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Subscribers are requested to note that, with this issue, the office of publication of the FORESTRY QUARTERLY is transferred from Ithaca to 396 Harvard St., Cambridge, Mass., to which all business communications should be addressed. This change of address does not apply to the Editorial department, which remains in the same hands and at the same address as before.

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 the forestry movement in the United States.

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

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

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FORESTRY QUARTERLY

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TO OUR READERS.

With this, the "sabbatical" volume, the FORESTRY QUARTERLY promises for the first time in its history, to become self supporting. As it is not the policy to make it a paying venture, but rather, as its finances permit, to enlarge its size and increase its usefulness, two new departments are to be added, namely, "Other Periodical Literature" under which caption brief references will be made to articles appearing in various magazines or journals, not of sufficient importance for briefing, yet of interest; and "Comments" which is to be open for short, free discussions of technical problems, technical notes, and editorial comment, and to which all readers are invited to contribute.

The Quarterly may claim to have demonstrated its usefulness to the profession, and may, therefore, frankly appeal to its readers for more generous support in the way of literary contributions.

So far it has rarely been necessary to solicit contributions, but it is believed that much more good material could be produced by those interested in professional development, in articles or short notes, and we appeal to our readers to give us their best support.

A FORESTER'S WORK IN A NORTHERN FOREST.

By Ellwood Wilson, B. A., C. E.

Forest Engineer, Laurentide Paper Company.

In July of 1907 the writer organized the Forestry Division of the Laurentide Paper Company, operating over Crown Lands held under license in the Valley of the St. Maurice and its tributaries, in the Province of Quebec. These lands lie scattered over a territory about 160 miles from north to south and about 100 miles from east to west, and generally contiguous although there are three isolated blocks of 50 square miles each and one of 225 square miles. The whole district is tributary to rivers and streams flowing into the St. Maurice, yet in some sections the drive requires two years. As yet, there is no railroad communication with any part of the territory, but the National Transcontinental Railway will soon tap a small section. The country is practically unbroken forest with a network of lakes and small streams and for the most part rolling, very rough in sections and without roads and trails except the old Indian portages. About 30 years ago the large pine was lumbered, and intermittent cutting has been done over about 1350 square miles.

The only maps which existed were the Government traverses of the main rivers and some plans showing the boundaries of the timber berths, both of which were often grossly inaccurate.

Crown lands in this Province must be cut according to Government regulations which prescribe a diameter limit.

The problems which had to be met were, therefore, the following: to ascertain and fix all boundaries; to make accurate topographical maps on which should be shown the rivers, streams and lakes, water-sheds, roads, trails, dams, &c.; to protect the territory from fire; to ascertain and map the various types of forest, and to obtain a reliable estimate of the kinds and quantities of timber available, and from these data to so regulate the cut that the Company's paper mill could have a supply of raw material for a long future.

One difficulty with all work in this region is the lack of communication; all supplies must be transported in canoes and on men's backs in the summer, and by horse or dog sleighs in the winter. For this reason work must always be planned for at least one year ahead, and every detail must be carefully thought out if the work is to proceed without delay and at the minimum of expense. Then, too, in the early summer from the first of June until the first of August the black flies and mosquitoes render the woods almost uninhabitable and in winter all woodswork must be done on snowshoes, and with the thermometer often from thirty to forty degrees below zero.

First, a survey party was organized, consisting of chief of party with his canoe man, plane table man with two rodmen, cook and assistant, and eight or nine men to pack, clear lines, move camps and so forth. The chief of party explores the country, locates the boundary lines, picks out the camp sites and lays out the work for the plane table man. The latter uses a small 15" plane table with telescopic alidade having stadia hairs and his two rodmen are equipped with balsam poles, having a ring of bark peeled every foot. Where the country is very thick with underbrush, traverses are made by pacing, and where there are roads as in the neighborhood of the settlements, these were mapped by buggy traverse. The plane table man as need be acts at the same time as fire-ranger. All work incident to camp moving, packing, &c., is done for the plane table party so that they are always free to keep steadily at their work. All boundary lines, lot and range lines, county lines, rivers, lakes, creeks, roads, trails, portages, dams, camps and caches, principal hills and ridges, burnt areas, pure stands of jack pine and black spruce swamps are located, and, where valuation surveys have already been made, as was done in one section, the beginning and end of each strip was located. Traverses are all closed with a limit of error of 1 in 66 and the error has only once or twice exceeded 1:132. This gives maps sufficiently accurate for the needs of the work. The rate of progress of this work during the past year has averaged fifty square miles per month, and about 700 square miles have been mapped.

The most important problem in the management of timber lands is that of fire protection. In this Province, the Government formerly appointed the rangers, generally men with some political backing who took a shot gun and their fishing tackle and located themselves comfortably in some village or depot and occasionally went a little way into the woods. This proved, naturally, so unsatisfactory that the holders of timber licenses asked to appoint their own rangers, and this has greatly increased the efficiency of the protection. This Company organized a corps of fire rangers consisting of seventeen men, mostly college men, either graduates or those who were studying forestry and wanted some practical knowledge of the woods. An inspector was appointed who travelled with a canoeman over the whole country to see that the rangers were doing their duty, and were supplied with provisions. The rangers travelled two together, each party having, besides a light fifteen-foot, canvas-covered canoe, baker tent, with mosquito net, light sleeping bags and cooking outfit. In addition each party had two axes, one shovel and two folding canvas buckets. Two men covered about one hundred square miles, the districts being laid out so that some large streams ran through each one of them and as all summer travel is by water, the rangers could see all parties going into their district, follow them up and put out at once any fires which might be started. They were required to keep a diary showing their location each day, the weather, names of persons going through their territory, a list of all fires, how, when and where started and by whom, when discovered and how extinguished. During the exceptionally dry weather of the past season only twenty fires were started and all but one were extinguished without damage. The one which could not be controlled was in a section which had been lumbered, and the tops and slash made it impossible to check it. The damage however was slight, but it would have been much worse if the rangers had not been there. All rangers are ex-officio justices of the peace with power to arrest any one caught breaking the fire laws. One arrest was made, the offender being fined fifty dollars or three months in jail under suspended sentence.

The most dangerous class of people in this country, as shown by an analysis of the causes of our fires this past season, are the settlers, who have no regard whatever for the law and are most reckless in setting fires in their clearings. We hope by educating these people as to the value of the timber, teaching them that it is the forest which gives them work and fire wood, building material and stream protection, and by making prompt arrests in cases of violation of the law, to greatly reduce this source of fires.

This coming season trails suitable for horses will be cut and it is hoped to install a few telephone lines by which help can be summoned in case of necessity. The cost of ranging, which includes extinguishing such fires as were started amounted to eighty-five hundredths of one per cent. of the value of the timber lands.

In addition to fighting fire the rangers cut out trails, watched caches, and made reports on the location and character of the timber.

It was realized that before any definite working plans could be advised, an immense amount of preliminary work was necessary and, therefore, until such time as this information could be obtained, the most important work would be to minimize the waste in cutting and to protect the young growth, and as far as possible do nothing to hinder the natural reproduction, which in this country is excellent. In order to accomplish this, a set of cutting regulations was drawn up, the main provisions being inserted in the contracts with the contractors, and a corps of inspectors organized to see that the regulations were carried out. The men who had fire-ranging in the summer were used for this work. Each inspector was given an assistant who spoke French and English, sleeping bags and cooking outfit, a twenty-five foot tape, magnifying glass, scaling rule and stamping hammer. A cabin with bunks and stove was built for him in a central location where he could easily reach all the jobbers cutting in that territory. The limits were divided into twelve districts, making twenty-four men engaged in inspection work, and a head inspector put in charge of them. So far, this season, the scheme has worked admirably, the jobbers have almost without exception shown themselves willing and anxious to follow the regulations, and the amount of wood saved to the Company by low stumps, taking out all sound trees of merchantable size, seeing that no logs are left in the woods, no trees left lodged, and that all profitable material in the tree tops is taken, will certainly pay for the cost of the inspection servicc. A weekly report in duplicate is sent into the head office, giving each jobber's rating on a separate sheet, showing in detail the rules which have been infringed, and in the case of stumps cut too high and trees cut under size the number of each species is given, and the head office immediately sends a bill to the offending jobber for the amount, as specified in his contract.

In addition to this work, valuation surveys by the strip method, using a party of four men, have been run over 100 square miles of territory, and general reports of the character and approximate amount of timber on 584 square miles of territory have been made. Besides, growth studies were made on six hundred and fifty balsam and three hundred spruce trees, giving the data for volume and yield tables. Five thousand trees were planted. Studies of the waste in logging under former methods have also been made.

The work is organized as follows. The Forester is in charge of the whole establishment of 42 men. One man attends to office work, supplies and outfits; one man in charge of maps, does the drafting and attends to such boundary surveys as must be made from time to time to determine whether trespasses have been committed or else to prevent them. There is also a head of survey division in charge of topographical surveys, and a head of fire ranging and inspection service.

Since the Government prescribes a diameter limit, not much can be done along silvicultural lines, except to try and log so as to hinder reproduction as little as possible, and to leave seed trees. The writer has noticed, however, that the balsam reproduces much more easily and rapidly than the spruce, and as the spruce has been the favorite wood for pulp the character of the forests has been gradually changing, the removal of the spruce favoring the reproduction of balsam which is everywhere coming in rapidly and crowding out the spruce. As the balsam yields less pulp and as throughout this country it is of poor quality, and at least 40% affected with heart rot and red heart, it seems that such a system of cutting is slowly but surely depreciating the value of the limits. This Company has gradually increased its cut of balsam, and the writer has advised cutting the balsam clean, down to the diameter limit set by the Government and leaving the spruce to grow for a future cut. One very important side of the work has been the business management which it has been endeavored to standardize, simplify and so conduct, that accurate cost records could be had of all the different kinds of work, careful inventories kept, and red tape, as opposed to practical system, eliminated.

