$ to which $s = \frac{P+p}{P-p} \times \frac{D-d}{2} - \frac{D+d}{2}$, and $z = \frac{xq}{xq.+(1-x)p_2}$

In determining the value increment of stands Borggreve's method, modification of Schneider's formula for volume increment is applicable, measuring from 10 to 30 trees and collating the data properly summed up by

$$pval. = \frac{Sa\left\{\frac{P.K.b.z.}{D+s}\right\}}{Sa.(P)}$$

K, the constant, being 200 or varied as above. A graphic table and other helps for easier calculations, etc. are given, too elaborate to reproduce here.

An example may elucidate the procedure: The value increment per cent of a pine is to be ascertained measuring d. b. h. *45cm*, the bored cores show in the last period (opening up 2 years ago) a width of 1.2 cm, i. e. a ring width of 1.5 *mm;* density of stand .7, height and form increment=0. From a table we obtain values for s, z, etc., and find $s=39$; $z=.91$; $p=\frac{200}{n}\frac{P-p}{P+p}=1$;

the value per cent then is

$$pval. = \frac{400\times.15}{45-1.2} \quad \frac{\frac{200\times.15\times.91}{16+62}}{45-1.2+\frac{\quad}{2}} + 1$$

which (read from graphic table) reduces to 2.7%. An extensive literature reference on the subject ends the article which was written for a doctor's thesis. B. E. F.

Beiträge zur Ermittlung des forstlichen Wertzuwachses. Forstwissenschaftliches Centralblatt. Sept., Oct., pp. 465-511.

Damages for Destruction of Timber.

The Supreme Court of Pennsylvania holds that, in an action to recover damages for the loss of growing timber by fire caused by the defendant's negligence, the measure of damages was not the value of the wood destroyed, but the injury to the farm as a whole by the destruction of the timber, where much of the timber was young and not marketable, and had no value as wood, but was growing into value and added to the value of the land it covered, and the whole of it added to the value of the farm of which it was a part. Bullock vs. Baltimore & Ohio Railroad Co., 84 Atl. R. 421.

American Lumberman. April, 1913.

Yield of Conifers in France.

After discussing some of the inconsistencies in the method of yield regulation in France, M. Hatt cites some silver fir-norway spruce growth per cent figures for Silver fir and Norway spruce which are extremely significant. These are summarized as follows: On "gres vosgien" soil, with a rotation of 135 to 144 years, the average production during the past ten years was 80 cubic meters per hectare (1145 cubic feet per acre) or a growth per cent of 25; in stands partly on "gres vosgien" and partly on "gres bigarre" soil the production was also 80 cubic meters per hectare for 10 years, or 27 per cent. In the second case, the rotation was 144 to 150 years. On granite soil with a rotation of 144 years the production was 70 cubic meters for 10 years, (1000 cubic feet per acre) making 21 per cent.

T. S. W. JR.

Revue des Eaux et Forêts, April 15, 1914, pp. 254-257.

UTILIZATION, MARKET AND TECHNOLOGY.

Log-Loading Device

Two well guyed trees or gin poles, one on each side of the track and 200 to 400 feet from it, have a $1\frac{3}{8}$ inch cable stretched tight between them 40 to 60 feet above ground. A special carriage that can be racked in either direction at the speed of about 800 feet per minute, rides this line. The lifting line and this carriage are operated by a 3-drum, 4-cylinder loader. The lifting line, handled by the lower drum, is fastened as a tail-hold to one of the guyed trees and then passes through the two lower sheaves of the carriage, looping down to a special block in the bite of this line. This gives the engine a block purchase on the log. The lifting and racking lines are handled independently. The advantages of this system are: (1) no roll-way or landing place is needed; (2) the landing is never blocked up, for the logs can be delivered by the yarder anywhere between the track and the guyed tree 400 feet away; (3) any log can be picked up to make up a load; (4) timbers 160 feet long are handled; (5) it is a safer system than any of the old ways; (6)

a greater choice of settings for the yarding engine is afforded; (7) the machine can also be used to spot cars.

American Lumberman, January, 1913.

Basket Willow Business in New York State.

The village of Liverpool, N. Y., with its 1400 inhabitants, was the first place in this country to start the manufacture of willow baskets. About 50 years ago the Germans there made baskets from willow for their own use around the home, and from this the demand grew to some 350,000 baskets annually at the present time, with shipments all over the country in car-load lots. Almost every family is now engaged in either raising the willow or cleaning it, or making the baskets.

Raising willows was formerly restricted to the back yards, and almost every German had a small patch, but now some farmers make it a business and have 40 to 60 acres of them. Cuttings are set about a foot apart and from each a cluster of 40 to 60 rods will grow annually after the third year. Considerable care is required to keep up good yields: the ground must be kept free of weeds; when cutting, the rods are clipped close to the ground; moist soil, although not necessarily swampy soil, is needed. When full grown, an average yield is about 3 tons of rods per acre each year; and they are worth about $18 per ton, green. The rods are 3 to 5 feet long usually, although some reach 8 or 9 feet; the latter are not much in demand.

After the willows are cut, they are steamed and the bark peeled off by hand, and the rods sorted into 4 or 5 sizes. It is dirty work to strip willows of their bark for they are slimy and wet. The peelings are "thrown into the back yards, and when they will hold no more they have to pay to have them carted away. No use has been found for the bark. No machine has ever been invented to strip willows successfully.

There are 150 basket factories in Liverpool, all doing hand-work. Almost every basket-maker has a shop in his house. One man can make 5 hampers a day or a dozen waste-paper baskets, and all of the work is done by the piece. Formerly 15 hours constituted a day, but now the hands work "only twelve hours."

The average wage for the basket-maker is $1.75 to $2.00 a day. Labor conditions are peculiar in that "no one is learning the trade," and as a result hands are scarce and they do about as they please, although many work all their lives in one factory. There are four sizes of hampers made; clothes, market, office baskets, and cat and dog baskets. Some years as high as 35,000 clothes baskets alone were made.

The Barrel and Box. 1912.

History of the Veneer Industry.

As a rough estimate there are about 1000 veneer establishments in the United States, using approximately one-half billion feet of lumber yearly. There is an annual production of veneer in 34 States; the leading States are Michigan, Indiana, Illinois, Arkansas, Missouri and Wisconsin. Practically every kind of wood is used; the leading ones in the order of prominence are gum, yellow pine, maple, poplar, cottonwood, oak, birch, elm, basswood and beech, besides foreign woods in less amounts.

There is evidence of veneer cutting in one form or another back as far as history goes; but those early efforts were hand-work and have little connection with modern veneer making. The use of fine face veneer in cabinet work seems to have started with Sir Ishambard Brunel in 1799 at the Chatham dock yards. Here he had the first steam saw-mill in England. He equipped a shop at Battersea about 1805, and developed the practice of sawing veneer from mahogany and rosewood. About this time he invented the veneer-saw, pretty much as we know it today, and cut veneer as thin as 1/16 inch with great precision.

Since that time there have been many veneer cutting machines invented,all of which may be classed under three heads: sawing, slicing and rotary cutting or peeling. The rotary veneer cutting industry was just attaining importance in the woodworking world 15 to 16 years ago. About that time there were some pretentious experiments tried at making built-up lumber, which proved unprofitable. The origin of the rotary cutting is obscured a little, but some of the old writers claim, without clear references however, that it originated in Russia. The best data seems to give Gen. Bentham in England credit; for the rotary method might logically develop from a power planer that he built. This machine had some resemblance to a huge hand plane mounted on slides, power driven, which in operation sliced thin pieces from a block of wood. The pieces were used at first for making light packages (hat-boxes). From these machines the modern basket factories developed, and since they had a greater capacity than was needed to supply the basket demand, the natural step for some outlet was the development of the plain veneer and the built-up lumber industry.

St. Louis Lumberman, December, 1912.

Block Paving in England and France.

Australian hardwoods such as karri and jarrah, also the so-called Canadian redwood and Baltic redwood, are used for paving-blocks in England. The blocks are usually 9x3x5 inches in size and are creosoted to about 10 lbs. per cubic foot of wood. Red gum blocks from America with medium to light traffic lasted 10 years, the other woods mentioned above last 15 to 20 years. (Other consular reports relating to the use of wood blocks in England appeared May 29, 1908, May 21, 1910, September 13, 1911; in Germany, August 3, 1910, October 7, 1910; in Italy, March 10, 1911.)

In France, pine from the Landes (in Southwestern France), "karre," a wood from one of the French colonies, teak, oak, and beech, all creosoted, are used for paving. A wooden lath $\frac{3}{8}$ inch thick is placed between the rows of block to form a space which is then filled with concrete and gravel. In Paris most of the leading avenues and public places are paved with wood blocks.

Southern Industrial and Lumberman Review. January, 1913.

Cigarbox Wood.

The standard wood for cigar boxes is Spanish Cedar. It is supposed that this cedar has a beneficial effect on the flavor of high grade cigars, although nothing definite can be said of the effect a box made of balsam fir, for example, would have on the cigars packed in it. The increased cost of the cedar has brought many substitutes into the market; where a solid cedar box formerly cost 7c now it is 11c. The substitutes, other than veneers of the cedar, make a cheaper looking package, and the dealer knows that the cigar will be judged to a considerable extent by the box in which it is packed. The principal substitutes are veneers of the cedar or basswood or gum, basswood stained without veneering, or covered with paper printed to resemble the grain of cedar. Many combinations are used. One box may have a solid Spanish cedar top; the sides of gum stained on the inside and veneered with cedar on the outside; the ends unstained gum but veneered with cedar on the outside; the bottom of soft elm stained a cedar color. Most of the material is re-sawed to ⅛ or 3/16 inch thickness. The cedar veneer is cut 1/100 to 1/40 inch thick.

American Lumberman, November, 1912.

Weights of Lumber.

The figures below are taken from data given in Service Circular 213 for the first column; from the official estimated weights of air-dry lumber as published by the Hardwood Manufacturers' Association of the United States for column 2; from similar official estimated weights both dry and green as published by the National Hardwood Manufacturers' Association for columns 3 and 4 except the figure for white pine in column 4 which was taken from Forest Service Circular 213.

Weight per M Feet.

	Absolutely dry	Air-dry	Air-dry	Green
Beech	3476 lbs.	4000	4000	5750
Birch	3435	4000	4000	5500
Hard Maple	3341	4000	3300	5400
Soft Maple	3222	3000	3300	5000
White Pine	2032	2400	2500	3535

American Lumberman, April, 1913.

Hardwood Distillation.

A number of problems concerning hardwood distillation are suggested by Dr. L. F. Hawley in a pamphlet issued by Arthur D. Little, Inc., chemists and engineers, Boston, Mass. The questions deal with the value of different species of wood as affected among other things by the products obtained, the amount of heat needed, the moisture content of the wood, the relative value of different parts of the tree, and recovery of products from escaping gases.

Hardwood Record, April. 1914.

Douglas Fir Distillation.

The results of four experiments carried out on a commercial scale to determine the value of distillates from Douglas fir stumps, along with other supplementary investigations, show that distillation as an aid for clearing land is entirely out of the question, according to G. M. Hunt of the Forest Service. The processes employed were steam distillation with and without subsequent extraction, destructive distillation, and combined steam and destructive distillation. The experiments are described in detail in a 3,000 word article, and the summary brings out a comparison of the yields of Douglas fir to those of Norway pine and Longleaf pine, although not an exact comparison.

	Turpentine	Other Oils	Tar	Rosin
Douglas fir	1- 4 gal.	3- 8 gal.	15 gal.	75-150 lbs.
Norway pine.....	8-18 "		10-20 "	300 "
Longleaf pine....	10-20 "	7-16 "	25-45 "	

The yield of charcoal is about the same for each. While the yields of acid and alcohol cannot be compared, those from Douglas fir are so low that it is doubtful if they could be profitably saved.

Besides the small amount of product, other things stand in the way of profit. The products are different from those of Norway and Longleaf, and are not favored on the market. The large stumps make expensive handling, and, besides, the mill-waste is more easily handled and is much more than sufficient to supply the Pacific Coast demands, even if the market would take kindly to the products and all of the eastern materials were driven out of competition.

Timberman, April, 1914.

Excelsior. By far the greater quantity of excelsior is made from small, second-growth basswood and poplar, although considerable is made from cottonwood, balsam, spruce, and willow. The wood is usually cut in 4-foot lengths, and peeled in early spring. The peeled wood produces cleaner excelsior and dries quicker. Poplar (probably Aspen) requires a year to become thoroughly seasoned. Green or damp wood is unsatisfactory because it clogs the machinery and is apt to become mouldy when pressed in bales. After the wood is seasoned it is cut square ended into 16-inch lengths. Open air seasoned wood is preferred to kiln dried.

There are two classes of machines: an upright double-head machine and an 8-block horizontal machine. Both are adjustable for different grades of excelsior. Excelsior is usually cut from 1/32 inch to 1/8 inch wide and about 1/100 inch thick; these machines can however, be adjusted to cut from 1/64 to 1/2 inch wide and from 1/500 to 1/50 inch thick. The double upright machines require about 5 horse-power each and have a capacity of 1 ton per day, that is approximately 1 cord of 4-foot wood. The horizontal machine cuts about 5 tons per day.

Excelsior is selling at $18 to $22 per ton and the finer wood-wool at $30 to $35. The cost of production varies for $3 to $5 per ton. Many of the large consumers have plants of their own.

The best grades of excelsior are made from basswood. That not more of this is used is due probably to its scarcity and to the high price of the stumpage. Cottonwood is the favorite excelsior wood, contributing 43.3 per cent of the total amount consumed. It was used by manufacturers in 18 States.—U. S. Bureau of Census Report for 1911.

Canada Lumberman and Woodworker. October, 1913.

STATISTICS AND HISTORY.

Prussian Budget. The Prussian budget for the year 1914-15 contains some interesting figures. It is marked by increased receipts and expenditures along most lines, as for many years.

For the *state* forests, an area of 7,518,159 acres, (or 6.7 million productive) receipts and expenses are estimated as follows:—

Regular receipts, ...	$36,660,000.00
Regular expenses, ...	16,160,000.00
Net income, ...	$20,500,000.00, or just

about $3 per acre; the expenditures being 44% of the gross income. Besides, there is an account of extraordinary expenses and incomes, largely made up of sales and purchases of forest land; the excess of expenditures over receipts, being $1,013,000.00; $700,000 alone are to be spent on adjusting rights of user.

Of the receipts, wood sales are predicted to yield 387,176,134 cubic feet (57 cu. ft. per acre) at a value of $34,200,000.00 (about 9 cents per cu. ft.). Special Uses are estimated to bring in $1,740,000.00; the chase $190,000.00.

The income for wood has in the decade increased by 43%, but the expenditure by 66% in steady rises.

Among the expenses there are the interesting items of $60,000 for telephones and $310,000 for road building.

The personnel for the current year comprises:—

1 Oberlandforstmeister; 5 Landforstmeister; 33 Oberforstmeister; 88 Regierungs—and Forsträte; 822 Oberförster and Forstmeister; 5167 Revierförster and Forster (Ranger); 49 Waldwärter (Forest Guards); altogether 6165 persons.

The annual forestry conferences among 18 groups of higher forest officers, described in Forestry Quarterly, Vol. VI, p. 444-445 are to be continued and $4,500 are set aside for additional travel costs arising therefrom. A. B. R.

Der Etat der Domänen Forst-und landwirtschaftlichen Verwaltung für das Etatsjahr 1914-15. Allgemeine Forst-und Jagd-Zeitung, April, 1914, pp. 140-144.

Private Forests of Germany.

Dr. Wimmer reviews a 32 page booklet by Oberförster Maucke, dealing with the regulations governing privately owned forests in the various states of Germany. The publisher is Paul Parey, Berlin. The exact title of the book is given below.

Aside from communal and corporate forests, there are in Ger-

*For equivalent position in U. S. Forest Service, see "The Prussian Forest Service" Forestry Quarterly, Vol. XI, No. 1, p. 48.

many 12,490,051 acres of privately owned woods, that is, 36% of the total forest area of Germany. (In the United States 395,-000,000 acres, 72% of the total 550,000,000 acres of forest, are privately or corporately owned.)

The author favors complete freedom of management (except in protection forests) encouraged by instruction and co-operation on the part of the government. This is already the case in Prussia and Saxony; in southern Germany restrictive laws are still in effect, dating from a time when the value of the forest was small.

As means of improving the condition of privately owned forests are cited:—Extension lectures; advice on the ground by neighboring state foresters, especially at the time of planting and of cutting; forming of associations; and the creation of a division of forestry in the agricultural council (Landwirtschaftskammer) as has been done successfully in eight provinces of Prussia and lately also in Baden. In Saxony, prizes are offered for the best managed private forest.

The author urges the need of a most careful census of all privately owned forests in Germany in order to get a clearer picture of existing conditions. A. B. R.

Die zur Erhaltun· der Privatforsten ... in den deutschen Bundesstaaten erlassenen ... Bestimmungen." Allgemeine Forst-und Jagd-Zeitung. April, 1914. Pp. 134-135.

Buying Forests in Italy.

According to an article by de Bendictis, the Italian Government recently purchased 2,859,018 acres for the price of $215,157. Other purchases are also listed. This is particularly significant when taken in connection with the recent purchase in France of the Forest of Eu belonging to the Duke of Orleans, who was forbidden by the State to make a sale to a private company, on account of the doubt which had been cast on the conservatism of future management. This forest was located in the Districts of Dieppe and Neufchatel. A total of 2,301,258 acres was purchased for a total of $2,100,000 or in round figures at 91 cents per acre. This forest was chiefly hardwood, coppice, high forest and coppice under standards. T. S. W. Jr.

Revue des Eaux et Forêts, April 15, 1914, pp. 267, 268 and 272.

POLITICS, EDUCATION AND LEGISLATION.

Forestry Training in Bavaria and Württemberg.

New instructions for the preparatory training in Bavaria and Württemberg wil be of especial interest to those readers of the "Quarterly" and of the "Proceedings" who are familiar with the requirements in Prussia† and Austria* and in our own countries of Canada and America.

In Bavaria, after the four year course at the University of Munich and passing of the theoretical examination at the close thereof, the government takes on a certain number of candidates for the administrative service—called Forstpraktikanten—who must serve a 3 years' apprenticeship; 19 months on National Forests, 17 months in a District Office. The first year is spent on a designated forest where the supervisor introduces the candidate into all the various lines of work granting him opportunity to actually carry on some of the work. Emphasis is laid on instruction in the technical and business procedure. Details to neighboring forests where work of special interest is in progress, are arranged.

At the end of the first year, the apprenticeship is continued on another forest, selected, this time, by the applicant himself. The object of this second year is to broaden the training of the first year; the applicant may be assigned the regular work of an Assessor (equivalent to our Forest Examiner) or of a Ranger.

Next comes the office experience where the applicant is detailed first of all to the Working Plan Section: from May to October in actual field work. Besides assisting in the making of working plans, he must independently prepare the plan for a certain unit—that is, do *all* the work necessary thereto. He gets his expenses for this work and a stipend of $1.20 a day!

The following 11 months (November-September) are spent in learning the District Office procedure.

This ends the time of preparation; the final or state examina-

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*See "The Prussian Forest Service," Forestry Quarterly, Vol. XI, No. 1, pp. 42-50.

†See "A Glimpse of Austrian Forestry," T. S. Woolsey, Jr., Proceedings of the Society of American Foresters, Vol. IX, No. 1, pp. 7-37.

*The working plan practice in Bavaria will be found described in "The Theory and Practice of Working Plans," John Wiley & Sons, New York, 1913, pp. 147-159.

tion comes in November. This examination is a written one but reference books—such as Lorey, "Handbuch der Forstwissenschaft" are allowed. Eighteen problems, covering the various phases of forestry, are assigned, three hours allowed for each: a total of 54 hours. The papers are marked independently by three higher officials of the Bavarian Service.

The Württemberg instructions provide for three examinations, similar to the Prussian schedule. 1) Preliminary examination in the basic sciences, 2) Referendar-examination at the close of the University course and 3) Assessor-examination after 2½ years of practical apprenticeship.* The number of candidates chosen for the government service from among those who passed the preliminary examination may be limited and those not chosen given certificates. Three months of practical experience in the woods must precede the Referendar-examination.

The 2½ years of practical apprenticeship are without pay, they are to be spent as the ministry decides. However, two semesters of advanced work at a university may be counted in with this. At the end thereof, comes the final or Assessor examination—a very 'stiff' one.

The time of training in Württemberg amounts therefore to 12 years of school (through the Gymnasium or about the equivalent of our sophomore year) plus 8 semesters of technical study, plus one year of military service, plus 2½ years of apprenticeship: a total of 19½ years. In Bavaria it is an even 20 years (with us the 10 years of school, 4 of college and one or two of postgraduate work for the Master's degree, makes a total of only 15 or 16 years). A. B. R.

Die neuen Bestimmungen ... für den bayerischen Forstverwaltungsdienst Allgemeine Forst-und Jagd-Zeitung, June, 1914, pp. 203-205.
Die Vorbereitung zum Forstdienst (Wurttemberg). Allgemeine Forst- und Jagd-Zeitung, May, 1914, pp. 173-174.

MISCELLANEOUS.

German Foresters Associations.

There are some 20 active forester's associations of more or less local character, besides the Deutscher Forstverein which covers the whole empire and comprises 2177 members (1913), the local associations showing a membership of over 4000, who represent pro-

†See "The Prussian Forest Service," F. Q., Vol. XI, No. 1, pp. 42-50.

fessional men and timberland owners. An account of the topics under discussion is given.

Die deutschen Forstvereine, ihre letzten Versammlungen und Beratungsgegenstande. Zeitschrift für Forst-u. Jagdwesen. May, 1914, pp. 296-302.

The Theoretical vs. The Practical.

At the closing exercises of the Yale Forest School on February 25, 1914, Dr. Fernow delivered an address on this subject.* In it he pointed out how the so-called practical man usually proceeds on the basis of unformed empiricism. Along much the same lines Forstassessor Weber argues in an essay on Science and Experience. That mere personal experience can ever displace careful scientific investigation is untenable. On this most authors are agreed. Occasionally some empiricist argues that experience is the best teacher. Among these Forstmeister Frömbling takes the view that personal experience alone can teach the forester how to proceed, on the ground that the exceptions to many important rules are so numerous that scientific generalizations are worthless and for the exceptions experience alone can furnish the answer. Has not Pfeil, himself, said: "ask the tree, it will teach you?" Answering this, Weber points out that science and practice must work together and be in constant reciprocity, that the practising forester must never lose sight of the scientific developments and must keep in constant touch with these. He must not forget that he alone, depending on his personal experience, can make no real progress and that, without application of strictly scientific methods of research in forestry, no lasting results can be secured. Granting that generalizations are worthless, individual experience is of necessity too circumscribed to furnish an adequate substitute. Careful scientific research, alone, can cover the field. Just because the theories of today do not solve all problems of practice is no reason to throw away theory. It is the aim of science not to solve all riddles—for this must always be impossible—but to probe deeper and deeper into the reason of things. Mere experience can not go as far as this, can not point the way with any assurance of success. Only when theory offers its sisterly hand to practice, when speculation is added to ex-

*See Yale Forest School News, Vol. II, No. 2, pp. 15-18.

perience can science thrive. It is interesting to note that this antagonisin between theoretician and practitioner has for more than a hundred years been discussed in forestry literature, Weber quoting the expressions of early masters. Among these, Moser in 1757 in his Principles of Forest Economy hits the nail on the head: "The road to wisdom and judgment by way of personal experience alone without systematic teaching is a rough and very uncertain one: few travel it without stumbling and many fall.

Only with a good scientific knowledge as a basis will experience make us wise. Without such basis it would be difficult to see what to observe, how to differentiate between the accidental and the essential. Moreover, this road is long!" A. B. R.

Wissenschaft und Erfahrung. Allgemeine Forst-und Jagd-Zeitung, April, 1914, pp. 117-126.

Forest Parks in Bavaria.

The Bavarian Government has recently set aside five areas on the Austrian frontier containing 343 hectares, in order to retain the original forest cover in its primeval condition. With the artificially pure stands which forest management generally finds most profitable covering larger and larger areas, it seems very desirable to retain a few examples of the old mixed stands.

In these parks all cutting and other use will be forbidden. Likewise, hunting and fishing will not be permitted so that these parks will also form game refuges.

The Bavarian Government has already set aside for the same purpose 77 hectares of peat bog and some stands of old oaks.
K. W. W.

Naturschutz in den bayerischen Staatswaldungen. Forstwissenschaftliches Centralblatt, May, 1914, p. 291.

First Saw-mill in United States.

Not long after the colony at Jamestown was founded the colonists began to manufacture lumber in a crude way and a cargo of "clap-boards" was exported from Virginia in June, 1607. As early as 1625 a saw-mill with upright saws run by water-power was established near the present site of Richmond.

St. Louis Lumberman.

OTHER PERIODICAL LITERATURE.

American Forestry, XX, 1914,—

Sixteen Thousand Miles of Forested Shore Line. Pp. 319-340. British Columbia coast conditions.

The South's Forestry and Water Resources. Pp. 377-379.

An Epitome of National Reclamation. Pp. 393-402.

Forestry on the Country Estate. Pp. 1, 101, 165, 261, 356, 448, 501.

Bulletin of the American Geographical Society, XLVI, 1914,—

A Method of Estimating Rainfall by the Growth of Trees. Pp. 321-335.

A Geographical Study of Nova Scotia. Pp. 413-419.

The Ohio Naturalist, XIV, 1914,—

Starch Reserve in Relation to the Production of Sugar, Flowers, Leaves, and Seed in Birch and Maple. Pp. 317-320.

The Botanical Gazette, LVII, 1914,—

The Significance of Tracheid Calibre in Coniferae. Pp. 287-307.

The writer concludes that there is considerable evidence that the width of spring tracheids is largely decided by two factors, systematic affinity and available water supply.

Morphological Instability in *Pinus radiata.* Pp. 314-319. Deals with shoot proliferation.

The Spur Shoot of the Pines. Pp. 362-384.

Winter as a Factor in the Xerophily of Certain Evergreen Ericads. Pp. 445-489.

Bulletin of the American Institute of Mining Engineers, 1914—

Fuel Oil in the Southwest. Pp. 1023-1070.

The Classification of Public Lands. Pp. 1139-1141.

Naturwissenschaftliche Zeitschrift fur Forst-und Landwirtschaft.

Erkankungen durch Luftabschluss und Ueberhitzung. Von C. von Tubeuf. February, March, 1914. Pp. 67-88, 161-169.

Discusses especially the influence of stagnant water on Ash, and of tarring wounds.

Hitzetot und Einschnürungskrankheiten der Pflanzen. Von C. von Tubeuf. Jan. 1914. Pp. 19-36.

Discusses the effect of mechanical strangulation of tissues and similar results produced by various fungi, as well as of frost, heat and drouth.

Gibt es natürliche Schutzmittel der Rinden unserer Holzgewächse gegen Tierfrass? Von Franz Heikertinger. March 1914. Pp. 97-113.

Demolishes convincingly the theory of protective means of plants against animals.

Nochmals Hitzeschäden in Waldpflanzen. Von Dr Münch. April, 1914. Pp. 169-188.

Addition to a previous article discussing in detail the effect of heat much more frequent than supposed and as important as frost, upon forest trees.

Aus dem Münchener Exkursionsgebiet. Von C. von Tubeuf, May, June, 1914. Pp. 217-258.

A richly illustrated account of the exotic flora in the valley of Bozen, Tirol.

Forstwissenschaftliches Centralblatt.

Beiträge zur Physiologie des Bodens. Von Dr. Bernbeck, Jan. 1914. Pp. 26-44.

Discusses soil depth (absolute vs. physiological); improvement of forest soils by choice of species and mechanical means.

Zeitschrift fur Forst- u. Jagdwesen—

Neue Wege der Forsteinrichtung. Von Oberforster Hiss. July, 1913. Pp. 447-454.

Untersuchungen über den Wertzuwachs von Kiefer und Fichte. Von Geh. Rg.-Rat Prof. Dr. Schwappach. August, 1913. Pp. 502.

Der Blendersaumschlag und sein System. Von Prof. C. Wagner. (Review by Dr. Kienitz). November, 1913. Pp. 727-41.

Einfluss hoher Essen auf die Verbreitung der Rauchschäden. Von Oberforstrat Reuss-Dessau. December, 1913. Pp. 782-90.

Der Kienzopf. Von Oberforster Haak. June, 1914. Pp. 3-46. A very full account of investigations into the disease occasioned by *Peridermium pini.*

Schweizerische Zeitschrift fur Forstwesen—

Reisenotizen aus Skandinavien. Schweden und seine Holzausfuhr. Von Prof. M. Decoppet. April, 1913. Pp. 105-113; May. Pp. 145-55; June, July. Pp. 185-95.

Centralblatt fur das gesamte Forstwesen—

Zur Praxis der Waldwertsberechnung. Von Dr. Theodor Glaser. January, 1913. Pp. 1-11; February, Pp. 49-60.

Der Voranschlag für die verschiedenen Zweige des staatlichen Forstdienstes und für die Staatsforste und Domanen insbesondere für das Jahr 1913. January. Pp. 1-11.

Schweizerische Forststatistik (Literarische Berichte). (Dr. Pittauer). February, 1913. Pp. 77-80.

Ein altbekanntes Kinderspielzeug als Lehrbehelf für die Forstwirtschaft im allgemeinen und dem Walbau insbesondere. July, 1913. Pp. 327-32.

Allgemeine Forst-und Jagd- Zeitung—

Die Sonnenenergie im Walde. Von Max Wagner. June, 1913. Pp. 185-200.

Chemie des Holzes unter besonderer Berücksichtigung der Impregnierungstechnik. Dr. F. Moll. April, 1914. Pp. 126-132.

A very full discussion of the chemical composition of wood and its reactions to various chemicals.

NEWS AND NOTES.

Co-operation between the government and the State against forest fires is made possible by the Weeks law, and has already been taken advantage of by the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Maryland, West Virginia, Kentucky, Michigan, Wisconsin, Minnesota, South Dakota, Montana, Idaho, Washington, and Oregon.

Under the terms of the co-operative agreements, the Secretary of Agriculture may terminate the co-operation at any time that he finds it not to be conducted in a satisfactory manner. In this way the responsibility for organizing and maintaining the work is placed upon the State, which must, therefore, keep its system up to a good standard of efficiency in order to have the co-operation with the government continued. Forestry officials of the department of agriculture act as inspectors to keep the department informed as to how the States are handling the work. Under this plan a great advance has been made in the development of efficient state systems of fire protection.

An agreement entered into between the U. S. Department of Agriculture and the State of Michigan provides for an expenditure by the government of not to exceed $5,000 a year toward meeting the expenses of forest fire protection in Michigan.

In Montana co-operative agreements involve the Forest Service, the State, and the Northern Pacific railroad. These have just been renewed to extend through the fiscal year to June 30, 1915.

The agreement with the State provides that federal and State patrolmen shall form one single force for handling forest fires, which force acts under the direction of the forest supervisor in charge of the nearest national forest. This arrangement, as is intended, "secures the greatest efficiency and avoids duplication of patrol." The agreement applies to all government and State lands lying within the exterior boundaries of the National Forests in Montana. The agreement between the railroad and the Forest Service provides for similar patrol arrangements.

The government allots the State the sum of $3,500 a year, to be expended for salaries of federal patrolmen, and the State agrees to spend at least an equal amount for fire protection purposes of any character.

One of the most progressive railways in matters of fire protection is the Boston & Maine, which operates in both the United States and Canada. In addition to following the general practice of most railways in burning off the right of way each year, to reduce grass fires, the Boston & Maine has adopted the policy of co-operating with land-owners along their lines, in getting the inflammable debris disposed of on a narrow strip adjacent to the right of way. It is recognized that in some cases sparks from locomotives will fall outside the right of way, which usually extends fifty feet on each side of the center of the track. Fires are likely to start in this way and cause serious damage before they can be extinguished. Similarly, the danger from small grass fires starting within the right of way is greatly increased by the presence of inflammable debris, such as old slashings, immediately adjacent to the right of way fence. So far as possible, the Boston & Main Railroad secures the active co-operation of owners of such lands in burning the debris at a safe time. Where this is impracticable for any reason, the Company does the work at its own expense, unless the land owner objects. The Company reports that on seventy-five such places last year, the fire hazard was materially reduced in this way. This is good business policy from the point of view of the railway, since the elimination of forest fires means in the long run not only decreased damage claims, but also increased freight and passenger revenues. The Company states that the adoption of the above policy means very little added expense, since the section men handle the work on rainy days, when there is no track work they can do. This is also the safest time for burning such debris, since the fires can not spread beyond control.

The Pennsylvania Railroad has also adopted a policy closely similar to the above.

According to the Fire Inspection Department of the Board of Railway Commissioners for Canada, the railways throughout the Dominion are doing very much better this year in the matter of fire protection than has ever been the case before. There has been better compliance with the requirements of the Board, and a far greater degree of co-operation between the various agencies interested in fire prevention. In particular, the railways are co-operating much more closely than previously with the fire protective organizations of the Dominion and Provincial Governments. The situation has also been greatly improved by the increase, in number and strength, of lumbermen's co-operative fire protective associations, of which there are now two in the Province of Quebec protecting a total of nearly 14,000,000 acres.

In the past, railways have always been regarded as one of the principal causes of forest fire destruction. This situation is now being rapidly changed, by the increasing care given this matter under the requirements of the Railway Commission. The fire hazard is being reduced by the expenditure of large sums by railway companies in disposing of inflammable debris on right of way. Great care is taken to keep the spark arresters on locomotives in good order. Through the more dangerous sections, special fire patrols are maintained, and everywhere railway employees have received special instructions regarding the reporting and extinguishing of fires in the vicinity of the track.

Reports received by the Chief Fire Inspector of the Board indicate that to a very much greater extent than in previous years the fires in the vicinity of the railways have been adequately handled by the railway employees, and that most of the serious fires reported as occuring in May, originated at a distance from the railways, frequently escaping from settlers slash-burning operations.

The Canadian Pacific Railway has reorganized the local administration of the special fire patrols on its western lines, required by the Board of Railway Commissioners, by placing the matter under the direction of its Forestry Branch of which Mr. R. D. Prettie is Superintendent, with headquarters at Calgary. The new arrangement affects the handling of fire protection work on all lines of the C. P. R. running through forest sections west of Fort William, Ont. The C. P. R. Forestry Branch has previously been closely associated with fire protection work, through the assignment of inspectors, but the new arrangements will greatly increase its scope by giving it administrative control as well. The new plan is altogether logical in an age of specialization.

The Dominion Parks Branch has just gotten out a new fire warning notice of striking and attractive form for use in the National Parks throughout the Dominion of Canada. The new notices are made of tin and the face with baked enamel. The initial cost is higher but this is amply justified when the superior lasting qualities of the tin over that of the cloth notices is taken into account. The lettering is in red and black sufficiently large to be easily readable at a distance. At the top of the notice is a picture of a forest fire, depicting in a vivid manner the ravage and devastating influence of fires to the timber resources of the country.

Wireless telegraphy has been brought into use in connection with protection of forests from fire. It is now possible for rangers in the remote regions of The Pas and Fort Churchill to communicate almost instantly with the Forestry Branch at Ottawa. This is probably the first practical application of wireless telegraphy to forest fire protection in America or elsewhere.

An electrical engineer recently stated that "in the near future the wireless telephone will not only progress far ahead of the wireless telegraph, but take its place." When instruments are perfected suitable for forest use, incalculable benefit for getting fires quickly under control will result.

The British Columbia Forest Branch, by widely distributing various styles of posters, etc., reiterating the danger from unwatched small fires, made efforts early this year to seek the co-operation of all people in the woods to prevent forest fires. Perhaps the two notices that will prove most striking are the forest fire law printed in six languages on a single sheet, and a pocket-size grindstone, on the enamel holder of which the user is cautioned against fires.

A report comes of a co-operative association for the prevention of forest fires formed by ranchers within and adjacent to the

Sierra National Forest, Cal. When using fire for clearing land for farming, it will be done on a community basis, members of the association being present to prevent the spread of fires.