With these ends in view, standard instructions have been issued covering different kinds of work; standard report forms, returns of expenses, analyses of costs, survey and valuation survey records, &c., have been prepared, all of a uniform size so that they can be filled into loose leaf binders. By a careful system of cost keeping, different parties doing the same kind of work can have their costs compared and past experience can be used in planning future work. In handling parties so far from a base it is very necessary to have a system which will show just what each has in the way of provisions, outfit and so forth, so that they will not run short and that the work will not be delayed by lack of supplies or necessary equipment.

Forestry is certainly not worthy of the name unless it is practical, and it seems to the writer that the most rigorous business methods should control its practice. Cost data are sadly needed, and while conditions vary widely in different parts of the country, owing to topography, weather, climatic conditions and so forth, still such records ought to prove just as valuable to the forester as they do to the engineer.

The forest policy of the Quebec Government is a most admirable one in theory, with one very serious exception. All timber lands are the property of the Crown and are not sold, but the license to cut is leased, practically in perpetuity, for a nominal ground rent and so much per thousand feet stumpage dues when the timber is cut. Cutting regulations are in force, but there is no adequate inspection and the regulations are obeyed by the licensees only because they believe it is to their interest and profit to do so. But the Government reserves the right to take lands out of a license-holder's territory for settlement, giving him until the first day of May, following the issuance of a ticket of location to a settler, to remove the timber down to the diameter limit set by law. The settler generally waits until the Companies have finished their winter's operations before applying for his land, so that there is no possibility of the Company removing the timber, and as the diameter limit does not apply to the settler he is able to cut the land clear, selling either to the original license-holder or to some rival concern. There would be no objection to the sale of lots to settlers if the lands were actually agricultural lands, better fitted for farming than for the growing of timber, but this is not the case. No attempt is made to classify the lands, and, when a license holder protests, some local official is sent to make an examination and report, and he is always ignorant and generally dishonest. Investors in timber licenses in this Province have called the attention of the Government to this state of affairs for a long time, and the general feeling now is one of distrust and insecurity. Large holders of timber lands are very anxious to manage them according to the most up-to-date forestry methods, are willing to put money into permanent improvements, roads, telephone lines, plantations on burnt over areas, etc., but they dare not do this since there is no assurance that at any time their ground rents and stumpage dues may not be raised beyond all reason, or their best lands given over to speculators masquerading as settlers. Only this fall, just before the general election, a member of the provincial parliament went to the Minister of Lands and told him that in order to win his election he must have some lots for his constituents. The order for the sale of sixteen lots was issued to him, lots whose only value consisted in the timber on them; there were no roads, the soil was poor, the land hilly and in no sense fitted for agriculture. Fortunately, the license holder discovered what was afoot, and by taking the matter directly to the Prime Minister succeeded in getting the sales cancelled. Capital, however, will not feel secure in investing in this province until such things are eliminated. License holders are practically in a position to be black-mailed at any time.

The great need is for an honest and intelligent classification of lands so that those better fitted for timber than for agriculture can be kept in forests, and that the man who puts in money in timber licenses can feel that he is being justly treated and his rights protected. Nowhere on the American Continent are owners of timber lands more ready and willing, indeed anxious to manage their lands under forestry methods than in the Province of Quebec, and its wealth lies almost wholly in its forests and water powers, and every thing possible should be done to conserve and protect them for all time to come.

Instructions to Fire Rangers.

You will continually patrol the territory assigned to you, following routes given. You will try to find on your routes hills from which a view of as much territory as possible can be obtained. Visit these points as often as possible during dry weather. Watch out for smoke. Should smoke be seen, proceed at once to that locality and attempt to extinguish the fire. If you find this absolutely impossible, go to the nearest place where help can be obtained. Put out the fire with water or sand if obtainable; if not, beat with Balsam or Spruce boughs. Do not leave any fire until it is entirely out. Examine carefully to make sure that the fire is not burning in the ground. If you cannot put out the fire by the means above given, try back-firing. Always observe the direction of the wind before starting back-fires, to make sure that they will serve their purpose and not spread the fire in a new direction. The best time to fight fires is in the evening and very early morning. Fires usually die down at night. Always remember that the best places to fight a fire are along streams, roads and tops of ridges. Fire always rushes up a ridge, goes slowly at the top and runs very slowly down the opposite side.

Camp-Fires and Smudges:

In building a camp-fire or smudge, choose a place where there is no moss or duff in which the fire might smoulder; then clear the ground of all inflammable material for four or five feet in every direction; then build your fire. Never leave a fire once kindled until you are sure it is entirely out and not burning in the duff. Never throw away a lighted match or cigarette, or lighted pipe ashes. Never make a fire against a dry stump, log or stub.

Settlers:

Do not in any way antagonize settlers or farmers. Always be civil and courteous and use tact. Always pay for your meals. Impress upon them the danger from fire and resulting loss of work, and of their own timber. If they are burning land, watch them, and see that their fires are kept away from standing timber. Warn settlers making fires unlawfully or carelessly, and, if the warning is not heeded, make arrests at once.

Hunters, Trappers, Sportsmen:

Watch all such people going into your territory. Call their attention to fire-posters. Tell them the law regarding fires. Explain the necessity for care. If possible follow them up; see that their fires are extinguished. Let them know they are being watched. In case of carelessness warn once, then arrest promptly.

Tents:

Tents must be protected from sparks. Fires must not be made too near. Shake the tent after a rain before rolling up. Be careful not to tear in driving stakes. Always carry your tent done up in a ground cloth.

Sleeping Bags:

Sleeping bags should be well aired once weekly.

Dishes:

Dishes must be regularly washed; avoid denting or bending them.

Canoes:

Canoes must not be dropped, and great care must be taken not to run on rocks, trees or snags. Do not leave the canoe in the sun. Turn upside down when on land.

Rapids:

Do not run rapids unless you have looked them over and feel sure you can do it.

Responsibility for Outfit:

Men will be held fully responsible for outfit, which will be charged one-half to each man. Credit will be given in full if the outfit is returned in good condition, showing ordinary wear and tear; tears and burns in tents will not be so classed; broken or badly damaged canoes will be repaired at the expense of the party.

Fishing:

Up to the first of October, fish can be taken for food. Do not catch more than can be eaten. No fishing or hunting is allowed on Club preserves.

Hunting:

Up till the first of September, it is against the Law to kill moose, caribou or deer. No infringement of the game laws will be allowed. It is forbidden to kill bear at any time.

Drinking Water:

Avoid drinking water that is unboiled at settlers' cabins; and St. Maurice water below La Tuque. Always see where your drinking water comes from.

Provisions:

You will obtain provisions at nearest Company Depot, or Depot of some other Company, giving order for same on order form furnished, putting all details of order on stub: Where obtained; Date; Full list; Signature.

Laws:

Read over carefully the following extracts from the LAWS OF THE PROVINCE OF QUEBEC in regard to fires. Remember that you are Government Officers, responsible for the execution of these laws.

Reports:

Reports must be made monthly and must contain a detailed record showing the following:

Weather; where camped; route followed; persons seen (always ask the names and addresses of persons going into the woods); condition of the woods-wet, dry, etc.; condition of the rivers—high or low.

Special reports must be made in case of fires, no matter whether they are large or small. Give the following data:

When first seen; how started; when; by whom; time required to go to the fire; means used in extinguishing it; time required to put it out; assistance, if any; names, addresses and time spent by each man; area burned; timber burned; say whether top fire, ground fire or brush fire; and whether trees have been killed or only scorched.

Other Work:

When weather is wet, or there is no danger of fire, you will be expected to cut trails and cruise or make reports and forest studies. Should a river drive come into your territory, watch to see if the men are careless with their fires, smudges, matches, etc. Report any carelessness at once to the Foreman of the drive in writing, sending duplicate report as soon as possible to the office.

Watch the limits of other Companies and report if they have Rangers out, giving their names. Should any Company not have Rangers on duty, report the fact at the first opportunity.

Instructions to Woods Inspectors.

You will look after N. N. and his Sub Contractors' territory, and give all your attention to the following:

1. That jobbers do not chop any White Spruce trees under 11″ on stump, Balsam trees under 9″, and Black Spruce under 7″.

2. That no tree-tops be left in woods that would measure 4″ and up in diameter at small end, by 13½ ft. long, in either Spruce or Balsam.

3. It is to the Company's interest that no Balsam or Spruce wood fit for pulp be wasted in either any felled trees, or any knocked down by felling larger trees. Even though there would be some loss in the log, this loss can be fairly deducted by Culler. Trees that break in felling must be got out, and should Jobber fail to do so, you will report number of trees thus left and contents in feet Board Measure.

4. That Jobbers do not butt Spruce or Balsam trees too much, and leave any sound wood laying in the woods. We would rather have a three inch loss in center of a fair sized Spruce log,

than lose a piece of sound wood 2 to 6 ft. long, often caused by butting.

5. That Jobbers are topping all logs with saw. We will not receive any logs topped with axe.

6. See that stumps are cut as close to soil as possible. Any cut at over 2 ft. from ground, you will keep account of, giving name of Sub-Jobber, and quantity of such stumps found.

7. In burnt and other territory, all Spruce and Balsam timber that is sound and dry, you will have cut clean, as small as 4″ in diameter at small end, by 13½ ft.; Tamarac and Pine not less than 9″ at small end, by 13½ ft.

8. Any Pine logs that Jobbers are liable to leave in woods on account of small rot in butt, which you notice Jobber does not haul, and that in your estimation there is sufficient good Pine timber in said log to warrant its hauling, and Company's expenses on same,—you will measure said log, advise the Company and also the Culler. Also see that Pine trees are felled in operations, especially in Croche territory—many such trees were left last winter, Jobbers giving for excuse that timber was too large and heavy.

9. You will have a Culler's stamp, and when examining logs in skidways, we want you to stamp them over, giving each log several good marks. See that Jobber has a good square sharp L. P. stamp, and not one all worn, with part of L. and P. broken off. Also do not fail to pay particular attention to the bark-marks by Choppers—have them long and wide enough in the wood to make them plainly seen.

10. You will measure length of logs in woods when Jobbers are cutting. This last winter a good percentage of our logs measured anyway from 12 to 13 feet 5 inches. We want logs 13½ ft. long. Should you find any shorter than 13½ft., mark length in blue pencil, so as Culler will notice when culling same.

11. You will furnish the Head Office and District Agent with a weekly report of your work, giving Subs' and Jobbers' names and location; and give full details of complaints against Jobbers in accordance with numbers on above instruction sheet, giving quantity in all cases.

12. While passing through some creeks where you find L. P. logs wintering over, you will stamp over all you can find.

13. When deep snow came last spring, Jobbers in Croche district felled two small trees to prevent log tree they were cutting from sinking deep in the snow. We do not wish this waste repeated and call your attention to same, so that you may warn Jobbers who may be intending doing this same kind of work this season.

14. Warn Jobbers not to cut good seed trees, bearing cones, which you will blaze special. Where several such trees are close together, all but one may be cut.

15. Do not allow the use of good lumber in building of camps and roads and skidways. Where Poplar and Birch is available, compel their use.

16. See that all logs are painted one end before being received. If it is at all possible, it would be advisable to paint logs in skidways before being hauled to landings.

17. See that no logs are left under snow in skidways.

18. Landings must be good open place on river and well cleared, skids being placed under logs.

19. As this is only second year of having Special Woods Inspectors, you must use your judgment in a good many cases, and if gone about in right way, there should be no reason for trouble between Jobbers and you for carrying out your instructions.

You will make a weekly report in triplicate, one copy to be given to the District Agent, and the other two to be forwarded to Mr. Kane at Grand Mère. All rollways must be cleared before piling logs, and must be in good places, must have no trees or brush in front of them, and skids must be placed under the logs. A badly placed skidway means loss of time and money to the Company in rolling.

All trees above Government size must be cut in your territory except two or three seed trees per acre which must be chosen for size, thrifty growth, and soundness.

Any live or sound dead trees, over Government standard, left by Jobber, must be marked with a number, counted, and the total given in weekly report. Each tree must be measured three feet from the ground and the diameter and species given.

Bark marks must be carefully watched and you will see that the letter "L" is cut through the bark and into the wood at least six inches long.

Logs must be stamped by Jobbers as soon as cut and you will see that no logs are piled unless bark marked and stamped.

No tops or branches must be allowed on ice.

See that all spruce and balsam used for skids is cut up and hauled out.

See that no logs are left by being covered with snow.

Should any fire occur through the negligence of any Jobber or his employees, put it out, and report at once, location, name of Contractor and Jobber, and the damage, number and size of trees burned.

You are in the woods to inspect and see that the Company gets all that it pays for and requires under its regulations. These regulations are reasonable and are meant to be enforced. You are under no obligation to the Jobber. You will be polite but firm with these men, remembering that they are ignorant, and explain everything to them carefully, patiently and often. Try to make friends with them, and give them every assistance in your power.

No trouble will be allowed with any Jobber, and each Inspector's work will be judged by its results. The high standard set by you all as fire rangers must be maintained, and I feel sure that you will continue to uphold the reputation of this Department.

Instructions to Woods Inspectors for Forestry Work.

Following the jobbers this winter you will measure as many trees as possible in white spruce, black spruce, white pine, red pine, jack pine, balsam, and tamarac, in the following way.

Height of stump from ground.

Diameter inside the bark on average axis at stump height.

Diameter outside the bark on average axis at stump height.

Repeat the two last measurements at each 13.5 foot cut.

Length of trunk from last cut to extreme top.

Diameter breast high 4.5 ft. outside bark.

On the stump and average diameter, and at each 13.5 foot cross section you will count the rings from just inside the bark inward to the heart. You will mark each tenth ring with a pencil, and measuring along a straight line give the length of each line from one ten year point to the next, taking for your notes the length of the first ten year joint from the outside, the length of the second from the outside and so until the center is reached.

Only normal trees are to be chosen, also average trees, no forked or unsound, or exceptionally large or small or suppressed trees should be measured. Give the type from which each tree was chosen, as ridge, slope, level ground, or swamp. In case of slope, note whether it has north, east, south or west exposure.

Notes must be taken on paddles and copied on forms. Make them complete and full, remembering that you will not be working them up, do not trust anything to your memories. The character of the notes will be used in judging of your work. Clear cut, clean, legible notes, showing good judgment will be counted very much in your favor.

Study your territory carefully and report fully on it.

THE FOREST SCHOOL AND THE EDUCATION OF THE FORESTER.*

By Hugh P. Baker.

The able English educator, Sir Horace Plunkett, in a recent comparison between colleges of a certain class in this country, gave expression to his observation of a well-marked change of trend in the general preparation given our young men and women before they enter a business or professional career. He emphasized the changed attitude of our people toward industrial education, which is causing courses of study in high schools and college curricula generally to be so changed as to fit the young people for not only future college work but for actual everyday service. There is now a general belief, although not always expressed clearly, that our young people should be educated, not for themselves alone, that they may earn—and spend or accumulate, but to increase their practical usefulness—that they may be of increasing service to the State.

Many of those who directed the early development of our agricultural colleges fortunately have lived to see that more than one vital principle originating during the struggle which agricultural education had for recognition is now being incorporated, or in some instances is largely replacing older systems, and more than any other cause has brought about the idea of educating our young people away from themselves that they may accomplish the most for others. Agricultural education has for its aim the improvement of the condition of every tiller of the soil; the raising of the profession of farming to the standard of other industrial professions, and the ever enlarging investigation of plant and animal growth and production that the energy of production may be greatly enlarged yet conserved. The contact with and the carrying out of such ideals on the part of young men has broadened their vision and has influenced the attitude of every other group of servants of the nation.

The gradual development of great movements having for their purpose the protection and perpetuation of the natural wealth of

*Read before the American Forestry Association.

this country and the promotion of the policy of the land for the people—with all that it contains and can produce—has slowly brought together a group of workers who have learned that the work with these great movements has been more enjoyable, more profitable to them than the mere accumulation of riches from other sources. These large movements, recent though they are, such as forestry and irrigation—all that we mean by conservation—are already having tremendous influence upon the trend of our educational development.

Forestry, which everywhere is increasing the wideness of its scope and every year meaning more to the general welfare of the people, is peculiarly different from other and often seemingly similar professions in the demands which it makes upon those who will follow it as a life work. There is no profession outside of the historic professions of the law, medicine, and the ministry, which demands a more thorough training. The forester is brought into contact with and must deal with every phase of our economic development; he must be able to deal successfully with every class of men, which necessitates a knowledge of the principles of business law controlling the business relations of men. At the same time he must be a forester with a thorough knowledge of the principles of silviculture, forest mensuration and management, lumbering and utilization, and must understand and know how to combat such enemies of the forest as fire, insects, and plant diseases. And last, but by far not least, he must understand and be able to appreciate the relationship of forestry to other great industrial movements in this country. Dr. Henry S. Pritchett, in a recent article upon professional education, sums up nicely the dangers of hasty and unprepared entrance into any profession which has to do with the welfare of our people. He says in part: "The only possible protection and assurance which the public can have is to insist upon fundamental training as a preliminary to any practice and it may rightly suspect the motives of any set of would-be practitioners who undertake to evade these reasonable requirements * * * not only does the public find its sole protection in the uniform requirements of high standards for entrance into these professions, but the tolerance of low standards means the maintenance of an open door for the benefit, not of the deserving, but of the unfit." If the profession of forestry is not kept to a high standard, the fault will lie alone with the trained members of the profession.

Young men of to-day are often attracted by forestry because it is a new profession, because of the glamour of out-door work in top boots and the rather wide travel which has gone with the work in this country up to the present time. It has and is attracting many young men whom, unfortunately for the men themselves, the years will quickly sift out, and yet there will be many who will get from the profession both permanent pleasure and great opportunity for usefulness and development. The different grades, the different opportunities in the work, which are more apparent than real, have demanded differences in the method of theoretical and practical training and the length of the training. Already we are developing different schools as to our attitude toward practical training; as to how little or how much one must have and whether the practical work should consist of the study of methods or the application of principles. A considerable number of graduates have been out of our forest schools for from six to eight years and with certain limits the character of their professional work and their development will determine the correctness of the training given in the schools. Unfortunately, the nature of practical work in forestry is such, at least as far as the management of timberlands is concerned, that a man may continue a wrong beginning or the practice of mistaken methods for some little time before such work can be demonstrated as wrong.