The Post Office department of the United States two years ago enlisted in the campaign against forest fires by instructing rural mail carriers to report fires to the proper officials, lists of names and addresses of local fire wardens and patrolmen being supplied the carriers. This year wardens and patrolmen have been instructed to seek out personally the mail carriers to discuss a plan of action to be followed.

Manufacturers of hunting, camping, and sporting goods are being asked for their co-operation also. It has been suggested that their business profits during seasons when fires are fewer, and so it would be well for them to issue with their goods printed slips of warning. Railways print such warnings on time-tables. They would aid still further if sportsmen's and campers' special tickets showed a brief warning printed in red.

In F. Q., vol. XI, p. 617, reference was made to the enlisting of Indians in the work of fire prevention. The following will be of interest as a result of asking the Indians for co-operation in this important national duty in Canada.

Owing to the precedent and example of Dominion Forestry Branch fire wardens, the ingrained carelessness of the Indian, for he has frequently and not always unjustly—been accused of criminal carelessness with fire, has been supplanted by an enthusiasm for forest conservation. Several hundred Indians last summer promised to observe every precaution to prevent forest fires, and, as the Chief Fire Ranger writes, "The fact of no fires this summer is proof positive that the majority of them have faithfully kept their pledge." During the course of the summer 63 Indians voluntarily visited the Chief's headquarters to discuss the plans of the Branch in the matter of conserving the remaining forest in western Canada.

Many of these Indians are sufficiently well educated to serve as fire rangers, and the Dominion government has enlisted quite a number of them in the fire-ranging service, finding that their knowledge of the country and their enthusiasm for the work make them admirably adapted for this service.

It is said that the best times of day to see forest fires from lookout stations are just after daylight and just before sunset.

On the Deerlodge National Forest in Montana one lookout station has the record of reporting accurately, by distance and direction, a fire that was 60 miles away.

Residents of Wallace, Idaho, now claim that results of the disastrous forest fires in northen Idaho in 1910 are being made evident in the changed flow from a watershed then burned over, which furnishes the city its water supply, not only for domestic purposes, but also for the development of electricity for power and light. In view of the situation, the Forest Service has undertaken to reforest the denuded watershed. Some planting has already been done and eventually all of the watershed which is included within National Forest boundaries is to be reforested.

A little more than 33,000 acres in the White Mountains have just been approved for purchase by the government at a meeting of the National Forest Reservation Commission.

These are in two separate tracts, both in New Hampshire, the larger containing 31,100 acres on the watershed of the Pemigewasset river, a tributary to the Merrimac. Most of the conifers have been cut to make paper pulp, but there are good stands of beech, birch, and maple of considerable value. With fire kept out there is said to be excellent promise of a new stand of spruce.

The smaller purchase consists of several areas lying on the watersheds of Little river and Gale river, both tributaries of the Connecticut. These lands cover 2,000 acres in the locality of the noted Franconia range and are contiguous to lands already approved for purchase; hence they go far toward giving the government a solid body of land in this locality. The forest has been cut over and consists chiefly of the northern hard-woods, though some spruce remains from the original stand.

At the same time that these White Mountain areas were approved, the Commission also approved the purchase of the Pisgah

Forest in North Carolina, from the George W. Vanderbilt estate. These tracts bring the total eastern forests up to 1,077,000 acres.

The Massachusetts Forestry Association is energetically working for visible progress. In addition to the contest noted in the first issue of this volume of the Quarterly, the Association this year announces a contest to encourage reforestation by the establishment of "town forests." The prize is to be 50 acres planted to three-year-old White pine transplants, 1200 to the acre.

There are over 40 different log rules now in use in the United States and Canada, showing a variation of over 50 per cent in the amount of lumber they ascribe to a log of any given size. Probably the best rule yet formulated is the International log rule prepared by Dr. J. F. Clark (F. Q., vol. IV, p. 92), when Chief Forester for Ontario.

So far as stumpage dues are concerned, it is safe to say that very often the lumbermen pay for only half the merchantable lumber the average log really contains. It is possible that when a bonus is paid by lumbermen in addition to stumpage dues this makes up for the loss in scaling. It is significant that when the British Columbia government recently decided to increase the royalty paid on timber cut in the interior of the province, it stipulated that the B. C. log rule should henceforth be used in that region instead of the Doyle rule, thus increasing by 45 per cent the amount of estimated lumber in the logs cut.

The only final remedy would seem to be the adoption of a general rule such as the International, or, better still, the substitution of cubic measurement of logs, a practice which has long been in operation in Europe where high lumber prices make accuracy not only desirable but necessary.

The American Wood Preservers Association in co-operation with the U. S. Forest Service recently issued a report on wood preservation.

1832 is the date given for the introduction into this country of the Kyanizing process. This was followed a few years later by the Burnett and the Bethel processes. All three processes, are largely in use today.

The report gives the progress in number of pressure plants as three in 1885, 15 in 1895, and, skipping to the present time. 117 in 1913.

In Great Britain and many European countries today practically every wooden crosstie and telephone or telegraph pole receives preservative treatment; while in the United States less than 30 per cent of the 133 million crossties annually consumed are treated, and the proper treatment of an annual consumption of 4 million poles may be said to have scarely commenced. Nevertheless, the impregnation of wood, with oils and chemicals to increase its resistance to decay and insect attack, is becoming an important industry, and the report states that the most notable progress yet recorded was made last year.

In southern Nigeria, on the west coast of Africa, the British government has done much to encourage the practice of forestry, eight hundred villages now have communal plantations of rubber trees. The natives supply the labor, the native chiefs the land, and the Forestry Department the seeds, technical knowledge and tapping appliances, the profits being divided equally among the three co-operating parties.

A Vancouver lumberman has estimated that "one ton of refuse goes to the burners for every M feet of lumber cut." In his own saw-mill he has eliminated this waste by breaking up the refuse into small pieces which are manufactured into fuel briquettes at a cost of only $3 per ton.

In this connection it has also been learned that a large lumber company in British Columbia is erecting a $50,000 plant, which will have a daily output of about 30 tons of such briquettes, which will sell for about $5 a ton at the mill.

Manufacturers have found that Red Alder from the Pacific coast makes a white, smooth, springy clothespin. As a result of this fact, a clothespin factory, said to be the first on the Pacific coast, may be established at Portland, Ore.

Zentaro Kawase, professor of Forestry at the Imperial University of Tokio, Japan, has been making a tour of the national forests of this country to learn the government's methods of selling timber and of reforestation.

At a State timber auction in Minnesota, aggregating some 40,000,000 feet sold at approximately $250,000, pine stumpage ran from $6 to $12 averaging $9, spruce, $4 to $5, tamarack and cedar $3 to $4, Jack pine $4 to $5, bakam $2 to 3. The premium paid in some cases amounted to over 140 per cent on the appraised price.

Mr. Ralph Sheldon Hosmer, who for a number of years officiated as Superintendent of Forestry, Bureau of Agriculture and Forestry at Honolulu T. H. has been appointed Professor of Forestry at the New York State College of Forestry, Cornell University in place of Walter Mulford who assumes the new professorship of Forestry at the University of California.

American foresters are beginning to compete for positions in foreign services. The latest development in this direction is the call of Mr. Douglas Mathews from the Philippine forest service to take charge of the timber holdings of the British North Borneo Company. The same bureau has furnished Mr. H. M. Curran to organize a forest service for the Argentine government.

We regret to learn from Major George P. Ahern that he is forced to resign his position as Director of the Philippine Forestry Bureau on account of trouble with his eyes. He will return in November, taking up his residence in Washington with a view of doing missionary work on behalf of the Islands. Mr. Sherfessee will replace him in the position of Director.

For fifteen years Major Ahern has held the position. He created the bureau and has brought it to noteworthy efficiency in spite of many drawbacks. Major Ahern began as a propagandist of forestry practice when Captain in the regular army, stationed in Montana some 20 years ago giving public lectures after he had sufficiently informed himself. In 1897 he secured the appointment of military instructor at the Agricultural College at Bozeman and immediately organized a class of students to study forestry. This was terminated when the Spanish war broke out in 1898, and when civil government was established in the islands Captain Ahern was the logical candidate for the position as the Director of the Forestry Bureau. His intelligent enthusiasm and capacity for organization are responsible for the success of the bureau.

Overton Westfeldt Price, Vice-President of the National Conservation Association and formerly Associate Forester of the United States Forest Service, died on June 11, at his family home in Fletcher, North Carolina. The ultimate cause of death was a nervous disorder from which he had suffered intermittently for years and which had returned in a sudden and acute attack only a few days before his decease; the immediate cause was a self-inflicted wound which was in itself a symptom of the malady. His untimely death removes from the profession of forestry in America one of its best known and ablest members, at the very height of his powers and to its material loss; while it leaves in the hearts of those who knew his capacity for friendship, his loyalty to noble ideals, his superb courage and fighting power, his stainless honor and rectitude of motive and deed, a vacancy that will not soon be filled.

The breakdown which closed his life may be traced back to his work in the Forest Service, where for years he had thrown himself ardently into the upbuilding of a system of national forestry. In this work he developed extraordinary powers of organization and administration. During the last two or three years of his term in public office particularly, he carried the main burden of internal administration of the Forest Service, doing his utmost to leave his chief, Mr. Pinchot, free to deal with the larger questions of policy and to wage his fight for national conservation. Under the strain imposed upon him by the conditions which immediately preceded the conclusion of his official responsibilities his strength was taxed to the utmost verge; and he never subsequently regained perfect health.

Mr. Price was born on January 27, 1873, in Liverpool, England, whither his parents had gone from North Carolina to live after the close of the Civil War. He received his earlier education in that country and at the Episcopal High School near Alexandria, Va. After a special course at the University of Virginia he took up work at Biltmore under Mr. Pinchot, and was thus one of the first Americans to turn towards what was then almost an unknown profession in the United States. One year later he went to Germany to obtain a complete technical preparation for his life work. Two years at the University of Munich were supplemented by a year of practical experience in various European forests. This work abroad was largely guided by the friendly counsels of Sir Dietrich Brandis. On his return to America he engaged in practical work at Biltmore and in the North Woods. In June, 1899, he entered the Division of Forestry of the U. S. Department of Agriculture as agent; a year later he was promoted to the position of Superintendent of Working Plans, and in 1901, when the old Division of Forestry was raised to a Bureau, became its assistant chief. The transfer of the National Forests to the charge of the Forest Service in 1905 gave a new and broader field for the employment of Mr. Price's remarkable organizing and executive capacity; largely to him belongs the credit for the work which established national forestry in the United States on a sound and permanent basis.

In January, 1910, his connection with the Forest Service was terminated; and he shortly afterward became Treasurer, and subsequently Vice-President, of the National Conservation Association. At the time of his death he was also consulting forester to the government of British Columbia, forester of the Letchworth Park Arboretum, and adviser in forestry matters of the estate of the late George W. Vanderbilt. In addition to a number of reports and articles on forestry, he was the author of "The Land We Live In," an admirable popular book on conservation written especially for boys, and of a work still in manuscript, on business organization. To the latter subject his attention had been especially turned in connection with the study of the Government's business system made by President Roosevelt's so-called "Keep Commission," or Committee on Departmental Methods. Though not himself a member of that committee, Mr. Price had much to do with its work and with the organization and direction of the numerous assistant committees which carried out in detail the various subdivisions of the inquiry. In this work as well as in that which he performed as Associate Forester he rendered a public service of permanent value.

As a technical forester Mr. Price made very substantial contributions to the development of American practice, not so much in the form of published writings of his own as through directing the work of others and through the influence which he exerted on the organization of the work of the Government in the field of forestry. H. S. G.

We record with great regret the loss of Mr. Louis Margolin in the wilds of the Sierra of California in June. He started out from the Dinkey Ranger Station in the Sierra National Forest to get to a camp some 12 miles away, but did not make his appearance. Some weeks later his torn shirt with card case, diary and other papers in the pocket was found in Dinkey Creek, an affluent of Kings River, along and across which his trail led, leaving no doubt as to his unfortunate fate. A thorough search along both rivers has failed to bring his body to light.

Mr. Margolin held the degree of F. E. from Cornell University, 1904, having completed his course at Harvard University. Since 1905 he was, with the exception of about a year and a half in private employ, a member of the U. S. Forest Service. At the time of his death he was in charge of the reconnaissance work and working plan activities of the Service in the National Forests of California.

CONTENTS.

VOLUME XII NUMBER 4

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

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Girdled Pine.

Severed Fork.

FOOD MOVEMENT IN TREES.
(See article page 559.)

Model of Regulated Forest.

FORESTRY QUARTERLY

VOL. XII DECEMBER, 1914 No. 4

A MECHANICAL MODEL OF A REGULATED FOREST.

BY O. L. SPONSLER AND E. C. LUEBBEN.

A mechanical model designed to demonstrate the growth of a "clean-cut and planted" forest, under regulation, was built and used as a part of the annual exhibit given jointly by the students of the Engineering Department and of the Forestry Department of the University of Michigan. The incentive for making this model was a desire to impress, at a glance, the idea that a forest can have a crop of timber to harvest at regular intervals and that all of the different sizes are gradually becoming larger. We wanted to show a series of 10 areas, each with a different age class ranging from 1 to 10; and we wanted the stand on each area to slowly grow taller, while the people were looking on, until the end of its rotation, when it would disappear and a new crop start on the denuded area. We did not intend to show an ideal area arrangement of the age classes of a forest, and the model does not do that; but rather we wanted to visualize a growing forest and convey the idea of crops harvested at regular intervals. At least 10,000 people saw the exhibit and the majority of those who were interested in this model, which incidentally formed quite a center of attraction, readily saw the points we wanted it to demonstrate. We mention this to show that the model is worth while and worth more thought.

Our first model, the one described and illustrated, is a very crude affair in construction and had to be built in a hurry, so simplicity was a necessity. The single cam idea on a main shaft for raising each compartment, was adopted as the simplest and most easily made, after quite thoroughly considering various arrangements of two cams for each compartment, individual and main shafts, racks and pinions, and sprockets and chains combined in many different ways.

The general construction is shown in the accompanying photographs, and a few of the details which may not be clearly evident are described here for the benefit of anyone wishing to build a similar machine.

The model is 7 feet long by 18 inches wide and 40 inches high. Each of its 10 compartments consists of a piston with the "trees" fastened to the rectangular piston-head. This piston-head is 7x17 inches, of 1 inch soft pine and the "trees" are arranged in 7 rows, 10 "trees" in 4 rows and 9 in 3 rows, making 67 "trees" in all for each compartment. The "trees" are centrifuge brushes, 9 inches long over all, the brush part is 3 inches long, 1 inch diameter at the bottom and ¾ inch diameter at the top. The bristles were stained green with Eastman's transparent photo colors. The ring at the end of the handle was bent at right angles and fastened to the piston-head by two staples. The piston rod is 2 inches square by 12 inches long. The lower end bears directly on the cam. In order to reduce friction here, the bearing parts were smeared with soap and then oiled.

The cams are made of ⅞ inch hard maple. The dimensions are given in the sketch. The shaft is of ½ inch gas pipe and has holes drilled at regular intervals to receive the pins which fasten the collars in place. The collars are of ⅞ inch hard maple 1¾ inch diameter. Each cam is nailed to its collars in such a position that its straight side is 36 degrees in advance of its neighbor on the left. Thus each compartment is raised one-tenth of its full height, higher than its neighbor on the right.

We have demonstrated that the model will work nicely and that it is worth developing into a neater and more finished form, and are now planning a few improvements which are suggested here. The wooden collars are to be replaced with metal and keyed to a solid steel shaft. Instead of a direct crank attachment to the shaft, a bicycle sprocket and chain will be used in order to gear down the shaft revolutions, and bring the crank to a more convenient height. The top of the model will be made a few inches wider and instead of ½ inch stuff, ⅞ inch cypress will be used and the holes through which the "trees" appear made 1⅛ inch instead of 1 inch. Underneath the piston-head a coil spring will be used to reduce the jar when the compartment falls after reaching maturity. The piston-rods will be made round instead of square.

All of the mechanism is, of course, hidden from view when operating and an attempt will be made to make the "forest" more realistic by dipping the stems of the "trees" into a thick brown paint, and by making a brown forest floor and a green meadow surrounding the compartments.

The principal part of the cost of material is in the brushes, which amounted to about $15.00. The rest of the material cost less than $5.00, and the labor was donated.

[It may be of interest to add that many years ago, the well-known Dr. Robert Hartig, of Munich, had constructed a model of a regulated forest with age-class distribution, which, while omitting the moving picture show idea of the above model, was designed true to nature in relative dimensions and number of trees per unit area, in each age class, in which respect the above fails.

A duplicate of Hartig's "Waldspiel" was exhibited at the World's Fair by the United States Forestry Division and afterwards found its way back to the Museum of the Department of Agriculture at Washington.—[*Editor.*]

THE CREATION OF AN IDEAL.

By James B. Berry.

While the correlation of theory and practice in American forest schools is usually very good, it is, one must admit, far from perfect, since the student is not brought into actual contact with practical problems until after his period of training is over and he is on a salaried basis. In other words, his possibilities, whether great or small, remain dormant during his period of training, and it remains for his employer to bear the expense of his further development, to see whether he possesses the "making" of a forester. Certainly this is unjust to the employer, for he must shoulder the responsibility of the student's training without any guarantee that the time and expense will be repaid. As conditions become intensive and competition stronger the discrepancies of the present system will become more apparent and will, undoubtedly, be righted in the process of economic evolution, which will in all probability be somewhat similar to that which has taken place in Germany. The German forestry student must have completed four years of work of University grade before he may come up for the State examination, the successful completion of which entitles him to further training and a position in the Government Service. Up to this time he may or may not have had "field work"—if he is the son of a forest official, his training has been very good indeed; otherwise the chances are that he has had little training outside of his University or Forest School courses.* That is to say, to the son who expects to follow his father in the profession, come greater opportunities than come to the man whose father is in another profession. Before completing the four-year course of study it is possible for the student to have obtained considerable practical experience, either through inspection of operations on various forests or by securing actual employment in a survey or estimating crew; although

*The writer overlooks that in most German State forest services, the young men entering the forestry career are required to spend one-half to one year on a forest under guidance of the manager, doing practical work and becoming acquainted with the business.—Editor.

the latter opportunity is open usually to the sons of forestry officials only—for favoritism exists even under the German system. In addition to this work, occurring during vacation periods, the school year offers many excursions, of from one day to a week's duration, besides some practical training in the use of instruments, particularly in connection with the courses in Mensuration and Surveying. The excursion inspection work is very good, although it is not possible always to arrange for the inspection work to follow closely the class-room work. As a rule the entire teaching force of the forest school takes part in the excursion, each professor drawing attention to illustrations of his own particular course or courses. Thus, the German forest student, up to the time of taking the State examination, has had a high grade of training in theoretical forestry, very good inspection work of practical operations and sufficient training in the use of instruments to make him entirely conversant with their care and operation. It is entirely safe to state that, if the student has had the advantage of "position," at the time of examination he has had a correlation of theory and practice unequalled in America; yet he is not considered as being fully equipped for his profession. Up to this time his training has been "memory work" very largely; in the future it is to be of a nature to develop his executive ability—in other words, a preparation to shoulder responsibility. Successful competition in his State examination carries with it the designation "Practicant" (in Bavaria), and he enters on a training period extending over three or four years, varying somewhat in the different States. The first year of this period, during which he receives no salary, the practicant has further opportunity for the formation of ideals. He is, in reality, an advanced student in forestry—a graduate student, if you please. He has been assigned to some forest where he is directly under the supervision of some forest officer—Supervisor (Oberförster), Forest Assistant (Forstassessor), Office Assistant (Adjunkt), Ranger (Förster). He is "under the supervision" of these men, yet his relation is rather that of a student to his teachers—they do not have the right to place him at manual labor—he is there to be developed and purely manual labor is not a means to this end. Much of his time he is in the forest with some one of these men, asking and answering questions. A sample day with the Supervisor might be as follows: The Officer keeps up a rapid-fire series of questions: "What species of tree is that? This? What species is that log? How do you know it is that species? What habitat does it prefer? What grade of lumber does it make? What's the matter with this tree? What species is this fruiting body? Is there any method of control? What insect did this work? Which of these trees would you fell in making a "light" cutting under the shelterwood system? How would you fell that tree? Is it sound? What would you estimate the volume of this tree to be? See how the stump analysis compares with your volume table. What quality of site is this? How would you regulate cutting on this slope? How would you secure reproduction of oak? Estimate the material, labor and cost of this stream regulation," and so forth. There may be no particular order, yet the questions are pertinent and of a character to bring out the best in a man. The forest officer gives explanations and makes corrections and suggestions, stating the results of his experiences. One not accustomed to this work is much surprised at the earnest enthusiasm which is present; the personal relation is invariably good, yet the practicant shows every respect for his superior in rank. Various work is planned and the practicant makes studies of practical forestry problems. In the office he becomes conversant with the working plan and the system of account-keeping. No one who has not been through such a "graduate" school can appreciate the wonderful correlation of theory and practice which is achieved, nor understand the rapid development in manly qualities. It is more like a year of private tutorage, and the practicant's ability to think and plan for himself is developed to a high degree. After the first year, the practicant receives a small salary and is given opportunity for further development. Perhaps he is given charge of some line of experimental work, gathering data for volume tables, or working up some problem in connection with regeneration. Whatever is the character of this work, he carries it to its completion and feels the entire responsibility of the enterprise. The last year, if his work has been very good, he is placed in charge of a small area of forest over which he has full supervision. In this way there is a gradual development of ability during the entire period and the result is a man of high efficiency—a professional man worthy of a good position. If his work has been entirely satisfactory, he is given the promotion standing of Forest Assistant (Forstassessor), although some of the States require a further examination for this promotion. Seldom is the entire period, as practicant, spent on one forest; usually he goes from forest to forest and from district to district so that he may see the best in each branch of work. In this way his training remains broad, and he retains his power to think independently.

The countries of Europe have never failed to recognize the value of the German educational system, especially in its application to forestry, and practically all of the educational Institutions now have regulations limiting the number of foreign registrations to a certain per cent of the total. Foreign students pursue the same courses as the German, take the State examinations and, usually, spend at least one year as practicant. Most of these men must take a further examination upon their return home, for few of the countries recognize the standard of State examination of the others. A few of the countries require that their students in forestry spend at least a portion of their period of preparation in Germany. England requires aspirants for the Indian Service to spend one year following the university course in practical work in Germany, and, in order that these men experience no financial difficulty, makes them an allowance of $1,500 for the year. Under a special arrangement with the Government these men receive the training of practicants, although they are given greater latitude in the choice of work. Semi-monthly they submit reports, in German, to the Home Office, describing the work performed and giving the data collected. Italy, Greece, Roumania all require that their students in forestry spend at least a portion of the time in Germany, although they offer no financial inducements.

Occasionally, German governments arrange foreign tours for members of her Forest Service and it is expected that this feature of the work will grow rapidly in the future. There should, in fact, be an exchange of forest officials between the different countries, for such an exchange of ideas would be most helpful to all concerned. Of especial value, however, is an inspection of German forest conditions to representatives of those countries whose forestry is in the embryonic stage. It is all very well for students to study methods of managment from books, but there can be no real conception, no ideal, without a visual impression of such a method in operation. Photographs and models may serve upon which to hang theory, but practical forestry demands practical demonstration. Germany is very fortunate in the extent of this demonstration work. Here the systems of management have been localized and, as one travels from one locality to another, he meets with demonstrations of each of the principal systems: clear-cutting, shelterwood, group, selection, advance growth. Many of these systems are already in the second rotation and the visual impression becomes an ideal for that particular system. Later on, as one attempts the application of a system of managment, he has a very real image toward which to work—something very different from photograph or a model. In this way, the man who is to become thoroughly efficient goes on gathering ideals so that whatever branch of work he takes up he has a clear and definite idea of what he is trying to achieve. Without this ideal, his work must be largely of an experimental nature.

The forester will not find all of his ideals in Germany, or even in Europe—many of these, particularly in utilization and transportation, he will find in America—yet in Germany he will find the best demonstration of system of management, and this is admittedly the foundation of the science of forestry.

With these statements as a basis, there are several suggestions which I would like to make for the consideration of American foresters.

1. Lengthening the period of training for students in forestry, so that the man who has completed his training may be a thoroughly efficient man in his profession. Perhaps this could be best achieved through the introduction of a practicant period extending over one or two years—placing the graduates of forest schools under the supervision of thoroughly efficient technically trained men and making the period one of practical advanced study. In this connection it should be borne in mind that "practical" does not imply "improvement work," but rather the "practical application" of the theories of the science of forestry. When the forester becomes a "common laborer" he does not merit the respect afforded a "workman." This period of training should not be spent on one forest but the practicant should be given opportu-

nity to visit the different forests of the several Districts, thus becoming conversant with the best work along each of the several lines of forestry. In this way he forms his ideals—the prerequisites of future efficiency.

2. Arranging for a few practicants, or forest officers of higher grade, to spend a few months in European forests under intensive treatment. This work could be planned so that ten or a dozen men each year would have the opportunity. Detailed plans as to routes, features of forestry to be studied, character of reports would, of course, be necessary. Perhaps it would be possible for these men to receive the courtesies afforded the English forest students. At any rate the entire work should be planned to build ideals.

3. The bringing about of a closer relation between America and those countries in which the practice of forestry is intensive; best achieved, perhaps, through an exchange of forestry officials. This would, of necessity, be limited to a few men each year or every other year, and the exchange period would extend over one or two years. These men would be given every opportunity they are offered at home for development and, during this period, they would be able to determine how much of the work could be put into practice on their own State forests. Such an arrangement would prevent much of the duplication of work which is going on at the present time—not that the several countries desire to duplicate work, but that they do not know, and often cannot learn, what other countries are doing. In addition, each man would receive a stimulus which would result in a fresh impetus of enthusiasm and greater efficiency.

THE SIZE OF STATE FORESTS.

By J. S. Illick.

Thirteen of the United States own forest land aggregating about 3,250,000 acres. New York ranks first with 1,645,000 acres and Pennsylvania second with 1,000,000 acres and 130 perches. The area of State-owned forest land in these two States comprises three-fourths of the total State-owned forest land in the United States.

The first requirement of every kind of soil management is the division of the aggregate area into suitable parts, *i. e.*, into administrative units and managerial units. This is true in forestry as well as in agriculture, horticulture, and gardening. A systematic organization of a forest, which presupposes a subdivision of it, is a prerequisite to orderly procedure. It facilitates the directive, inspective, executive and protective function of the personnel.

This article will consider the division of State-owned forest land into administrative units. Special reference will be made to the forests owned by the State of Pennsylvania, because in them organized forest management has been in operation for some time. Pennsylvania owns at the present time 1,000,000 acres of forest land located in 26 counties and purchased at a total cost of $2,277,962.31 or an average of $2.27 per acre. The area owned in the 26 counties varies from 1,176 acres in Wyoming and 3,538 acres in Lackawanna to 126,155 acres in Potter and 126,777 acres in Clinton. The total acreage of State-owned forest land in the last two named counties comprises more than one-fourth of the total owned by the State. The major part of the State-owned forest land is located in the rough or mountainous part of the State, and usually found in rather large contiguous areas. Most of it is located in the northeastern, north-central, central, and south-central part of the State. In order to facilitate the direction and inspection of the various forestal activities, a grouping into districts has been proposed and in part inaugurated. The districting will be worked out primarily on a geographical basis. A district may simply embrace the forest of a single county or it may include those of a number of counties. A proposed scheme of districting the State-owned forest land is as follows:

District 1. To comprise all State-owned forest land located in the northeastern part of the State.

District 2. To comprise all State-owned forest land located in the north-central part of the State.

District 3. To comprise all State-owned forest land located in the central part of the State.

District 4. To comprise all State-owned forest land located in the southern part of the State.

Some have suggested a division of District 2 into two separate districts on account of the large acreage of State-owned forest land in it, and a division of District 3 into an eastern and western part on account of its elongated form and its large acreage. A few, rather small, and isolated areas, such as those located in Dauphin and Westmoreland counties, may not be embraced by the proposed districting. They must be treated independently or included in the most convenient district. Future purchases by the State may modify the proposed districting.

Each District will be in charge of a forest officer known as a District Forester. The duties of a District Forester may be limited to the forest land owned by the State, in which case he could oversee 10 to 20 State forests with a total area of 200,000 to 400,000 acres, or they may embrace also other functions, namely, the supervision of all Fire Wardens within the District, as well as the giving of technical advice to private owners and co-operating with the officers of Forest Protective Associations which are becoming numerous throughout the State. In the latter case he would not be able to oversee nearly so large an area of State-owned land. Each District will usually comprise a number of executive charges formerly known as State Forest Reserves but now known as State Forests. A State Forest then is an area in charge of one executive officer known as a Forester. At the present time the State-owned forest land of Pennsylvania is divided into 49 State Forests with a technically trained Forester in charge of each one. Each Forester is assisted by 1 to 6 Forest Rangers and usually a permanent labor force. In some instances the Forester is assisted by a recent graduate from the Forest Academy who is serving a period of apprenticeship, usually of one or two years' duration, prior to being given charge of a State Forest. A State Forest may be isolated, as the Buchanan State Forest, or it may be a part of a large contiguous area, as the Pine Grove, Caledonia, and Mont Alto State Forests. The last three are collectively known as the South Mountain State Forests. The eight contiguous State Forests which comprise all the State-owned forest land located in the Seven Mountains in the central part of the State are collectively known as the Seven Mountain State Forests.

The area in charge of one executive officer varies considerably in size. This is true in the National Forests of the United States, the State Forests of Pennsylvania, and the State Forests in the different States of Germany, where forestry has been practised for almost two centuries. The State Forests of Pennsylvania vary from 4,145 acres (Nittany State Forest) to 60,000 acres (Sinnamahoning State Forest). Their average area is about 20,000 acres. A large number of factors influence the size of a State Forest, *i. e.*, the area placed in charge of a Forester. The following are the most important factors.

1. *Intensity and Kind of Management.*

The more intensive the management the smaller should be the area under one Forester or in one executive charge. The kind of operations which the annual budget contains and the amount of money allotted for them indicate in part the intensity of management. State Forests which are very productive and yield high returns should be smaller than those which yield little and are practically unproductive. It is quite evident that a Forester can handle a much larger area under extensive management which consists mainly of informing the public concerning the importance of forestry, protecting the area from organic and inorganic agencies, regulating the cutting operations, planting unproductive areas, and waiting watchfully for the economic time and the development of public sentiment, than he could handle under intensive management, which considers in addition to the above enumerated fundamentals also such technical subjects as increment, the determination and regulation of the yield, the subdivision of the forest, age-class and growing stock conditions, etc. The development of a Demonstration Forest is contemplated in

Dauphin county where the State owns 3,358 acres. This acreage is small in comparison with the other State Forests, but is of ample size for a forester in view of the intense and detailed activities required in a demonstration forest. Under extensive management as one finds on the National Forests, a Forest Supervisor often has more than 1,000,000 acres under his charge; under conservative management as one finds in the State Forests of Pennsylvania, a forester has charge of about 20,000 acres on an average, while under intensive management as one finds in the forests of the State of Saxony, Germany, a *Forstmeister,* or *Oberförster* as he is called when first appointed, has charge of about 4,130 acres on an average.

2. *Species, Forest Structure, and Means of Regeneration.*

Hardwood species are more difficult to handle than coniferous species, and mixed stands more difficult than pure stands. The natural forests of Pennsylvania are mixed, with the hardwoods species far in the majority, hence a forester will not be able to handle as large an area as if they were pure and coniferous in structure. On account of the recent artificial establishment of large areas the forest structure is changing. The transition is gradual and cumulative in favor of the conifers. Natural seed regenerattion is a more extensive method of reproduction than artificial regeneration, hence wherever natural seed regeneration is the prescribed method of reproduction a forester can handle a larger area than where artificial regeneration is in practice.

3. *Degree, Kind, and Amount of Utilization.*

The total amount of material that is utilized annually has an influence upon the size of a forest. The greater the productivity, which manifests itself in the annual or periodic yield, the smaller the area of a forest should be. Under extensive management the total yield consists of the final yield but as the management becomes more intense the intermediate yield becomes more important and may amount to as much as 50 per cent of the total yield.

At present the thinnings in the State Forests amount to little, but in the future they will amount to more. If history will repeat itself we may be able to anticipate the growing importance of thinnings by a study of the development of thinnings in the Municipal Forest of Heidelberg, Germany.

Years.	*Average Annual Yield of Thinnings per Acre (Cubic Feet).*
1837–1846	4.2
1847–1850	0.35
1851–1860	8.82
1861–1870	6.86
1871–1880	7.28
1881–1890	13.16
1891–1898	24.36
1898–1900	34.72
1901–1909	44.94

A forester who is required to make extensive thinnings, cleanings, damage cutting, cannot handle as large an area as he could if such operations were absent. In regions with a dense population one finds greater demands for small material, especially fuelwood, which is absent in sparsely settled regions. The sale of small material and of small lots as well as the filling of special and small orders complicates the work of a forester. The satisfying of a local market tends to reduce the area of a forest. The degree or extent to which a forester refines his production before he sells them will help determine the area which he can handle properly. He may sell the material upon the stump, or he may fell it and cut it into logs, poles, posts, ties, cords, etc., and then sell it, or he may refine it still further by running it through the sawmill, and then dispose of it.

4. *Number of Trained Men Available.*

During the formative period of any art or business the number of technically trained men able to handle it is usually very small. Forestry was no exception to this. In response to a constant demand for trained foresters many forestry schools have sprung up. In 1898 the first forest school in the United States was established at Biltmore, North Carolina. In the same year a second one was established at Cornell University. To-day 24 forest schools prepare men for the practice of forestry as a profession and 50 more given general or special instruction in forestry. On January 1, 1908, the State of Pennsylvania owned 752,492 acres of forest land. At that time only 10 men, trained especially for the position of forester upon the area, were available with an average of more than 75,000 acres per man. Three years later, January 1, 1911, the total acreage had increased to 933,115 acres. By this time 40 foresters were available with an average of 23,328 acres. At the present time the State owns 1,000,000 acres which is in charge of 49 foresters or an average of a little over 20,000 acres per forester. In time the average acreage per forester will be reduced to about 10,000 acres.

The training, which the executive managers of forests in America have, varies widely. In Germany it also varies, but less widely, because each State has some prescribed qualifications which a man must be able to meet before he can be promoted, and the prescribed qualifications in the several states approximate each other. The German Oberförster is about 40 years of age when he is appointed to this position. He holds subordinate positions up to that time. It has, however, been recommended that the limit be lowered so a man could attain this position not later than at the age of 36 years. In America only a few executive managers have as yet attained this age.

The salaries which these trained executive managers receive bear comparison and are given below:

State.	*Annual Salary.*
Württemberg	$725–$1125
Hesse	700– 1500
Prussia	750– 1800
Saxony	975– 1875
Bavaria	1200– 1800
Pennsylvania	720– 1500

5. *Number and Kind of Assistants.*

The larger the number, and the better the training of the assistants to a forester are, other things being equal, the larger the area that he can handle. A forester who has another subordinate forester assisting him, and in addition has a large number of permanent and emergency rangers, a large permanent labor force, and a satisfactory office force and office equipment, certainly can handle a larger area than a forester who has very little and poorly trained assistance. The number and kind of subordinate officers should be determined by the area of the State Forest and the intensity of management.

6. *The Time a Forester Necessarily Devotes to Office Work.*

The ordinary duties of foresters are alike in kind but differ in degree. All have office work and forest work, but the amount of office work some have far exceeds that of others. The apportionment of time for forest work and office work helps to determine the area which one forester can handle. The office work of a forester is diversified, consisting of such items as correspondence, reports, bookkeeping, making of working plans, utilization plans, and planting plans, preparing cost reports of prospective operations, advertising and reporting wood sales, etc. A certain amount of office work for a forester is natural, but too much means that his work in the forest is managed poorly or given into the hands of a subordinate, in which case the forester plays simply the rôle of an inspector, which is very unsatisfactory. In cases of excessive office work a clerk, either permanent or temporary, depending upon the amount of office work, should be supplied. Up-to-date equipment should be found in the office of every forester to facilitate office work. The office work upon some of the State Forests of Pennsylvania is starting to become burdensome. It will become more burdensome as the management becomes more intense. Conditions are not different in Germany. An accurate diary kept by a conscientious Forstmeister shows that he spent during the year only 132 days of 9.4 hours each in the forest and 128 days at office work. A forester who must spend one-half of his time in the office certainly cannot manage as large an area as one who spends only one-fourth of his time there. A forester should spend at least 4 whole days per week or their equivalent supervising in person his forest activities.