Because of the absolute newness of forestry and the unusual demands on the government bureau having the work in charge for men with at least some training, institutions of every grade giving instruction in forestry have until recently of necessity given undergraduate training to college graduates and others. This is being gradually remedied by the recent development of undergraduate courses and schools; by the raising of standards for entrance to post graduate work, and by the gradual accumulation of a considerable number of trained men to meet the immediate needs of the country. The exceedingly strong demand during the past five years for men with some forestry training has put into the field a number who have obtained the training by short cuts, which have been along the line of intensive drilling in methods of practical work with little emphasis of the principles involved. If such men have had previous collegiate training, or if the men without proper foundation work are located in the same forest region as that in which the practical drill was given, they get a start toward development which has landed and may continue to land them to a safe place in the profession. Any institution in which such short cut work is given is decidedly unjust to students if it does not make clear to them that satisfactory development in the profession can come only as result of continued and advanced training which that institution is not able to give. It will be indeed unfortunate and humiliating for students to begin this short cut training at say the age of 21 or 22 with the expectation of becoming full fledged foresters, and then at the age of 25 or 30 find that they must start over again to learn the fundamental principles of the work of which they may have an excellent practical knowledge, if they are going to reach the top of the profession. I contend that no young man is starting in to-day to train himself for forestry who has not in view rapid advancement, and that to the top of the profession. If the development of men in other professions means anything, we are safe in believing that the man thoroughly trained in principles, with full development of observational and investigative powers, through a certain amount of practice in applying principles, is the man with the right start and the man who can develop indefinitely.

Because the proper training of a forester must include much work along the line of botany, and because the principles of plant growth and propagation are taught in horticulture, we have had a number of men with excellent training in these two last named professions who have entered the profession of forestry on the ground that they know the forest trees, or understand principles of growth and plant propagation. While it is true that well-trained botanists are peculiarly fitted for the investigation of certain phases of plant growth and distribution which are of great importance to the forester, yet the development of properly trained men cannot help but eliminate in the course of time these men who are trained in but one phase of the subject. Furthermore, as the harvesting of the forest crop and its proper utilization demand a considerable knowledge of civil and mechanical engineering, we find men trained in these lines taking upon themselves the practice of forestry. All of this is the natural result of the development of a profession which is exceedingly important in the welfare of the entire country, and which is attracting attention from everyone. Professions now well established have gone through the same stages in their development, and we need not worry as to the outcome in forestry. And all of this not as a criticism, but a pointing towards sources of danger in the development of trained foresters. There is no question but that we would be many years behind the present splendid development had not persistent interest been taken in forestry by engineers, agriculturists, botanists and horticulturists.

Already educational work in forestry has developed far enough to allow some suggestions as to the future. It is probable that there will be two main classes of men with a possible third class demanded in the future of forestry in this country. First, the forest ranger or woods superintendent, whose training will be largely along practical lines; second, the technical forester, who will plan and carry out the management of large forest areas and guide to a large degree the work of the forest ranger and do the investigative and administrative work demanded, and finally a group of men dealing with the educational problems. This last group must of necessity be drawn from the technically trained foresters, but their training should be as continuous and advanced as possible.

In line with the demands of the profession there probably will be developed three classes of forest schools: First, the rangers school or academy, which plays an important part in the training of old world foresters, and which is especially fitted to prepare men who have not the requisite training to enter more advanced schools for positions as forest managers and rangers. The more advanced schools will draw upon these schools for students, for there will always be many who will wish to take more technical courses because of inspiration received in the elementary schools. I was very much impressed with this while giving a short course in forestry for rangers at the Colorado Agricultural College, in February, 1907. There were some thirty men whose schooling ranged from a few months during two or three winters to four years in some of our leading universities. The training given in the short course was, of necessity, very elementary in nature, and yet the eagerness of the men seemed to show a great need for the training of men for work on our National Forests. The establishment of a ranger's course of nine weeks at Colorado College, Colorado Springs, is a step decidedly in the right direction. Following the first rangers' school, it is probable that there will be an increasing demand for schools and academies where young men of limited preliminary training and limited finances may get enough to start them in the early grades of the work. The step which Pennsylvania has taken in the establishment of an academy for the training of men to manage the State reserve, is an excellent one. The rangers' schools or academy as so far organized in this country, has been taken to the woods, though by so doing they are largely limited to drilling in methods of practical work which may be of the highest grade, but which cannot take the place of thorough study and application of principles. It is probable that our academies will not be provided with regularly established and fully equipped departments of botany, geology, soils, chemistry, mathematics, and civil engineering, without which the requisite foundation work cannot be given.

The undergraduate school of forestry has been in existence for a little time in this country, but is only now taking an important place. The undergraduate schools, especially if located in institutions where there are schools of engineering and agriculture and fully developed experiment stations, may be made an exceedingly important factor in the preparation of young men for forestry. The men are taken during their formative period and are in the work for four years, giving such a hold on them that they may be controlled and directed even after graduation, which is the case with no other class of forestry students.

A brief statement of the work which with our present development should form a part of the curriculum of our undergraduate schools may be of interest at this point. During the first year it is an advantage to give the foundation work which is an absolutely essential part of the training, and which students will take with better grace during the first two years than later. The subjects of advanced mathematics, botany, chemistry, plane surveying, some modern language, rhetoric and English literature and shop work may make up the first year. At the same time very elementary phases of forestry may be touched upon in connection with the plane surveying, botany and shop work, and the forest school will find it to its advantage to meet the men early in some of its own work. In the second year the preliminary training should be continued and should also include such subjects as zoology, entomology, physics, geology, soils, agricultural chemistry, plant propagation, and breeding, organic and agricultural chemistry and continued work in French or German and English composition. The plane surveying should be enlarged by considerable work in topographic surveying. If this course is followed the last two years may be given largely to essential forestry subjects and very closely related lines. These forestry subjects, such as mensuration, silviculture, forest protection, lumbering and utilization, advanced histology and wood technology, with various lines connected with forest economics should be covered thoroughly with enough practical work to acquaint students with application of principles involved. There should be given in connection with this work in forestry more or less work in forest entomology and problems involved in fish and game preservation with a continuation of civil engineering dealing with the building of roads, trails, splash dams, etc., and a course of lectures of greater or less extent involving elementary principles of irrigation engineering. It seems desirable to leave some leeway for the men to specialize or elect during their last year advanced work in political economy, psychology, or the languages, or to follow bents along the lines of advanced botany and plant diseases, or work in civil and mechanical engineering. During the first four years time should be given for several weeks in lumber camps and saw mills, and students should be expected to take a number of trips for inspection of examples of practical forestry work and of industries closely connected or dependent upon the forest. Often men may be placed during summer vacations in lumber camps, saw mills or yards, or in forest nurseries, and my experience has been that the men are more than anxious for such practical work. After a year or more of practical work, men who have completed a four years' undergraduate course, should if possible, go to our postgraduate schools to continue their training along the lines which were most attractive to them in their undergraduate work. The opportunity for development and advancement along special lines of forestry is increasing rapidly, and within a surprisingly short time there will be a strong demand for a high grade of post graduate work. It is pleasing to note that some of our post graduate schools have already matured plans for advanced courses in lumbering, silviculture, and forest management in specialized forest industries and forest economics.

The post graduate school is the most important factor in the development of forestry in this country, not only because it will play an important part in the training of professional foresters, but more than any other factor it can influence and control the standards to be maintained in the work.

That the educational work in forestry in this country may be made logical in its sequence from rangers' schools to post graduate work and that the schools may be more closely drawn together, it is hoped that there will develop an organization of forest school instructors who may suggest, if not determine, the processes and methods whereby we will produce trained foresters in this country. It may be that the Society of American Foresters can accomplish this as the American Medical Association is influencing to a large degree the training of physicians.

THE SCIENCES UNDERLYING FORESTRY.*

By B. E. Fernow.

In connection with the preceding article by Professor Baker, the following thoughts on the relative importance of the Sciences underlying forestry, formulated for a different occasion, may not come amiss.

The writer agrees most fully with the tripartite subdivision of foresters which Professor Baker makes, namely, into lower grade local executives, higher grade local managers, and highest grade leaders, and that according to the needs of these three classes schools or curricula ought to be devised.

It is still open to question in my mind, whether an undergraduate course cannot be devised and conducted that shall at least satisfy the second class. My experience at Cornell University would lead me to believe that a sufficient basis can be laid by such a course to enable the later development in the practice of first class managers; and even leaders may develop out of those graduates, who, endowed with native ability and through private study, develop superior judgment. After all, the personality of the man, and the personality of the teacher have more to do with the result than the course.

The undergraduate four-year course, as outlined by Professor Baker, very closely resembles the one laid out by the writer for the first professional forest school at Cornell University, and again revived in the University of Toronto.

To meet the requirement of a better educated class of foresters, and yet to maintain the idea of an undergraduate course, a course has been devised at the University of Toronto for those that can afford it, which, lasting through six years, leads to both the Arts degree and the undergraduate Forestry degree at the end of the six years.

The idea underlying this arrangement is the early introduction into the professional subject and a longer occupation with it, and thereby a longer time for digestion of the same, while the added humanistic or cultural courses will help to broaden the mind in both cultural and professional direction. This, we think, is prefer-

*Read in part, before the Sigma Xi Society.

able to the arrangement of securing the Arts degree first, and then in two short years a Master's degree in a subject for which the Arts course has only questionably prepared the student.

It may be of interest to show what form this novel combination course has taken, which does not, however, displace the regular four year's course.

I	week hours
Mathematics	3
Physics	5
Biology	6
German and French	4
English	2
Latin	3
Forestry	1
	24

II	week hours
Chemistry	4
Biology	4
German and French	4
English	2
History	3
World History	1
Forestry	2
Science Option or Latin	2
	22

III	
Chemistry	4
Mineralogy	3
Geology	1
Surveying (Plane)	4
German and French	2
English	2
History	3
World History	1
Forestry	1
Option in Mathematics or Physics or Philosophy,	2
	23

IV	
Chemistry	2
Geology	2
Meteorology	1
Biology	3
Surveying (Topographical)	4
Political Economy	2
Constitutional History	1
Forestry	4
Philosophy Option	1
	20

V	
English	2
Political Economy	3
Constitutional Law, History	2
Philosophy Option	2
Science Option	3
Forestry	6
	18

VI	
Mathematics	2
Chemistry Applied	1
Political Economy	2
Law, Mercantile	1
Engineering	4
Philosophy or Science Option	3
Forestry	5
	18

Forestry is an art which, like agriculture, is concerned in the use of the soil for crop production. Just as the agriculturist is engaged in the production of food crops, so the forester is engaged in the production of wood crops. Finally, both practice their art for the same practical purpose, namely for revenue. The art is carried on as a business in which naturally the money result is the ultimate aim.

All arts have a scientific basis, are applications of science proper, or of parts of various sciences. The knowledge of these may have been acquired either systematically or empirically, and may be possessed in different degrees; but even the commonest arts are based upon more or less systematized knowledge.

The butcher, the surgeon, the sculptor, all rely upon a knowledge of anatomy; although, according to the different object, their knowledge is of a different degree and acquired in a different manner. Similarly, the botanist, the horticulturist, the forester need knowledge of botany, each in a different manner.

Success and improvement in the practice of the technical arts depends finally upon the volume of applicable knowledge of sciences. Volume, however, is a product of area and depth. And as even the specialist possesses depth only in certain parts of his field or his area of knowledge, so the practitioner, though he may have to survey a broad field of science, needs depth only in portions, so that his bottom of scientific knowledge may exhibit a rather undulating surface of uneven depths. In other words, the thoroughness with which the different sciences and parts of sciences underlying his art must be known by him is variable according to his necessities in their application.

Yet as the true artist needs genius to produce a master work, so the practitioner in a technical art needs more than the merely technical contents of the professional branches and parts of sciences, the practical details of which may be learned outside of Universities. He needs judgment and business instinct, he needs a degree of general education which contributes towards forming breadth and depth of judgment; he needs thorough familiarity with the principles underlying facts, and the capacity for applying knowledge and inventing new combinations. Hence the most efficient practitioner requires not only more knowledge than the mere modicum of applicable science but also other branches of education, which do not appear in the professional curriculum.

From the dual character of forestry, namely as a technical art and a business, its fundamental basis is found in two different sets of portions of science. The technical side, to which we give the name of silviculture in the broadest sense or forest crop production, necessarily relies upon natural sciences, while the business side, which we comprise under the name of forest economy relies mainly upon mathematics, and political economy, and practical knowledge of industries, markets, and other business concerns.

While in all other branches of production human labor is the most important factor—even in agriculture and horticulture—in forestry the factor of nature plays the most prominent part; the materials and forces of nature are the source of the mighty processes of organic life, which find expression in forest growth; and during the long period of accumulation of annual product in the growing tree, there is but limited chance to interfere and influence the result. Yet some knowledge of natural history can be brought to bear to direct nature's forces into more useful production than its unguided activity would secure for us. Nature, taking no count of space or time, or the needs of man must be improved upon to secure economic results.

The field of natural sciences, which the forester must survey is quite extensive, but the different parts are of very unlike relative importance, and hence, since he does not study the sciences for their own sake, he must exercise a wise limitation, whereby the depths of his knowledge, as has been intimated, will be very uneven, to be sure, but located at the right places.

This does not exclude occasional expansion and deepening in certain portions beyond the immediate necessities, and such expansion has led foresters usefully to specialize and develop science in the direction most interesting to them. Thus economic entomology and economic and physiological botany, and especially ecology, have experienced considerable advances by specializing foresters.

Inherent disposition and exterior conditions combine to produce the results of growth; all measures which the forester employs to secure the largest, most useful and most valuable crop are based upon the knowledge of these two biological factors, just as in agriculture. Hence, being engaged in plant production, botany, geology, meteorology, with physics and chemistry as hand-maidens, and zoology to a degree require attention.

That portion of botany which may be segregated as dendrology, the botany of trees, forms naturally the main basis. In this connection let me point out that the arborescent vegetation is to some extent *sui generis;* their persistence through centuries, the long period of life, and their elevation above the rest of vegetation, which exposes them to the seasonal changes and hence subjects them to the climatic factors throughout the whole year, make trees exceptional organisms, and render their life history more varied and of greater interest than that of the annually deciduous plants of those half-woody plants which winter under the protection of the snow.

But to study such segregated portion of the large field of botanical science presupposes a certain amount of general botanical knowledge. In order to know, recognize, and classify his crop materials the methods of classification, the general anatomy, histology, and physiology must be familiar to the forester. Soon, however, specialization becomes necessary, and his botanical studies must concentrate themselves upon the botany of trees, and this does not mean mere descriptive, systematic dendrology, the mere knowledge of the species, their classification and geographical distribution, but physiological and ecological or biological dendrology, the life history of the tree in the individual and in communities, a very special study, to which few botanists have as yet given much attention.

The knowledge of the species, the plant material, is a necessary equipment, but the knowledge of the laws of tree growth and of the life history of the limited number of species at least which have forestal importance is infinitely more necessary. Only a few species comparatively form the basis of forest production in a given region: out of the 500 species of which this continent boasts, hardly more than 100 are of economic significance. The life history and development of these under varying conditions needs to be known fully; here depth is needed.

It is only within very recent times that botanists have developed systematically in the direction of ecologic studies, in studying the relation of plants and plant communities to their surroundings and to each other, a study which to the forester has been for a century of greatest necessity and which he has carried on empirically and unsystematically with more or less success. He has discovered and applied his knowledge of the fact that different species are not only more or less adaptive to varying soil conditions but that their requirement for light is variable and that trees as well as other plants can be divided into groups, according to this relative requirement into light-needing and shade-enduring ones, and finally this one factor of light influence for the development of the crop has become so prominent, that one could define the art of the silviculturist, as the art of managing light conditions in the growing forest so as to secure best results. Nor is the forester satisfied to know the general broad features of the biology of the species, their development from seed to maturity, their requirements regarding soil, and light conditions, and their general relations to surroundings; but, as he is a producer of materials, he is most emphatically interested in the amount of production and the rate at which this production takes place. For, different from the agriculturist's crop, his is not an annual one, but requires many years of accumulation, and as each year's waiting increases the cost of production by tying up the capital invested, it is of importance not only to know the likely progress of the crop but also how its progress may be influenced.

Here is a phase of biological dendrology, the mathematics of accretion, which to most botanists is probably an unknown depth and as far as our own species are concerned largely an unexplored area even. Foresters almost exclusively have developed this portion of botanical science. The laws of accretion have through many years of measurement, especially by German foresters, been recognized, and form a most fascinating study. As in man's development the infantile, juvenile, adolescent, virile, and senile stages are recognized, so in tree life these stages appear, and the dependence of tree growth on its environment—"the factors of site"—is even more pronounced and readily recognizable than in the animal, which can change its "site".

Besides the more intimate knowledge of trees and tree life, some knowledge of the lower vegetation especially in its ecologic relations is of service. Weeds are enemies to be overcome; but they also are indicators of soil conditions and of light conditions, and hence the study of what the Germans call *Standortsgewächse* —plants indicative of the character of the site—forms a special branch. Again fungi are destructive to the young crop and others deteriorate the old crop, calling for knowledge not merely of their names, but of the conditions which favor their development and the means of preventing it. It will be observed, then, that botanical studies form a prominent part through three years of the curriculum.

As must have become apparent from the reference to the rate of growth as influenced by the factors of site, the knowledge of these factors, soil and climate, general and local, and their relation to plant life is indispensable. The study of geology and meteorology as far as they explain this relationship, as far as they teach the chemico-physical basis for wood production, and form a criterion for the adaptation of species to various conditions is required.

The Germans have segregated the portions of these sciences, which contribute towards an understanding of these relationships as a special branch called *"Standortslehre."*

Especially the subject of soil physics, only lately developed into a science, furnishes much useful information to the forest grower. It is now a well substantiated fact that wood growth is much less dependent on the mineral constituents of the soil, than other vegetable growth, and especially the agricultural food and fruit crops, that trees live and thrive literally on air, and from the soil derive mainly the necessary water; hence the physical conditions of the soil, which influence the water conditions are of much more moment than the chemical composition; hence also manures are not required, and conservation of favorable water conditions is the main concern of the forest owner.

Since limitation is wisdom it is wise to confine the geological and mineralogical studies to such small portions as are necessary for a general understanding of how and what soils are formed from different rocks, and secure depth of knowledge only regarding soil physics. A more elaborate introduction to the geological history and dynamic geology may be of general educational interest, but it is not required by the practitioner who is concerned only with what has relation to tree life.

There is one other branch of natural sciences which has concern with tree life, namely zoology. Animals feed on plants, hence become enemies to the forester's business. Especially does he find a limited number of insects which can become troublesome and call for protective measures. He should know them and their life history as well as that of his friends who help him keep down the pests. Forest entomology, the knowledge of the insects preying on forest growth and the means of combating them, is, therefore, a well developed branch of general entomology. Nevertheless a mere modicum of knowledge will suffice, by no means comparable with the requirement in the branches mentioned before.

Since, however, forests are the harborers of game and forest waters of fishes, a knowledge of game and fish and their life habits may become not only of natural interest but of practical utility and hence claim some attention.