7. *Auxiliary Duties of the Forester.*

A forester who has no duties aside from those on the State Forest upon or near which he is located, can manage a larger area than if he has many or extensive outside duties. A forester may devote little or much time to informing the public concerning the importance of forestry, to assisting private owners in developing their woodlands, in cooperating with the numerous Fire Protective Associations which have sprung up in recent years. In some forests considerable time may be devoted to the location and supervision of camp sites, while in others little time may be required. Five large and eleven small forest-tree nurseries are operated in connection with State Forests in Pennsylvania. The amount of nursery work which a forester must attend to will influence very decidedly the amount of forest land which he can handle in connection with the nursery. The number and kind of his assistants is a very potent factor. One forester, without trained assistance, cannot manage a nursery with an annual yield of one million seedlings and at the same time handle properly a State Forest of 25,000 acres. The area under the charge of a forester should have such a size that his entire time will be completely used up without being overburdened either by office duties or by technical forestal activities. In addition to his official duties he must have time for personal development as well as scientific and managerial investigations. Last, but by no means least, he needs some time for his family. His isolated location brings many family tasks to him which men with homes in more populous regions are not required to fulfill.

8. *The Situation, Form and Coherence of the Forest.*

A certain amount of State-owned forest land may be so situated with regard to other State-owned forest land that it will become necessary to include the former in a State Forest even though its acreage may be somewhat excessive or somewhat below that which a forester could carefully and conveniently handle. For example the Stuart State Forest, named after ex-Governor Stuart, contains only 8,749 acres. It is located in eastern Westmoreland and western Somerset counties. It is so distant from other State-owned forest land that the acreage cannot be increased. Contemplated purchases may increase the acreage. Hence its isolated situation primarily determines the area of this State Forest.

The form of the area also influences the total acreage which a single executive officer can handle. If the area is in a compact block approaching a square or regular in outline one can handle a larger area, other things being equal, than if the area is decidedly elongated and very irregular in outline. The Poe State Forest is on an average two miles wide and 14 miles long. The distance around this area is about 45 miles, while it contains only 14,000 acres. The same area could be in a block with a perimeter of less than 20 miles. If such were the case, it undoubtedly could be managed more easily.

Coherence is also a factor which influences the size of an executive charge or State Forest. If the total area is in one compact mass, the area allotted to one forester can be larger than if his forest consists of scattered patches, blocks, and ranges. The Buchanan State Forest, named after ex-President Buchanan, consists of two parts separated by a distance of six miles. The total acreage is 10,973 acres, 6,760 acres in one part and 4,213 acres in the other part. With the same effort, the forester could manage a larger area if it were in a coherent block. Interior holdings also make management more difficult. In case of scattered tracts too much time is spent on the road.

9. *Topographic and Climatic Factors, Location of Forester's Headquarters, and Means of Locomotion and Communication.*

In a rough and mountainous country one man cannot handle as large an area as in a level or rolling country. In regions with intense and prolonged winters and in regions with heavy and extended rainfall a forester can spend less time at activities in the forest than in regions with less rainfall and with a longer open season. The location of the headquarters is a factor in determining the size of the areas over which a forester can take charge. The most favorable location from the viewpoint of accessibility is usually within the area or at the side of it. In some cases this is impossible and the forester may be compelled to live at a short distance and sometimes at considerable distance from his forest. The means of locomotion is closely interrelated with his headquarters. He may be able to look after his forest better with headquarters on the outside of it than by having them within if he has good means of locomotion in the former case and poor in the latter. Good railroad and trolley service may aid him considerably. Good roads will enable him to drive, or ride on horseback or a motorcycle. A few foresters have automobiles, which are very helpful to them where good roads are abundant and ramify through the major part of their forest. Telephone communication with subordinate, coordinate and superior forest officers will enable a forester to take charge of a larger area than the absence of it. The more important State Forests are now well equipped with telephone communication.

From the above classification one can see that the number of factors which influence the size of the area under one executive officer are many. It is impossible to classify the factors in order of their importance. Their importance varies with the general environment of the area. In some cases it is the conjoint influence of a number of factors, rather than the influence of a single factor. These factors have their influence under intensive as well as under conservative and extensive management. On account of these numerous factors and their influence under all kinds of management, one can never expect to have State Forests of equal size.

We have been and are still learning much from German experiences and experimentations in forestry. The executive manager of a forest in Germany is known as a Forstmeister or Oberförster, in the National Forests of the United States as a Forest Supervisor, and in the State Forests of Pennsylvania as a Forester. The average acreage under the charge of one of these executive managers in several states of Germany is given below:

State.	*Area in Acres.*
Saxony	4,130
Hesse	5,000
Württemberg	6,175
Braunschweig	6,250
Oldenburg	8,000
Bavaria	8,250
Baden	9,000
Prussia	11,500
Alsace Lorraine	14,000

The average area under one executive manager or in one executive charge varies from State to State and changes from year to year in the same State. In 1908 it was 7,700 acres in the State of Bavaria, and in 1911 is was increased to 8,250 acres. These average figures for various States are interesting and instructive, but they do not give one any idea of the variation in size of forests in charge of one executive officer within one and the same State. The subjoined data will show the variation within the State of Württemberg:

1	Executive charge	with less than		2,500 acres
7	"	charges (5%)	with	2,500- 3,750 "
22	"	" (14%)	"	3,750- 5,000 "
50	"	" (33%)	"	5,000- 6,250 "
43	"	" (29%)	"	6,250- 7,000 "
20	"	" (13%)	"	7,000- 8,750 "
7	"	" (5%)	"	8,750-11,250 "

150 Executive charges with a total area of 925,000 acres or an average of 6,175 acres to each executive charge.

From the above outline one can see that there are in Württemberg 30 executive charges, *i. e.*, one-fifth of the total number, that have less than 5,000 acres, and 80 or over one-half of the total number, that have less than 6,250 acres. These figures are of a comparative value and will act as a guide for those who are concerned with the allotment of areas to forests. In Germany a single executive charge may comprise State, Municipal and Communal forests which make the forester's work more difficult.

The subjoined data of 10 of the 49 State Forests of Pennsylvania will show their wide variation in size:

State Forest.	*Area in Acres.*
Nittany	4,145
McClure	6,093
Stuart	8,749
Buchanan	10,973
Coburn	15,000
Hull	23,290
Caledonia	26,700
Blackwell	29,000
Cross Fork	59,592
Sinnamahoning	60,000

One cannot help but realize that the factors which influence the size of the area under the charge of one executive officer are operative in all countries. The degree of their importance varies, however, within the same country, the same State, and often the same local region. That the size of State Forests varies at the present time can be seen in the above tabulation of the State Forests of Pennsylvania and that they will ever continue to vary can be inferred from the tabulation given above of the forests of Württemberg, where forestry has been in practice for more than a century. We can never hope to have all our State Forests the same size. It is, however, desirable that an attempt should be made to equalize them as far as the results of the equalization prove to be practical. The truism that "history repeats itself" stands out clearly when we see how the development of forestry in Pennsylvania recapitulates the development of forestry in Germany. No doubt we will pass through exactly the same course of development, only at a greater speed, on account of our present economic condition and the many theoretical and practical lessons which we have and can still learn from the experiences of the countries and States of Continental Europe. If we cannot *adopt* their results, we may at least *adapt* them, and if we cannot adapt them, they will at least suggest problems to us and indicate the best means of avoiding circuitous methods of procedure in solving them.

NOTES ON GERMINATION AND REPRODUCTION OF LONGLEAF PINE IN SOUTHERN MISSISSIPPI.

By P. L. Buttrick.

In the spring of 1914 the final term of the senior class of the Yale Forest School was held on the holdings of the Great Southern Lumber Company in Marion County, Mississippi. Marion County adjoins the Louisiana State line on the south and is drained by the Pearl River.

The following data were partly collected by the students in assigned work and later tabulated by the writer, who added observations of his own.[1] They do not make a complete account of Longleaf pine reproduction, but present some data which may be of some value to others studying the problem.

The region lies within the Longleaf pine belt in what is known locally as the pine ridges. The surface of the country is quite undulating and rather more hilly than most of this pine land. The forest is pure Longleaf pine and practically all virgin. The section has been settled for nearly a century, but save for small agricultural clearings the forest has not been disturbed by the ax.

Since the first settlement forest fires have been an annual occurrence. Early every spring the woods are burned over, exposing the mineral soil, and, as a result, undergrowth is the exception rather than the rule. While individual fires do little damage to the mature timber, their cumulative effect, by killing the old trees and preventing the growth of others to take their place, will probably be the gradual elimination of the forest. Comparatively few trees under 100 or over 300 years are found. The average age is about 220 years. What little reproduction is found is in scattered groups and is totally insignificant in area compared with the forest as a whole. It is evident that, if conditions continue as they are, in another century the forest will

[1]Acknowledgments are due to the Yale Forest School for permission to use the data, and to Professor H. H. Chapman, of the School, for suggestions as to field study and criticisms of this paper.

be reduced to widely scattered groups of trees, and later will disappear entirely.

The assigned work for the class consisted in individual studies to determine the following points:

1. Number of seeds deposited from seed trees at different distances from their bases.

2. Per cent of seeds germinating on different types of ground cover[2]: pine needles, grass, hardwood litter, litter of varying ages and depths.

3. Effect on reproduction of fire and other agencies.

The study was made by taking small-sized sample plots (generally one foot square) under various conditions, but on sites unburned that season, and counting the seeds and seedlings on them, and noting the distance from the seed trees. Since but one crop of seedlings was present, there was no danger of including those of more than one age-class.

The year 1913 was a seed year for Longleaf pine in this region. The seed fell during the fall and winter and began to germinate in February.[3] By the time this study was made, in late March, the germination period was practically over. The seedlings bore cotyledons fully expanded and the root system was often two or three inches long. During or shortly after germination much of the ground was burned over, destroying most of the seedlings. A few escaped and some showed signs of at least a temporary recovery from the effects of the fire. According to the best evidence, seed years in the region occur about every seven years.

Seed Dissemination: The greatest distance given for the fall of seed from the base of a seed tree was 150 feet[3] (from a tree on the edge of a field). The average maximum distance was 140 feet. Several observations were made to the effect that the radius of seed dissemination seldom exceeded the height of the seed tree. The dominant trees of the stands in the region average about 120 feet high.

The amount of seed falling on about sixty plots one foot

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[2] This percentage is of course smaller than would be obtained from seed tests in a nursery, and should not be compared with them.

[3] U. S. Forest Service reports that by early December, most of the seed had germinated, little seedlings of 2 or 3 inches high being found growing in great numbers, and that at that time groups of seedlings were found by the Conservation Commission of Louisiana as far distant as 300 feet from the nearest seed tree.—Ed.

square at different distances from the bases of seed trees has been plotted on cross section paper and a curve drawn which curve shows the relation between distance and distribution. From this curve a table was read, which shows that the maximum amount of seed falls between 20 and 30 feet from the base of tree. This table might be of use in connection with other data in fixing the number of trees to be left per acre under some systems of forest management.

Average Number of Seedlings Growing at Different Distances From the Base of Seed Trees.

Distance (feet)	*No. Seedlings per Sq. Ft.*
10	8.4
20	12.0
30	10.6
40	8.5
50	6.2
60	4.0
70	2.5
80	1.9
90	1.8
100	1.5
110	1.2
120	0.8
130	0.5
140	0.2
150	0.0

Germination: A mathematical average of the germination counts on 753 square feet (.017 acres), under all canopy and ground cover conditions, was 48%. The average maximum was about 60%. The average minimum was about 25%. The percentages seldom ran over 65 or under 25%.

Classifying the plots according to their ground cover, we get the following germination percentages:

On one-year crop of pine needles................50%[4]
On grass.................................... 53%
On hardwood litter........................... 28%

The difference between the results from pine needles and grass are too small to leave room for generalizations. Individual

[4] These figures average 44 instead of 48%, the difference being due to the necessity of excluding certain plots for which no site data were given.

opinions, as expressed by the students, vary as to which affords the better germination site. Both, although different in appearance, generally offered much the same conditions for germination, the ground having been burned over immediately before, so that seeds could easily reach the mineral soil. As to hardwood litter, the results seem conclusive; not only was germination much lower, but it frequently did not occur on well-seeded areas where there was an excess of litter. Plots were taken on pine litter of upwards of four years' accumulation, but not in sufficient numbers to afford reliable averages. It was evident, however, that the germination per cent decreased in proportion to the depth of the litter, and seemed to disappear altogether when a litter of four or five years' accumulation was reached. It seems that the chief requisite for germination is that the seed be in contact with the mineral soil. Although occasionally seeds germinate on rotten stumps and logs (but grow only a few weeks), none germinate on litter so deep as to prevent instant contact with the mineral soil.

The study shows an average of 2.6 seedlings per square foot for all sites, or 113,256 per acre (counts on 543 square feet). If 25,000 seedlings per acre be regarded as full stocking, such a crop as fell in the fall of 1913 should be ample to provide for reproduction. Judging from statements of the local inhabitants, this was about an average crop for a seed year.

Destruction of Seedlings: Since there is actually no new forest growing up, the question immediately arises: What becomes of these seedlings? As has been intimated, fire kills the major portion of them before they are fairly started. Late summer and fall fires account for the loss of many more. Summer drought and the shade of the old trees, light as it is, cause many more to succumb. Under the combined effect of these factors, only an infinitesimal portion of the seedlings survive the first year. To discover the fate of those seedlings which did escape and get beyond the first year, the writer made a study in the next older seedling age class. A sample plot was taken on a site where conditions were such that part of the crop of the seed year of seven years ago had survived. The results from the study of this plot give much information on the stocking.

rate of growth, and fire resistance of the seedlings. Following is a copy of the notes taken on this plot:

Date: April, 1914. *Size of Plot:* One-quarter acre, square.

Site: Crest of a lateral ridge between two water courses one-half mile from their sources. About 25 feet above stream bottom. Plot represents conditions prevailing for three-quarter mile along summit and upper slopes of ridge. It is in an old turpentine orchard.

Soil and Moisture: Soil a sandy loam, locally considered fit for agriculture. Moisture conditions slightly better than average for the section.

Seed Trees: None on the plot. Nearest, 100 feet distant. At that distance plot is well surrounded with them. Average height, 80 to 100 feet.

Overhead Cover: Four pine saplings, 4 to 20 feet high, about 15 Spanish, Willow and Black Jack Oaks from 3 to 7 feet high, and from 1 to 3 inches in diameter.

Ground Cover: Grass 2-3 density, 2 inches high, a little oak brush 1 foot high, but not interfering with the pine seedlings. Many down trunks of old turpentined trees.

Seedlings: Age, all, 7 years; size, range from 1 to 12 inches high; tap root, 1 to 2 feet long. Number, total, 759; under 3 inches, 381; between 3 and 6 inches, 330; over 6 inches, 48. One Shortleaf pine seedling.

Fire, etc.: Plot shows evidence of having been burned annually ever since the seedlings started, but unfortunately it is impossible to tell whether it was burned the first year or not. The last fire, about six weeks previous to the making of the study, had killed but two seedlings, although it destroyed the needles on all save a few of those under 6 inches high.

Extended to acre terms there would be slightly more than 3,000 seven-year seedlings on this area after it had been burned annually for at least six years. Even this number should be enough to provide for full stocking at maturity if only normal losses occurred.

The chief thing which the plot shows, is what may be expected in the way of stocking and growth, in spite of annual fires, when overhead and ground cover conditions are favorable.

FIGURE 1. Seven-year-old Longleaf pine seedlings on the [illegible] ground. They have been burned annually for [illegible]. Compare with growth of unburned seedlings shown below.

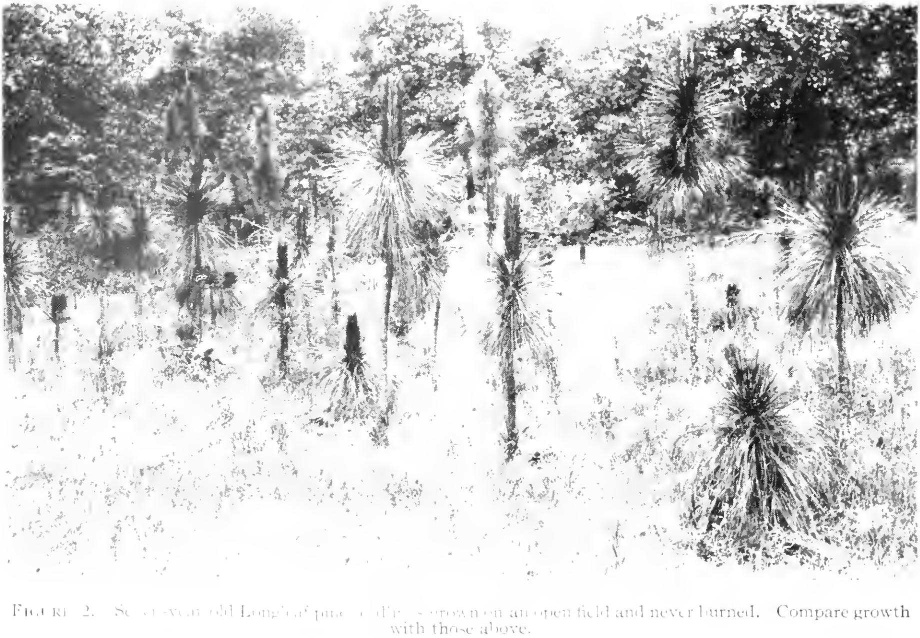

FIGURE 2. Seven-year-old Longleaf pine seedlings grown on an open field and never burned. Compare growth with those above.

Seedling Growth: That Longleaf pine seedlings are capable of making a much better growth than that indicated by this plot is shown by the accompanying photographs. Figure 1 is a view taken on the plot, the small black spots representing the seedlings. Figure 2 shows a group of seedlings of the same age which average two feet and over high. They come from the same region, but grew on an open field and never had to contend with fire. The field was abandoned some fifteen years before and was well turfed before the seed fell. While soil and moisture conditions may have been slightly better in this field than in the old turpentine orchard where the other photograph was taken, they could not possibly have been sufficiently so to account alone for the great difference in size. Assuming even as much as one-half the height growth shown in Figure 2 to be due to superior soil and moisture conditions, it is evident that fire has retarded the height growth of the seedlings shown in Figure 1 more than 50 per cent.

A group of 15-year-old Longleaf pine saplings grown on an old field averaged 3 inches in diameter and 20 feet in height. This shows that Longleaf pine can make a very rapid growth when conditions are in its favor.

Summary: The conclusions from the data here presented may be summarized briefly as follows: (1) Longfeal pine seeds are not apt to be carried more than 150 feet from the seed trees which stand in the woods; (2) Longleaf pine seeds will not germinate on a heavy litter; (3) germination takes place best on mineral soil from which the litter has been burned; (4) most of the seedlings perish from fire, drought or shade before the end of the first season; (5) seedlings one year old will often withstand surface fires where the litter is only the accumulation of a single year; (6) with soil, moisture and light conditions favorable Longleaf pine seedlings can withstand annual fires after their first season for at least ten years and *may* be able to withstand them many years more; (7) such fires, however, retard their height growth at least 50% for the first decade.

FOREST PLANTING IN NEW ENGLAND AS AN INVESTMENT.*

By J. W. Toumey.

The desirability of an investment increases with the interest returns, the increase in the value of the property and the diminution of the risk of impairment of the capital. A government bond fetches a low rate of interest, but the capital is not diminished and the risk of impairment is very slight. On the other hand an unseasoned industrial bond may return nearly twice the income but the risk to capital is correspondingly increased. The greater the risk the higher should be the return in interest, the less the risk the lower the return. In Europe, forest property is classed with government bonds and other high grade securities which involve but little risk of impairment of capital. One reason for this is, forest soil or the land itself without the growing timber is gradually increasing in value the world over.

The last two or three decades in New England have seen forest soil increase to from two to four times its former value. If we start therefore with a piece of denuded forest land having a present sale value of one to five dollars an acre, and plant it with timber, at the end of the rotation when the trees are cut and the land again denuded it ought to be worth two or three times its former value.

In the discussion of planting in New England as an investment we are inclined to turn to Europe and argue that since with their lower cost for labor, higher wood values and less danger from fires they cannot secure higher interest returns than 2 to 4%, but we hope in this country that forest plantations will earn even this low rate of interest.

This argument, however, does not hold, because interest returns depend almost entirely upon the soil value upon which it is figured. It is the custom in Europe to increase soil value with increased earnings from the forest so that necessarily the interest on the

*Read at the Annual Meeting of the Society for the Protection of New Hampshire Forests.

capital appears to remain low. In other words, if soil value in Prussia had not been increased in the calculation during the past fifty or sixty years the forests would now show an earning capacity of possibly 8 or 9 instead of the present 2 to 4 per cent.

In figuring interest from plantations in New England we have a decided advantage over Europe *in our low value of forest soil,* viz., from one to five dollars per acre. This value combined with the cost of planting brings the cost of the established forest usually well under twenty dollars per acre or but one-fourth to one-half the cost in Europe. Because of this great difference in *soil value* in Europe as compared with New England our products from plantations may sell for less than one half that in Europe and still we are able to earn a much greater interest on the investment. The income from a forest plantation as an investment is determined primarily by the initial cost, *i.e.*, the cost of the forest soil and the cost of planting. If our initial investment is too high, no forest is capable of earning an acceptable rate of interest. Even under the most favorable conditions of private planting as an investment in New England it is my belief that the initial cost should not exceed twenty dollars per acre.

In private forestry the great indirect value of the forest or the benefit which comes to the entire community disappears as an incentive for planting waste and idle land. Here the incentive for planting and managing a forest is based entirely upon the income in dollars and cents which the investment in the land, the cost of planting and the cost of maintenance will return.

New England has many examples of plantations made thirty-five or more years ago, which have already been cut and have returned 6% compound interest or more on the investment. Many other plantations have been measured in recent years and the growth shows an equally large earning capacity. The same earning capacity is shown in thirty-five to seventy-year-old fully stocked second growth stands, which are no more productive and usually less so than well-established plantations.

Dwellig, of Massachusetts, reports the cutting of 200 cords of White pine from two acres of fifty years' second growth. Stockbridge, of Massachusetts, reports the cutting of one hundred thousand feet of five-eighths-inch box boards from two acres of thirty-year-old second growth. In the spring of 1871 and in the spring of the following year, three acres of poor, exhausted meadow in Westmoreland, N. H., owned by Elijah Wyman, were planted at from six to seven-foot intervals. This tract of three acres was sold by Mr. Wyman in 1904 for $350 to Mr. Leon Hall. In 1911 Mr. Hall sold the tract for an even $1,000.

A stand of White pine established in Switzerland by planting was accurately measured when forty-two years old. The yield per acre was 77 3-4 cords, or an average increment of approximately 1.8 cords. At a stumpage value of $8.50 per thousand feet board measure, which is no higher than in some localities in New England, its value per acre was $9.30. These are only a few of the large yields recorded from plantations of White pine and fully stocked second growth stands. From results already obtained not only in New England but abroad it appears that one can expect from fully stocked plantations and second growth stands on first quality sites under a fifty-year rotation a maximum yield of one hundred cords and an average of at least sixty-five cords per acre. The study of a large number of fully stocked second growth stands in New England on first quality sites gave an average yield of nearly seventy cords per acre at fifty years.

These figures of maximum yield and high value per acre should not be taken as an index of results to be expected from general planting. They do show, however, what has and what can again be attained in the most favorable localities. Experience has shown that the average yield of White pine in fully stocked second growth stands on third quality sites is less than forty cords per acre at the end of fifty years. Plantations of White pine made in southern France on very poor soil in 1873 gave an annual increment of only about one-half cord per acre at the end of thirty-eight years. It costs as much and usually more to establish a forest by planting on poor sites as it does on first quality sites, while the yield may be but one-half or one-third as much. In New England where the value of all forest soils is relatively low a handsome profit may well result from plantations on first quality sites, while a loss would result from planting the same species on third quality sites because of the small difference in initial cost and the great difference in yield. The high yields and values obtained from plantations and second growth stands of White pine on first quality sites in New England, under a rotation of thirty-five to seventy years, only takes into account fully stocked stands accessible to a good market. The average yield on first quality sites in New England is likely far below these figures because of the fire hazard and the damage from other external agents. So also the value of the product would be less were our inaccessible waste lands planted because of the poorer market. In my opinion the recent investigations of the National Forest Service, and other investigations as well, clearly show that 4 to 6% compound interest is well within the possibility of second growth stands of White pine on plantations when the soil value and the cost of regeneration falls below fifteen or twenty dollars per acre; when the rotation is between thirty-five and seventy years; and the property is located near a present or prospective market comparable, for instance, with that at Keene, N. H., at the present time.

Although even under present conditions forest planting by private individuals may be a profitable investment, it is my belief that indiscriminate planting with all sorts of species, on all classes of sites, under all conditions as regards damage from external agents and in all localities as to markets is a very poor investment for the owner of denuded forest land in New England.

In general, the returns from coniferous woods are much greater than from broad-leaved species on the same quality of soil. Europe, with a relatively small proportion of broad-leaved forests, is increasing her coniferous stands and decreasing her areas of hardwoods. Thus today we find the celebrated Sihlwald of Switzerland and the Wienerwald of Austria being rapidly changed over into coniferous stands. New England with her large areas of hardwoods, which reproduce abundantly by natural means, has little or no need for the planting of hardwoods. She has great need for the planting of conifers, particularly White and Red pine. To my mind these are the only species that give reasonable assurance of success in planting as an investment in most parts of New England. Although we have no plantations of Red pine old enough to determine increment and value, plantations up to fifteen years of age in southern New England show an even better growth than White pine under similar conditions. Because of the relative freedom of this species from insect and fungus damage it is my belief that future studies will warrant its extensive use in New England either in pure stand or in mixture with White pine.

Under present conditions forest planting in New England as a profitable investment for private individuals must, I believe, meet the following conditions:

1. Be confined to the species which have an established market and which experience has already shown produce the highest financial return. These species are chiefly White and Red pine.
2. Be confined to first or possibly in some localities to second quality sites, because the initial investment on such sites is but little less than on third quality sites and the yield is much greater.
3. Be located near a good present or prospective market, where an outlet can be found for thinnings and all classes of wood products at remunerative prices.
4. Be confined to areas where the fire hazard has already been practically eliminated.
5. Be confined to states or localities where the problems of forest taxation have been satisfactorily and permanently adjudicated.
6. Be confined to sites where the market value of the denuded land is ten dollars or less per acre.

When plantations can be made in New England that meet all of the above requirements the investment is, I believe, of high grade and gives assurance of returning a large income on the capital invested. Only a small part, however, of the waste and unused lands of New England meet all of the above requirements. As more and more of these requirements cannot be met, the investment in planting becomes less and less attractive and finally, if it is done at all, must be done by the State or community.

The earnings of governmental and communal forests, unlike private forests, cannot be measured by the interest return on the investment alone, derived from the sale of forest products. It must be measured also by the influence of the forest on the industrial, economic and social life of the community. The indirect value of forest growth to the community as a whole, particularly on land unfit for agriculture, is so great that governmental and communal forests must be classed as sound and excellent investments even when the direct return in interest on the investment is very low.

It must, therefore, be left to the State and the community to reforest by planting the idle and waste lands in New England that on account of their location or quality are not attractive as a planting operation by private capital and which, under natural conditions, will not reclothe themselves with desirable stands of timber. It is well to leave to private capital the planting of such areas as can be planted with reasonable assurance of a profit on the investment. Such areas in New England are relatively small, and we can be sure that private capital will not wander much beyond these limits. The State and community, however, must assume their responsibility, and purchase and reforest areas that private capital cannot profitably undertake. They can do this when private capital cannot because they measure their profits not only in wood products, but in the indirect value of the forest to the community.

Investments made by States and smaller governmental units in waste and denuded lands unfit for agriculture and in planting them with valuable timber are fundamentally sound. They are unlike most other governmental investments such as expenditures for public buildings, roads, etc., in that they soon begin to return an income on the expenditure while the others do not. It is my contention that at least a part of the present large expenditure by our States and communities for public improvements should be spent in the purchase of denuded land that the private citizen cannot afford to own, much less to reforest and improve it by re-establishing the forest.

TAXATION OF FORESTS IN MASSACHUSETTS.*

REMARKS BY PROFESSOR CHARLES J. BULLOCK.[1]

In 1912 Massachusetts adopted a constitutional amendment permitting the classification of wild and forest land for the purpose of taxation, and the following year a commission was appointed to draft a new law for the taxation of forests. Last January this commission submitted its draft of a scientific forest tax law which was adopted substantially without amendment and given the title of The Forest Classification and Tax Act. The enactment of this measure marks the end of a large campaign, carried on through many years, for a system of forest taxation that would encourage the conservation and development, rather than the destruction, of the forest resources of the State.

The new law does not provide a new method of taxing all wild and forest lands, but, like those recently enacted in other States, is limited in its operation to lands registered under its provision. Such registration may be made with the clerks of cities and towns, after the assessors have determined that the land is suitable for forestry purposes, and have made separate valuations of the land and the timber growing thereon. Land may be classified either as woodlot or plantation, the former being defined as land having on it timber of merchantable value, the latter being land without such timber.

By registering his land the landowner receives the benefit of the new system of taxation. Lands registered under the Act of 1914 are exempt from other taxation, and subject to, (a) forest land tax, which is levied at the land rate upon the bare value of the land excluding timber; (b) forest product tax, which is levied on all timber when cut, and upon any other income as it accrues; and, in the case of woodlots, (c) forest commutation tax, which is levied upon standing timber taxed in the year 1913, and at the valuation of that year. The land tax will, of course, be very small upon land that ought to be used for forestry purposes. The tax on the product will be levied at the

*Presented at the Annual Meeting of the Society for Protection of New Hampshire Forests.

[1] Harvard University.

time when the owner is receiving an income from his land and can afford to pay a tax; and is in line with the provision of recent legislation in other States.

Forest commutation tax, however, is an innovation. Proposals to abolish taxation of standing timber and to introduce a tax upon timber when cut, long encountered opposition in Massachusetts, and in other States, from forest towns that derived a large part of their revenue from taxes on standing timber. The commutation tax will have the effect of insuring during the life of timber now standing, the revenue that the town received in 1913. It will, however, prevent all increase of timber valuations, and will therefore prevent an increase of the taxes levied in 1913 on standing timber. This condition is to continue until 1919 when the commutation tax levied upon land thereafter registered will be the amount of tax paid in respect of standing timber in the year prior to registration. When timber standing upon land at the date of registration is cut, forest commutation tax comes to an end, and such land thereafter is subject only to forest land and forest product taxes.

In return for the benefits of the new system of taxation, owners of registered land will be required to plant any portion of such land not already forested, to cut timber in such ways as to encourage natural reproduction or, failing this, to replant, and to make suitable disposition of slash. Enforcement of this part of the new law will naturally fall to the State Forester, whose office is materially enhanced in usefulness and importance by the enactment of the law of 1914. While the duties imposed upon landowners may at first thought appear somewhat formidable, there is in reality nothing in them that is not actually for the interest of the landowner. The law simply prescribes good forest management and discourages slovenly methods; and this will be apparent to landowners as they become familiar with its provisions.

The law also makes suitable provision for consolidating small woodlots into forests; expressly authorizes the formation of corporations, without limitation of term, to engage in forestry under its provision; and finally permits the withdrawal of land from registration under suitable conditions. What it will accomplish, it is too soon to predict; but in the opinion of those best informed, the law of 1914 offers capital an opportunity to engage in forestry upon reasonably attractive terms in Massachusetts.

FOREST TAXATION AND THE SINGLE TAX.*

By Louis S. Murphy.

The report of the sub-committee on taxation of the Fifth National Conservation Congress last November would lead one to believe that the adoption of the single tax would not leave a tree standing or even permit one to grow, in other words, would force the destruction of the forests and absolutely discourage anyone from attempting the practice of forestry. This conclusion has as a basis the general statement of single tax propagandists to the effect that "virgin forests are a part of land, a free gift of nature, and should consequently be taxed as land or as a land value." On the strength of such a statement their assumption follows that the value of the land and the value of the timber are to be added together and taxed on an annual basis.

But the assumption is in error in at least two fundamental particulars. The assumption first of all ignores the fact that the term "land" has an economic as well as a common meaning. It is patent that if interpreted in its economic sense the above statement is perfectly intelligible and clear; otherwise it is not. Land in the economic sense comprises all the elements of nature, the rocks and soil, the forests, the minerals and the waters. When it is understood that the above basic statement simply means, therefore, that the forest—the virgin growth—is a part of nature and that its value should consequently be taxed as a natural value, must we conclude that the only way open to us is to tax it as land surface is taxed? Herein lies the second error in the committee's assumption that it is necessary on the theory that being a single tax there can be but one way to apply it, or some single-taxer may have said so, misled, undoubtedly, by the archaic general property tax idea.

The single tax is simply a tax on the utility values in nature. There is nothing whatever in either the spirit or the letter of the single tax doctrine requiring that timber be taxed annually.

*Read at the Annual Meeting of the Society for the Protection of New Hampshire Forests.

There is, consequently, nothing in reason to prevent the tax being applied in the form of a cutting or yield tax. In fact it can be shown that such method of application is the one simple and sensible way to apply it to timber and mineral resources as well. Both of these resources have a utility value entirely different from the utility value of either the soil or a water right. The two latter may be used, so far as we know, year after year, indefinitely, and it is therefore proper that they be taxed annually. But a given group of trees in the forest or a given portion of a vein of ore once cut or mined may not be so utilized again. That value which attaches to them in their natural state, therefore, cannot justly be taxed more times than it can be taken from nature. In the case of the forest, nature may produce more trees in the same place, but their value will be a new and entirely distinct value.

And if, therefore, we tax a piece of virgin timbered land by laying an annual tax on the market value of the bare ground and a yield tax on the value of any timber that is cut, how will this force the destruction of our forests? Such a method of taxing forests, the committee tells us in the main body of its report, will not force the cutting and destruction of our forests, but will aid in their conservation and conversion into well-managed and regulated forests.

The committee's fear that the adoption of the single tax will operate to the detriment of the practice of forestry may likewise be set at rest. As a tax exclusively levied upon natural values, labor and capital values of all kinds are expressly exempted under the single tax. Now those who have attempted to practise forestry themselves or have induced others to do so know that it involves the investment of both labor and capital. So that to the extent that forestry is practised under a single tax régime there would, to that extent at least, be a decrease in taxes on the value of the forest until with the planted or regulated forest there would be no tax on the value of the forest at all. The soil would, of course, be taxed annually according to its market value as it should be. Instead, therefore, of being destructive in its effects, the single tax would be constructive so far as our forests and forestry are concerned, whether applied to the virgin forest, the planted forest or any of the transitional forms.

PITFALLS OF TIMBER BOND ISSUES.[1]

By Montgomery Rollins.

Although the Timber Bond in its present form is somewhat new, yet the idea of loaning upon timber land is by no means new. It is an old custom, but the loan was made in the usual form of an ordinary real estate mortgage and of a size so that the whole amount might be taken by a single individual or an institution, but as the need and desire arose to borrow larger amounts, it became necessary to resort to the bond plan in order that the loan might be divided up among many holders as being too large for a single investment. Besides, the industry had been divided into small units dependent upon the portable sawmill, but the more enterprising manufacturers realized the waste incident to operating small tracts, so the tendency to consolidation and centralized ownership, as it were, entered into logging and milling—the same as in other industries. The larger financing incident thereto, caused recourse to the investment banker.

Thus it was, that about 15 years ago, the timber bond actually came into prominence.

Although the first issue was in the early "nineties," yet it is rather a strange fact, as we view it today, that the interest rates prevailing were 5%, whereas, of late years, 6% has been the ruling rate on securities of this nature.