Finally it may be proper to point out that the aim in the study of natural history by the forester should be rather to secure a general intelligence of nature in its relationships than a mere agglomerated knowledge of unrelated facts and forms.

Now, turning to the other side of forestry, namely, the business side, there are two branches which contribute towards building out the subject of forest economy or "forest regulation," namely, mathematics and political economy. There is needed a certain amount of mathematical instinct, if not elaborate knowledge, to understand the relationships of the laws of accretion.

To measure the quantity of production, which must form the basis of business calculations, a more elaborate use of, and familiarity with, mathematical operations is necessary: forest mensuration has, therefore, developed into a special branch of mathematics and many methods have been developed by which not only the volume of the single tree, but the volume and rate of growth of whole stands or acres of trees can be more or less accurately determined.

One of the most important mathematical problems for the forester to settle is, when his crop is ripe. This is not as with agricultural crops and fruits determined by a natural period, but by the judgment of the harvester based upon mathematical calculations. There are various principles which may be followed in determining the maturity of a stand or in determining what is technically called the rotation, that is the time within which a forest managed as a unit shall be cut over and reproduced. Either the largest average volume production, or the largest average value production, the largest "forest rent," or the largest "soil rent" may be the aim.

In either case a complicated measurement and calculations are required to form the basis. If we follow the principle of highest volume production it is only necessary that actual volumes produced in different periods of time be known, in order to choose that time when volume divided by years of its production be at its maximum, that is, when the average annual accretion culminates, and this we know occurs by an interesting mathematical law when it has become equal to the current accretion. If we express these relations in percentage, we find the interesting formula for the current accretion per cent. $\frac{400}{nd}$, in which d is the average diameter of a representative number of trees, and n the number of annual rings for one inch which these trees have formed on the average during the period of growth just finished. We have also the remarkable mathematical discovery that average accretion per cent. culminates when it is equal to $\frac{100}{a}$, in which a is the age of the stand. And as this culmination occurs when it is equal to the current accretion, we have the equation $\frac{400}{nd} = \frac{100}{a}$, from which we determine a, the age of maximum forest production $= \frac{nd}{4}$.

If maximum value production is looked for, matters become more complicated, for with change in the size of logs, which make up the volume, their value changes because more useful material can be cut from them, the percentage of waste being reduced.

Finally, if we begin to calculate on the capital of soil and standing timber, which is involved in accumulating volume and in the production of value, and try to secure an adequate interest return, compounding, of course, since neither these capitals, especially the wood capital, nor the wood interest can be withdrawn until the long distant harvest time—we come into forest finance calculation, a mathematical branch which has been more highly developed than such calculations in any other business excepting perhaps life insurance, with formulas which are unfamiliar to the average mathematician.

The long time element in forestry is unique and involves most elaborate planning and calculation in order to enable the forest grower to carry on a continuous "sustained yield" management profitably.

With the discussion of what an adequate rate of interest is, with which to charge this business with its long time production we come upon the field of national economy as one of the fundamental sciences for forestry.

Morevover, the aims and objects of forest management are to a large extent of national economic character. The claimed influence of forests on climate and water flow seem to impose upon State governments the duty to supervise, regulate, or undertake the management of forest areas, and, since other considerations of State besides the cultural interests of forest areas, involved in the peculiarities of the forestry business, indicate, that State management of forest areas will eventually become universal, it is desirable, if not essential, for the practice of technical forestry, that the fully educated forester should have clear conceptions of the principles underlying such duties of the State. Not only are, therefore, those branches of economics which concern themselves with the development of business principles to be thoroughly mastered, but a knowledge of the functions of the State, of State politics are to the forester even more needful than to the generally educated man, for his business is in closer relation to the State.

In addition to the fundamental sciences, forestry must borrow from other arts and professions. The manager of an isolated property must have varied knowledge—accessories to his art. He must have enough familiarity with the principles of business law to avoid pitfalls; he may have to be his own architect, surveyor, and engineer. There is especially a considerable amount of engineering knowledge needed by him in providing methods and means of economic harvesting and transportation of his bulky crop.

The forester is really in the same business as the logger or lumberman, namely, to supply wood materials to the community with only the added obligation of continuing in the business after the first harvest. He must, therefore, be a competent logger, and all the engineering knowledge of the "logger" and somewhat more is his need. Forest surveys, especially, will for a time be the occupation of the first foresters, and hence surveying is an essential accessory, including road building, locating of railways, and cruder engineering works.

Every business man needs a certain amount of knowledge in practical commercial law. Singularly enough this has still all to be learned in practice, at the expense of employers and litigation, instead of a systematic course in the university. Every man who claims to have a modern education should have had the opportunity of acquiring such knowledge, and foresters, especially, who become administrators of properties away from civilization cannot dispense with it.

So many portions of science have to be segregated and combined towards the one end which the forester seeks to accomplish, and so much has he added to it that perhaps he may be entitled to dignify that organized sum of human knowledge which is taught in the purely forestal courses of a professional forestry school as the science of forestry and thus justify the claim of this youngest accession to our university courses as a science in itself.

THE ORIGIN AND EARLY DEVELOPMENT OF CHESTNUT SPROUTS.

By W. R. Mattoon, F. E.

In a silvical study which the writer made in southern Connecticut the aim was to determine the leading facts concerning the origin of sprouts and their growth during the first few years, and, in addition, the variations under definite known conditions. As the Chestnut, *Castanea dentata,* Borkh., is one of the more valuable species of forest trees of the northeastern states, the study has a bearing on the practical problem of forest management. The principal region of study was a mixed hardwood tract of some 400 acres near New Haven, Connecticut, known as the Maltby tract. This region has been cut over repeatedly under the coppice system, in rotation of 20 to 70 years. In it at least four forest types are clearly demarkated, corresponding with regularity to definite site conditions:

(a) *Bottomland type:* This occurs in the moist soil of depressions and along streams, the species giving character to the type being Red Maple, Ash, Red Oak, Chestnut and Tulip. (b) *Chestnut type:* Around the borders of the depressions, the preceding type is apt to grade into one in which the Chestnut dominates, although seldom forming over 50 per cent. of the stand. In this collar of the low basins, the soil is deep and drainage good, thus bringing about the optimum situation for the Chestnut. (c) *Oak Ridge type:* This type covers the rocky ridges and plateaus where the soil is frequently shallow and relatively dry; a site, where growth is still possible and blanks are not infrequent; Chestnut Oak, White Oak and Hickory mark the type. (d) *Average Hardwood type:* This is distinctly an intermediate type, occurring on situations midway between the Bottomland and Oak Ridge types, and constitutes in area approximately 40 per cent. of the stand. The mixture is quite uniform, of Red Oak, Chestnut, Hickory, with Maple, Birch and Chestnut Oak. The tract is in many respects a good type of the prevailing woodlands of Southern New England, and affords ample material for the study of the reproductive capacity of the Chestnut in its various stages, including advanced decline.

An additional region of study lay in northern central Pennsylvania. It represented mostly first cutting, with some good examples of coppice forest resulting from lumbering, and also from forest fires. The special contribution from this region to the subject under investigation consists of measurements of sprouts from stumps of trees of seedling origin, clear and selective cuttings for poles, posts and ties being made continuously over the tract.

Except where otherwise stated the method used in obtaining the data for each of the investigations was the same throughout. In general, the following plan prevailed: Sample plots or strips were selected, in shape and size depending upon conditions of topography, the area of the particular type or site quality, and the character of the investigation in hand. Sample plots were generally 66 feet square, and strips 4 rods wide; measurements were taken on all living stumps of the specified species within the sample area. In the studies pertaining to height-growth (except in certain cases) only the three dominant sprouts of each colony or stump group were considered. In young sprouts, the diameter measurements were taken at a height of 2 feet from the ground. Measurements were also made of the amount of yearly growth in height for successive years in young sprouts. The limits of growth up to the age of about 5 years, are defined by one or more of the following external appearances: Ring of the bud scale scars, or enlargement at nodes; aborted dead tip of previous year's growth; cluster of branches at terminus of year's growth (inconstant); decided change of color and markings on bark. Descriptive notes on local conditions of site and silvicultural features were taken for each sample area.

Sprouts arise from two classes of buds, dormant and adventitious, the former often continuing in existence for many years before developing into a shoot. It seems likely, however, that sprouts arise more frequently from adventitious buds. The formation of these can result only from some local stimulation. Through the sudden and relatively large increase in food supply at all points in the stump caused by the removal of the upper part of the tree such a stimulus is created. There are other sources of irritation, which are either chemical or physical in their nature and internal or external in respect to the point of their application. The enzyme of a fungus mycelium, the attack of insects, bruising or wounding the surface by falling limbs or gnawing animals, and the scorching effect of a light groundfire are typical examples of a wide variety of effective sources of irritation. The result of the stimulation in all cases is practically identical in bringing about that form of rapid and complex multiplication of new cells which makes for the regeneration of the individual.

The Locality of Origin.—In the Chestnut the region of sprouting is confined to a belt with comparatively narrow vertical limits surrounding the stump and near the contact of the ground surface.

The height at which the parent stump is cut influences to a limited degree the position of the succeeding sprouts. In low-cut stumps the sprouts have a lower origin than under opposite conditions. Again, the point of insertion was observed to be higher in the more moist situations, under a good degree of shade, and on the cooler aspects. In the Red Oak the upper vertical limits for the origin of thrifty sprouts is somewhat higher, perhaps as much as 5 to 6 inches. Chestnut rarely if ever makes "stoolshoots" as do occasionally the oaks, frequently the birches, and normally the beech.