In this connection, it is somewhat amusing to have read a recent publication of a society interested in social science, one issue of whose magazine is devoted to timber bonds as investment securities. It is evident that most of the articles appearing therein are the efforts of men directly or indirectly interested in the sale of the wares discussed, for, although the fact was probably not realized by the publishers, their pages were used as an advertising medium to boom bond issues of the class we are considering, and several misleading statements were incorporated. To illustrate: take the matter of the interest rate; evidently the writer who was treating that subject was somewhat new to the in-

[1] Read at the Annual Meeting of the Society for Protection of New Hampshire Forests.

vestment business, for, certainly, if he had been closely identified with that branch of banking during the last decade of the nineteenth century, he would have realized that he could not explain the present[2] 6% prevailing interest rate on timber bonds by declaring that it was because the securities were somewhat new, but that, in time, they would be better appreciated and sell upon a 5% basis. The reason why timber bonds are now being placed at 6% as against 5% about 15 years ago (of which latter fact the social science writer evidently was quite ignorant) is not to be accounted for by his method of reasoning, for, in truth, up to comparatively recent days, rates have been increasing rather than decreasing. However, this rising rate has not been confined to Timber Issues alone.

But that is quite in line with much of the enthusiastic literature which is put out, especially by some bankers, as they call themselves—and who reckon not of the hereafter—who suddenly bloom out with an office selling such issues, and who have had little, if any, previous training in the very serious business of selecting and marketing investment bonds.

There is no question but that, as a class, timber bonds have suffered much abuse, due both to the lumbermen and the bond houses. Such issues ought to be among our most desirable securities, because the property behind the mortgage is a staple product which should find a ready market. A commodity of this character undoubtedly has some good loaning basis. The present condition of the market (which has been one of increasing suspicion as regards the attitude of many investors towards timber issues) would seem to be due, therefore, to unnecessary causes.

For some years previous to nineteen hundred and eight or nine, there was a phenomenal increase in the value of timber holdings throughout this great country; so steady and rapid was this increase that lumbermen grew to believe that there was no top to the market price of their properties. During the last two or three years, however, they have watched the pendulum swing in a lessened arc, and prices have been sagging, if moving at all, so that in the present market, there are bargains to be had which would not have been dreamed of three or four years ago.

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[2] This article was prepared by Mr. Rollins, just previous to the outbreak of the present European War.—Editor.

Again, touching somewhat historically upon this subject, it is interesting to note that the first outlet for timber bonds was largely among the lumbermen themselves. Such investments were then attractive, for the lumbermen could not be deceived by false statements or values. Having shown his faith in the value of the security, confidence was then established with outside investors who, through the continued prosperity of the lumber market, were deceived into believing that almost any issue of like nature was good. But the investor was not alone misled in this regard, for the bond houses were imposed upon in much the same way, with the result that instead of these concerns dictating to the lumbermen as to the terms of the mortgage, the lumbermen, to a great extent, actually took the whip hand and obtained pretty much what they desired. Is it not a generally accepted fact that a good many lumber companies sold their properties to the bondholders at fancy figures, and retained their equities (if such they were) or, at least, temporary additional profits, through their stock ownership?

Another evil which has crept into the business within the last few years, is that of the investment bankers attempting to straddle the fence, so as to speak. They had seen so much money made in the lumber industry that some of them decided that it would be to their advantage to become stockholders in the enterprises that were being financed.

When they assumed this position, their judgment was naturally and unquestionably warped, to the detriment of the investor.

But the present condition of the timber security market is not altogether due to the mishandling of the issues. It has been caused, in part, it is believed, by a wrong principle in issuing the bonds; and here we come to the serial or sinking fund feature—in other words, the method of ultimate redemption. There are instances where bond issues have been readily purchased by investors, because of the large amounts maturing serially or of the large sinking fund requirements, the investor supposing that the quicker the issue should be retired the safer the investment. This is very fallacious reasoning; it boots little that any form of redemption, dependent upon earnings, shall be greater than the ability of the concern to meet the same.

Any company that is obliged to force its product upon the market, no matter what the condition may be, in order to meet the charges for interest and principal, is poorly financed. Thus it is a fair conclusion that no bond issue should be burdened with maturities or sinking fund provisions such as to force an uneconomical marketing of the product securing the mortgage. Too many issues have been put out in such form, and the market has been glutted with an oversupply of lumber, largely because bond houses, with the idea of increasing the salability of the issues, have wrongly financed them as above suggested.

Serial bond issues are desirable upon tracts that are being cut off, although a straight long term mortgage may be more desirable upon properties that are not being lumbered, but, in the latter case, it must be provided that in case lumbering begins, bond redemptions shall also begin or a sinking fund become operative proportionate to the depletion of the values.

It is all too true that we are faced, probably, through the rapid waste of our heritage, with a future scarcity of wood, yet that may not be so imminent as to justify the placing of a sentimental value upon a timber property, for it is not likely that the scarcity will be so seriously felt as to materially enhance the value under the mortgage during the life of the issue, for in mortgages based upon all natural resources which are being exhausted, such as mines, oil wells, timber lands, etc., it is a principle of finance not likely to be disputed that the loan shall be such as, through some plan of redemption, to all be retired considerably within the estimated life of the property itself. Future values, therefore, should not be seriously considered; rather hard, bed rock worth based on present and more or less recent known commerical experience. Of great importance is it that the last maturity shall fall due while there still remains ample stumpage to protect the holders.

The ordinary sinking fund method is by a payment to the Trustee of so much per thousand feet or cord of lumber marketed. Thus a sinking fund itself is a movable factor, and one should not be beguiled into supposing that the amount of the sinking fund, as estimated by the then output of the mills, may be as great in succeeding years. The better timber may, at the moment, be that which is being operated, or market conditions may change.

Under the serial form, a given amount of bonds matures yearly, regardless of the output of the mills.

Another objection to the sinking fund plan is that the amount of money turned into the Trustee is dependent upon the honesty of the officials, unless a plan for a periodical audit of the accounts has been provided. Then, again, a not over discriminating management may select and cut the more choice tracts first, with results naturally undesirable.

It may be said here, that in timber bonds, more than in most security issues, the good intentions of those managing the property is an element to be reckoned with, and, perhaps, therefore, it is all essential that the mortgage itself should provide also for a periodical inspection of the property. This is in order to ascertain that the provisions of the mortgage, which, in themselves, should properly safeguard the investor, are being complied with.

Where timber companies are using their machinery for the manufacture of lumber or pulp for other concerns, a certain protection should be given the investor so that he shall benefit by the earnings received from such outside sources as an offset against the natural wear and tear of the mortgaged property.

In some instances, a form of sinking fund is provided for buying additional stumpage each year to offset that cut. This provision may be fully as safe as an actual cash sinking fund or a serial form of redemption, but it is a provision, nevertheless, that places so much confidence in the hands of the officials of the company, that many experienced financiers are not favorably inclined towards its adoption. The character of the timber thus purchased may be far inferior to that which has been cut. Thus all the conditions as regards the purchasing of such stumpage should be as carefully passed upon by an expert employed in the interests of the investor, as in the case of the whole property at the time of the issue. It is just as necessary that timber land replacing that cut should come up to the requirements of the careful investor as that originally covered by his mortgage.

Under the serial form of issue, it is natural that the first maturities should be the safer. This fact appeals to banks which are legally permitted and do invest in timber issues, thus the earlier maturities are naturally selected by those more experienced investors. Upon the other hand, the ordinary investor more naturally inclines to the longer term bond as providing a more permanent form of investment, consequently, but not necessarily always, assuming the greater risk.

The conditions attached to the application of sinking funds differ, but the best form is that which applies the money, as raised, directly to the extinguishment of the debt for which it was created, thus avoiding any possible loss by temporarily investing it otherwise.

But my argument has lead me ahead of the natural order of things, for the examination of the property and its valuation by timber experts of large experience is a primary consideration.

Too many timber bonds have been sold upon a "dressed-up" circular. One reads, for instance:

"Our cruisers estimate so much timber" or

"Our cruisers estimate the value of the timber to be such and such; the mills, railroads and permanent improvements amount to so much."

The above statements, which may show fine figures and make the issues attractive from the standpoint of the circular fabulist, can, at the same time, be very misleading. The timber bond industry unquestionably developed a new cruiser, viz., the "Timber Bond Cruiser." From experience, it has been learned that the old lumbermen's cruiser, whose office was a tent in the woods, and whose duty it was to get reliable and conservative facts for his employer, who was to buy the timber on his estimate, was a much more reliable and careful checker than a majority of the "timber bond cruisers" whose offices are in some twenty-story office building in a metropolitan city. It is very easy for the latter to estimate that on a rough piece of land the loss by wreckage, when the timber is cut, may run as high as 25%. It is also easy for him to include, in the stand, timber such as over-mature hemlock, in some sections, or hardwood in others, that only find a profitable market under most favorable conditions. In the estimated value, the same thing holds true. There never was a circular issued that stated such a fact that because of the inaccessible location of a certain portion of the tract, the timber on it is worth so much less than other timber nearby, more favorably located.

Again, it is very easy to add the cost of the logging railroad and sawmills to the value of the property, but this is liable to lead to a financial fallacy. When the timber becomes cut off, the mill and railroad may have no further value. Consequently, while these properties will undoubtedly increase the value of the stumpage for the purpose of operation, nevertheless, conditions may be such that a very heavy depreciation should be provided to take care of their final charge off.

No matter how excellent the timber may be, its accessibility for milling and market purposes is even more important. For instance, of what value would be the best electric light plant in the world located in the midst of the Desert of Sahara? Upon the other hand, a more or less run down property may have great potential value in the center of a thickly populated area where its earnings will not only provide revenues for satisfactory dividends, but a surplus for the proper rehabilitation of the property itself.

Thus a good milling site, rail or water transportation facilities, and all such conditions as enable one to economically and scientifically harvest and mill the product, and furnish an outlet for profitable conversion into money, are imperative.

For fear of omitting a possible asset from the standpoint of the bondholder, I will mention the value of the land itself after the timber has been stripped. It is undoubtedly true that some lumber companies have marketed cut-over land for more than the original cost of both land and timber, but that will be hardly a fair statement as based upon present conditions, or, at least, it will be a misleading statement, because the values which would now be placed upon timber properties for loaning purposes are quite different from the cost of such properties when acquired, perhaps, many years ago, at prices immensely below present values. It is to such as those that the rare occasion of selling the land at greater than the original cost of the whole property must apply. Then the character of the soil beneath the timber is important if this factor is to be counted as an asset at all—whether such land would be adapted to agricultural purposes, its location as regards marketing agricultural products, and the like. At times, mineral values have been found underlying the timber, but such exceptions must be classed along with the usual chances of mining.

It would be useless to attempt the discussion, in a limited paper, of the hundred and one features to be considered in the drawing of a mortgage for the full and ample protection of the bondholder. There are so many things to be considered that, after all, one must place a good deal of reliance in the character of the bond house offering the securities and in the reputation for experience in the drawing of such mortgages of the lawyers employed by the house. Personally, it would not satisfy me to know that a house had made a specialty of timber bonds only and had dealt in so many dozens of those issues! I would much prefer to seek an old established bond house which has had the experience incident to handling corporation issues of various kinds, for only in such a training can the wide knowledge necessary for the protection of the bondholder be acquired.

Therefore, it is almost useless to elaborate here on such facts as the following: that all titles to the tracts must be clearly shown upon the records; that the mortgage must be a first mortgage, or that the legal wording of the mortgage will vary according to the State in which the land is located, and according to other conditions, the same as in all corporation mortgages, etc. But it may be worth while to suggest that there should be conditions included such as that the maker of the mortgage must safeguard the property by installing a fire patrol system and other methods of protection; that the property as well as the books shall always be open to inspection, and that regular sworn statements of earnings shall be rendered to the bond house; and so on.

Taxation of timber lands is a vital matter to be considered, particularly so in the case of long time bonds covering properties bought for speculative purposes rather than immediate cutting. Where the timber is rapidly being marketed, the question of exorbitant taxes is not so material, but in timber that is to be allowed to stand for any considerable time—covered by what are termed "Holding Loans"—one must be assured that the local taxes are not likely to eat up a great deal of its value.

I am not very enthusiastically inclined towards guaranteed securities, unless guaranteed by a corporation, and even then, there are many pitfalls, but timber bonds, when guaranteed, often carry the endorsement of an individual. Unless that individual puts up marketable securities, for the value of his guarantee, I should not care to accept it regardless of the timber value. He is no more than human; he may be rich today and poor tomorrow.

Thus the merits of the investment should be judged entirely aside from the guarantee. This does not assume that the latter is an undesirable feature, it may prove very desirable; everything else being equal, it should not be refused. The great danger lies in that the guarantee of some very wealthy man may be so alluring as to blind the bond house, and cause omissions ordinarily incorporated for the protection of the buying public.

Many will remember that one of the great factors which led to the widespread losses in farm mortgage investments during the early 90's, was the fact that they were guaranteed. Also, those who, only a few years ago, so confidentially bought irrigation securities in immense numbers through one of the leading banking houses in the Middle West, have cause for serious self reproach, because the guarantees have proved absolutely worthless. A man's guarantees cannot very well be limited. The tendency is that, when once entering upon this vicious form of greasing the ways for security marketing, no sane limit is ever exercised, so that even if guarantees to a certain value might prove safe, it is almost unheard of that the guarantor ceases his pernicious methods within such limits.

There is also a legal phase to be considered here, viz., the status of an investor holding a guaranteed security in case of recourse upon the guarantor, who may be forced into financial difficulties thereby. The bondholder would merely come in with all the other unsecured debts of the guarantor, all of whose property may have been mortgaged or put up as collateral for other loans, and thus his endorsements prove of little assistance.

One more consideration which I shall attempt in this discussion is the fire hazard, for many objections have been harbored by investors that timber bonds are more than ordinarily risky investments, because of the danger of having their property wiped out by fire. This belief is certainly very much exaggerated, and, in the large proportion of timber issues, mostly without foundation.

This risk from fire to timber properties has in some ways greatly diminished, due to government and state fire wardens and patrols, and the general better education of the public as well as the keen desire natural to the lumber companies for protection against such a fearful plague.

Upon the other hand, because of the railroads pushing back into the wilderness, spreading sparks in territory never before traversed by a locomotive; because of the almost universal use now of the type of cigarette which does not go out but consumes itself to the last ash after it has been carelessly thrown aside by the thoughtless smoker; because of the increasing trend towards camping life and one thing and another, the fire hazard has not only increased, in some ways, but the area of such risks has been enlarged.

No matter, therefore, with what assurance the vendor of a timber bond may argue with a prospective buyer as to the lack of risk from fire, yet it is practically impossible, in some stands of timber, to wholly elminate such a risk; thus certain odds prevail upon an issue of this nature as against an insurable property like manufacturing plants or other combustible improvements.

I think it is fair to say, however, that as yet no large bond issue has been put in jeopardy by a devastating fire, although there must have been countless instances where such fires have only been averted by prompt action—so the risk cannot be escaped.

An enthusiastic dealer in bonds of this class will declare that there are other greater dangers to the standing tree than fire; that insects, animals, storms, etc., are more damaging. This is probably true the world over, but it would not be true in the case of a given tract—the insect, animal and storm destruction upon one side as against fire upon the other. The latter might wipe out the entire area in forty-eight hours. So, too, a cyclone or hurricane might sweep through a narrow tract, but, even then, the timber would not be destroyed, and it could be salvaged immediately, although, to a certain extent, fire swept timber may also be salvaged.

So let us guard against misleading statistics and misleading statements; statements which tell only half the truth as suggested by the great destruction going on in standing timber from insects, etc.

As a final word, it seems economically unsound that one should loan money upon security which must, according to the contract, be depleted in intrinsic value in order to pay off the loan, and which really is opposed to usual practice, as most other corporations contemplate the payment of indebtedness from earnings rather than through a depletion of the properties.

An instance might be cited of a timber bond issue which does meet this requirement. The debt is secured by mortgage upon a segregated tract of land. It was provided in the mortgage, that, during the life of the issue, no timber should be cut upon the land so segregated. The issue was guaranteed by another company, and the guarantor covenanted that he would deposit with the trustee a certain number of dollars per thousand feet of its cut on additional and surrounding land, so that the debt might be liquidated without lessening the value of the property securing it.

Nevertheless, many issues which have not met the rigid requirements of the foregoing somewhat sweeping conclusion, have been profitable and satisfactory investments, and probably many others will prove equally so.

THE PROBLEM OF FOOD MOVEMENT IN TREES.

By S. B. Elliott.

The old theory regarding tissues in which food materials move, namely, the sieve tubes of the bast, would appear faulty when we have to deal with girdled trees. There are examples of trees completely girdled which nevertheless continue to live and grow for years, showing that food materials must descend without the bark and bast, and food materials and water must ascend in sufficient amounts in the older portions of the wood. It is also interesting to note that this takes place in conifers, which are without tracheal tubes, the latter being known to assist in food movement of broadleaf trees.

We can add one good illustration to the collection of evidence. A young White pine girdled about 18 inches above the ground by some rodent (the teeth marks being visible) by which bark, cambium, and some sapwood had been removed supported three whorls of branches above the girdle, but had no leader nor branches below the girdle. No bark had formed on the girdled part. The diameter below the girdle is 2.2 inches, at the girdle 2.1 inches, at 6 inches above girdle 3.9 inches, halfway between first and second whorls 3.8 inches and halfway between second and third whorls 2.2 inches. A counting of rings shows 13 (possibly 14) above and 8 at and below the girdle, showing that the tree had lived at least 5 years after being girdled without supplying food to the roots except what could have passed outside of bast tissues through old wood.* (See frontispiece.)

Some of the questions raised by the conditions given in the above description are: First, Why did not the tree die when so severely girdled; second, since it continued to live, why did the lower portion between root and girdle not continue to grow; and, third, why has that part between second and third whorls of limbs made so little growth each year as to appear, by diameter measurement, to have remained stationary?

*An account of a similar case is found in the U. S. Forestry Division Bulletin 22: The White Pine.

First, the sapwood being practically uninjured, the mineral food must have passed from the roots to the leaves.

Second, because the lower portion ceased to grow we know that food necessary for growth had no means of passage from the leaves; or at least growth was infinitesimal, while enough food must have passed to keep the roots alive.

The answer to the third question regarding the apparent non-increase in size of the still growing section between the second and third whorls, remains an enigma.

If the injury to the tree were great enough and the root development very much retarded a much reduced supply of mineral food and especially water would be furnished. This supply would be drawn upon to the usual amount by the leaves of the first whorl of branches, and, only a scant supply being left for their requirements, the upper leaves were not able to elaborate sufficient food to that part of the trunk to enlarge it.

A second case, also a White pine, presents even more interesting features. This unusual specimen is still alive and all its parts are thriving. It was originally a forked tree, one of the forks having been severed from the mother tree, the man in the picture touching this fork. Its history relates that in 1882, for the purpose of securing pitch, a large chip was cut from beneath the fork of the branch now without support of stump (about 2 1-2 feet from the ground), the cut, however, not being of sufficient depth to entirely sever the branch from the stem. It is not known at what time the complete separation shown in the illustration occurred. (See frontispiece.)

Natural grafting between the two forks has taken place in three, probably four, places. The two branches of the forked tree unite 8 feet above the severed end for a distance of 5 feet 4 inches. The second union is 2 feet 8 inches above the first, and is 1 foot 8 inches long; while, again, 6 feet above this junction, the third graft is seen, where a large limb from the rooted tree is joined to the severed branch almost at right angles.

There are no live branches below the first junction on either stem, and it is probable that the dead ones had ceased to live before the cut was made, for the tree is found to have been growing in dense shade. The growth in height of crown of the severed branch for the last decade averaged 7.5 inches per annum, this crown now being more vigorous and thriving than that of the rooted tree. Splendid results have been attained by Nature's endeavor to heal the wound at the base of the severed trunk.

The diameter measurements of the severed branch in comparison with those of the trunk supported by the roots are level with the shoulders of the man standing by the tree (or trees) 12.25 inches and 17 inches; and at the first junction 12 and 13 inches. So, while in the rooted tree the taper is 4 inches, that of the severed branch is only one-quarter inch. That a reversal of the natural taper has been taking place probably ever since the cut was made is borne out by careful measurements of a photograph of the tree taken 12 years ago from the identical point from which the one here produced was secured (*Forest Leaves*, vol. 8, p. 168), which give the relative diameters at the lower end as 8.5 and 13 inches, and by such other data as can be secured. The tree stands near Mont Alto Furnace in Pennsylvania.

Increment cores taken at both the lower and upper ends show that the annual rings are larger at the upper end.

The important features brought forward by this case are the continual healthy growth of the severed stem below the graft and the more rapid increase at the junction end of the branch than at the severed end. Manifestly the same forces are working here as in the first case, and the cambium layer is alone active in the severed stump, though, as mentioned before, it is not known how long natural feeding from both roots and leaves was going on before the lower end swung free from the mother trunk. Roots, live limbs and leaves being absent, the reason the upper end grows faster must be because that end gets a larger supply of food, the upper end not allowing any more food to pass its doors than is not actually required for its own growth.

AN APPRECIATION OF DR. SCHENCK.*

By Austin Cary.

When Dr. Schenck gave up his work among us, American forestry lost its most picturesque figure, also one of its strongest individual forces.

Carl A. Schenck, a trained Hessian forester, came to this country in 1895 to assume the management of Mr. George Vanderbilt's forest estate in North Carolina, succeeding Mr. Pinchot, who started the work. Here he found the only field at that time open in America which was suited to his training or tastes. Here he could plant and thin, and try experiments. Here he could build roads for the orderly and permanent working of a forest property. Here, without necessity of producing immediate profit, he could lay out a plan of development and improvement that had in view income, and that on a limited scale, only at the end of twenty years.

All this Dr. Schenck, being not only a well trained but a bright man, could do most competently; but he did much more than this. His system of protection, in the first place, was an original and effective one. Then, finding that to get his products to market, methods of operation and transportation were required suited to the country and of a style new to him, with the utmost energy he set himself to meet the situation. His experience at this point was interestingly related at the last Pacific Logging Congress. In the end and in the main, he succeeded, and the fact was a triumph for his persistence and ingenuity. Incidentally, he acquired, as he often expressed, a great admiration for the competence and initiative of plain American men.

Those men are very blind to facts who look on the Vanderbilt property as a fair sample of genuine American forestry, as that must be conducted on a large scale. As a matter of fact, it was a German forest district transplanted to America, made possible by a benevolent millionaire. It was, however, a mighty useful thing to have among us, and no man in the world, probably,

* Written in June.

was better fitted than Dr. Schenck to develop its possibilities or more competent to play it up.

Many interesting lessons might be drawn from the history of the Pisgah Forest, which history, as a private owner's attempt at forestry, has just now closed. Among them is one too important not to mention in passing. The writer in the spring of 1900 made a break in his own work in the Maine woods by paying a visit to this contrasting field. With all his admirable adaptability, Dr. Schenck was in many ways a high-class German still. This was shown particularly in his treatment of labor. Any man in the Maine woods who would talk to woodsmen as Dr. Schenck did would get his head cracked on the spot. North Carolinians took it differently; they laid low, and took out their grudge with a fire later on. The lesson that forest managers must make allowance for the rights, interests and feelings of local populations is one not likely to be too strongly taken to heart.

Dr. Schenck's experience on the estate, his acquaintance all over the country gained through forestry meetings, and his consulting work seem gradually to have liberalized his views. That liberalizing process further developed after he severed his connection with the estate, and ran his school peripatetically, and was completed seemingly under the stimulus of contact with the lumber industry in the Pacific Northwest. His admiration for Northwestern lumbermen, their ingenuity, force and daring, hardly knew bounds. Through this contact, apparently, he filled out his sympathy with the lumbering industry.

It was a marvelous thing for a man to do—to come over here from that country in all the world where the individual is most restricted, and where the most intensive forest management anywhere in force is fortified by a century of science, of popular training, of established practice of the art—with this background behind him to sense the contrasting conditions of a much newer country, and sympathize with our lumbering industry in its present form; but that Dr. Schenck did. It is not to be wondered at that in his reaction he went somewhat to extremes. Some such strong reaction as his to balance opposite tendencies in the forestry profession of the day, in fact, was needed.

At the bottom of Dr. Schenck's teaching there seem to have been three primary ideas. The first was, that forests exist for the people, and not the other way around, as some apparently would have it. The people, too, in his view, were not posterity alone, but included the people of today, and from that classification the members of the lumber industry were not excluded.

Another thing he taught was that the economy of existing forest measures, the future of forest land also in large measure as well, was not mainly a matter of planting, thinning and other silvicultural operations on a minute scale, but was bound up with the methods and organization of the industry at large, and in great measure depended on its prosperity and success. Under financial pressure and low prices for lumber, he saw that neither good economy nor protection are possible, while fine silvicultural measures must be dropped out entirely.

The third thing that Dr. Schenck made the subject of much teaching was that conditions in the industry will be improved from the inside, and cannot be greatly changed in any other way. The idea of regulation from outside in advance of proved necessity and of plans laid out for an owner without consideration of his financial circumstances and business organization, were things that filled him with disgust.

To these effects ran the weight of Dr. Schenck's teaching. Plenty of other men in the country hold much the same ideas, The weight that Dr. Schenck gave them arose from the fact that he was a trained and recognized forester, a German one at that.

Criticism and a negative position are easy. The Biltmore Forest School was Dr. Schenck's contribution on the positive side. Here his chief aim was to train men for the lumber industry. Biltmore in the old days was a school not mainly of the class-room, but of the woods, and after it began its travels, the same character prevailed. Whatever his classes may have gotten in Europe, in this country they went where actual logging and mill work were going on, and studied those processes face to face; and when they left the school, the majority of the men found places in the industry. This, however unsatisfactory it may have looked to the systematic educator, was effective work nevertheless. Dr. Schenck brought his men in contact with realities and showed them how to react upon them. The sons of lumbermen and others had their wits sharpened, their horizon broadened; got starts and slants that will direct their thinking and modify their actions through all their succeeding lives.

Dr. Schenck in the last number of "Biltmore Doings," suffering doubtless under intense disappointment, minimized his own results. He need have no such feeling as long as the young men whom he stimulated and taught were of the right stamp to start with, and at the finish got foothold in the industry. Results will be in evidence in due time, all the sounder for being a little delayed. If, on the same occasion, he forgot some men who have reached prominence in other lines, it is but fair to remember the set purpose of the man, to work through the industry itself.

In the hurry and scramble of actual life, men do not always carefully consider their words or maintain a position of nice balance. It was so with Dr. Schenck, as has been indicated above. Of an intense nature, his reactions and sympathies were strong. When, for instance, as he did before the Society of American Foresters, he said that forestry was anything that had to do with the woods, he went to an extreme, and his friends had to take him up. Forestry in any meaning sense is no more that than it is German forest practice introduced on a large scale in America today. Both are extremes, and the sensible, practical mean lies between them. This, as far as private land in large areas is concerned, consists in the first place, as all so far agree, in good utilization and in protection that is efficient and on an adequate scale; and these things we know depend, in turn, on the maintenance of values. Further than that, forestry includes in some cases conservative cutting, reservation of young and thrifty stands and cheap measures for re-stocking, all under conditions imposed by sound finance. These things, to be sure, are not ideal, but they are practicable to an extent, and they secure something that is actual and worth while. All are in operation at one place and another within the industry today, carried out under actual business organization; and extension of these desirable things halts mainly for lack of men so equipped and so placed as to carry them out. To the extension of the area over which those things should hold, Dr. Schenck's school contributed; being, in fact, in that line, the most effective thing we had. The two-year plan that was in Dr. Schenck's mind when he quit looked almost ideal. Those who criticize, for the most part, have not grasped the fundamental aim.

It is hard to write of the Biltmore School as a thing of the past. We shall miss Dr. Schenck, and the country has lost a force that was highly useful. Nobody will grudge him anything good that he carries back home. We wish he might find a way to return to work among us. If ever he feels like coming back for a visit, there are men all through the country, from one coast to the other, whose pleasure it will be to take hold and "give him the time of his life."

*We regret to state that it is creditably reported that Dr. Schenck fell in battle in France.

NOTES ON FORESTRY IN RUSSIA.[1]

Education. The Imperial Forest Institute at St. Petersburg was founded 110 years ago at the time the Russian Department of Forestry was established. At this school, a great deal of research and experimental work is carried on by foresters and other scientists; and the results are applied in the Department of Forestry. The qualifications for an instructor are a wide range of experience in forestry in Russia and the study of forest conditions in other countries, preferably Germany, France or the United States, for a period of at least one year. Forest school graduates must spend one summer on a private or national forest, engaged in investigative work, before they are admitted as Forest Assistants. The requirements for the position of Forest Supervisor are technical training, about five years' experience as a Forest Assistant or a Deputy Supervisor, and the construction of at least one working plan.

Investigations. The investigative work is entirely carried on by experiment stations with the exception of a portion of it which is done at the Imperial Forest Institute. Forest Supervisors and Forest Assistants attached to forests do not pretend to carry on any of this work, but merely put into practice the results obtained by investigators.

There are twelve experiment stations in the country, all located within easy access to a railroad station, this being considered highly important. The average annual appropriation for an experiment station is 10,000 rubles.[2] Each station is in charge of a director with two or three assistants, and in addition to this permanent force a number of students are added in the summer time.

The buildings at experiment stations are of a pretentious character. A 3,000 ruble house is provided for the director, and smaller houses for the assistants with families. There are also

[1] From conversation with M. Tkatchenko, member of Superior Forest Special Committee of the Russian Department of Forestry.

[2] 1 ruble=100 copecks=$0.73. The ruble is practically of the same relative value with our dollar for commercial purposes.

private rooms for visitors, while separate buildings are maintained for office, library, laboratories, etc.

Yearly, in February, there is a meeting of the Central Committee for investigative work held in St. Petersburg, to which come all directors and assistants at experiment stations, together with professors of forest schools and specialists in allied lines of research, such as plant physiology, ecology, and meteorology, who are specially invited, and if these latter deliver lectures their expenses are paid by the Government. At this meeting the work of the past year and plans for the next year are discussed; the studies to be carried on during the next year are decided upon and allotments of funds are made for each project.

There is a Superior Committee on Experimental Work which passes on all reports and decides which are to be published. This committee consists of three members.

Utilization. Russia furnishes one-half of the lumber supply of Great Britain and one-third of that of Germany. Great Britain gets principally *Pinus sylvestris* and *Picea excelsa;* Germany the same, but in addition some *Quercus pedunculata* and some *Alnus.* A large amount of wood is exported to Germany for mine timbers, *Picea excelsa* being the principal species used for this purpose.

The following is the average scale of timber prices per cubic foot: Oak, 18 to 36 cents; Spruce, 10 to 22 cents; Pine, 15 to 25 cents; Larch, 12 cents, and Ash, 18 to 55 cents.

The best grade of pine and oak brings 2,000 rubles per hectare[3] ($590 per acre) on the stump; average quality for 800 rubles per hectare ($236 per acre). Three hundred rubles per hectare ($88 per acre) is the minimum selling price for any timber and this is for such species as birch, aspen, etc. The land cannot be sold.

Pine is the wood principally used for ties and these are sometimes treated with creosote or zinc chloride before they are laid. Larch is also used to some extent. The ties are sold by the cubic foot. An engineering corps has entire charge of the preservative treatment of timber and this is completely outside the jurisdiction of the Forest Service.

Pinus sylvestris is the chief source of naval stores. The cup and gutter system is used.

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[3] 1 hectare=2.471 acres.

Milling operations in Russia are on a much smaller scale than in this country. In Archangels 275,000 cubic feet is a good average cut for one mill.

In Northern Russia the usual top limit for cutting is 5 inch with a log length of 20 feet, though this last may vary. After cutting, in North and East Russia, the logs are driven to the mills in streams. In West Russia there is some river driving, but the usual means of transportation is here by canals and railroads, while in Central Russia the only means of transportation is by railroads.

The net annual income of the Russian National Forests is $40,000,000 to $45,000,000.

Management. There are ten divisions for management work and making of working plans. Each division has a chief called a Revisor of Management, and this chief has three or four assistants. These so-called "Taxators" perform the necessary field work with the assistance of two technical men and several laborers to aid in running the compass, chaining, etc. The chief of the management division visits the forest in queston to determine if the method is satisfactory. If so, he sends the preliminary plan to the Department of Forestry at St. Petersburg. Before the field work is started a conference is held between the District Forester or Revisor, the Chief of the Management Division, the Taxator and the Supervisor. After one and one-half years the working plan is supposed to be completed and is sent to the Department of Forestry which, in turn, sends it to the Forest Special Committee in St. Petersburg. Reports of this Committee must be sent to the Vice-Secretary of Agriculture for his approval or disapproval. It is composed of ten to fifteen members, the chairman at present being Mr. Orloff, Professor of Management and Mensuration in the Imperial Forest Institute—the best man in his line in Russia. One member must read the plan and bring up the main points in one of the committee meetings, when it is either accepted or rejected, and if the latter is the case, the working plan must be modified or in some instances entirely reconstructed.

In Central Russia the minimum cost of making a working plan is from four to five cents per acre and up to 7 cents, which includes maps, survey and the necessary mensuration work.

Every ten years the working plan must be revised and each revision costs approximately 3 cents per acre. In 1765 A. D. an excellent survey of the whole of Russia was made and the working plan maps are based on this. Very fine boundary maps have been constructed for most of the national forests.

A good average size for national forests in Central Russia is 7,500 to 12,000 acres, while in Northern Russia they approximate those of this country.

In Central Russia where subdivisions exist a compartment contains 100 desiatins[4] or 270 acres, and on the best National Forests only 25 desiatins or 67 acres, while in the North of Russia it often contains 64 square kilometers (15,810 acres).

For working plans, the area is carefully mapped and sample plots accurately measured in order to determine the actual contents of the stand. Sample trees are felled and measured, and the volume of the stand is computed by the Urich method.

In Northern Russia the selection system is used for Scotch pine, while in Eastern and Central Russia the strip system, followed by artificial regeneration, is applied to the same species. Economic conditions are the reason for this difference, Northern Russia being very thinly populated and the timber values are relatively low, hence a more intensive and consequently more costly system of management cannot be profitably applied. On a good quality of locality the stand (shelterwood-compartment) method with cuttings at fifteen year intervals is used. For spruce in the north, from St. Petersburg on, the shelterwood system, with two or three fellings instead of the four called for in the complete system, is used, if the seed years are poor and if there is a ground cover of dense grass, it is necessary to aid natural reproduction by planting.

The corridor system devised by Mr. Molchanoff for use in the State of Tula in Central Russia has been very successfully applied to oak. This is used where a mixed type of young aspen, maple, ash and poplar occurs. All the trees are cut out in narrow strips ("corridors") three and a half feet wide, with intervening strips fifteen feet wide, in which the stand is left untouched. The corridors are then planted or sown to oak. The stand in the fifteen foot strips then acts as a nurse, cleaning

[4] 1 desiatina=2.7 acres.

the oak without shading it or, in Mr. Tkatchenko's terms, "giving the oak an overcoat without a hat." These other species are cut out year by year, as is necessary when they interfere with the oak, and are used for fence posts, etc.

In Central Russia the size of the timber at the end of the rotation is calculated very closely and often it is cut to a ten inch limit on a hundred year rotation.

Sometimes, after cutting, the land is given over to the peasants for agriculture for three years and then again planted with trees.

Very few grazing fees are collected, because there is little grazing in the forests; furthermore, it is the policy to permit the peasants to graze their stock free, thus making them friendly to the Forest Service.

The loss by fires is much less in Russia than in this country, due to the fact that the dry seasons in Russia are less severe than in parts of the United States and that peasants must go to a fire within a radius of fifteen wersts[5] (approximately 9 miles) without compensation; but beyond this distance they receive pay for their work.

Mensuration. The cubic measurement is used entirely in Russia. Two hundred and twenty cubic feet, comparable to our 1,000 board feet, is the unit of timber sale work. In scaling, each log is cubed as the frustrum of a paraboloid.

In accurate investigative work for determining the rate of growth, the tree is cut at the surface of the ground so that the entire age may be ascertained. The error which enters when the tree is cut at some distance above the ground, and the total age found by adding the number of years required by seedlings of the present day to reach that height, is considered a great one. The rings of annual growth are counted and measurements taken much the same as in our work, though in many cases the distance to each fifth ring, instead of each tenth ring, is measured. Whether the rings are counted from the outside in or from the inside out depends upon the character of the investigation. If a volume study is being made, the first method is used; if only the rate of growth in diameter is desired, the latter method is employed. Complete stem analysis work is never carried on in con

[5] 1 American mile=1.5 Russian "wersts."

nection with logging operations, because the sections cut under such conditions are of varying length, and usually too long for accuracy. It is thought that too many errors arise from interpolation.

The length of sections into which the tree is cut for investigative work varies from one to three meters, according to the accuracy desired. Frequently the sections are only one meter long. Sometimes the wood is used for fuel, but usually it is left to rot after all the desired data has been obtained.

The diameter at each section is taken north and south, east and west, and in the direction of the prevailing winds. The direction of the longest and shortest diameters and radii are also recorded. When sections are longer than one meter, taper measurements are taken at this interval throughout the length of the stem.

In computing the volume of the tree at different ages, the formula for the paraboloid is employed. Thus, the tree is computed as a single length, and is not divided into sections computing the stump, logs and top by different formulæ as in this country.

The Pressler increment borer is used in rough work only. For accurate work it has been found very unsatisfactory.

The Russian method of curving the growth data is much the same as ours. A great deal of stress is laid upon form factors and annual growth per cent. The growth is usually shown in tables by decades.

Nursery Practice. Russian nursery practice is nearly the same as that in vogue in this country. Most of their methods have been obtained from Germany. Sometimes the "transplant board" and "trencher" are used for transplanting, while sometimes "dibbling" is practised, or a notched board is laid along the edge of a trench, into which the seedlings are placed by hand. The term for the transplant bed is the "school," taken from the German.

Very little water is given to nursery stock which is to be planted on xerophytic sites, because it is considered best to get the stock as well adapted to dry conditions as possible before it is planted on such a site.

It was found in one of the Russian nurseries at one time that many of the young seedlings were dying from frost killing, while the thermometer readings at the usual height gave temperatures slightly higher than freezing. However, when the thermometers were placed on a level with the tops of the seedlings instead of at the usual height it was found that the temperature was several degrees lower than freezing.

Planting and Seeding. There is in the Russian Department of Forestry a branch of planting for work after fellings have been made and another branch for planting on difficult treeless sites. This latter work has been highly successful. Both of these branches are entirely separate from the main division of planting.

The first White pine plantation was established over one hundred years ago by Mr. Shatillow on his estate "Mochowje" at Novosilin in the State of Tula, Central Russia.

On favorable sites 85% is a good average of living seedlings in a plantation; and on very poor and exposed sites 20% is considered excellent. Ball planting is practised on the most difficult sites, for in such places this method is considered cheapest in the long run.

When conifers are planted the stock used is nearly always 2-years transplants.

Planting on the steppes has proven very successful until the trees are in their thirtieth or fortieth year; then the trees begin to die at the tops, and finally the whole tree dies. The soil is very rich and well adapted to agriculture, but investigations show there is too much Na_2CO_3 and Na_2SO_4 for trees. It is considered by Professor Kravkoff that there is a deficiency of N_2O_5 and P_2O_5 in the soil. The salts $CaSO_4$ and $CaCO_3$ are present in considerable quantities, but are considered indifferent.

Recently it has come to be a rather general opinion among Foresters that a better root system is obtained from direct seeding than from planting. The seed spot method is used to a great extent, but considerably larger spots are made than is the practice in this country. The soil is cultivated before broadcast sowing and it is a common practice to rent the land to the peasants for agricultural purposes for a few years before sowing the seed for forest trees.

Cost of Planting, Eastern and Central Russia. The cost of planting pine seedlings on dry soils, 9,600 per desiatina (3,855 per acre), can be figured as follows:

Labor (per desiatina)		
0.65 to 0.90 horse days	0.8– 1.1 rubles	
2.9 " 5.9 man days	5.8–11.8 "	
8.6 " 15.2 woman days	11.4–20.2 "	
Total	18.0–33.1 "	
Cost per acre	7.3–13.4 "	($5.33 to 9.78)

Oak seedlings one to two years old in plots two feet square by eight inches deep, 400 plots her hectare (162 per acre) and from three to five seedling per plot.

0.09 horse days	0.1– 0.1 rubles	
8.8–12.0 man days	17.6–24.0 "	
5.8– 6.2 woman days	7.7– 8.2 "	
Total	25.3–32.2 "	
Cost per acre	10.2–13.0 "	($7.45–9.50)

On the steppes in Southern Russia, 10,800 transplants 1-3 year are planted per desiatina (4,371 per acre), the species used being elm, oak, ash, black locust, honey locust and others. The planting area must first be plowed up in narrow strips. No figures were given on the cost of this operation. The cost for labor per desiatina, including transportation of plants from nursery, grading, counting, pruning, and planting, is as follows:

⅔– 1.0 horse days	0.7– 1.0 rubles	
9.0–14.5 man days	18.0–29.0 "	
11.0–17.5 woman days	14.6–23.3 "	
Total	33.3–53.3 "	
Cost per acre	13.5–21.7 "	($9.85–15.85)

After two years all the grass must be cleaned away from the plants. The cost of this work per desiatina is as follows:

½–1½ horse days	0.5–1.5 rubles	
½–1½ man days	1.0–3.0 "	
Total	1.5–4.5 "	
Cost per acre	0.6–1.8 "	($0.44–1.30)

Two years later, or four years after the time of planting, this operation must be repeated, at a cost of 1.5 to 5.2 rubles per desiatina (.67 to 2.1 rubles per acre).

After ten to fifteen years, thinning may be necessary. The cost of thinning per desiatina is as follows:

1–2 man days (cutting trees)	2.0– 4.0	rubles	
1–3 woman days (carrying away material)	1.3– 4.0	"	
Total	3.3– 8.0	"	
Cost per acre	1.3– 3.2	"	($0.95–2.33)
Total Cost of the Plantation per acre	16.9–31.9	"	($12.34–23.28)

Cost of Seed Plots. Oak seed plots, 5-7 square feet per plot, 100-200 plots per desiatina (40-81 per acre), 50 acorns per lot.

Labor (per desiatina)			
3.7–5.3 man days	7.4–10.6	rubles	
6.7–8.4 woman days	8.9–11.2	"	
Total	16.3–21.8	"	
Cost per acre	6.6– 8.8	"	($4.80–6.38)

Forest Enemies. Melolontha vulgaris, a species of the order Coleoptera, does an immense amount of damage to young plantations. The larvae which do the damage by devouring the roots of the young stock remain in the ground from three to four years, depending on climatic conditions. The adult beetle emerges in the spring feeding on the needles of the trees, and the female deposits the eggs in the ground during that season, hence all ages of larvae may be found in the soil at one time. Sometimes it has been found impossible to re-stock an area after a fire until ten years have elapsed because of the damage done by these larvae. No method of effectually combating this pest has been found. Pouring kerosene and benzine into the soil around the seedlings has been tried without success.

In 1908, *Lyparis monacha,* a white moth, did an immense amount of damage to spruce in Scandinavia and Russia; in 1909 in Russia and Prussia, and in 1910 in Saxony, Austria, Russia and Prussia. The insect eats the needles, completely defoliating the tree. It also attacks hardwoods, but these put on new leaves the next spring; since the spruce cannot do this, it often dies. Pine also suffers, but generally the defoliation is not complete, and consequently this species usually recovers.

In 1909, Russia alone spent 90,000 rubles in an effort to check the ravages of this insect. The method practised was to put rings of a special glue ("caterpillar lime") around the trunks of the trees at about breast height, which was done at a cost of 20 rubles per hectare ($6.50 per acre). First, approximately, the infected area must be thinned, then a ring smoothed on the bark of each tree to make a surface for the glue. However, this method proved valueless, since the larvae hatched out from the egg clusters above this ring, and it is impossible to collect the egg masses because they are laid on all parts of the tree.

The only methods of combating this pest are to cut out all infected trees, to cut clean and change species, or to change the system of management of the spruce, giving many more thinnings than is customary. If a tree becomes infected in the summer it must be cut and the bark burned before the eggs hatch in the following spring, otherwise an enormous number of new larvae will develop; besides, the wood of the tree will begin to deteriorate, being attacked by blue rot and other fungi.

The rabbit is a great enemy of oak plantations, eating the leaves and gnawing the bark of the young trees. Shooting seems to be the only means of checking the damage caused by this animal since poisoning has proven unsuccessful.

Forest Laws. Over twenty-three years ago a law was enacted making it compulsory for every private owner of forest land to have a working plan for his forest, and only permitting him to cut the timber in such a way that a continuous supply will be assured from the holdings.

For stealing timber from windfalls the penalty for the first offense is a fine of 50 rubles plus the actual value of the timber; for the second offense from one to three months' imprisonment; and for the third offense from one to six months' imprisonment. The penalty is much higher for stealing logs already cut for timber, or for felling trees. If the timber is stolen from a planted area the fine is possibly thirty times as much as that for the first trespass on wind thrown timber.

The laws in regard to forest fires are very severe and rigidly enforced. No fire warning notices are posted anywhere except in the office of the head man in each village. If a fire is started by carelessness such as smoking, etc., the fine is 100 rubles. Fires started maliciously are divided into two grades in regard to penalties. The first penalty is a jail sentence of from four to sixteen months. The penalty for the second grade, in case only timber is destroyed, is deprivation of any noble or official title the offender may possess and two years on improvement work (no work in the mines) in Siberia; if any houses or settlements are destroyed the term in Siberia is made much longer.

Salaries and Wages. A Forest Supervisor receives a salary of from 1,500 to 2,500 rubles per year. In addition he is furnished with a house costing from 1,500 to 3,000 rubles and has the use of from 40 to 80 acres of agricultural land. The entrance salary of a Forest Assistant is from 800 to 1,000 rubles, depending upon qualifications and the nature of the work.[6]

For common labor the wage scale is: Central, Southern and Eastern Russia, 1 to 2 rubles per day; and in Northern Russia, 3 rubles per day. A woman receives about half to two-thirds as much per day as a man.

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[6] After July 1, 1913, all forest officers were to receive an increase in salary of about 50%.

SUGGESTIONS FOR FOREST ADMINISTRATION IN CHINA.[1]

By P. C. King.

Introduction.

Although the complete deforestation in China, accompanied by its disastrous consequences, has served the world as a moral lesson, yet few have inquired into the causes of such destruction. Economic pressure is often employed to explain the existence and disappearance of certain social institutions. But its application here is hardly plausible. The economic condition of the Chinese people in the past was not any worse than that of the people in India or Japan and perhaps not worse than that of the Europeans in the medieval ages. Yet forests in these countries are for the most part preserved.

Even granting economic pressure as the ultimate causal factor, it must have favorable conditions under which to operate. In the absence of better explanations, the writer offers to present three causes or favorable conditions under which deforestation has been going on without check. These are: (1) the early decay of feudalism, (2) the *laissez faire* policy of the government, and (3) the frequent outbreak of internal disturbances.

In the third century B. C., when the larger part of Europe was still in tribal condition and was hardly ready for feudalism, feudalism in China had had an existence of more than two thousand years and was beginning to decay rapidly. The conquest of feudal kingdoms with the final establishment of a great empire in 221 B. C. dealt the final death blow to feudalism in China. The overthrow of feudalism effected a great change in property conditions. Heretofore forests had been owned by the princes. The pleasure of hunting indulged by them had kept the forests under good care for the chase and, as on record in the classics, manned with a regular force of forest officers. When

[1] This article is part of a thesis prepared by Mr. King, a Chinese student at Cornell University, for the degree of Master in Forestry.—Editor.

these kingdoms were conquered and an empire established, and the habit of hunting was giving way to more secluded pleasures, forest land was free to all for exploitation. The growing population probably demanded increasing clearing of land for agricultural purposes. At all events, there have been since then no more appointments, and the rank of forest officials to take care of the forests fell into disuse. Vigorous exploitation and clearing must have occurred at this time.

That the change from feudalism to other forms of state organization has its effect on forest conditions may be seen in European history. From the 15th to the 18th centuries, when feudalism was dying out in Europe, the change of property rights and the uncertainty of property conditions resulted in considerable deterioration of the forest. "Every forest ordinance," says Dr. Fernow in describing the forest condition at this time, "began with complaints regarding the increasing forest devastation." Japan escaped this fate, only because the overthrow of feudalism there in 1886 was immediately followed by the introduction of the modern and efficient state organization.

Had the Chinese government, upon the fall of feudalism, taken measures to nationalize the forest or to regulate the exploitation, the change in the forest conditions in China would have followed a quite different course. Unfortunately, the theories of government as understood by the statesmen in China advanced very little in the past twenty centuries. Until lately, the government always took a disinterested attitude toward what the people were pleased to do; except in such cases where the peace of the country might be disturbed or the safety of the throne endangered, state interference was never resorted to. A policy of *laissez faire* was always observed as far as possible. When the people are allowed, in following their own interest, to do what they will, the result cannot be otherwise than it was in China.

Internal disturbance or civil war must have contributed its due quota in changing the forest conditions in all countries. We have evidence of this fact in the Thirty Years' War and in the French Revolution by which both the German and the French forests were impoverished considerably. In the forty centuries of the Chinese history there were twenty-five major revolutions and numberless minor and unsuccessful ones. Although there is no record to show how these revolutions affected the existence of the forests, there can be little doubt that the property condition must have been disturbed by these political upheavals. It is stated that the civil war in the middle of the 17th century destroyed extensive forests in Szechuan province and in the western part of China.

These seem to be the salient causes of deforestation in China. It is to counteract the evil effects of these causes that the institution of a vigorous forest policy by the government is now most urgently needed.

Attitude of the People Toward Forestry.

It is an unfortunate fact that the Chinese people have in the past twenty centuries never appreciated the value of a forest and have neglected its welfare to the extreme. As indicated in the introduction, it was not so in the days of feudalism. Forests were then regulated and placed under responsible officials. Fragmentary sayings can even now be extracted from the classics to show that warnings were served on the people by ancient sages who apprehended the exhaustion of timber. But these good institutions were long ago obliterated and these warnings were never heeded. The result is the long continued devastation of forest resources without ever being interfered with, or opposed to, or even thought of by the Chinese public.

With the rapid march of western civilization into China in recent years, there has come also a gradual realization on the part of the educated people of the importance of forestry. The repeated occurrence of floods in central China during the last few years has set many people to thinking about the problem and to seeking the causes, and the removal thereof, of such disastrous phenomena. It is interesting to note that people who are apparently least informed of the science of forestry are particularly loud in asserting that reforestation would cure the floods. The idea of reforestation by artificial planting has been taken up readily everywhere and has engaged considerable public attention.

Late in the spring of 1914, the writer conducted an investigation into the general agricultural and forest conditions in China by sending out circular letters to the Industrial Commissioners of the various provinces, requesting them to give the desired information. As the project was started rather recently, only three provinces replied so far. Among them two provinces have established tree nurseries and have started planting on waste lands. The spread of the popularity of reforestation by artificial planting is here quite evident.

Another case of interest is the colonization work at Nanking, conducted by Mr. Joseph Bailey. It was originally a famine-relief project conceived by Mr. Bailey, by which project a famine-stricken people were taken to Nanking to reforest the foothills of the Purple Mountain. This work was admired and highly commented on by the government. Lands, contributions, and general support, both from governmental and private sources, have been given him to extend the work on a larger scale.

These desultory efforts in reforestation do not indicate anything beyond the growing interest in the matter of forestry. They are, however, straws that show the direction of the wind. Instead of a passive indifference toward the welfare of the forest as in the former days, an active interest and enthusiasm in the practice of forestry is beginning to leaven the whole country.

The reforestation work in China is a gigantic task. In view of the vastness of the country and the depleted forest conditions, it is easily greater than all the reboisement work either accomplished or contemplated in Switzerland, France and Austria. But the work should be faced, squarely and boldly. The rising generation should see that this growing interest be energized, widened and systematized so that success will be our final reward.

Physical Conditions of the Country.[2]

Occupying a central and important part of the eastern hemisphere and lying between 20° and 53° North Latitude and 74° and 134° Longitude east of Greenwich, China is, in position and in extent, comparable to the United States. Topographically speaking, however, there is a great difference. The great mountain ranges and the great rivers in China generally run in an east and

[2] See also article by R. Rosenbluth, F. Q., vol. X, pp. 647-672.

west direction, while those in the United States for the most part run in a north and south direction. The country is divided into three natural divisions by three great rivers: the Yellow River in the north, the Yangtze River in the middle and the West River in the South. Almost parallel to these three rivers and forming their watersheds, there are three important mountain systems: the Alashan Range which is north of the Yellow River; the Peling Range, between the Yellow River and the Yangtze River; and the Nanling Range which lies north of the West River. From these, as spurs, minor ranges run to the coast and to Manchuria. Since the mountains rise in the west and northwest of China, the country slopes towards the east; this is clearly indicated by the courses of the great rivers. With vast plains in the coastal region, fertile valleys along the river basins and mountain and tableland between the great rivers and in the west, the topography is, indeed, varied, and is well apportioned between agricultural land and forest area, though the amount of the latter is said to be very small now and to have been stripped of the verdure it once possessed.

Climatically speaking, no part of China, except the deserts in Manchuria and in Chinese Turkestan and the snow-clad mountains in Thibet, is unfavorable for tree growth of certain species. In temperature, the northern part is rigorous, reaching extremes in Mongolia; the central part is mild; and the southern part partakes of a semi-tropical character. Thus, the temperature in Pekin registers 100° F. as the maximum and 4° F. as the minimum, the mean annual being 54.8° F. In Shanghai, the thermometer registers 96.5° F. as the highest in the summer and 10.5° F. as the lowest in the winter. In Canton, the maximum varies from 96° to 100.4° F. and its minimum is rarely below the freezing point. These records are taken in cities along the coast. As one goes into the interior part of China, these figures must be modified considerably by the altitude and other factors. But these figures do represent the general range of temperature. The growing season decreases from 10 months in the south to 15 weeks in the extreme north bordering Siberia.

While the annual precipitation along the Pacific coast in the United States increases northward from the driest part of southern California to Washington, where the annual rainfall is the greatest, the annual precipitation along the Pacific coast in China has just the reverse order; it decreases northward from 79 inches in Pakhoi to 37 inches in Pekin. This may be shown by the following table:

Locality	Latitude	Ann. Precipitation, in Inches
Pakhoi	21° 29′	79.0
Amoy	24° 27′	43.0
Shanghai	31° 12′	40.4
Tsingtau	36° 4′	27.3
Peking	39° 57′	27.0

The annual precipitation also decreases from the cost to the interior, as the following figures tend to indicate:

Locality	Longitude (E)	Ann. Precipitation in Inches
Chinkiang	119° 30′	41.0
Wuhu	118° 22′	40.8
Kuikiang	115° 48′	53.0
Hankow	114° 20′	51.0
Ichang	111° 19′	42.3
Chunkiang	104° 11′	39.2

Though rich in many other natural resources, China is sadly lacking in forests. On account of the lack of a survey of natural resources, the forest area in China cannot be given, although the general impression received by travelers in China is that the whole country is practically devoid of any good-sized forests. The only extensive tract of forest is in the northern mountains of Manchuria. Here pine, spruce, oak, birch, elm, walnut and willow are found in abundance. Timber from here supplies mostly local demand in Manchuria and supplies only limited amounts to the northern part of China. In Mongolia and in the provinces north of the Yellow River, forests may be said to be entirely lacking. Whatever remnant there is of forests in the central and in the southwestern part of China is indicated only by the presence of a small amount of timber trade. This is chiefly in the provinces of Hunan, Anhwei and Kweichow. Small-sized timber of hardwood comes from these provinces. Fokien is the only province along the eastern and the southwestern coast that has some wooded slopes on the steep headwaters of the streams. Forest conditions being such, is it any wonder that even with her extremely economic use of timber and the presence of many kinds of wood substitutes in building and in constructions, China is still importing one-third of the amount of her timber consumption?

Although the Chinese people are noted for intensive farming, they have allowed vast amounts of cleared but untillable land to be idle, especially on barren slopes and hills. From the topographical configuration of the country, the area of such land is easily double that of the tillable land. It is here that the reboisement work should eventually concentrate.

Altogether the physical condition of the country is, with the exception of the outlying territories, generally favorable for tree growth. But centuries of ignorance and misuse have reduced most of the once forested area to the present treeless condition. The demand of timber to meet various industrial developments is already great and is growing greater every day. Nothing but a vigorous policy of reforestation initiated by the government, can save the country from industrial dependence on foreign sources of timber supply.

Governmental Conditions.

As already indicated in the *Introduction,* one of the principal causes of deforestation in China is the *laissez faire* policy maintained by the central government. To keep the country at peace and to allow the people to manage things in their own way so that the throne might not be endangered by uprisings was the main object of the government. Promotive and police functions were seldom exercised by the government except in case of necessity. The people were so accustomed to the *laissez faire* policy that they looked upon government initiative and promotive measures with great disapproval. It is really no exaggeration to say that the attempt, a good attempt withal, made by the Manchu government to nationalize all railroads was met with such opposition that it started the revolution of 1911.

Since the establishment of the Republic and through the experience of much hardship, the country has gradually come to realize that the government interest is nothing more than the composite interest of all the people, and that, in order to enjoy and insure this collective interest, each individual must sacrifice a portion of his own. State interference is permissible in so far as it promotes public welfare. The present administration has aimed, with determined efforts, to unify all China in one concerted action and to concentrate the power at Pekin. Many railroads which were once strongly opposed to nationalization under the Manchu rule are now being nationalized. A centralized system of tax collection and financial control has been inaugurated to displace the provincial system of financial management. While the present administration has been severely criticized for its dictator-like policy, no progressive mind can sincerely doubt that the national problems of China, with her international entanglements without and her confused system and disconcerted actions within, are not to be solved by any meek, passive, *laissez faire* policy of the old ways; on the contrary, it must be met by a vigorous, responsible, guiding and enlightened policy of the truest kind.

Suggested Policy of Administration.

a. General Considerations—In taking up this part of the essay, the writer must acknowledge his limitations in the knowledge, not to say experience, of any administrative work. Hence the discussions should be viewed only from the theoretical standpoint.

In such a vast country as China, it is really an open question whether such administration as a Forest Service, an administration which is secondary in importance to Army, Navy and Finance, should be centralized or decentralized. In the opinion of Dr. Nagao Ardgo, an eminent Japanese jurisprudent and Constitutional Adviser to China, the central government should consist only of such important departments as Army, Navy, Finance, Foreign Affairs and the Court of Justice, leaving such departments as Agriculture, Commerce, Communication, etc., to each Province. The central cabinet should be non-partisan. The political arena is thus limited to each Province. This novel idea has few supporters. Viewed from the standpoint of efficiency, a centralized service seems the most desirable. True, the vastness of the country may cause unavoidable delay in the work, but development of the means of communication is rapidly coming to supply this deficiency. On the other hand, a centralized organization is not without distinct advantages; it is responsible for the success of the work and is therefore responsive to public opinion.

It regulates and distributes work, it avoids duplication, and therefore reduces expenses. It co-ordinates the results of work, it is better able to judge where lies the cause of success or the source of failure.

The service should be in the form of a bureau and not in the form of a commission. The latter is fit, by nature of its constitution, only for deliberation and not for quick execution. As most of the work of such a service requires prompt action, the principle of expediency demands a bureaucratic organization.

The matter of appointment is an important one. Since it concerns the government service of all departments, consideration of this matter should not be limited to the forest administration alone. At present, as the organization of the various departments has not been completed, there is no uniform rule governing the admission into the government service.

In the future, a uniform system based on the idea of Civil Service examinations as in the United States may be worked out. The civil service examination was a very old institution in China, abolished only some ten years ago on account of its well-known abuse in basing the examination exclusively on literary culture. If that abuse is remedied and the examination is put on a more scientific basis, there is no reason why that old institution should not be restored. To all intents and purposes the system based on testing the knowledge and ability of a man is the best, if not the fairest, in admitting employees to the government service after balancing all advantages and disadvantages. After admission into the service, further promotions may be made on meritorious achievement and on seniority. The combination of both principles appear more rational than dependence on either one alone.

b. Organization of Central Service—With the possible exception of establishing a National Forest in Manchuria, where forest management will be the chief work, the forest administration in China will be for years to come engaged principally in the work of reforestation, especially along the headwaters of important streams. Since this work means a very heavy initial cost with very uncertain returns and draws heavily upon the treasury of the nation, it has to get along on a small scale at the outset and to organize the work so as to secure the maximum efficiency, expanding the work as previous successes warrant. There is no place for showy work. It would be foolish to attempt in the beginning to organize the service as completely as that of the United States or of any other countries. But the skeleton of the service may take somewhat the following form:

The Central Forest Office is to be established first: a provincial forest service will be established in the Provinces where the need of reforestation is most urgent. The Central Service is placed under the Department of Agriculture and Commerce in the Bureau of Agriculture and Forestry.[3] The head of the Service is the Forest Director. In the administrative work of the Service four divisions seem indispensable. These are: Information and Editing Division; Land Division; Investigation Division; Accounts.

The Information and Editing Division is charged with the publicity and the editing work. Data and results are co-ordinated and compiled here. Publication and information of general interest and not local in character are edited here in order to avoid duplication.

To the Land Division is given the charge of the record of the government lands. At present, the government lands are in the form of small patches in every magistrate district. These may be mountains, swamps, waste lands, and farm lands. The central government has no record, the record being kept by the magistrate and the provincial authorities.

The records ought to be returned over to this Division. This Division would see that these lands are reclaimed and kept in good condition and, if possible, exchange agricultural lands for those in mountains and on headwaters so as to make the government lands a continuous tract of considerable area without being mixed with private properties. To this Division may be also assigned the function of acquiring land for the Government by purchase if the Government desires to do so.

The Investigation Division has the general function of encouraging directly or indirectly the timber industry in the country. It may be engaged in introducing and developing new uses of forest products, in experimenting on silvicultural problems and

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[3] The Department of Agriculture and Forestry has been changed into the Department of Agriculture and Commerce which has four Bureaus, namely, (1) Bureau of Agriculture and Forestry, (2) Bureau of Commerce, (3) Bureau of Mining, and (4) Bureau of Fish and Game.

in informing the public of the results. One systematic work of great importance to the timber industry that needs to be done by this division is the introduction of a uniform and rational system of measuring wood to be used throughout the country. Like the Chinese currency, the Chinese system of measuring wood is very complicated and exhibits no uniformity. It needs to be standardized; it needs not adopt the unit from any particular country, but the unit should be easily convertible to other units and admit of mathematical calculation. In doing this work, the Division should try to have the cooperation and support of all the timber guilds in the country.

To the Division of Accounts is assigned the usual work of recording money transactions.

c. The Provincial Service. The provincial service may be called the Forestry Bureau of such and such province. The head of the Provincial Bureau is responsible to the central office at Peking. If the reforestation work to be done in a province is on a limited area, the administrative work of the head of the Provincial Bureau will consist in organizing and directing a forest planting force with the help of a few assistants. There is no need of an elaborate organization. If the forest interest in a province, however, is considerable and promises extensive and permanent work, the provincial administration may have the following divisions: Reconnaissance, Reforestation, Extension, Investigation and Accounts.

The work of reconnaissance is necessary in reforestation work of considerable proportion. To this Division is therefore assigned the work of ascertaining (1) how much forest area there is in the province, (2) of what character and condition is the forest, (3) where lies the need of improvement, (4) where is the need of the reforestation work most urgent, etc. These conditions, when ascertained, must be reported to the Central Bureau.

The Reforestation Division handles the organization and direction of the forest planting force, and supervises the field work. It should also keep records of the areas forested, species used, cost per acre, percentages of success or failure with explanations thereof, etc. These also should be reported to the Central Bureau.

The work of the Extension Division is mainly to arouse public interest in forestry and to help any private enterprise in forest planting. This may be done by traveling lectures and the circulation of pamphlets containing simple advice in the practice of forestry. These projects, besides enhancing the interest in forestry, will have the value of instilling the elements of rural education.

The work of the Investigation Division is similar in character to that of the same division in the Central Bureau, only more local in its interest. It will help the Central Bureau to standardize the unit of timber measurement.

The Division of Accounts keeps record of money transactions in the Provincial Bureau.

All officers in the Central and in the Provincial Bureaus are appointed or promoted by the Minister of Agriculture and Commerce, with the recommendation of the Director of the Central Bureau.

d. Education and Training. Recognizing the education of her people as the greatest asset of the nation, the Chinese Government has within the last ten years or so taken up the gigantic task of providing Government institutions for practically all branches of learning. Impoverished as her treasury is, she has not hesitated to set aside, just a few months ago, $12,000,000 for promoting and encouraging scholarship in advanced learning. In forestry, there is now a Government Agricultural and Forestry College at Peking, in which forestry is given as a separate course with the expressed intention of educating foresters for Government work. In a number of provincial agricultural colleges forestry is given as an accessory science. This spread of the educational movement will certainly make the people more conscious of the need of forestry in China.

When once the field of forestry is open, the demand for educated foresters will naturally increase, but there will be no such rush demand as was once experienced in the United States; for the simple reason that most of the work will be reforestation which cannot be carried out on the same scale as the management of existing forests. Such demand can therefore be met by Government schools. Private schools will not come into existence for some years.

The standard of the Government schools, central as well as provincial, must be set high. This requirement can be automatically regulated by ordering that all graduates from forest schools of collegiate grade who intend to enter Government service must pass the same civil service examination.

Promising students, upon their graduation from Government schools, may be conditionally admitted into the service and employed in the various lines of work for one or two years. Then they are sent abroad for two to three years to study foreign conditions. After they return they may be admitted into the service without examination upon their presenting a written report of their experience and work abroad.

Steps Necessary in Application of This Policy.

During or before the organization of the service, certain preliminary measures are necessary. The following merely indicates the types of such measures.

Education of the People. Every modern movement depends for its ultimate success upon the intelligent support of the people. This is especially true with forestry. The people must be educated to understand the broad significance of the movement and thereby to give their unwavering support. Such an education can be brought about in three ways:

Extension work among the rank and file of the people is necessarily important. Public lectures on principles of conservation among the educated classes and illustrated talks on farm forestry to the country folk all help along the movement. The opportunity of publicity through the press should be fully utilized. This work should be taken up not only by the service but also by men outside of the Government service interested in forestry and the conservation movement.

Objective teaching in the form of model forests or experimental work is often more effective than lectures. It has the value of showing the people what a forest should look like and how it can be brought about. It is of more educational value to those who can observe things and can think for themselves. In a few provinces model forests have been established. This kind of work should be extended more vigorously.

The Forestry Association is an institution that cannot be dispensed with in pushing forward this movement. It makes use of combined and organized effort in arousing the interest and in educating the masses. It has played and is still playing an important part in awakening public interest in forestry in Switzerland, in the United States and in Canada. That the Forestry Association when established in China should exert a guiding influence cannot be doubted.

Most of the reform measures now going on in China have been taken up with the endorsement of a few leaders and promulgated without the demand of the masses. This is a wrong way to bring about true reform. True reform must be brought about from the bottom up. While the government should exert a guiding influence, such influence should consist in awakening and hastening the demand of the public for reform. In making the forestry movement a truly progressive measure, the Association can be of unlimited service to the Government.

b. Reconnaissance. This is not the regular reconnaissance survey which is a part of the work of the Provincial Bureau. That would be too intensive for the preliminary step of administration. It is simply a collection of the rough estimates from each magistrate district in the different provinces. In each of the organized districts (towns) in China (practically all districts in China proper have long been organized, those in Manchuria are beginning to be organized, not so with Mongolia, Chinese Turkestan and Thibet) there is a district magistrate who receives his appointment from the Central Government. These magistrates can therefore be ordered to consult men versed in local conditions and to report on the following points: (1) land area of the district; (2) Government or public land area in the district; (3) the area of unreclaimed or waste land and its ownership; (4) area of forest land, if any, in the district; (5) location and general character of the forest (species, quality, etc.); (6) area of forest according to ownership—public, private, temple, etc.

The estimates will necessarily be rough, but will give a general idea of the forest conditions of the country, data which are now sadly lacking. When these estimates from one district are checked by those of the contiguous districts and by the railroad and land surveys, they are much superior to the guesses now made by authorities writing on Chinese forest conditions.

Further, these estimates have another important use in showing the public what the actual forest conditions of the country are, how much land lies idle, how much is the loss to the country, and what is the prospective gain if such land is made productive by being reforested. These concrete descriptions of actual facts will add force and vividness to the appeal to public sentiment and will foster real interest in this movement.

c. Legislation. Since forest laws will be a new feature in Chinese legislation, they should have the following characteristics: (1) the ameliorative and the protective measures should be given more emphasis than the restrictive measures. (2) They should be simple and never too wordy. (3) They should be capable of being enforced, *i. e.*, practical.

When these laws are enacted, their usefulness should be carefully explained and the broadcast publicity of them should be insured.

Restrictive measures should be applied to the exploitation by lumbermen, but the purpose of the law should be made known to them, so that a good understanding and cooperation may be established. At the same time measures of fire protection and the measures against trespass should also be rendered available to the lumbermen.

A good system of forest taxation goes far in promoting forest interest in the United States. This will be the case in China. But, as most of the waste lands are at present abandoned without ownership and, therefore, go without taxation, the land reclaimed by planting should be free from taxation for a considerable length of time and any taxation after that period should be nominal in order to insure permanent establishment of the forest.

CURRENT LITERATURE.

Forest Regulation, or the Preparation and Development of Forest Working Plans. Vol. I, Michigan Manual of Forestry. By Filibert Roth. 1914. 218 pp., 8°. Published by the author.

To anyone who knows the author of this textbook, his personality reveals itself on every page. As was to be expected, originality of treatment characterizes the book.

There are two methods of approaching a complicated subject, the analytical or the synthetical, the deductive or the inductive, coming from the concrete to the abstract or the reverse. Professor Roth prefers the former, or empirical method, and hence starts with the description of a concrete case of "German forestry business," and follows it up with the description of "an American case." Throughout the book the effort is made to keep in close company with practical problems, and in this lies its principal value as compared with other textbooks. At the same time in this method lies also a defect as a manual, for it leads to diffusive discussions of matters that have only a distant bearing on the main topic, and the systematic disposition of material is somewhat hampered. To give an example, the normal forest idea, which, consciously or unconsciously, is fundamental to the whole scheme of forest organization, appears as it were incidentally in the middle of the book when the methods of budget regulation are being discussed. Especially in the absence of an index this lack in the arrangement of matter somewhat disturbs easy reference. Yet this fault is of minor consequence, and we would rather lose this point than hamper the interest which is kept up in these discussions from cover to cover.

In passing, we may note two minor defects we have found in the description of European methods of budget regulation (regulation of the cut). The essential of Judeich's age class method is dismissed with a brief sentence, "the condition of younger stands is also considered." Upon this consideration, however, and the manner in which it is done rests the method: it is, as the name implies, its characteristic.

In discussing the Hundeshagen method, which the author seems to favor, it should certainly have been pointed out that it is based on the false premise that wood capitals behave like money capitals, hence a caution as to its application should have been extended.

The book contains pretty nearly all that the German textbooks as a rule discuss, the one omission that we have noticed, but which is also noticeable in German books, is a full chapter on increment, which to us seems to belong here as an important basis for budget regulation. On closer study we might perhaps find other defects, but the value of the book lies, as we have accentuated, in its thoroughly practical aspects and originality of treatment, and must not be judged by pedantic standards.

There are, however, some points on the literary side which we feel bound not to overlook. While the straightforward and unconventional or informal, sometimes breezy language for which the author is noted, has its attractions, especially in the spoken discourse, we are old-fashioned enough to take umbrage at its too free use in print. Here, literary style and more polished diction is indicated; especially in a book intended for students, carelessness in this respect is unfortunate. This lack of attention to form is also painfully noticeable in other directions, as for instance on the same page we may find written Lodge Pole and lodgepole, and that with the "pine" left out.

Altogether, we may take this occasion to inveigh against the malpractice in the use of capitals, which has become a besetting sin of American foresters, and is found in a pronounced manner in this book, in which every word that approaches the meaning of a forestry term is capitalized, like "Wild Woods," "Protection," "Utilization," "Silviculture," "Forest," "Forester," "Forestry" and "Forestry Business," "Market" "Site," "Species," "Rotation," etc. Proper usage is to capitalize when a *title* is to be indicated, like a National Forest, when a specially designated tract is to be named; the Forester, a title of an official; a course on Utilization, a title of the course. Decapitalization is the general tendency of the present day, but we believe that the retention of capitals to designate titles is useful. We may not go into the doubtful usage as to capitalization of genus and species names of trees, except to announce that we believe ease of reading—which is the object of print—makes it desirable to capitalize at least the species name and write "White pine," in order to make its term quality at once apparent to the eye.