An effort was made to determine any tendencies of location within the horizontal plane of the sprouting belt. There is evidence that the root-system exerts an influence in this respect. Frequently the largest groups of sprouts as well as the tallest and best individuals are found at or near the retreating angle between the two main branches of the lateral root system. Often, yet less frequently, the sprouts spring from the convex and more exposed surface of the same roots. In the former position, the bark is less thick and tough, and in general, offers less resistance to the exit of the soft tissues of the growing shoot. The locality is favorable also to the protection of the shoot from external mechanical sources of injury.

The Root System of Young Sprouts.—This centers in a consideration of the length of time and the extent to which the old root system continues its function and, correspondingly, under what conditions and to what degree new roots are formed and relied upon by the new generation.

Only a very small portion of the old root system is called into activity by the sprouts of the first year. The relative demand for water by the new generation is exceedingly light; moreover, the stump and roots at the outset hold a good store of moisture and food materials. In such a state of inactivity, roots can maintain for only a brief period of time their potential capacity for a renewal of functional activity. While in this condition, there are many species of insects, bacteria and fungi ready to effect the early destruction of all living tissues in the root.

Those portions of the old root system, however, which are early brought into functional activity by the demands of the new sprouts, survive the first year, which appears to be the most critical period during the process of readjustment. During the following years, with the enlargement of the aerial portion of the sprout or colony, comes a corresponding increase in the demand for soil moisture. This demand is met either by an extension of the old root system previously appropriated by the young shoot or by the production of new roots near the base of the shoot.

Low-cut stumps tend toward a deeper point of origin for the sprouts, and such show a greater tendency to develop new lateral roots, thus becoming in a measure independent of the roots of the parent which in so many cases are in a degenerate condition.

Relation of Age to Sprouting.—As is to be expected, there is an age-predisposition with respect to the production of sprouts. Chestnut is subject to far wider limits in this respect than the majority of coppice species. Local study in Connecticut, where 50 to 60 years is the average rotation in practice, failed to fix upon the maximum or the optimum age. Up to this age, the number of sprouts generally was directly proportional to the size of the stump in circumference.

In the northern Pennsylvania tract, however, where seedling trees of various ages and sizes had been recently cut, the relation was clear. Fresh stumps, 80 to 170 years old, produced a full thicket of short, spindling sprouts, while neighboring stumps in age from 30 to 60 years, bore a much smaller number of tall, stout sprouts. Evidently some point below 60 years may be regarded as the optimum age.

The figures in the following table are quoted from results obtained by Mr. Raphael Zon on the Chestnut in Maryland. The number of sprouts in relation to the diameter of the stump is given; it is presumable that the data were obtained under uniform conditions, so that the age is proportional to the diameter.

Diameter of Stump, inches,	9	10	11	12	13	14	15	16	17	18
Number Sprouts per Stump,	13	18	22	24	25	26	26	26	25	24

The number of sprouts is not of so much importance as their size and general thrift. The comparison is one between a thicket of small low sprouts and a small group of tall stout sprouts. There is evidence that the optimum age for sprouts coincides in general with the close of the period of maximum height growth, which occurs somewhere about the twentieth to thirtieth year. Sprouts from old age stumps, if produced are less vigorous and their appearance at the end of the first season is in general similar to that of sprouts from stumps cut somewhat late in the spring season.

The Early Growth of Sprouts.

The Diameter Growth of Sprouts.—After the first year there is a very rapid decrease in the amount of annual growth in height. The rate of diameter growth in the sprout during this decrease is interesting.

The rapid height growth during the first year secures for the shoot access to light and carries it beyond close competition. At best, the first year's growth is spindly. The second and third year's growth is in quite an opposite direction to that of the first, viz: a small increase in height but a large expanse in cross section area, as high as 235 per cent. increase in the second year's growth being found. The general form of sprouts, thus, changes from cylindrical to a conical after the first year. An increase of nearly 1 inch per year in diameter during the first 8 to 15 years has been observed on stumps in the most favorable situations.

The cross section area averages (at 2 feet above ground) for maximum dominant sprouts, .44, .99 and 2.7 sq. in. and for dominant sprouts, .011, .037 and 1.6 sq. in. for the first three years respectively.

The increase in cross section area for the average dominant sprout is for the second year about 130 per cent. to 150 per cent., and for the third year 140 per cent. to 170 per cent. over that of the preceding year. In contrast to this the growth in height of the same sprouts during the same years is striking, since they show a decrease in the amount of height growth for the two years of 43.5 per cent. and 23.7 per cent. respectively.

Annual Height Growth of Sprouts.—The Chestnut is one of the more fastidious species in respect to its natural surroundings, and the total amount of growth during any period of years in early life is largely determined by the favorableness of the situation. There is however a relation between the amount of growth during the first and the succeeding years which is much less variable, hence the comparative height growth made during the first, second and third years under various conditions was investigated.

1. Sprouts from Stumps of Seedling Trees (Penna.).—The amount of growth in height for each year was measured on 100 three-year old sprouts, taking only the 3 dominant sprouts on each stump. A variety of ages of parent stumps was represented. The general site was Quality I; Density, 2-4. The rate per cent. is based on the growth of the first year.

Period.	*Growth in Height.*	*Rate.*
1st year	6.87 feet	100 %
2nd "	2.78 "	40.4%
3rd "	2.12 "	30.8%

2. Sprouts from Coppice Parent Stumps (Conn.). a. Average Good Situation.—These are sprouts after several generations of ancestors. They represent the thriftiest average stock to be found in Southern New England, and were growing in Bottomland type Quality I; Density, 4.

Period.	*Growth in Height.*	*Rate.*
1st year	5.69 feet	100 %
2nd "	2.62 "	46.5%
3rd "	2.11 "	37.2%

b. Average Poor Situation.—Here the natural quality of the site differentiates the situation—the species occurred in about the same proportion of mixture. The site was a warm S. E. exposure of moderate slope, unfavorable soil depths and soil moisture. Type: Average Hardwoods; Quality II to III; Density, 2-4.

Period.	*Growth in Height.*	*Rate.*
1st year	4.48 feet	100 %
2nd "	2.37 "	52.9%
3rd "	1.82 "	46.2%

There is a rapid decrease in rate of height growth under all conditions after the first year; this continues to a small degree (as shown for one year here, and from repeated observation in older stock) in later years. In the less favorable situations the rate of annual growth shows a less rapid decrease. An average of the three tables above gives: first year, 100 per cent.; second year, 46.6 per cent.; third year, 38.2 per cent. The amount of growth falls to less than one half after the first year, and diminishes thereafter at a slow rate.

Effect of Midwinter and Late Spring Cutting Upon Sizes of Sprouts.—An excellent opportunity to study the effect of winter and late spring cutting was afforded in the Pennsylvania tract. Sound, mature Chestnut trees of seedling origin had been selected and removed for poles during the month of May, while a clear-cutting of the same type on a similar site had been made on closely adjoining ground during the December and January previous. The region was visited in December at the end of the first season's growth of sprouts, and measurements made which gave the following results:

Season of cutting parent stump.	*Average Number of sprouts per stump.*	*Average Heights of sprouts in feet.*	*Average diameter of sprouts (Inches).*
Midwinter,	22	6.15	.42
May,	35	3.5	.23

The sprouts from the May cutting, while more numerous, are decidedly inferior in quality and size. The average show them to be about one half normal size. Uniformly, the tips of these shoots are soft, and the wood cells imperfectly lignified for a distance of 8 to 15 inches down the stem at the end of the season, and hence from 30 per cent. to 50 per cent. of the growth is winter-killed. In December, the thin, soft and pliable, light green leaves, overtaken by early frosts, were found clinging tightly to these immature shoots, in marked contrast with the tough, thick, rigid, dark-brown leaves of the normal, full-season shoots.

If cutting advances into the summer months the chances of virile sprouts become less up to or beyond midsummer. The numbers of sprouts produced is less and the season for growth short. It appears that root pressure constitutes an influencing factor being "present in trees only during a limited period at the beginning of the growing season, and almost entirely absent in summer when the greatest amount of water is used."

Effect of Light and Shade on Height Growth.—Measurements were taken on two adjoining plots similar in slope, aspect and soil conditions, but differing in light conditions. In one, a clear cutting had been made three years ago, while in the other, timber for ties, posts and poles had been removed at the same time, leaving still a rather full crown cover, density about .6. The results are here summarized:

Period.	*Under Full light.*	*Partial Shade.*
1st year,	5.6 feet	5.1 feet
2nd "	4.0 "	2.4 "
3rd "	2.9 "	1.5 "
Total	12.5 "	9.0 "

The difference in amount of growth in height is much the least for the first year. In the second year the sprouts in the open make a growth of 66 per cent. greater than those in the partial shade, while for the third year the increase is 93 per cent. These results reaffirm the statement elsewhere made concerning the relatively high tolerance of sprouts during the first year of life. As the food supply in the parent stump diminishes and the sprout comes to depend to a greater degree upon the products of photosynthesis its tolerance diminishes. The rate is seen to be relatively rapid if, as is probable, the conclusion is warranted that the slower rate of growth results from a diminished supply of light.

There is still a greater difference in diameter growth under the two conditions. Sprouts growing under a moderate shade do not even by the third year attain the stout form which is usual with sprouts in the open. The decimation of sprouts in shade is to be found in a following section.

Effect of soil conditions on Height Growth.—The amount of annual growth in height for each of the years was measured on three year old chestnut sprouts, in each of the four different forest types, to determine the influence of site quality. The Maltby tract contains in small plots a wide variety of site conditions. There are at least three distinct site qualities with regard to moisture and depth of soil, where the Chestnut forms a prominent share of the mixture. These grades of site are marked off from each other by the factors of soil depth and soil moisture. Beyond these limits are conditions of extremes toward which the species rapidly fades in number and quality.