Lastly we may call attention to the fact that the author has revived for the title of his subject the term *forest regulation*, the direct translation of the most generally used German term, instead of *forest organization*. The latter term covers as fully, indeed even more fully, the contents of the subject and relieves us of the doubt arising in the use of its synonym which suggests police regulations.

All the strictures, however, which we have made are minor faults, and we commend this volume, which is distinctly an American product, to students and practitioners alike most heartily.

B. E. F.

Elements of Forestry. By F. F. Moon and N. C. Brown. John Wiley & Sons, New York; Renouf Publishing Co., Montreal. 1914. Pp. XVII + 392. Ill.

This book covers practically the entire field of forestry, and contains general information on every phase of the subject except dendrology. It is designed for use in undergraduate and short courses. In the words of the authors, the chief object has been to gather data from sources not readily available, and to present them in a form easily grasped by the average student.

To bring the discussion of so broad a subject within the limits of one handy volume is a very difficult task. One must not only choose with fine discernment from a formidable mass of material, but also exercise the greatest care that generality and brevity are not attained at the expense of accuracy and clearness. The critical reader of this volume may find room for criticism, especially on the broad generalizations, which are frequently made. Here and there the work leaves the impression of having been done rather hastily.

Statements in different parts of the text are not always in harmony. On page 34, Loblolly pine is said to be "extremely light," while on page 352 it is characterized as "fairly heavy." On page 79, it is stated that the shelterwood system cannot be used with intolerant species, and yet on the same page the examples of its use include Western Yellow, Lodgepole and Longleaf pines, which, according to the table on page 32, are intolerant. On page 217 sapwood is said to be "much more susceptible to decay (than heartwood) owing to its greater moisture content." On page 228, "sapwood is more susceptible to decay than heartwood because of its greater percentage of moisture and food for fungi and bacteria;" while on page 229, durability is said to depend "on certain chemical constituents, such as resins, gums, tannin and other decay resisting materials" which are more abundant in heartwood than in sapwood.

Not only are there numerous instances of faulty composition, typographical errors, and inconsistencies, but, what is more serious, there are not a few misstatements of facts. Many of the faults are due to the attempt to make brief general statements without qualification.

And yet for its chosen field the book will serve a useful purpose. Study of it will afford the non-technical man a good general view of the whole subject, and should bring him into closer touch and sympathy with the forestry movement.

S. J. R.

Report of the Central Investigative Committee. U. S. Forest Service. Washington, D. C. 1914.

In the U. S. Forest Service, a Central Investigative Committee prepares annually an elaborate program and report on investigations of a scientific character, listing projects in a classified order and reporting on the progress of each.

In the report for 1914, the classification comprises nine projects under Dendrology, 31 under Grazing, 62 under Products, and 240 under Silviculture, altogether 342 projects; 70 less than in the previous year, 44 projects having been abandoned, 74 completed or nearly so, and 47 new ones inaugurated.

As a result of these investigations, there were 55 bulletins published, besides 75 articles published by outside journals. Altogether around $290,000 were spent on these investigations during the year, nearly two-thirds of the total for Products, and less than one-half of this for silvicultural projects. We recall with a smile the fact that in 1898 the "timber physics" work of the Forestry Division which was precisely what is now called "Products" was abandoned and relegated to the scrap heap as not germane!

The subject "Silviculture" seems to be the *olla podrida*, it comprises everything that is not specifically assignable to the other three classes. Here problems of forestation, forest influences, management, protection, mensuration, regional studies, silvical studies, tree studies, and lumbering find their harbor. From time to time, a Review of Forest Investigations is published; so far only volumes I and II have appeared in 1913, and it appears that then this useful publication has ceased.

Here the organization of the direction of this work is given. The projects are submitted annually by District Investigative Committees, composed usually of one representative of each of the major lines of investigation and one supervisor of technical training, and are based upon recommendations made by the different Branches represented in the District organization submitted to the Forester. The programs are reviewed by the branch chiefs of the central office, and then submitted to the Central Committee of three members, which merely amalgamates and revises the program, suggesting improvements in the procedure, and outlining the investigative policy for the entire Service. The Review also discusses objects and methods of the different lines of investigation.

For the products investigations, as is well known, the elaborate laboratory at Madison, Wis., serves mainly, while for the silvicultural studies a number of small experiment stations are equipped which it is proposed to enlarge so that a wide range of experiments may be carried on. A distinction is made between administrative experiments having in view answer to specific problems of some locality, and investigative experiments trying to establish broadly applicable principles. The Committee of 1914 recommends enlargement in the latter, reduction in the former class of investigations.

The Investigative Program itself is a bulky volume of 100 closely printed pages. In this program every project is briefly described under ten headings, namely a brief statement of the project; its object; cooperation, if any, with outside agencies; location; status of investigation; plans for further work; use to be made of results, publication or otherwise; probable date of completion; assignment of the investigation to various stations or agencies or investigators, proposed expenditures.

To scrutinize critically such an elaborate program would take more space than we can afford. Suffice it to say that as far as organization is concerned it is made on a great scale, and, if the experiments are carried out as thoroughly as conceived, a remarkable advancement of technical knowledge should be the result.

B. E. F.

First Annual Conference of the Woods Department, Berlin Mills Company. Gorham, N. H., 1913.

This well-printed volume of 141 pages (for private distribution only) denotes an interesting, new and significant departure attesting to the progressiveness of the company which produced it. Mr. W. R. Brown, the general manager, is one of the directors of the American Forestry Association.

The meeting was, of course, conceived with a view of securing greater efficiency through the exchange of ideas among the staff of this widely branched department.

The volume collects some twenty-two addresses by as many members of the department, covering all the various practical questions and problems of the Woods Department. This department, by the way, was represented at the meeting by 70 members, among whom four are designated as Foresters.

We may recite only the titles of the addresses, of which, while some of them are of elementary character, many are replete with practical suggestions:

Scientific Management in Lumbering and the Care of Timberlands.

Wood and its Uses.

Government, Seigniory and Patented Lands in Canada.

Species, Value and Growth of Trees.

Preliminary Estimating, Surveying and Mapping.

Conducting Forest Surveys.

Making, Driving and Loading 4-foot Pulpwood.

The Making, Driving and Scale of 13-foot Logs.

Making and Driving Long Logs.

Pulpwood Scale and Inspection.

Scaling of Long Logs.

Bookkeeping and Reports.

Agency and Contracts.

Business Functions of a Quebec Notary.

Railroad Transportation and Traffic.

Horse Management.
Bark and its Uses.
Mechanical Accessories to Logging and Driving.
Purchasing.
Funds and Banking.
Insurance.
Meals and Cooking.

Mr. Brown outlines what the work of a forester, developing plans for a timber company, should be. The organization which he conceives should include an inspector, to save waste, head-scaler, telephone man, cost accountant, machinery expert, traffic manager, purchasing agent, verterinary, and statistician, who gathers and tabulates information in a logical way for the manager's guidance in the future.

He divides the operation of any enterprise into three natural divisions, the "legislative," forming plans of what is to be done, laid down in a budget; the "executive," which performs and records the work; and the "judicial" or "statistical," which by synthesis and analysis of record forms judgments. "Such judgment joined with courage, imagination and capital, leads to the forming of another plan."

A simple form for budget planning—which should be done by securing a concensus of opinion of the district manager—is appended; "The budget is to reduce loose plans or opinion down to a scientific guess." The same skeleton plan should be followed for budget, accounting, and statistics, a general formula of elastic and free interpretation to be used for all headings under ten questions: time, amount, kind, labor, equipment, measurement, records and accounting, price, costs and payments, conditions, accessories and incidentals.

It is of interest to note Mr. Brown's remark on the labor side of scientific or efficiency management, "being uncertain as to its advantages." "I doubt if it is always best to set wages by the result of processes, or that tangible results always represent the true value received from the service. The human and psychological side often plays strange pranks with logic, and justice should be often largely tempered with mercy."

B. E. F.

The Mechanical Properties of Wood. By S. J. Record. John Wiley & Sons, N. Y., 1914. Chapman and Hall, Ltd., London; Renouf Publishing Co., Montreal. XI + 165 pages, 52 figures, 22 tables, $1.75.

A notable addition to the series of books on forestry published by John Wiley & Sons of New York is Record's "Mechanical Properties of Wood." Record is Assistant Professor of Forest Products at the Forest School of Yale University. In his chosen field of Wood Technology he has already written one important book, "*Economic Woods of the United States,*"[1] which deals largely with the structural and physical properties of wood and the means of identifying the wood of different species. His present work is, therefore, directly in line with his former, setting forth, as it does, the mechanical properties of wood.

The author develops his subject in three parts and an appendix. Part one treats of the mechanical properties: tensile strength, compressive strength, shearing strength, transverse strength, toughness, hardness and cleavability. This material includes numerous tables showing the various strength values of many of the more important American woods.

Part two deals with the factors affecting the mechanical properties of wood, such as rate of growth, heartwood and sapwood, weight, density and specific gravity, color, cross-grain, knots, various injuries, locality of growth, season of cutting, water content, temperature and preservatives.

In part three, the author describes the methods of timber testing, taking as standard those followed by the Forest Service of the United States Department of Agriculture in its work at the Forest Products Laboratory in Madison, Wisconsin.

This is suitably followed in the appendix by a sample working plan used by the Forest Service in timber testing and by a table showing the strength values of structural timbers.

A bibliography and an index complete the work, which exhibits throughout that excellence in printing and binding which we have learned to expect from the publishers, and that painstaking thoroughness for which the author is already known.

First and foremost, this book will serve as a text in forest schools and as such fills admirably a long-felt want in the subject

[1] Review in Forestry Quarterly, Vol. X, pp. 495–497.

of Wood Technology. The author has wisely included the elementary mechanics of materials in general, at the same time avoiding all unnecessary technical language and descriptions.

But the book is more than merely a text. It is a valuable reference work inasmuch as it brings together in concise form data from a great many more or less inaccessible publications, sifts the essentials from out a bewildering mass of details and presents them in easily understood language.

It remains for the author to write, as a corollary to his two previous books, a third dealing with the technical uses of wood: such as paper pulp, wood distillates, etc. That Professor Record is admirably fitted for this task no one who has read his present work will deny.

A. B. R.

The Lumber Industry, Part IV. Conditions in production and wholesale distribution including wholesale prices. Department of Commerce, Bureau of Corporations. Washington, D. C. April 21, 1914. Pp. 933.

Some years ago Congress directed the Bureau of Corporations to make an investigation of the lumber industry for the purpose of ascertaining whether or not there existed a "lumber trust" for the control of lumber production and sales. After the expenditure of a large sum of money and the lapse of several years' time, three volumes, in four parts, have been printed and distributed. The first three parts in two volumes deal with the standing timber of the country and its ownership; also the tendency toward concentration of large areas of lands into comparatively few hands.

Part IV, dealing with conditions in production and wholesale distribution, including wholesale prices, is by far the most voluminous and contains a severe arraignment of the lumber industry, especially in certain sections of the country.

It is believed that the avowed intention of Congress in creating the Bureau of Corporations and at different times charging it with the investigation of certain large industries, was to provide an agent which not alone would point out any transgression of the Sherman Act, but also would pave the way to needed reforms which would place the industry on a sound basis and enable it to carry on its business affairs in conformity with existing laws.

Congress certainly did not contemplate the disorganization of large industries which in a great measure are attempting to live up to the laws as ordinarily interpreted, and whose continuance in a prosperous condition are essential to the welfare of the Nation. Constructive investigation, not destructive, was without question the intent of those responsible for the establishment of the Bureau of Corporations.

The report deals mainly with the activities of various lumber manufacturers' associations, which are charged with openly attempting to control output and prices during the earlier years of their existence, and later attempting to violate the provisions of the Sherman Act by subterfuge. It is admitted that the first charge is more or less true, but the public should not lose sight of the fact that such actions were not then looked upon unfavorably by the general public. In the southern yellow pine trade especially, uniformity of action on the part of manufacturers appeared imperative, since the competition of southern yellow pine with white pine and other woods was exceedingly keen in northern markets; yellow pine mill men did not have their sales methods as well organized as their competitors; and yellow pine was a wood not in especially strong favor in the Northern markets because its qualities were not well known to the consumer. All of these things and others tended to very low prices and ruinous competition among manufacturers throughout the South and it was only by organization that they could protect their own interests and secure even a low price for their product.

The charge of evasion of the Sherman Act by men in the yellow pine industry would be difficult to prove and is believed to be unjust in the extreme. It is inconceivable that public-spirited and high-minded men of national repute, many of whom come under this broad charge, should be knowingly guilty of an act of this character, not alone because of the legal consequences involved, but also because of the moral issues at stake. It is scarcely conceivable that lumber manufacturers would have willingly and gladly opened all their records to the Bureau of Corporations, and aided in every possible way the investigation by this Bureau, had they knowingly been guilty of any violation of the Sherman Act. It is possible that innocent technical violation may have occurred, since even the advice of the best legal talent of the country has been conflicting as to what may be done legally under the provisions of this Act.

The conclusions reached by the Bureau of Corporations as to the activities of lumber trade associations will hardly meet with the approval of those who are thoroughly conversant with the forest problems of the country and who are interested in the preservation and wise use of our forest resources.

The statement is made that the activities of associations in fixing prices and restricting output have profited the lumbermen at the expense of the consumer. Those familiar with lumber prices during the past few years know that the profits secured by lumbermen have been meager and that in some cases stumpage has been liquidated at a loss. Persons conversant with the general economic situation in the industry deplore the general range of low prices secured by lumbermen since close utilization fluctuates with the market value of the sawed products of the tree—low prices tend toward greater waste in the woods, while high prices mean the reverse.

It is a well-known fact, illustrated by the low market demand now existing due to money stringency and unsettled business conditions, that supply and demand are the chief factors governing values in lumber, and that any artificial standard can not be maintained for long unless the visible supply of lumber can be strictly regulated by some powerful organization. In the curtailment policy of individual members of the associations the Bureau of Corporations believes it detects the exercise of this strong hand. This assumption is undoubtedly not warranted, since curtailment is a personal matter with each manufacturer, who closes his plant during a period of low prices, provided he can afford to do so. There are operators, who, because of the actual need of cash to meet current obligations, must continue to operate even under the necessity of liquidating their raw material at a positive loss, since money cannot be borrowed readily from banks, and creditors are often unceasing in their demands for settlement. There are other factors which affect the policy of curtailment and greatly narrow the limits within which it is feasible. Many operators feel a moral obligation towards their workmen and rather than throw them out of employment and disrupt the labor organization, the plant is kept running. Overhead charges are only reduced to a limited extent by closing the plant, hence only a small reduction in expense is effected.

It is ordinarily assumed that an association or organization to successfully control supply and by this means regulate prices, should be able to dominate at least 50% of the cut of that particular species. A comparison of the sales of the members of the Yellow Pine Manufacturers' Association with the total cut of southern yellow pine for the years 1907–1912 inclusive, shows that in 1907 the cut of the association represented 27.8% of the total cut of southern Yellow pine; in 1908, 31%; in 1909, 23.2%; in 1910, 29.5%; in 1911, 35.4%; in 1912, 36%. It is certainly impossible for any organization representing from 23 to 36% of the cut of a single species to dictate prices. As a matter of fact, during the last few years when the association membership has represented a greater per cent of the cut than at any previous time, there has been less discussion of and less cooperation in curtailment of cut than at any other period.

It would be commercial suicide for yellow pine manufacturers to attempt to boost, by artificial means, the price of lumber, since such actions would only increase the chances for cheaper competitive woods of the Pacific Coast, which would flood the yellow pine territory and automatically lower the price of yellow pine to a level probably below what it otherwise would have been.

The statement "that the standardization of grades is the first step to price fixing" seems a most puerile condemnation of one of the most useful phases of association work. The Forest Service for some years has devoted much time and energy to the encouragement and development of grading rules, because they are a vital part of the wise use of the products of the forest. It is inconceivable that any department should take the stand, at least by inference, that such activities in any way are a detriment to the public interest.

The volume contains many extracts for lumber trade journals bearing on the control of output and prices; correspondence between association secretaries and others; price lists of lumber and graphic representations showing the movement of prices for specific grades of lumber during a period of years.

The general field covered is as follows: Introduction, Co-operation among manufacturers' associations, Southern Yellow pine, Douglas Fir, White and "Northern" pine, hemlock, spruce, shingles, hardwoods.

It is greatly to be regretted that the report has been prepared in an aggressive rather than a cooperative spirit, since there is no great industry of the country which is more vital to the general welfare of the people; therefore an investigation of the above character should be carried on in a constructive manner rather than a destructive one.

R .C. B.

Relative Resistance of Various Conifers to Injection with Creosote. By C. H. Teesdale. Bul. No. 101, U. S. Dept. Agr., Washington, D. C., 1914. Pp. 43, ill.

One of the most perplexing problems in timber preservation is the varying resistance different woods and parts of woods offer to the penetration of creosote. This is especially the case where, instead of treating to refusal, a limited or partial treatment is given. The average injection per cubic foot is obtained by dividing the total amount of oil consumed in the process by the total cubic contents of the material treated. This does not take account of the distribution of the oil. If just enough oil is injected to give an average of, say, ten pounds per cubic foot, some pieces will probably receive too much and others scarcely any.

What is wanted is uniformity of treatment and to this end extensive experiments have been made with a view of devising some practical means of grading material before treating The investigation reported on in this bulletin was concerned with the relation between the structure of wood and the ease of injecting with creosote.

This appears to be an excellent piece of work very painstakingly done, but unfortunately it does not settle the question at issue. In the words of the author, "No satisfactory theory has yet been offered to explain the penetration of wood by creosote." It would appear from the apparently conflicting results obtained that penetrability is not dependent upon structure alone, but that the chemical properties also are concerned.

The following conclusions are given as a result of the experiments: "1. Radial and longitudinal resin ducts penetrate intimately the interior of the wood and thus form passages for the preservative. Radial resin ducts were found to be especially important. Where these occurred the wood was usually penetrated radially from one-fourth to three-fourths as far as longitudinally.

and tangential penetration could usually be disregarded. Where no radial ducts were present, radial and tangential penetrations could be considered as equal, and they were found to be between one-twentieth and one one-hundred-twentieth of the longitudinal penetrations.

"2. Absorption curves platted for the specimens treated in the cylinder show that those species which were most difficult to impregnate gave the most uniform absorption results, and that the sapwood of those species containing resin ducts gave the most erratic absorption results. They also showed that the sapwood of pines, as distinguished by its color from heartwood, was not always easier to treat than the heartwood. The color line in the wood does not necessarily separate the easily treated wood from the portions treated with difficulty. Some sapwood treated like heartwood and some heartwood treated like sapwood; all of these conditions are possible in the same cross section of a tree. As a consequence of this, the absorption curves for pines were, as a rule, very erratic, especially the sapwood curves.

"3. The results obtained with a given species of wood can not always be applied to another species, however similar in structure the two may appear to be. This fact is strikingly evident in the treatment of heartwood larch and tamarack. Even woods of the same species show variations when grown under widely different conditions, as, for example, Western Yellow pine from California and from Montana."

An attempt is made to group with respect to treatment the woods of the twenty species of conifers tested, but the proposed classifications are based too much on empirical data to be wholly satisfactory. The following species may be successfully treated in the round form: Engelmann spruce, Douglas fir, tamarack, Western larch, and all of the pines. Those considered unadapted to treatment in the form of round timbers include the Alpine, Noble and White firs, Eastern and Western hemlock, Redwood, Sitka spruce, and yew.

S. J. R.

Wood-using Industries of the Maritime Provinces. By R. G. Lewis, assisted by W. G. H. Boyce. Bulletin 44, Forestry Branch. Ottawa, Canada. 1914. Pp. 100.

This bulletin is the second of a series dealing with Canadian wood-using industries, and embodies data gathered from over 600 manufacturers using wood as raw material, in the provinces of New Brunswick, Nova Scotia and Prince Edward Island.

The industries concerned used over 200 million feet of raw material with an average value of $18 per thousand board feet. In this amount 28 tree species groups were comprised, 16 of them native. The bulk of the material used (88%) is of local origin, being grown in about equal amounts in Nova Scotia and New Brunswick, the province of Prince Edward Island supplying only the small quantity of 1.3 million feet. The raw material purchased outside the maritime provinces comes largely from the United States, and this is mostly hard pine used in car manufacture.

General building construction requires over 60 million feet of raw material or nearly one-third of the total amount used. The manufacture of wood-pulp uses 21%, car construction 18, cooperage 11, boxes and crating 8, flooring 3, boat building 2, and furniture manufacture 2%, of the total raw product required by the wood-using industries.

Spruce is, of course, the most commonly used wood, this making up 57% of the raw material of the manufacturers. The other woods used are: White pine 11.8%, hard pine 8.8, birch 6.4, Balsam fir 5, hemlock 3, oak 1.9, maple 1.8, beech 1%, and small quantities of various species.

The average values of these woods per thousand board feet were: spruce $13.69, White pine $23.58, hard pine $31.27, birch $17.86, Balsam fir $11.79, hemlock $12.39, oak $41.17, maple $17.60, and beech $18.13.

The uses to which the various woods are put are given in a set of detailed tables. Thus, 33% of the spruce goes into wood-pulps 32% in building construction, and 14% is used in cooperage plants. Similar percentages for some of the other leading species, are as follows: White pine—building construction 60%, cars 16%, boxes 8%; birch—flooring 27, furniture 15, cars 13, building construction 13; Balsam fir—pulp 43, boxes 24, cooperage 17; hemlock—building construction 74, boxes 15, pulp 8; oak—cars 64, boats 12, furniture 12; maple—flooring 39, handles 28, furniture 19, cooperage 15%.

The bulletin is replete with information, much of it in tabular form, giving a wholesale view of the wood-using industries and at the same time enabling one to look up details regarding any particular wood or any particular article of manufacture. The qualities of each kind of wood are described, and the suitability for various purposes discussed. A valuable list, by species of wood, of the articles manufactured from each kind, is given, and a useful classified directory of manufacturers. Seventeen educative illustrations are given, illustrating various manufacturing processes and products.

The data compiled are very readable and useful, and it is to be hoped that the bulletin is given a wide circulation among all dealing in forest products.

J. H. W.

Does Cronartium Ribicola Over-winter on the Currant? By F. C. Stewart and W. H. Rankin. Bul. No. 374. N. Y. State Agr. Exp. Sta., Geneva, N. Y., 1914. Pp. 53, ill.

Cronartium ribicola is an heteroecious rust fungus parasitic on *Ribes* and the five-needled pines, especially *Pinus strobus*. In its aecidial stage, which is known as *Peridermium strobi*, it produces the destructive blister rust of the White pines. On the leaves of the currants and gooseberries, both wild and cultivated, it produces what is known as felt-rust and is of little economic importance.

The fungus is perennial in the bark of the pine trees, but the fungus cannot spread from pine to pine but must go from pine to *Ribes* and back to pine. On the leaves of *Ribes* two fruiting forms are developed, one of which (the uredospores) may infect only other *Ribes* plants, while the other (sporidia from the promycelia of the teleutospores) can infect only the pine. Since the leaves are the only part of the *Ribes* plant affected, and the uredospores are short lived, the fungus is believed to be unable to over-winter on *Ribes*.

The appearance from time to time since 1906 of the felt-rust on the Experiment Station grounds at Geneva, but without any cases of the blister-rust being discovered, led to a special investigation to see if the fungus could over-winter on *Ribes*. The experiments gave only negative results and the conclusion is that over-wintering occurs rarely, if at all, and only under very exceptional conditions. The chances of such occurrence are considered so small that it is unnecessary to quarantine currants affected with felt rust. The only precaution which needs to be taken is to see that affected plants are leafless at the time of shipping.

The repeated outbreaks of the disease were explained by the discovery, finally, of two white pines affected with blister-rust.

S. J. R.

Amounts and Kinds of Wood Used in the Manufacture of Boxes in the United States. By J. C. Nallis. The National Association of Box Manufacturers in co-operation with the U. S. Forest Service. Washington, D. C. 1914. Pp. 14.

The manufacture of packing boxes and shooks, crates, crating, fruit and vegetable packages and baskets is the second largest wood-using industry of the country, consuming annually 4,547,973 M feet of lumber of which 69% is softwood. Practically all of the wood used for boxes is the product of the sawmill, comprising 11.6% of the lumber cut of the year 1912.

Statistics are given for the first time showing how much of each kind of wood is used in the box industry and the amount consumed by box makers in each of the important regions and states. Virginia ranks first in consumption, using approximately 433 million feet; New York is second, using 390 million feet; Illinois is third, using 389 million. Nearly three-fourths of all the boxes, shooks, crates, crating, etc., are manufactured in the region east of the Mississippi River and north of Tennessee and North Carolina. Some of the woods used in the greatest quantity in the order of importance are White pine (1131 million feet), Yellow pine (1042 million feet), Red gum (401 million feet), spruce (336 million feet), Western Yellow pine (289 million feet), cottonwood (210 million feet), hemlock (203 million feet), Yellow poplar (165 million feet). A large number of species are used in quantities less than 100 million feet.

Increase of Revenue from Forests as a Result of Their Drainage.

In the Report of the Russian Department of Public Domains for 1912 are given figures of the increase in revenue from forests of poorly-drained soils as a result of their systematic drainage begun since 1871. The excess in revenue from the State forests since their drainage is estimated at approximately $2,500,000. The cost of draining them was $750,000. A general increase of $125,000 in the net annual revenue, which is not ascribed to the drainage of the swamps, has taken place during the last decade. By deducting from the increased revenue the cost of draining and the increase in the annual net revenue which is not due to the draining of swamps, the increase in the revenue directly traceable to the drainage of swamps constitutes about 16.4% on the invested capital. This does not take into account the greater annual increment of the timber on the drained land nor the increase in its value.

R. Z.

OTHER CURRENT LITERATURE

Effects of Varying Certain Cooking Conditions in Producing Soda Pulp from Aspen. By H. E. Surface. Bulletin 80, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1914. Pp. 63.

Yields from the Destructive Distillation of Certain Hardwoods. By L. F. Hawley and R. C. Palmer. Bulletin 129, Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1914. Pp. 16.

Southern hardwoods as the oaks, Red gum, tupelo and hickory have not been important in distillation and no information has existed in regard to the amount of the varous products which could be obtained. This bulletin aims to supply the above information, also the relative value of the commonly used species and of the different forms of material such as body wood, limbs and slabs.

An Outfit for Boring Taprooted Stumps for Blasting. By H. Thompson. Farmers' Bulletin 600, Department of Agriculture. Washington, D. C. 1914. Pp. 5.

Directory of Officials and Organizations Concerned with the Protection of Birds and Game, 1914. Bureau of Biological Survey, Department of Agriculture. Washington, D. C. Pp. 16.

The Lumber Industry. Part II: Concentration of timber ownership in important regions; Part III: Land holdings of large timber owners (without ownership maps). Bureau of Corporations, Department of Commerce. Washington, D. C. 1913. Pp. 264. Maps 12.

This report contains a portion of the results secured by the Bureau of Corporations in its investigation of the lumber industry. It is chiefly a more detailed treatment of the subject matter contained in Part I, which was issued January, 1913.

Origin of the Scenic Features of the Glacier National Park. By M. R. Campbell. Department of the Interior, Office of Secretary, Washington, D. C. 1914. Pp. 42.

A popular treatise dealing "with the causes that have been active in producing the surface forms and the various conditions which have modified and controlled the results." Prepared for the information of travelers.

Proceedings of the Society of American Foresters. Volume IX, Number 3. Washington, D. C., July, 1914, pp. 293–456.

Contains: Plan for Better Management of Farm Woodlots, by J. H. Foster; Co-operative and Community Marketing of Woodlot Products, by F. F. Moon; The Administration of a National Forest for Naval Stores, by I. F. Eldredge; Turpentine Possibilities on the Pacific Coast, by C. S. Smith; Discussion, by W. H. Lamb: Essential Features of Protection, Finances, and Fire Plans, by J. F. Preston; An Economic Aspect of Slash Disposal, by E. Koch; The Replacement of Moth-infested Oak Stands in New England, by J. Murdoch, Jr.; The Control of Rodents in Field Seeding, by C. P. Willis; Taper Curves in Relation to Linear Products, by F. S. Baker; Forestation a Success in the Sand Hills of Nebraska, by S. D. Smith; Replacement of Yellow Pine by Lodgepole Pine on the Pumice Soils of Central Oregon, by T. T. Munger; Forest Taxation in Washington, by F. G. Miller; Reviews.

Instructions for Making Improvement Thinnings and the Management of Moth-infested Woodlands. (3d Ed.) By H. O. Cook and P. D. Kneeland. Boston, Me. 1914. Pp. 35.

A Forestry Arithmetic for Vermont Schools. By A. F. Hawes. Vermont Forestry Publication No. 14. Brattleboro, Vt. 1914. Pp. 30.

Connecticut Forest Fire Manual, 1913–14. Issued by State Forest Fire Warden. New Haven, Conn. Pp. 39.

Report of the Botanist: Part I of Annual Report of Connecticut Agricultural Experiment Station for 1913. By G. P. Clinton. 1914. Pp. 42.

Contains: Notes on Plant Diseases of Connecticut (among them some forest tree diseases); So-called Chestnut Blight Poisoning, discussing the supposition of connection between the blight and certain cases of sickness.

Reforesting. (5th Ed.) By C. R. Pettis. Bulletin 2, Conservation Commission. Albany, N. Y. 1914. Pp. 38.

The Conservation Law in Relation to Fish and Game and to Lands and Forests, as amended to the close of the regular Session of 1914. Albany, N. Y. 1914. Pp. 293.

Lumber Manufacturing Accounts. By A. F. Jones. Ronald Accounting Series, The Ronald Press Co. New York. 1914. Pp. 112.

A treatise on lumber accounting methods suitable for either a large or small business.

It contains chapters on the following subjects:

Part I. Lumber Manufacturing and its Records.

1. Fixed assets: Timber bonds.
2. General office.
3. Classification of construction and operating expenses.
4. Logging and sawmill costs.
5. Public utilities and outside operations.
6. Shipping department.

7. Monthly and annual closing.
8. Debatable points in lumber accounting.
9. Technical terms used in the lumber business.

Part II. Records used in Lumber Manufacturing.

Graphic Methods for Presenting Facts. By W. C. Brinton. The Engineering Magazine Co., N. Y. 1914. Pp. 371.

A book of value to anyone who has need of presenting facts in a graphic manner.

Wood-Using Industries of Pennsylvania. By R. E. Simmons. Bulletin 9, State Department of Forestry in co-operation with the U. S. Forest Service. Harrisburg, Pa. 1914. Pp. 204.

Catalogue of Ohio Vascular Plants (Ohio Biological Survey, Bulletin 2). By J. H. Schaffner. Ohio State University. Columbus, Ohio. 1914. Pp. 247.

Report of the North Carolina Forestry Association, Asheville Meeting. Press Bulletin 129, North Carolina Geological and Economic Survey. Chapel Hill. 1914. Pp. 8.

A Forest Policy for North Carolina. By J. H. Pratt. Press Bulletin 130, North Carolina Geological and Economic Survey. Chapel Hill. 1914. Pp. 4.

The following are mentioned as necessary state forestry measures:

1. A state forest fire protective system.
2. State owned and operated demonstration forest and experiment stations.
3. The encouragement of forest planting by the maintenance of one or more forest nurseries.
4. A forestry department supported by an adequate appropriation.

Soil Acidity. By J. E. Harris. Technical Bulletin 19, Michigan Agricultural College Experiment Station. East Lansing, Mich. 1914. Pp. 15.

Utilization of Muck Lands. By C. S. Robinson. Bulletin 273, Michigan Agricultural College Experiment Station. East Lansing' Mich. 1914. Pp. 27.

A Botanical Survey of the Sugar Grove Basin. By R. F. Griggs. Bulletin 3, Ohio Biological Survey. State University, Columbus, Ohio. 1914. Pp. 33.

Constitution and By-Laws of the Kennebec Valley Protection Association. Pp. 7.

First Annual Report of the Kennebec Valley Protection Association.
This Association ended the first year with 27 members, and with a total holding of 1,189,391 acres. The total expenditures during the year were $1,106.51, of which the Maine Forestry District paid $319.00.

The Flood of 1913 in the Lower White River Region of Indiana. By H. P. Bybee and C. A. Malott. Bulletin 22, Indiana University Studies. Bloomington, Ind.

The Amalgamated Wood Workers' International Union of America, a historical study of trade unionism in its relation to the development of an industry. By F. R. Shipp. Bulletin 511, University of Wisconsin. Economic and Political Science Series, Vol. 7, No. 3, pp. 235–445. Madison, Wis. 1912.

A thesis submitted for the degree of Doctor of Philosophy at the University of Wisconsin. It treats in an interesting manner of the industry and its early organization, and the history of the foundation, structure and policies of the Amalgamated Wood Workers' International Union of America.

Advisory Pamphlet on Camp Sanitation and Housing. Commission of Immigration and Housing of California. San Francisco, Cal. 1914. Pp. 54.

Suggestions to owners and superintendents of labor camps and the following topics are discussed:

Location of camp; layout of camp; water supply; tents and buildings; kitchen and mess house; garbage and refuse disposal; toilets; bathing facilities; towels; flies and manure; mosquitoes and malaria; sanitation service.

Tamalpais Fire Directory. Tamalpais Fire Association. San Francisco, Cal. 1914.

A list of the officers of the Association, the addresses of fire agents, the location of fire fighting tools, and fire trails.

A Preliminary Note on a New Bark Disease of the White Pine, By A. H. Graves. Reprinted from Mycologia, Vol. VI, No. 2. 1914. Pp. 4.

Commission of Conservation: Fifth Annual Report. Ottawa, Canada. 1914. Pp.

Contains of forestry interest: Report of the Committee on Forests; Forestry Work in the Trent Watershed and in British Columbia; Work of the Forestry Branch, Department of the Interior; Necessity for a Forest Reserve in the Lake of the Woods District of Ontario.

Protection of Migratory Birds. By W. S. Haskell. Reprint from Fifth Annual Report of the Commission of Conservation. Ottawa, Canada. 1914. Pp. 8.

The Planting of Waste Land. Leaflet 65, Department of Agriculture and Technical Instruction for Ireland. Dublin. 1911. Pp. 4.

The Proper Methods of Planting Forest Trees. Leaflet 66, Department of Agriculture and Technical Instruction for Ireland. Dublin. 1905. Pp. 4.

Trees for Poles and Timber. Leaflet 67 (revised), Department of Agriculture and Technical Instruction for Ireland. Dublin. 1911. Pp. 4.

Trees for Shelter and Ornament. Leaflet 68 (revised), Department of Agriculture and Technical Instruction for Ireland. Dublin. 1911. Pp. 4.

Planting, Management, and Preservation of Shelter-belts and Hedgerow Timber. Leaflet 70 (revised), Department of Agriculture and Technical Instruction for Ireland. Dublin. 1913. Pp. 4.

The Management of Plantations. Leaflet 71 (revised), Department of Agriculture and Technical Instruction for Ireland. Dublin. 1912. Pp. 4.

Felling and Selling Timber. Leaflet 72 (revised), Department of Agriculture and Technical Instruction for Ireland. Dublin. 1911. Pp. 4.

Cost of Forest Planting. Leaflet 94 (revised), Department of Agriculture and Technical Instruction for Ireland. 1911. Pp. 4.

Annual Progress Report on Forest Administration in the Presidency of Bengal for the Year 1912-13. By C. E. Muriel. The Bengal Secretarial Book Department. Calcutta, India. 1913. Pp. 45, 1 map.

Rate of Growth of Indigenous Commercial Trees. Compiled by R. D. Hay. Bulletin 8, Department of Forestry, New South Wales. Sydney. 1914. Pp. 2.

Report on the Botanical and Forestry Department of Hong Kong, China, for the Year 1914. 1914. Pp. 21.

PERIODICAL LITERATURE

(The war in Europe delays or entirely prevents the circulation of foreign periodicals. This explains the meagerness of this department. For example, this issue of the QUARTERLY ordinarily reviews the July, August and September numbers of the leading forestry periodicals; so far, however, only the July and some of the August numbers have reached this country, and some have discontinued with the July number.)

FOREST GEOGRAPHY AND DESCRIPTION

Swedish Conditions and Practice

As a result of tke interesting institution of the Austrian Forest Service, namely, annually to send a number of its forest officers under proper guidance to visit other forest administrations and wood technological establishments, Janka publishes an interesting account of what was seen on the excursion in 1913, describing at the same time general conditions.

A modification of the strip method of stock-taking has been introduced in the work of ascertaining Sweden's timber and forest production as a basis for the estimate. On the 32-foot strips which are run every 4 *km* (about 2 miles) or more, all trees of 8 inch and more diameter are calipered; within this strip on a portion 16 feet wide all trees 4 to 8 inch were also calipered, and on a 3-foot (1 *m*) broad strip also all 2 to 4 inch trees. Furthermore, on limited portions of the strip, countings of the smaller regeneration were made.

For Vermland, on about 3.5 million acres, the stand was found to average around 8,000 cubic feet and the growth per cent 3.5%. In the description of a typical broadleaf forest property in South Sweden the account of the attempts of reforesting heath lands is of interest. Pine, spruce, also *Picea alba* and larch proved failures, and finally beech was used with tolerably good results for fuelwood, by plowing and underplanting the rot infested pines or by natural regeneration. With prices for fuelwood ranging in the neighborhood of $8 per cord, it is not necessary that the beech stands be very good. In a typical conifer forest (pine 70%, spruce 30%) of Middle Sweden the reproduction is secured by leaving single pines, 12 to 20 per acre as seed trees, burning over the surface after logging; but, if natural regeneration fails, the area is immediately planted. Or else the area is rented for rye fields to farmers for about 5 years, during which time it must be fenced, and after the first season it is sown with tree seed, pine and spruce in the original proportion. When the pine is about 20 feet high the trees which are expected to form the dominant stand are pruned of dry branches at a cost of 3 ore, or .81 of a cent.

Such stands at 100 years have an average height of 85 feet, 330 trees to the acre and 7,680 cubic feet, with an increment of 138 cubic feet, less than 2%, the diameter having grown at about 1 inch in 10 years. The site of these stands is .6 to .8, Swedish sites being expressed in fractions of the best site 1, the poorest site being .2.

Sawlogs here must be at least 6 inch at small end in lengths of 14 to 22 feet, woodchoppers' wages being 48 cents per 100 cubic feet. While the price f.o.b. of logs is about $3 (less than $4 per M feet B.M.), Railroad ties (red heart) bring 25% more, the tie costing about 50 cents; pulpwood about 25% less.

In a forest in northern Sweden (63° lat.) the influence of climate on growth is exhibited by the open stand and the conical crown form of all conifers, raw humus formation and frequent swamps. Here the spruce does *not* thrive, the pine becoming entirely predominant. Fire had often visited these forest areas, giving rise to good regeneration. At an age of 125 to 160 years on the best sites, the stands contain rarely over 80 pines to the acre, say 80 feet in height, 12 inch diameter (1 inch in 12 years), and 8,000 feet to the acre; the spruce having then attained only 6 to 8 inch.

Regeneration is secured by planting, for the old trees give rarely good seed; although sometimes natural regeneration is successful.

Sweden has taken the lead in trying to secure acceptable pine seed, which has taken the form of forbidding the use of German seed on State forests entirely and to impose a heavy tariff on imported seed so as to make importation undesirable; hence seed collecting on own account is the rule. Since seed years in pine are rare, this is a bad handicap; the price in 1913 going to over $1.25 per pound. Storing the seed in large glass balloons of 80–90 lb. capacity, closed, airtight, preserves germination well, losing only 1 per cent. a year. A description of several seed-extracting establishments is given. The yield is from .6 to .8 *kg* per 1 *hl*, or ½ to ⅔ lb. per bushel.

Cheap transportation by water, the rivers being of easy grades, all short to sea, yet amply supplied with water, and the average haul not over 4 to 5 miles, has given to Sweden its position in the world's timber market. The water transportation also improves the quality of the wood; it becomes less hygroscopic, less liable to shrink and swell, to twist, to check, to rot. It is more easily sawed than dry wood, hence produces more lumber. Yet the disadvantages of driving and rafting, damage to logs, sinkers, hung-up drives, jams, etc., damage of all sorts, are not absent. Details regarding water conditions and methods of driving, sorting, etc., are given, which latter do not differ much from American usage.

In regard to wages at the booms, the practice is to hold back a certain amount, which is not paid until the season's work is finished, so as to keep laborers steady. At one booming ground 800 men work day and night sorting the logs of different owners; at another 100,000 logs a day is the task. The loss by sinkers and otherwise for sawlogs is from 1 to 3%, for pulpwood 8 to 10%.

The logs are made from 10 to 30 feet, 18 feet average, and top diameter 7 inch or more, rarely over 12 inch, average 8 inch, *i. e.*, only small logs, and a further reduction in size is anticipated. The number of logs driven in any one water system counts by the million. A few examples of cost of transportation are given as 3 to 7 cents per log (including damage from driving). On the Angermanelf with a length of about 250 miles the cost is between 5 and 6 cents, about one-tenth of what railway transportation would cost; for pulpwood the cost would be not over 2 cents per piece. The rivers are divided into districts of from 3 to 25 miles length, and the boom company charges differently for each district according to the difficulties per normal logs of certain length and diameter, so that a just distribution of cost is secured. The damage to adjoiners is ascertained by an expert jury, and for a given district (*Dalekarlien*) amounts annually to about $6,000. The cost of up-keep of dams, etc., is figured at about $650 per mile, while maintenance of railways would require about $20,000 per mile. In other words, logging is cheap in Sweden, and with an export of over $50,000,000 (40% of which goes to Great Britain), its wood trade represents nearly 50% of all exports.

Eine forstliche Studienreise nach Schweden. Centralblatt für das gesammte Forstwesen, January and February, March and April, 1914, pp. 57–72, 138–148.

Forests of the Far East

Dr. Wimmer reviews Dr. Hofmann's recently[1] published book on the forests of Japan, Formosa, Korea, and adjacent parts of the Far East.

Dr. Hofmann was for five and one-half years professor of forestry in the agricultural faculty of the University of Tokio which gave him ample opportunity to become acquainted with the territory described.

After describing the climatic features of Japan, Hofmann divides Japan into four vegetative zones:—

1. Tropical zone—type trees: Ficus, Wightiana.
2. Subtropical zone—type trees: Evergreen hardwoods such as Camphor tree.
3. Temperate zone—type trees: Fagus japonica, Castanea, Magnolia, Thujopsis.
4. Cold zone—type trees: Abies veitchii.

Hofmann emphasizes the desirability of introducing into Europe only such species as have no close kin there, and are not to exigent in their demands on soil, climate and site, *e. g.*, Cryptomeria, Larix leptolepis, Alnus firma, Populus balsamifera, var. suaveolens, Betula Bhojapattra, Albizzia, Sophora, Gleditschia, Cladrastis, Phellodendron amurense, Cercidophyllum japonicum, and Zelkowa keaki.

The forest area of Japan (including Hokkaido, Sachalin and Formosa) is 74,841,000 acres or 65½% of the total land area. In Formosa the forested area is 81% of the total land area. According to ownership it divides:—

State forests..................	44,460,000 acres.
Imperial forests................	5,434,000 acres.
Private forests.................	24,947,000 acres.

Of the last named 8,398,000 acres are communally owned, 247,000 acres belong to temples and 16,302,000 acres are truly private forests.

In old Japan (Honshu, Shikoku and Kyushu) the coniferous forests comprise 21%, the hardwoods 25%, mixed forests 45% and

[1] Wilhelm Frick, Vienna, 1913. Price about $3.00.

9% are blanks. Eighty per cent of the forest is managed as high forest.

In the State forests under working plans only about 14.3 *cubic feet* per acre are cut per year. The net income is $.187 per acre per year (figures of 1907).

Hofmann describes the interesting minor industries of Camphor gathering and of lacquer from *Rhus vernicifera*. The camphor industry at present utilizes only 30% of the camphor in a tree. Camphor is a state monopoly: the exports in 1906 were valued at about $2,500,000.

"*Aus den Waldungen des fernen Ostens*," Allgemeine Forst- und Jagd-Zeitung, July, 1914, pp. 236–237.

A. B. R.

Growth of Sequoia gigantea

This species is quite extensively used for ornamental planting in Switzerland, where it thrives. Two specimens which in 1877 were planted before the forest school of Zürich had to be removed in 1913 and were analyzed by Prof. Jaccard.

One of these trees had been sickly for some time and had reached only little over half the diameter and 20% less height than the sound one, hence its record is of no value. The other, 45 years of age, had attained a height of 66 feet and a diameter of 32 inches, with bark of 2 to 3 inches, a bark per cent of 24, and the very low form factor of 24, the tree being beset with branches to the very base.

The quinquennial periodic increment of diameter ran from the first five to the last five years as .08, .15, .26, .36, .47, .68, .59, showing a culmination in the 35th year. The wood is extremely light, its specific gravity being .37, with a moisture content of 80 to 88 per cent.

The root system is described as consisting of a large number (eleven) of stout roots, descending for a considerable distance straight into the ground before branching or sidewise expansion; the circumferences of this root system added together is 16 feet, while the circumference of the tree at breast high measured only 8 feet.

Die Wellingtonien der Forstschule in Zürich. Schweizerische Zeitschrift für Forstwesen, June, 1914, pp. 176–180.

Eccentric Growth of Ash

Studies of eccentric growth in trees have shown that in general the increased wood formation takes place on the concave side in conifers and on the convex side in hardwoods. The phenomenon is to be noted in the case of horizontal branches, roots, isolated trees exposed to wind, trees growing on a slope or on the border of a dense wood, and in case of branches or trees accidentally or experimentally kept in a bent position.

The general explanation offered is that the eccentric growth is a result of the longitudinal forces of tension and compression set up in the convex and concave sides respectively by the bending. In the case of conifers the cells of the increased growth are abnormally lignified, and the wood in consequence is more adapted to withstand compression than tension; whereas in the hardwoods, these cells are found to be very imperfectly lignified and correspondingly more elastic and able to withstand tension. This leads to Metzger's explanation of the appearance of the greater amount of wood on the concave side in conifers and convex side in hardwoods; taking the character of the cells into account these sides are the necessary locations to strengthen the stem or branch.

In this article, the results of bending experiments with six five-year-old ashes are given, these having been in progress from May to November, 1912. Three of the ashes were bent to the east—one all the time, the second only on alternate days, and the third on alternate weeks. The fourth tree was tied to the east or west on alternate days, and tree five on alternate weeks. At the end of the season each trunk was cut into five sections, usually at the base of each year's growth, and the increment for 1911 and 1912 measured on the base of each section along the north, south, east and west radii.

The data from the first three trees showed for each tree, the 1912 ring on the west or convex side from 2 to 3 times the breadth of the ring on the concave side, taking the average of the five sections. In the case of trees four and five, the average growth on the east and west sides was equal, in keeping with the alternate bending. Comparison of the amount of growth on the east and west sides with that along the neutral north and south radii brought out the fact that the stimulated growth on the convex side exceeded relatively the mean of the north and south current growth, and also the ratio of the west radial increment to north and south mean during 1911. This was even the case on both the west and east sides of trees four and five, which were bent alternately east and west. In these two deductions, allowance was made for the maximum percentic deviation of west-east from north-south radii during 1911 when all the trees grew normally.

It is noticeable that the absolute radial growth in all four directions was lower in general in the bent trees than in the control tree.

One wishes the experiments had included more trees.

J. H. W.

Experiments in Eccentric Growth of Ash. Quarterly Journal of Forestry, July, 1914, pp. 218–29.

Transfer of Mineral Substances

E. Ramann gives a complete analysis of the ashes and of the nitrogenous content and phosphoric acid in green and dead leaves of oak, birch, maple, and locust. The results show that in all cases during the normal falling of the leaves there occurs a transfer of nitrogen, potassium, and phosphoric acid from the leaves to the trunk of the tree. The amount of lime and silica, on the other hand, in the dead leaves greatly increases and sometimes even doubles. The migration of the substances from the leaves into the trunk at the time of their death is accomplished in a comparatively short time.

R. Z.

Zeitschrift Versuchs-Station 1912, p. 157.

SOIL, WATER AND CLIMATE

Soil Maps and Instruction

Professor Graf zu Leiningen at the school for Soilculture at Vienna discusses at length the making and use of soil maps, and incidentally propositions of how to teach soil knowledge.

Pointing out the inadequacy of geological maps as soil maps, partly on account of their scale, partly because the geologist does not consider the character of the rock from the standpoint of soil formation (*e. g.*, red sandstone of the geologist comprises clays and limestones), he contends that at least in Germany and Austria the problem of soil mapping is not solved. Cooperation of geologist, petrographer, chemist with agriculturist and forester, the practical men, who know what the map is to be used for in practice, is necessary to solve it; and the map maker needs special preparation for his business with special knowledge of the needs of agriculture and forestry. The information on the map should be such as to direct practical problems: the statement that a soil contains much lime means that manure is quickly decomposed and utilized; a sand or granite soil, poor in lime, indicates danger of raw humus and hard pan formation, that manuring without liming is without value, that some tree species like the beech do not prosper on such soils. Sufficiency of lime in the fodder is of significance for meat and fat production. Even soils derived from limestone contain often only traces of lime, which one would not suspect unless the map calls attention to it. A soil map for practical use should be on a scale of not less than 1:25,000, and for detail maps 1:5000 (the U. S. Soil Survey seems satisfied with a scale of 1:62,000). It should give answer direct or indirect to the following questions: elevation above sea level; exposure; degree of slope; drainage data; irrigation possibilities; water level (accessible to roots) and stagnant water; typical soil profils and soil classification of upper and lower strata; petrographic character of geological formation; presence of stones, quantity, size and location; lime contents of upper and lower strata (most important); humus contents; clay and sand contents (heavy and light soils).

Besides the main map, the author suggests parallel or aid maps on transparent paper, giving some details by which to relieve the legends on the main map.

Besides borings, fewer or more according to circumstances and at least 6 feet deep, sample diggings are necessary to secure insight into the stratification of the soils which influence aeration and water conductivity. In loose soil the depth of bore holes may have to be extended to 16 feet, since for forest purposes in such soils the water conditions to that depth come into consideration. Depth to layers of impenetrable soil and to groundwater need to be ascertained, the latter by observation through several years. Since on soils liable to raw humus formation or to other deterioration the growing of even-aged uniform stands must be avoided, it would be desirable to designate such soils. There is no need for many chemical analyses which have only problematical value, except the knowledge of lime and humus contents which should be noted on the maps. Moor or peaty soils should be classified, as their value varies much. On one of the parallel maps the manner of present use, tree species, etc., might be usefully noted.

Even though the direct, practical use of such maps by farmers may only be rarely secured, this could be increased by developing rules of soil preparation, fertilization, crop sequence, drainage, etc., to accompany the map.

The teaching of soil knowledge in professional schools, the author contends, should not be left to geologists but to instructors in plant production who appreciate the interrelation between soil and plant.

Bodenkartierung und bodenkundlicher Unterricht. Centralblatt für das gesammte Forstwesen, March and April, 1914, pp. 81–97.

SILVICULTURE, PROTECTION AND EXTENSION

Conversion into High Forest

The problem of converting the forests of beech and oak from the coppice-with-standards form into high forests has engaged the attention of French foresters for a long time. The earlier methods were either to clear out and plant, or else fell the coppice and leave the standards for natural regeneration. Both methods were failures on account of suppression of the young growth by the new coppice shoots.

The conversion is now generally accomplished by first dividing the whole area into periodic blocks, say 4 blocks for a rotation of 120 years. The first block is left untouched for 30 years to allow the coppice shoots to grow up and kill each other out to some extent, and the shoots to become exhausted. Coppicing is continued as usual over the remainder of the forest. At the end of the 30 years, regeneration fellings are begun. A series of fellings gradually opens up the crown cover, the best of the coppice shoots and standards being kept as seed trees. The removal being largely confined to the smaller trees, the story of the cover is raised. Thus, during the second period of 30 years, while the second block is lying untouched, the regeneration of the first block is accomplished, either by natural or artificial means or by both. The diminishing yield of coppice is to some extent offset by the increasing yield of improvement thinnings.

In the Jura and Vosges much underplanting or sowing with conifers (chiefly Silver fir) is carried out during the conversion. (See also F. Q., vol. VI, p. 151.)

J. H. W.

The Conversion of Coppice-with-Standards into High Forest in France. Quarterly Journal of Forestry, July, 1914, pp. 208–12.

Supply of Pine Seed for Germany

Since the year 1913 was a "fail" year for the seed of Scotch pine throughout Germany, it was natural that the question of a permanent supply of native-grown seed should receive a great deal of attention at the Forest Congress at Trier that summer. The main difficulty is that the commercial seed concerns have been offering for sale mainly seed from Southern France and Southern Hungary which can be collected more cheaply. Naturally, however, this has led to deterioration of planting material since seed of exotic origin is not suitable for German conditions.

The supply of native-grown seed has been decreasing steadily for the last seven years and the price has jumped. For example, in 1906 native seed was quoted at four-and-a-half marks per kilogram while in 1913 the price was twenty-one and seven-tenths marks per kilogram, an increase of nearly 500% in seven years. This has not been due to poor crops in Germany because statistics show that since 1890 there have been only three fail years, viz—1896–1897, 1901–1902, 1913–1914, or three in a period of twenty-four years.

The total demand for German grown pine seed has been estimated to be one hundred twenty thousand kilograms annually. In 1913 the dealers were able to supply less than 1% of this demand from home-grown material.

The disadvantages that arise from this lack of good seed are many. Cutting must often be delayed and the whole plan of forest management deranged. The only remedies are State oversight of private firms or the collection of seed by the State. The problem affects mainly the private forest owners since the State Governments generally collect their own seed. However, it seems inadvisable for the state to attempt to supply enough seed for the private and communal forests since this would result in destroying the business of the commercial concerns. Therefore, State oversight of the firms seems the lesser of the two evils, although it will be difficult to manage it efficiently.

Beschaffung von Kiefernsamen deutscher Herkunft. Forstliches Centralblatt, June 1914, pp. 315–326.

Damage by Coal Fumes

Carl Batz, in charge of a forest near the industrial towns of Barmen and Elberfeld from which emanate large masses of coal smoke, warns against overrating the damage to forest properties, which there is a tendency to do.

After detailing his observations in a long article, he draws the following conclusions:

Where there is much smoke there is damage. It is not, however, sulfur dioxide which occasions the damage but higher oxidations, which do not, as has been assumed, interfere with assimilation but exercise a direct exterior influence. Snow, frequent mists and slow rain are especially dangerous conditions, as they produce accumulations of acid on the foliage, destroying it, especially at time of budding.

Topdryness or dead branches may or may not be caused by smoke, nor is absence of vegetation on beech trunks a criterion.

Soil-poisoning by sulfuric acid does not seem to occur, plantations of broadleaf trees succeeding well, although it is possible that the acid seeks to combine with bases and may absorb lime, and also kill microbes.

Conifers are most susceptible; among these most resistant are *Pinus austriaca* and *strobus* with *Picea sitchensis* and Japanese larch. Of broadleaf trees, oaks, *Robinia*, beech and birch are most resistant.

Tolerant species are not to be grown pure in smoke-infested localities, since they cannot preserve favorable soil conditions—the most important need.

Wieler is quoted as doubting the influence of smoke on assimilation and the propriety of determining damage by acid poisoning because acid has been found in the analysis.

Die durch Steinkohlenverbrennung am Walde entstehenden und vermuteten Rauchschaden. Zeitschrift für Forst-u. Jagdwesen, March, 1914, pp. 158-174.

Fighting Fungus

A great and unique fight has been carried on for 8 years in all the pineries of Prussia (nearly 4 million acres) to get rid of the infection by *Trametes pini* on Scotch pine. Over 200 million cubic feet of infected wood has been cut and often the whole management of revirs has been disturbed thereby. Dr. Moeller, at whose instance this war was begun, reports on results. Tables give details. Some $120,000 extra expenses were incurred in designating and marking the infested trees and in removing fruit-bodies and painting the scars with insect lime. Out of 365 revirs, only 97 are not yet entirely free of fruit-bodies, and it is estimated that nearly 85 million cubic feet more of infested material remains standing.

The breaking out of the "consols" and painting the scar with insect lime on trees that cannot at once be removed is done to reduce spore distribution and retard formation of new fruit-bodies. The latter do not reappear on the painted scars. The efficacy of these measures is attested. Fruit-bodies occur usually from 10 to 20 years after infestation, so that the infection does not become visible early, and hence much of the new fruit-bodies had their origin before the fight began.

Moeller considers the final victory absolutely sure, if the measures are continued, the strictly localized occurrence of its only fruit-body permitting such expectation.

Investigations by Moeller lead him to side with Hartig in believing the Trametes on spruce as identical with the pine fungus, although an absolute decision is still withheld.

Der Kampf gegen den Kiefern- und Fichtenbaumschwamm. Zeitschrift für Forst- u. Jagdwesen, April, 1914, pp. 193–208.

Mahogany Borers of the Gold Coast

The general method of timber extraction on the Gold Coast is to haul the logs by manual labor to the nearest stream, down which they are floated to the mouth and there rafted. During last August, when the number of logs were greatest, there was an unusually small rainfall and insufficient water to carry the logs to the rafting points beyond the sand bars at the mouths of the rivers.

During the last seven years stranded timbers have shown signs of attack from borers belonging to an undescribed species of

Teredo, the damage being especially severe during August, 1913.

The borer enters the log, from its stage as a free swimming fry, by a minute hole and bores its way into the wood, quickly enlarging the size of the bore until it measures about ⅛ inch in diameter. At this stage the borers do not exceed 10 inches in length. The borers do the greatest damage when the river currents are sluggish and the tides high. Both new and old timber is attacked, also barked and unbarked logs.

It is stated that no antiseptic treatment yet discovered can be recommended as an effective preventive.

Damage is said to be greatest in the vicinity of mangrove trees, which also are severally attacked, and it is recommended that logs should be hauled out of the water if possible, and in any case they should not be tied up near mangrove trees.

Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew. No. 2, 1913, pp. 72–75.

MENSURATION, FINANCE AND MANAGEMENT

Universal Dendrometer or Polymeter

Fritz Lauterbach of Battweiler has constructed a simple universal dendrometer (to be had from Eckstein-Eisenach) for which he claims that for easy handling, rapidity and accuracy it excels all existing ones. It measures horizontal angles to 2′ accuracy, can be used for topography in degrees or per cent, with or without support on tripod, staff or pendulum; for height measuring with or without base line. From the illustration we would judge that it was not quite so simple as desirable.

Ein neues Universalinstrument. Forstwissenschaftliches Centralblatt, July, 1914, pp. 395–6.

One Only Yield Table

A startling and, if fully substantiated, most important and far-reaching discovery is announced by Oberforstmeister Fricke, namely, that one yield table probably suffices for each species, if properly constructed, applicable wherever the species grows.

He comes to this conclusion by comparing yield tables of Scotch pine from Russia, Sweden and various regions of Germany, after having made them comparable. To do this, it is necessary to determine by graphical or calculatory interpolation the development of stands of the same height—the height development having been recognized as the best criterion of site. Calling the height at 100 years of age the *index height*, being an index of stand and site quality, he determined the progress of height development from yield tables for stands with different index heights. He finds that stands which have the same height at 100 years have approximately the same heights at other ages no matter whether grown in Russia, Sweden, North Germany, Black Forest, Alps or Rhine valley. Differences appearing in the table are much smaller than those which are met in a confined locality on the same site, hence cannot be due to climatic influence. A table of average heights, which the author claims would do service equally well in Germany, France, Siberia, Canada, Japan and China, has been figured out from the yield tables, smoothed out according to Weber's law which determines the decreasing rate of height growth as $1 : \frac{1}{1.op^x}$, x being age diminished by the duration of the juvenile stage, and p a growth per cent derived from the yield tables. This table also enables one to compare the different yield tables, no matter what site class differentiation has been made.

We can give only a sample of this table.

In Age	Stand Index Height at 100 Years if the Stands have a Height of						
	10	11	12	13	14	15	etc. meter
30	24	26	27	29	31	33	
40	19	21	22	24	25	27	
50	16	17	19	20	21	23	

e. g., when a 50-year stand has a height of 15 *m* it will be 23 *m* at 100 years, or if 13 *m* then 20 *m*.

Thus everywhere the same trend of height curves furnishes the possibility to make uniform site classifications by the index height —a purely objective classification found in the stand itself independent of the estimator.

Next, it is found that the development of form factors is in all regions the same: One can therefore everywhere determine the volume for the same age and height and same treatment of stands by using the same form factor. The influence of climate, to be sure, is expressed in the stand height, and on this height the form factor depends, hence the stands grown slowly in the far North at the same *age* have a higher form factor, they are more cylindrical, but two stands in different climate which at the same age have the same *height*, have approximately the same form factor or taper.

An investigation into the cross-section area progress reveals the same condition. The whole investigation permits the claim that the same yield table based on height relation may be used in all climatic conditions.

A comparison of spruce yield tables has given the same result. Especially for site classification the author believes this procedure of using the index heights will prove most welcome.

Einheitliche Schätzungstafel für Kiefer. Zeitschrift für Forst- u. Jagdwesen June, 1914, pp. 325–342.

Practical Forest Valuation

Hönlinger explains, in replying to a criticism on his book of this title, the difference of his way of calculating from that of the soil rent theory, which lies mainly in the manner of charging expenses; the soil rent theory charging expenses only against soil, and hence coming occasionally to a negative soil rent, while Hönlinger distributes expenses against soil and stock.

The fundamental formulae of the two theories compare as follows, for forest- soil- and stock value of the ideal management class:

Soil rent theory: $F=\frac{Y_r-ra}{.op}$; $S_r=\frac{rY_r}{1.op^r-1}$; $St=\frac{Y_r}{.op}-\frac{rY_r}{1.op^r-1}$

Hönlinger: $F=\frac{Y_r-ra}{.op}$; $S_r=\frac{r(Y_r-ra)}{1.op^r-1}$; $St=\frac{Y_r-ra}{.op}-\frac{r(Y_r-ra)}{1.op^r-1}$

Centralblatt für das gesammte Forstwesen, December, 1913, p. 564.

Approximating Soil Values

Glaser points out that values are, in general, always compromises or averages of subjective opinions. The average of these opinions may be considered as the average value of the object, or the general basis on which the price is fixed by the exchangers. Hence, to find simple approximation formulae to be used in figuring values should be the aim of forest finance.

The mathematically correct formula for soil rent values is mainly influenced by the chosen interest rate p, which is most uncertain in its determination and which is usually based on some supposition of soil value, which makes the formula to be a chain in a vicious circle. Glaser proposes to obviate the difficulty by assuming that the interest on the incomes before the year r compensate the interest on the expenditures up to the year r, and hence the approximation can be made $S_r = Y_r + \Sigma T_r - c - ra$. This looks like the forest rent, but as soil rent it expresses the return every *r years* from the area unit, while as forest rent it is the annual income from *r units*.

The assumption of the equality of interest charges is left without basis, but the author considers it as well justified as the other assumptions of the formula, namely, of eternally equal yields, continuously equal rotations and interest rate.

Setting this approximate soil value as S_r, the true soil value formula would be $S_r = sr.f(r)$, when $f(r)$ signifies the average values of $\frac{S_r}{s_r}$, figures for $r = 40$ to 120 and the different species and site classes.

The author then compares the results of this and other approximation formulae with the theoretically "actual soil value" figured with 3% for various species, site classes and rotations, and finds his method furnishing best results.

Having ascertained the soil values of site I and setting them as 1, the following fractions were found to approximate satisfactorily values for other sites.

Site	I	II	III	IV	V
Soil value	1	.7–.75	.42–.47	.21–.23	.084–.088

Näherungsformeln für die Waldbodenwertsberechnung. Zeitschrift für Forst- u. Jagdwesen, April, 1914, pp. 222–229.

More About Soil Rent

Dr. Wimmenauer looks back upon twenty-seven years of teaching at the University of Giessen (in Hesse) and reviews the stand he took on the question of soil rent at the beginning of his teaching activity (March, 1888). At that time he had defined the object of soil rent as a "satisfactory interest rate on all forms of capital entering into forest production."

He added: "The fight about the theory, it is to be hoped, will soon be a thing of the past; its practice in the forest belongs to the future."

Unfortunately the fight about the theory is not yet over. Opponents of the soil rent theory are still active as witness the periodical literature on this subject. However, Wimmenauer, after carefully reviewing the matter, sees no reason to change the stand he took twenty-seven years ago (in common with Pressler, G. Heyer, Judeich and Martin) that it is the task of forest management to strive for the highest interest return on the forest capital possible with the species and the silvicultural system.

When it is remembered that Dr. Wimmenauer preceded his academic activity with twenty years of practical experience, this result of forty-seven years of well-balanced thinking will not be weighed lightly.

A. B. R.

Ueber den Streit um die forstlichen Reinerträge, Allgemeine Forst- und Jagd-Zeitung, July, 1914, pp. 221–224.

UTILIZATION, MARKET AND TECHNOLOGY

Railroad Ties in Germany

Last year a peculiar association was formed in Germany, the Beech Industries Association, excluding from it the firms which handle railroad ties, who make undesirable competition to the other industries, stimulated by increase in prices of the latter. With the reduction in the offerings of oak ties, the use of beech ties is increasing. Yet in the contracts for ties made last fall, for this year's delivery, prices have somewhat declined.

To cover the requirement of the Prussian railways of 840,000 pine ties and 314,000 hardwood ties, over 3,900,000 pine ties and 1,210,000 hardwood ties were offered, but of these only 143,800 foreign oak ties. On pine ties an increase up to 11 cents (price varying much with locality) was experienced, but beech ties, while as a rule from one-half to 10 cents dearer, in some places show slight declines.

Prices for pine ties ran as a rule between $1.10 and $1.20 and for foreign ties a little lower; creosoted ties are from 25 to 50 cents higher; oak ties run up to $2.00, while treated beech ties run somewhat lower and up to $1.66 at most.

An interesting discussion—made more interesting on account of the war—was published in 1912 by General von Liebert, comparing metal ties and wooden ties from the standpoint of military value. He points out that the requirements of metal ties as regards road-bed, fastenings, and tamping are such as to make them undesirable in war time, while the wooden tie fits into any situation and can be fastened to the rail much more simply. He advises, therefore, on the frontiers to use only wooden ties, also because restoration of destroyed tracks would be more easily effected. (Half of Germany's mileage is on metal.)

Considering that in 1910 about 5 billion cubic feet of wood for tie purposes had to be imported, it would appear that there is no need from the forestry point of view to advocate the wooden tie.

Vom deutschen Holzschwellenmarkt. Centralblatt für das gesammte Forstwesen, January and February, March and April, 1914, pp. 76, 77, 162–165.
Die Bucheneisenbahnschwelle. Centralblatt für das gesammte Forstwesen, December, 1913, pp. 559–561.

STATISTICS AND HISTORY

Forestry in United Kingdom

The Development and Road Improvement Act of 1909 provided for the creation of a Development Fund and a Development Commission, and with the end in view of promoting the economic development of the United Kingdom. The fund now aggregates $14,500,000, and may be applied for agriculture and rural industries, forestry, reclamation and drainage, harbors, inland navigation, fisheries, etc. As defined in the Act, forestry includes the conducting of inquiries, experiments and research for the promoting of forestry and teaching methods of afforestation, and the purchase and planting of suitable areas. Money from the Development Fund may either be granted or loaned, and applications for advances are received only from public bodies, not from individuals. The Commissioners have no executive powers, do not make grants or loans, or carry out any schemes, but merely act in an advisory capacity to the Treasury.

From this report we find that through the recommendations of the Commissioners the Board was granted $32,500 for 1913–14 for forestry research, technical advice, etc. Of this, $12,500 went to support advisory officers at Oxford, Cambridge, Cirencester, Bangor and Newcastle.

Steps were taken to enable the utilization of the Forest of Dean for a forest demonstration area. An equipment grant of $68,500 provides for a foresters' school, woodmen's school, museum, library, laboratory and arboretum. The maintenance grant for the ensuing year is $8,500, which seems low. It is expected that the Dean Forest will thus develop into a national centre for forestry studies and experiments.

The Corporation of the City of Liverpool was recommended for a loan of $125,000 for afforestation purposes.

J. H. W.

Fourth Report of the Development Commissioners. The Journal of the Board of Agriculture, October, 1914, pp. 663–64.
Scottish Forestry in regard to the Development Fund. Royal Scottish Arboricultural Society, vol. XXVIII, part 2, 1914, pp. 138–53.

Statistics Great Britain

"The first annual joint report of the Forestry Branches of the Board of Agriculture and the Crown Office of Woods gives, besides a review of the year's work, a brief survey of the attitude of the State towards forestry from early times to the present, an outline of the history and present position of the Crown forests, together with descriptions of the woodman's school and the distillation works on the Forest of Dean. An account is also given of the timber trade of the United Kingdom from the eighteenth century onwards. A map showing the extent of woodlands and uncultivated land in England and Wales accompanies the report."

From the report we learn that the total woodland in England and Wales is about 1,884,000 acres, 3.4% of which belongs to the Crown. The annual production for Great Britain is around 20 million cubic feet, or about 4% of the raw material used in the Kingdom. The imports of wood (manufactured and unmanufactured) into the United Kingdom averaged $160 million annually for the decade 1903–1912. The imports of the principal kinds of unmanufactured timber had risen 23.5% per capita in 1911 over that of 1891.

J. H. W

Forestry Report for 1912–13. The Journal of Board of Agriculture, August, 1914, pp. 430–33.

Bavarian and Baden Statistics

The Statistics of the Bavarian State Forest Administration for 1912, and in part for 1913, are exceedingly interesting. The figures are arranged as far as possible in conformity with the 1910 instructions for forest organization in Bavaria.[1]

Area: The present forest area of Bavaria is 6,473,408 acres, of which 2,300,975 acres are state forests (of which, in turn, 1,981,259 acres are listed as better suited to growing timber crops than for any other purpose.)

Cut: The annual cut per acre in 1912 was 80.51 cubic feet per acre as against 64.49 cubic feet per acre in 1908, a total annual increase of 28,440,642 cubic feet due to the change from the former ultra-conservative policy.[2] What this means in increased income may be judged by the fact that in 1908 the annual net income per acre was $5.12 per acre and in 1912 $6.49 per acre, an increase of 26.6%. The quantity of material increased 18% in these four years; the gross income 24.5%.

Other Uses: From other sources than wood sales the income increased 78% in these four years. The income from the chase alone was in 1912 $96,692. This is the highest money return from the chase of any state excepting Württemberg, as the following comparison shows:

Württemberg	$.065 per acre of forest.
Bavaria	.046 " " " "
Prussia	.025 " " " "
Saxony	.025 " " " "

Receipts and Expenses: To show the volume of business it is interesting to note that during 1912, the total receipts were $15,510,371, the total expenses were $7,116,610, making a total net income of $8,393,761, or $1,737,502 more than in 1912.

Planting: The total cost of planting amounted to $25.15 per acre restocked; per acre of forest land $.37.

Road Building: This cost $.36 per acre of forest land.

Forest Fires: Amounted to only one acre out of 24,754.

[1] See "Management of Alpine Forests in Bavaria," FORESTRY QUARTERLY, Vol. XI, No. 3, pp. 347, 348.

[2] See Practice of Working Plans in Bavaria, pp. 147–159, Theory and Practice of Working Plans, John Wiley & Sons, N. Y., 1913.

Wages: Pay for workers in the woods rose from average of $.715 per day in 1908 to $.833 in 1912.

In Baden the statistics for 1912 are as follows:—

Area: On January 1, 1913, the total forest area was 1,451,315 acres, of which 246,163 acres are state forests (of which, in turn, 237,160 acres are listed as better suited to growing timber crops than for any other purpose.)

Cut: The annual cut per acre in 1912 was 101.82 cubic feet as against 61.35 cubic feet in 1878. The price of each cubic foot sold averaged $.14. Products other than wood netted $.30 per acre. The total net income was $5.64 per acre in 1912.

Species: Of the total growing stock on state forests oak equals 5.3%, beech 19.6%, other hardwoods 7.6% and conifers 67.5%.

Planting: The following figures show an interesting decrease in the area artificially restocked due to the propaganda for natural regeneration.

Years.	Area sown Acres	Area Planted Acres	Total Acres
1878–1890	336	1,685	2,021
1891–1903	257	1,556	1,813
1904–1912	215	1,304	1,519

In 1912 the cost for sowing averaged $7.03 per acre sown; for planting $28.40 per acre planted.

Road building: During 1912 $.48 per acre of forest was spent for road construction.

A. B. R.

Mitteilungen aus der Staatsforstverwaltung Bayerns. Allgemeine Forst- und Jagd-Zeitung, August, 1914, pp. 273-275.
Statistische Nachweisungen aus der Forstverwaltung des Grossherzogtums Baden. Allgemeine Forst- und Jagd-Zeitung, August, 1914, pp. 275-276.

Swiss Imports and Exports

Swiss importations in 1912–13 of non-manufactured wood products averaged 240,000 tons against an export of 35,000 tons. The values of these imports and exports were $6,900,000 and $1,260,000 respectively ($28 against $36 per ton).

The imports of 1913 were by over $1,200,000 less than the preceding year; the export on the other hand increased by over $200,000, the situation showing greatly reduced domestic consumption, which was met by the public forest administrations by reducing the cut by 7 million cubic feet.

Schweizerische Zeitschrift für Forstwesen, June, 1914, pp. 181–3.

MISCELLANEOUS

Acorns, Horse Chestnuts and Beech Mast as Food

Acorns, horse chestnuts and beech mast, if not mouldy or fermented, and if given in small quantities together with other food, may be used with good results as food for stock, but care must be exercised. Large quantities of acorns, without adequate supply of other foods and of water, are liable to cause acorn poisoning, especially in the case of young cattle under three years. Care should also be exercised in feeding these nuts to pregnant sows and dairy cattle. Their food value consists in the digestible carbohydrates they contain; they are therefore suitable to give with green fodder and food rich in protein.

Horse chestnuts also contain carbohydrates. They do not appear to have any poisonous effects, but if taken in large quantities, not supplemented by green fodder or watery foods, have a tendency to bring on digestive disturbances, especially stoppage. Oil cakes (protein), hay, straw are foods to be used in conjunction with horse chestnuts.

Beech mast (the kernel only should be used, the husk containing too much crude fibre to be suitable as food) contains albuminoids, and so would be a supplementary food to those poor in protein but rich in carbohydrates. It can be fed to cattle and pigs freely; poultry, especially turkeys, fatten quickly on it. It, however, contains a constituent injurious to horses, and sheep will eat it only under compulsion.

All these nuts, acorns, horse chestnuts and beech mast make better food if crushed and ground into meal. One pound of horse chestnut meal contains starch equal to that found in 1 lb. 1 oz. feeding barley, 1 lb. 4 oz. oats, 1 lb. 8 oz. bran, or 2 lb. 5 oz. meadow hay. Fresh and unprepared nuts have been fed daily in the following quantities; sheep ½ to 1 lb., or up to 2 lbs. to fattening sheep; dairy cattle 4 to 10 lbs.; working oxen ½ lb.; horses 6 lb. Pigs prefer the meal, and have shown good results from 1½ lb. daily.

Special Leaflet No. 9, Board of Agriculture and Fisheries, October, 1914.

American Forestry, XX, 1914,—

The Story of Hemlock. Pp. 577-587.

Insect Pests in Forest Seeds. Pp. 588-590.

The World's Greatest Woodlot. Pp. 632-640.
Description of Pacific forests.

Fire Protection in California. Pp. 679-683.

A Forest of Stone. Pp. 709-718.
Yellowstone Park.

Practical Tree Surgery. Pp. 719-730.
Technique.

Filipino Foresters. Pp. 743-744.

Forests, Lumber, and the Consumer. Pp. 745-750.
Relationships.

Pulp and Paper Magazine of Canada, XII, 1914,—

Commercial Planting of Spruce. Pp. 483-485.
An account of the planting operations of the Laurentide Company, Quebec.

Bulletin of the American Geographical Society, XLVI, 1914,—

The Period of Safe Plant Growth in Maryland and Delaware. Pp. 587-590.

Forest Leaves, XIV, 1914,—

Forest Planting—Pennsylvania Department of Forestry. Pp. 149-151.

Work accomplished in spring of 1914, with figures of cost.

Chautauqua Meeting of the American Forestry Association. Pp. 154-156.

British Forestry. Pp. 165-166.
Discusses the general situation.

Wood-Using Industries of Pennsylvania. Pp. 169.

The Botanical Gazette, LVIII, 1914,—

Evaporation and Soil Moisture in Relation to the Succession of Plants Associations. Pp. 193-234.

The Popular Science Monthly, LXXXV, 1914,—

The Coniferous Forests of Eastern North America. Pp. 338-361.
Largely silvical notes on the different species.

Tree Distribution in Central California. Pp. 417-424.
Treats of the relationship between root characters, ground water conditions and local distribution of *Quercus agrifolia, Q. lobata* and *Q. douglasii.*

Quarterly Journal of Forestry, VIII, 1914,—

Some Douglas Fir Plantations. Pp. 187-190.
This gives statistical results of an inquiry conducted by the English Board of Agriculture into rate of growth, on five plantations ranging from 31 to 61 years. The figures differ from Hanzlik's tables in greater diameter, fewer trees per acre and greater volume.

The Journal of the Board of Agriculture, XXI, 1914,—

The Cricket Bat Willow. Pp. 289-292.
Discusses the identification, soil requirements, propagation, cultivation, etc., of *Salix coerulea* Smith.

The American Enquiry into Agricultural Co-operation in Europe. I. Mortgage-credit. Pp. 594-603.

Mountain "Ash" Berries as Food. Pp. 637-638.

Readily eaten by birds. In some parts of northern Europe ground into flour. Chief use is in preparation of a game jelly.

Transactions of the Royal Scottish Arboricultural Society, XXVIII, 1914,—

Discussion on Forestry in Scotland. Pp. 121-138.

Mostly resolutions to the Government regarding assistance to the cause of afforestation.

Position of Scottish Forestry in Regard to the Development Fund. Pp. 138-153.

Associated with the preceding article.

Allgemeine Forst- u. Jagdzeitung, 1914,—

Über den Streit um die forstlichen Reinerträge. Pp. 221-224.

A commonsense definition of the financial aims of forestry.

Weitere Mitteilunger über die Wirkung von Düngungen in Forchenkrüppelbeständen des württ. Schwarzwaldes. Pp. 228-231.

States on the basis of experiments (among others with Banksian pine) that the favorable influence of once fertilizing and scarifying the soil surface lasts only a few years.

Naturwissenschaftliche Zeitschrift für Forst- u. Landwirtschaft, 1914,—

Aus dem Münchener Exkursionsgebiet. Pp. 294-311.

Gives interesting details of what may be seen of forestal interest within reach from Munich.

NEWS AND NOTES

It is the aim of the Quarterly to publish interesting news as to the activities and whereabouts of men in the profession. It is hoped to do this more fully than heretofore by the appointment of one of the editorial staff to look after this field. To this end all readers having news of interest are requested to write Mr. A. B. Recknagel, Department of Forestry, Cornell University, Ithaca, N. Y.

In running this Department it is the intention to do for the whole profession what is now covered by such local publications at the Yale Forest School News, the Field Program and the monthly news letters of certain Districts in the Forest Service. It is to be understood that in a Quarterly only news that can lay over two months may be printed.

The President of the Society of American Foresters during the summer sent out a letter to the members inviting them to co-operate in making the Society more effective, suggesting some methods of doing so, and asking for suggestions. Out of a membership of around 250, only 9 replies were received. Members who read this and feel guilty are asked to re-read the "round robbin" and mend their ways!

Pursuant to the expressed desire of the Society of American Foresters (see page 300 of present volume), the President appointed a Committee of 21 members to revise and standardize the terminology of forestry terms. The membership of the committee comprises ten schoolmen, six members of the U. S. Forest Service, two State Foresters and three Canadians.

The members of the committee are: Messrs. H. P. Baker, W. B. Barrows, R. C. Bryant, W. M. Drake, E. H. Frothingham, A. Gaskill, J. M. Gries, A. F. Hawes, C. D. Howe, B. P. Kirkland, Clyde Leavitt, P. S. Lovejoy, W. N. Millar, A. B. Recknagel, S. N. Spring, J. H. White, W. W. White, Ellwood Wilson, K. W. Woodward, T. S. Woolsey, Jr., and A. E. Ziegler, and the President.

The committee was subdivided into five sub-committees, each having under advisement the terms referring to certain groups of subjects. Following is the list of the subcommittees: Silviculture, Silvics, and Forest Description; Organization, Mensuration, and Management; Utilization and Protection; Valuation, Administration, and General Terms; Collating Committee.

The following letter of instructions was all that was sent to the members of the committee, leaving otherwise each subcommittee to devise its own way of procedure.

"It is proposed to revise and explain the forest terminology, with a view to securing as far as possible uniformity of usage; selecting the terms in use which are preferable, and establishing a synonomy.

"This revision may be based upon Bulletin 61 of the U. S. Forest Service, keeping in mind that this first attempt at a terminology is neither exhaustive nor in some respects acceptable.

"To make the work of a large committee practicable, it would appear desirable to classify by subjects, each subject or class of subjects to be assigned to a small subcommittee for first consideration, its findings to be submitted to a collating committee. The report of this committee is then to be submitted to the whole committee, and the final findings, with appropriate argumentation, to be printed for discussion by the profession at large before final acceptance.

"First, attention should be paid to those terms the use of which is doubtful or not uniform and to those lacking in term value, leaving out of consideration those which appear generally accepted.

"The first duty of each subcommittee should be to assemble the terms in use referring to its particular subject or subjects, and report same to collating committee without fear of overlapping, the collating committee acting as reviser.

"The Committee is to consist of 19 members from the Society, with three assessors from the Canadian Society of Forest Engineers, thereby giving the decisions an international character.

"It is expected that the chairmen of the subcommittees will do the work, securing from the other members of each subcommittee their criticisms."

The work of the committees can naturally proceed only slowly, and so far only progress reports can be made. The following statements have been made by the chairmen.

Subsection on *Silviculture, Silvics and Forest Description:* "The members of this subsection met in May at Ithaca at the time of the opening of the Forestry Building. It was decided to take the terms in Bulletin 61 of the Forest Service relating to the subjects assigned and modify, reject or add to these. Each member was to prepare a separate list. Such list of terms and definitions have been prepared by four of the five members. Compilation and review of these, together with a study of their present usage in forestry literature, has been delayed but is now under way. The compiled results will shortly be resubmitted to the members of the sub-section and to others for criticism and suggestion."

Subsection on *Organization, Mensuration and Management:* "This committee was organized for work on April 16, under the following plan of campaign: Based on Bulletin 61 and other available sources, a list of the terms in use referring to our particular subjects was compiled by the chairman and submitted to each one of the subcommittee for criticisms and suggestions. These criticisms and suggestions were compiled and sent to each member of the subcommittee for a final vote; terms favored by the majority of the subcommittee to be referred to the collating committee for further action.

"In accordance with this plan the nomenclature for Forest Organization was sent out to the members of the subcommittee under date of 29 May, criticisms and suggestions being asked for by June 15. Owing to inevitable delays all the critcisms and suggestions were not received and sent out to all the members of the subcommittee for final vote until August 21. As yet only two members of the subcommittee have responded with their decisions on the Organization terminology; however, the others should be received before long.

"Upon the suggestion of Mr. T. S. Woolsey, Jr., the draft of May 29, together with the compiled criticisms of August 21, were sent to the Forester on August 21. Under date of September 24, the acting chief of forest investigations writes, 'Your terminology for Forest Organizaion is now being gone over by various members of the Washington office. As you know, it takes some time to secure comments on anything of this sort from a number of different men, and I am afraid that it will be hardly possible to return the material to you by October 1. I hope, however, that the suggestions may be secured and compiled so as to reach you not later than October 15.'

"The same plan was followed in the terminology for Forest Mensuration. The first draft was sent out to members of the subcommittee under date of July 23, and replies were asked by

August 15. Up to the present all but one member of the subcommittee have replied with criticisms and corrections. Reply from this member should be received shortly, whereupon the compiled comments will be issued to the entire subcommittee for a vote.

"Owing to the geographical position of the members of this subcommittee, everything has had to be done by correspondence, which, of course, involved delay. It has also been difficult to get action during the field season. The tentative draft of the terminology for Forest Organization includes 72 terms; the one for Forest Mensuration comprises 76 terms."

One of the University members of this committee reports: "Since receipt of draft with committee comments, our faculty has held five two-hour (+) sessions, bringing out a tentative definition of 19 terms only—about an hour per term for the five of us. We found that we did not know very much about our own usages, that we differed among ourselves as to exact meaning and practice, that it was necessary to re-define terms we had thought finally done with, etc." Then, after elaborating on the difficulties and the necessity of much work to come to any conclusions, he continues: "Our faculty has found the work so interesting and profitable that we propose to go on through the lists as rapidly as practicable—for our own benefits alone."

Sub-section on *Valuation, Administration and General Terms:* "It will be at once evident that the Valuation terms, or better the Forest Finance terms are engrossing the bulk of the committee's effort, since the need for concise scientific definition is greatest in finance. Exactly here is one of the weakest spots in English forestry literature, so that this committee's task is not one of the easiest.

"This method of procedure is to construct a tentative alphabetical list of the terms needing definition, erring on the side of too many terms rather than too few. A hasty review of the English literature on the subject is made in doing this and the terms admitting of ambiguous or conflicting use are specially marked. This list is then used as a guide to the detailed work.

"The committee endeavored to divide the work alphabetically, and when the chairman has assembled the manuscripts, it is to be submitted entire to each member of the committee for suggestion on terms submitted by other members. The final draft is then made for the central collating committee."

The subcommittee on *Utilization* and *Protection* has divided the field geographically among the three members, the Rocky Mountains and Pacific Coast being one assignment, the North, East and Lake States being another, and the Appalachian and Southern region a third.

Each member of the Committee is to make not only a revision of the logging terms contained in Bulletin 61, but also to prepare a list covering the terms used in lumber maunfacture. Results are placed on "three by five" library cards, in order that they may be readily classified. One member has already defined some 250 terms, and hopes to greatly increase these during the next month. "I have found it somewhat difficult to properly define some of the terms in a brief and concise manner, but I think that we will be able to work that out satisfactorily before long. It has seemed both to Kirkland and myself that it was very desirable that special stress should be laid on the terms used in manufacture, since at the present time there is no glossary of such terms available, and personally, I have devoted more attention to this part of the work than I have to the logging terms."

The Grand Trunk Pacific Railway has announced that contracts have been let and other arrangements made for the installation of crude oil as locomotive fuel on their passenger engines to be operated between Prince Rupert, B. C., and Jasper, Alta., a distance of 718 miles. It is expected that this installation will be complete by next June. The announcement does not cover the use of oil-burners on freight engines, it being understood that these will continue to use coal, at least for the present. The entrance of the Grand Trunk Pacific into the list of oil-burning railways will nearly double the oil-burning mileage of Canada, the total of which is 726 miles at the present time, all in British Columbia. This is made up of 477 miles of Canadian Pacific lines, 134 miles of the Esquimalt and Nanaimo, and 115 miles of the Great Northern.

A most successful and enjoyable meeting of the Society of North-Eastern Foresters was held from July 18 to 20 in the timber holdings and mills of the Berlin Mills Co., in New Hampshire, the members and their friends to the number of some 25 being the guests of the Company under the excellent personal guidance of Mr. W. R. Brown. A special feature was a visit to the areas logged under Mr. Cary's advice some ten years ago. Without anybody familiar with the ground and the detail of previous condition and treatment this visit was, however, not as instructive as it might have been. In the selection forest the influence of any operation can be studied only by carefully ascertained detail descriptions before and after.

This meeting was followed by the meeting of the Society for the Protection of New Hampshire Forests at Gorham, N. H., which as usually was full of meat. The new taxation laws of Massachusetts, Vermont, and Connecticut were explained and "forestry investments" discussed. The most important feature, however, was an arraignment of the procedures of the commission having in charge the purchase of forest reservations in the White Mountains, for having neglected to acquire virgin timber before logging where scenic beauty and protection require it.

Owing to war conditions the Forestry Convention, which had been arranged by the Canadian Forestry Association in Halifax, September 1 to 4, was indefinitely postponed.

A bill appropriating $1,000,000 for the purpose of enlarging the Florida National Forest has been introduced in Congress, showing that the idea of federal ownership of forests is acceptable even to the Democratic states.

The Kaibab Forest in Northern Arizona is a very heavily wooded region, containing two billion feet of timber, more than half of which is mature and ready for the axe. The government has decided to sell the mature timber to the highest bidder, under fixed terms. An investment of large sums of money, possible only where returns can be spread over many years, will be needed. The necessary railroad extending the length of the tract will open the region to tourists and campers, who will find here much beauty; the sawmills will give employment to many and other uses of National Forests will also induce settlement.

The Philippine Bureau of Forestry was to make their first shipment of material for exhibition at the Panama-Pacific International Exposition to be held at San Francisco by October 15. Their building at the Exposition is to be finished entirely in Philippine woods. Species so foreign to Americans will arouse interest. Representatives of the Bureau, competent to give information on all branches of forestry and lumbering, will be in charge, and the hope has been expressed that the result, for the Islands, will be an increased export trade in the commercial woods. Primitive and modern logging, by means of moving pictures, will also be a feature of the exhibition.

Distribution of seed of native trees has been begun in the Philippine Islands by the Bureau of Forestry. The Bureau of Education is co-operating and the Bureau of Public Works will utilize all trees that can be spared for planting along roads. The species found by experiment to thrive under adverse conditions and at the same time to be valuable for market are: Teak, Molave, Narra, Lumbang, Lanutan and Tuai.

Guijo, a Philippine wood, is being investigated by the Forest Service to determine its possible use in decking boats and ships. Hitherto the navy department has used mostly of the domestic woods, Longleaf pine, Sugar maple and beech.

This brings to mind the fact that the first known forest reservations in this country were made for naval material.

Mr. Ngan Han, Chief of the Forestry Division of China, visited the Philippine Islands for several months for the purpose of studying Bureau methods, investigating both field and office work thoroughly.

Mr. Ngan Han is a graduate in forestry from the University of Michigan.

Settlers in Western Kansas are cutting and marketing soap weed, or Spanish bayonet (*Yucca bacata*), to supply the demands of soap manufacturers, the tops and roots being the parts of value. Though its qualities have long been known, the harvesting of soap weed is just now becoming commercially important.

This weed has been a nuisance, its nature being to spread over extensive areas and kill off other vegetation. For the sake of range improvement, the government desires to rid the forage areas of all such injurious plants, and so Forest Service officers hope that the commercial demand for soap weed will reach such proportions as to not only take an otherwise useless product but also eradicate it from areas utilized to supply forage to cattle and sheep.

From the Indian reservations of New Mexico and Arizona, Juniper is furnished as material for pencil wood.

One of the uses for blight-killed chestnut that should not be continued is that of crating stone. Quarry owners have found that this wood leaves an indelible stain on marble or granite.

The Powell National Forest, Utah, has passed 10 successive years without a forest fire.

Sixty little Lodgepole pine trees to the square foot were counted in Southern Idaho in the spring, from seed sown broadcast on the snow. The dry summer following, however, killed all plants not sheltered.

The barking of Lodgepole pine trees, at various periods before cutting them for use as telephone poles, in order that the effect of the exuded resin as a preservative may be secured, is being tried in the Beaverhead National Forest.

Lodgepole pine, when given preservative treatment, compares well with red cedar as a pole timber, the latter untreated and outside its own region being dearer than the former. Fire-killed Lodgepole pine showed a strength, under test, equal to 80 per cent of that of live red cedar.

The increased price of creosote since 1912 of from 7.25 to 10.04 cents per gallon led to an investigation relative to the comparative economy of treating piles. Taking as basis the price of 10 cents per foot for untreated and 30 cents for treated Douglas fir piles, the length of life of untreated piles as eight years, and the investigative result that an increased cost of one cent per gallon raised the cost of treated piles one cent per linear foot, it was found that the treating of piles would be economical up to 22 cents per linear foot, a creosote cost of the same amount per gallon.

Port Orford cedar, though sufficiently light, has been found to be too coarse and brittle for the manufacture of artificial limbs. It was tried as a substitute for English willow.

The United States Department of Agriculture is to inaugurate a tree distribution system in the Western States. Mr. W. A. Peterson, superintendent of the newly established Field Station at Mandan, N. D., which is to be the distributing center, recently visited the nursery station at Indian Head, Sask., with a view to collecting informaton as to the method of handling the work in Canada.

The State Board of Forestry of Indiana appointed two arbor days for this year, one in the spring, the other in October, and requested that the many hands of the people of the State make light the labor of planting 1,000,000 trees. The Forestry Board outlined its share of the work by offering to assist people to a knowledge of what species are suited to certain localities, and what care is needful to these trees.

A railroad company and two individuals have been fined recently for shipping lumber from an area quarantined on account of the gipsy and brown-tail moths. The existence of this quarantine, under the Plant Quarantine Act of Agust 20, 1912, was given general publicity throughout the quarantined area by sending copies of the order to all transportation companies and to individuals, as well as by extensive newspaper advertising.

On November 9, 1914, an Order-in-Council was promulgated at Ottawa, Canada, viz.: Plant Disease Regulation II, under the Destructive Insect and Pest Act (9-10 Edward VII, Chap. 31), reading:

"The importation into Canada of the following species of the genus Pinus and their horticultural varieties, viz.: White pine (*Pinus Strobus* L.); Western White pine (*Pinus monticola Dougl.*); Sugar pine (*Pinus cembra* L.), and all other five-leaved species of the genus Pinus is prohibited."

In the last issue of FORESTRY QUARTERLY reference was made to the use of wireless telegraphy for the purpose of speedy transmission of news of forest fires. Our statement that practical application of this science was first put in use for this purpose, and that but recently, by the Dominion Forestry Branch has been corrected by the information that wireless telegraphy has been a regular part of the forest protection service of British Columbia for the past three seasons, the Dominion wireless stations on the coast weekly reporting fires visible from the stations, and, also, when conditions are especially dangerous, giving the location, weather, direction and velocity of wind, enabling guards to reach the danger zone possibly in time to check incipient fires.

The St. Maurice Forest Protective Association of Quebec patrolled last year somewhat over 11,000 square miles, a little over 16 per cent of the provincial lands under license, with only 11 men. Of the 306 fires, 115 were started by settlers, 17 by river drivers, 8 by sportsmen and 17 by railways. The Government contributes $1 per day per man. There were 8 lookout stations and 15 miles of telephone wire constructed and 200 miles trail cut. The patrols traveled 60,800 miles, the total expenditures were $23,000. It is calculated that fire losses had been kept down to 1-1,00 of 1 per cent of the timber values involved.

As a result of the work done by the St. Maurice Forest Protective Association, there has been incorporated this year another association under the name of the Lower Ottawa Forest Protective Association, for the purpose of protecting against forest fires the districts in which are the Nation, Lievre, Rouge and Gatineau Rivers. The area of timber limits protected by this Association has grown during the summer from about 9,000 square miles to 11,812 or 7,500,000 acres. Forty-nine rangers under a manager and four inspectors are permanently employed and these in turn employ temporary help when needed. Forty convictions of settlers for starting fires without a permit have been secured, and it is expected this class of timber fires will be more rare from now on.

The provincial revenue for Quebec from forests last year was $1,760,466, with an expenditure of $327,383, $90,000 for forest service and inspecting, only $18,000 for fire protection, and $5,000 for forestry education.

The Laurentide Company, having completed, under the forestry division, a survey of its limits of 2,350 square miles of land, mostly timbered, and a map, showing drainage, roads, portages and trails, lookout stations, telephone lines and timber conditions, proposes now to enlarge its forest nurseries as a provision for replanting large areas of non-agricultural and cut-over lands. Another step toward forest management!

This progressive company is also experimenting with reindeer to take the place of dogs.

The timber revenue of the Dominion amounted to only $434,-196, the result of the cut of 375,000 M feet and some 500,000 railroad ties, lumber sale prices ranging from $13.80 to $18.30 at various mills. There are 7,371 square miles under license and 970 square miles under permit. The sales of lumber in the West ern Prairie Provinces are reported as 1,434,000,000 feet B. M., but it appears that only about 25% comes from home sources, the bulk coming from British Columbia, and nearly 20% from the United States.

The crown timberlands of New Brunswick in 1913 furnished 270 million feet B. M., yielding stumpage dues of around $300,-000. About 65% was spruce and pine; fir somewhat over 20%, cedar and hemlock about 10% and hardwoods a little over 1%. Other products added some $14,000 to the revenue.

Douglas fir makes up 68% of the cut of British Columbia, and the cut has increased 38% during the last two years, all other kinds showing decreases.

Poplar (Aspen) is coming more and more into use. Latest statistics show that 5,000 cords are used in Canada for the manufacture of excelsior, employed largely in packing furniture.

Dominion government forest reserves and parks in the Western provinces total 28,027,424 acres.

Two prizes of $100 each are offered for two photographs of the largest tree of a nut-bearing variety in the United States—chestnut, oak, walnut, butternut, pecan, etc.—and of the largest broadleaf tree which does not bear edible seeds—elm, maple, tulip, poplar, etc. Photos of cone-bearing trees will not be included.

These prizes are offered by two members of the American Genetic Association, Messrs. Charles Deering, of Chicago, and W. A. Wadsworth, of Genesco, N. Y.

The contest closes July 1, 1915.

It is hoped in this way to find out in what situations and under what conditions trees attain their best growth, and later, perhaps, to secure seeds, cuttings, grafting wood, etc., from the regions where such trees thrive, for purposes of propagation in less favored districts.

The University of Montana has now a Forest School, a new department opened this session, with Dr. Dorr Skeels, an expert logging engineer of the Forest Service, as Dean. Missoula, in which city both the University and the Federal Forest Service are located, is the center of an important forest region and of a rapidly growing section of the country.

Mr. W. N. Millar, for the past two years with the Dominion Forestry Branch as Inspector of Forest Reserves in Alberta, has been appointed to an assistant professorship in the Faculty of Forestry, University of Toronto. Previous to his leaving the United States Forest Service, to take charge of the work in Alberta, Mr. Millar was in charge of the Kaniksu National Forest.

Professor James B. Berry, formerly of Pennsylvania State College, is in charge of the newly established Forest School, of the State College of Agriculture at the University of Georgia, at Athens. This forest school is the only one in the Southern states offering a four-year course leading to the degree of Bachelor of Science.

Mr. James B. Berry, who has spent some time in Germany, wrote interestingly this summer, under date of July 1st, as follows:

"I have just completed my first year in Germany and am very well satisfied with the results. I must confess that the University courses are not markedly stronger than ours at home; yet because of the "post-graduate" work, the correlation of theory and practice is better. I have been able to visit many of the forests of Germany, and everywhere I have found much that is interesting. The localization of theories, which has taken place in the past, makes each locality a new study. . . .

"Forstmeister Meister of the Sihlwald, Zürich, is just completing 40 years of service on one forest and is to be retired this fall. I think his forest is in better condition than any I have visited thus far.

"While in Zürich I met Dr. Engler and his staff of assistants. My inquiries as to the card index of international forestry developed the fact that the man who inaugurated the idea had left Zürich, and that the present force had not had an opportunity to take it up. I think the real difficulty lies in the fact that no one had any conception of the enormity of the task, and that it was not until after the collection of data had really started that any idea was had of the amount of work necessary to carry it to a successful completion. One of the assistants told me that the work might be taken up again at almost any time, provided sufficient support were forthcoming."

On September 13, Dr. Wm. Saunders died at London, Ont., ending a most useful life in his eightieth year.

The older generation of foresters and forest reformers remember him as one of the early pioneers, not only in making propadanga but instituting practical measures in the direction of forestry work. In 1882, he was one of the three commissioners sent by the Canadian Government to the Forestry Congress at Cincinnati, who invited the Congress to meet in Montreal that same year.

As organizer and director for more than 25 years of the remarkable string of agricultural experiment stations of Canada, as early as 1886 he planted demonstration areas to test the behavior of different species and in different spacings under forest conditions at the Central Experiment Farm at Ottawa and at all stations. It was he who inaugurated the growing and distribution of plant material in the prairie section, which now under the Forestry Branch has reached such large dimensions. One of the most interesting and, for a northern climate, most complete arboreta owes him its conception and close personal attention. In the remarkably sane development of the agricultural experimental work of Canada Dr. Saunders, with rare versatility, kept his hand on every detail, and unquestionably was in all matters of agriculture the best informed man of Canada, and that not in an amateurish but more or less specialist manner.

With all the characteristics of efficiency, he combined a kindly and gentle disposition, which made him friends wherever he appeared.

We need not recite the ephemeral honors by which the contemporaneous generation tried to distinguish him—his work will live forever, and be his greatest distinction!

Dr. Bernard Borggreve, known by his literary activity and especially by his selection method of thinning, even to American foresters, died in his seventy-eigth year in April of this year.

He was retired as Oberforstmeister. For many years he was director of the forest academy at Münden, a highly suggestive teacher, but pugnacious to the extreme in literary warfare.

Mr. R. H. Campbell, the Director of the Forestry Branch of the Dominion of Canada, who attended the diamond jubilee conference of the Royal Scottish Arboricultural Society at Edinburgh in July last, was made a Colonial Honorary Member of that body.

COMMENT.

The great war, as everybody by this time must have realized, extends its blighting influences to the remotest corners of the earth and into the smallest concern of the single individual, of combatant and neutral nations alike. Even the FORESTRY QUARTERLY is no exception, for an important part of its raw material, the European forestry literature, is to a large extent, cut off. The German and Austrian magazines have ceased to arrive since August, and the probability is that they have ceased to be issued. We still receive, albeit belated, Swiss and Scandinavian publications, but the French have been discontinued or have at least not reached us.

That most serious consequences must appear in time may be inferred from the contemplation that in this war from 12 to 15 million men are withdrawn from useful productive occupations—and that the most efficient portion of population—while the less efficient portion has to feed these millions; that daily not less than 30 million dollars are wasted in destruction of materials, leaving out of consideration the destruction of capital values in the war zones; that five billion dollars' worth of trade (Germany's export and import trade) is practically entirely stopped, and that half the world's trade (that of the warring nations) to the extent of some 25 billion, is jeopardized; and the neutral nations see their trade injured proportionately.

At this juncture we are naturally inclined to speculate as to what the influence of the war on forest administrations may be. In our neutral nation, the financial depression which is in part here, in part still to be accentuated, will bring naturally in its train industrial depression, discourage enterprise, reduce not only exports, but home consumption, and hence curtail logging and mill operations. Such setback may also be inimical to forestry work, wherever such had been begun by private forest owners, for retrenchment is the word, and this can be most easily applied by pruning off unnecessary innovations. The same feeling of the necessity of retrenchment may also be reflected in the public services. At least expansion is not likely to be permitted; the forestry movement will be at a standstill while more urgent interests demand attention. In Canada, the same conditions prevail and in addition the call for men and for public expenditures for the war, as well as reduction in industrial enterprise, will also at least prevent extension of forestry work, if not curtailment.

In the European, especially the warring nations, the questions of personnel and labor supplies are probably of greater importance than the market question in the practical field of forest administration, although the problem of securing forest supplies may also influence the latter, and that sometimes in unexpected places. The first definite views of this latter influence comes from Switzerland. Strangely enough it is the supply of fuelwood that is mainly deranged and in its turn is deranging silvicultural operations, as we think possibly in part favorably. The usual import of 80,000 cords, which figure in the total wood import of some 35 million dollars, as well as the supply of coal is in difficulty. The federal government advises, therefore, the cantonal governments to take measures to meet the difficulty. The result will be a considerable increase in thinning practice besides increase of fellings in fuel forests.

Great Britain, which relies practically for all its forest supplies to the extent of around 160 million dollars on importations, has her imports to some extent curtailed, and in some respects has already suffered lack.

The Forestry Association points out that mine props and similar material could be supplied from native woodlands but for the excessive railroad freight charges which forbid traffic except by water. A petition to the Royal Railway Commission to secure the reduction of freight rates is supported by the Royal English Arboricutural Society and the English Forestry Association. The grievances have been aired for many years, but the war conditions have revived the agitation.

As regards importations, France can probably secure as much as its wood industries may at this stage of reduced activity need.

Most of the French forest area is in coppice (75%), which can readily be neglected for years without much damage. The government forest area is relatively small (3 million acres), and will probably suffer little.

But in Belgium and northeastern France, the scenes of the greatest devastation in modern times, forest areas have naturally suffered severe damage and sometimes utter destruction, and in the occupied country all forest administration has, of course, practically ceased to exist. It will take many years to recover the lost ground.

From all reports, it is evident that the forests in the war zone have played no subordinate rôle in the warfare, being used for cover of movements, for barricades and breastworks, and, on the other hand, having been razed to prevent such use by the other party. Artillery fire has destroyed or devastated many an old stand, and common fire many a coppice growth or young age-class. Recovery, as in all forestry work, will be slow—slower than that of the ruined towns and cities.

In the end, the worst hit, as in every other respect, will be Germany. While this country comes next to Great Britain in the size of its wood imports with 150 million dollars, it exports manufactured wood materials to the extent of 35 or 40 millions of dollars, so that we may assume that the wood industries reduced in their activity to strictly home needs can probably be supplied by the home product, with such additions as can be secured from Sweden and Austria. But the fine machinery of forest administrations will probably be very considerably damaged through the disturbance of its administrative personnel and woods labor. When we hear that Oberforstmeister Fricke, Director of the Forest Academy of Münden, fell in battle, we can assume that the majority of administrative officers will have taken the field. Indeed, such is the conception of duty to defend the fatherland that probably the whole service is dismantled and left in the hands of those Oberförster and Förster whose age prevents their joining the army. The universities are closed, and there is little doubt, the forest schools are in the same condition.

In Germany, different from France, the Forest Service is not directly related to the military organization, except that aspirants for the lower service fulfil their regular military duties in special battalions—Jaegerbattalione, where they receive instruction in forestry matters and are developed as sharpshooters. In the higher service there is only a group limited to 75 officers who, while pursuing their regular forestry education are under military organization as despatch bearers, an institution dating from the time of Frederick the Great—the *reitende Feldjäger Korps*.

Woodchoppers are probably also scarce, and felling budgets will probably fall behind as well as planting operations if the war lasts beyond spring.

If the Germans succeed in keeping their enemies out of the country, the effect of the disturbance of regular administration will be negligible, but if the country has to suffer an invasion, especially on the Russian frontier, where extensive areas of coniferous forest are located, the loss by fire will undoubtedly be heavy, and it will require a long time to bring back the equilibrium of age classes, which it has taken a century to establish. The same causes of forest destruction which have been active in France and Belgium may repeat themselves on German soil.

Of course, all scientific and experimental work is for the time abandoned, and after the war for some time there will be, no doubt, curtailment necessary in this direction for financial reasons. The question may be raised whether financial difficulties after the war may not influence the forest policy of the German states, should Germany lose and be mulcted by her enemies. In our opinion, there is no danger in that direction, the management under sustained yield in the state forests has proven too well as the best financial policy to be easily abandoned. The time for sale of state forest property as a financial need is passed. After the war of liberation 100 years ago, it was Hartig's merit that he prevented the sale of state forests; they were mortgaged instead, and it is only within a few years that the mortgage on the Prussian forests had been entirely paid off. At that time the forests were not one-tenth as valuable a property to loan on as now when their regular income could be capitalized at 600 million dollars for the Prussian forests, and for that of the whole of German forests at two billion dollars. The communal forests will not either be allowed to be disturbed in their administration more than necessary.

In Austria, conditions are more variable than in Germany, the far eastern forest areas being still exploited, and there as well as in the western part of the bulk of the properties is in private hands. Financial necessity is much more likely here to disturb the management for sustained yield, or urge less conservative exploitation.

Whatever happens, whoever the victor, such a dislocation of financial and industrial activity as this world war necessarily brings about can only be detrimental to all peaceful enterprises, such as forestry.

CONTENTS