The results are given in the table, and shown graphically in the diagram.

Site I: The "Bottomland" areas (not swampy).

Site II: On this the type "Average Hardwoods" occurs.

Site III: Verging on the rocky ridges and the "Oak Ridge" type.

Quality of Site.	*Period.*	*Average Height growth in feet.*	*Total Height Three years.*
I (Maximum)	1st year	6.08	
	2nd "	3.41	
	3rd "	1.73	11.22
I (Average)	1st year	5.69	
	2nd "	2.62	
	3rd "	2.11	10.32
II	1st year	4.48	
	2nd "	2.37	
	3rd "	1.82	8.67
III	1st year	3.63	
	2nd "	2.11	
	3rd "	1.30	7.04

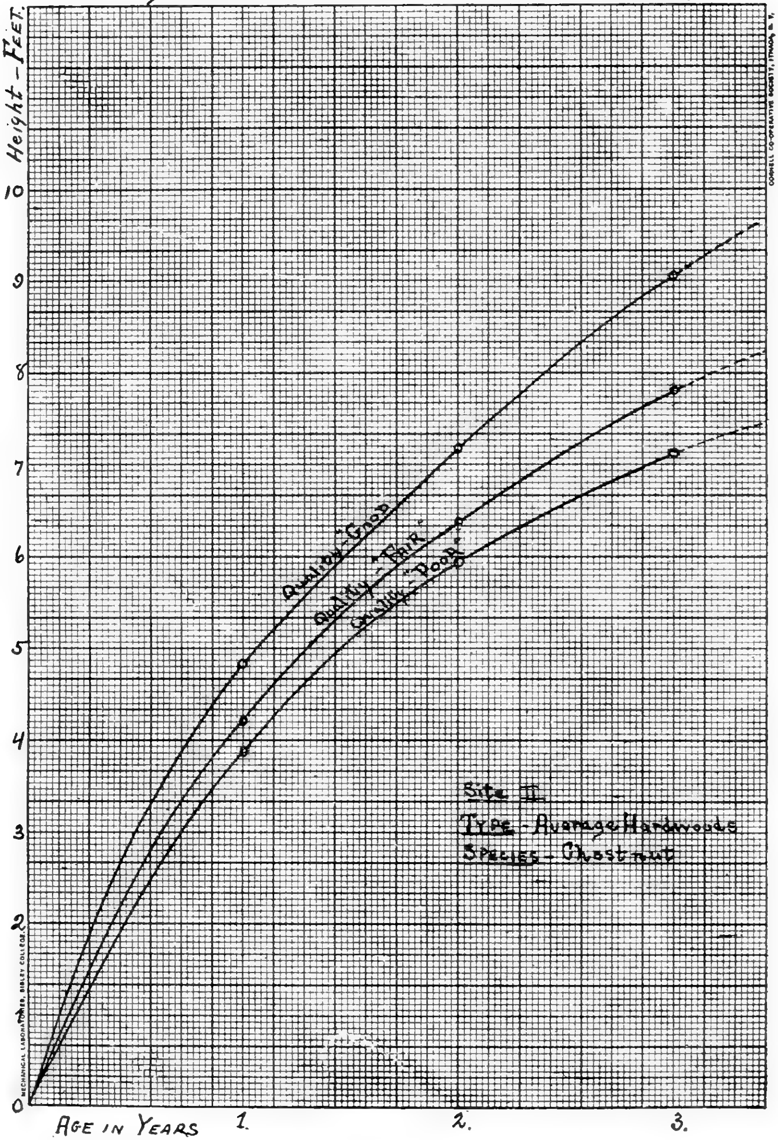
In the best situations the largest advantage for height growth comes during the first year. Afterwards, growth on sites I and II is more nearly the same in amount. In the third year the amount of height growth on site III diminishes much faster than upon more favorable situations. The maximum quality I (the largest set of results obtained from any one plot of quality I site) shows a large increase over average conditions for the same quality.

Relation of Soundness of Parent Stumps to Height Growth of Sprouts.—The removal of a crop of first or second generation coppice wood of the ordinary type in Connecticut, usually reveals a wide variation in the condition of soundness of parent stumps. The problem here presents itself as to the subsequent rate of height growth of sprouts from stumps of different degrees of soundness.

A study was made under the following conditions: (1) The

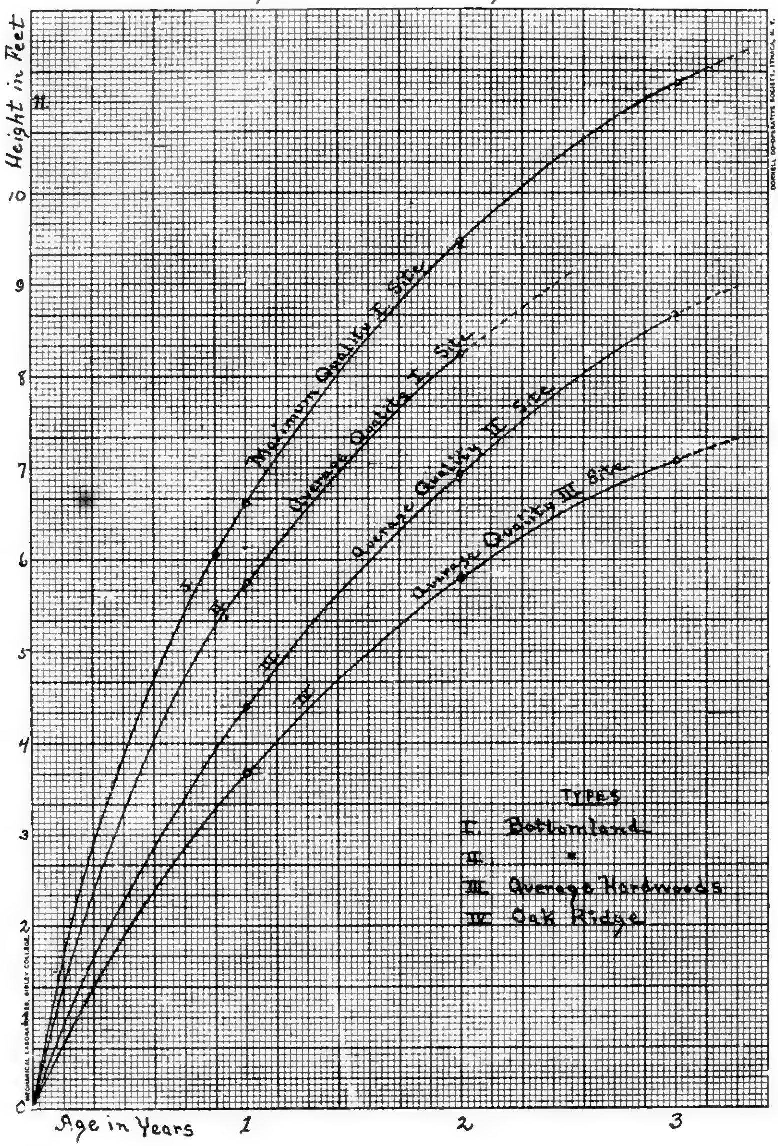
HEIGHT GROWTH OF CHESTNUT SPROUTS

Showing Effect of Soundness of Parent Stump



Height Growth of Chestnut Sprouts

Showing Effect of Quality of Site.



sprouts had completed the third year's growth and were in dormant winter condition. (October). (2) The present stumps were 2nd to 4th generation sprouts. (3) The situation was site II; Type, Average Hardwoods. (4) Three grades of quality of stump were made, viz., good, fair and poor on the basis of conditions of external observations cited in the foregoing study. Many stumps of grade "poor" had produced no sprouts of a size assuring the participation in the later wood-crop, and all such were not accepted in the count. The aim was thus to determine if possible within narrower limits the effect resulting from disease infection. The average of each of the three years' growth in height of sprouts from stumps of each quality is shown in the following table.

Quality of Stump.	*Length of growth in height in feet.* 1st year.	*2nd year.*	*3rd year.*	*Total.*
Good	4.88	2.23	1.9	9.01
Fair	4.18	2.20	1.51	7.89
Poor	3.97	2.0	1.23	7.20

From these measurements it appears that the rate of growth is better sustained during the years following the first in the case of sprouts from the soundest stumps. Accompanying disease in the stump, shown by unsoundness, the curve of the upward growth flattens out comparatively soon. The high average of the curve for the poor quality stumps is due to the conditions already stated, *i. e.* no measurements taken on stumps which were so badly diseased that no sprouts were produced promising a fair participation in the wood-crop. The effects of disease are thus taken from a narrower source.

Comparison of sprout growth from seedling and coppice stumps.—The rates of height growth of sprouts from two classes of stumps—coppice and seedling origin—growing side by side under identical conditions, are suposed to be different. The figures in table convey some idea of the actual amount of difference in growth.

The study was made on a tract of Site I for Chestnut. It is almost exclusively in such locations that seedling-trees occur at all in Connecticut; here, also, coppice maintains a relatively good thrift for successive generations. In situations where favorable soil factors prevail, the seed crops are generally more frequent and larger, the seed vitality better and the early growth of the seedlings progresses under advantageous conditions.

A tract of about four acres was found with three year old sprouts where about 120 of the Chestnut trees of the last generation were of seedling origin. The usual method of, taking only the three dominant sprouts from each colony was followed. The growth of each tree was measured and results averaged.

Period.	*Seedling Parent Stump.*	*Coppice Parent Stump.*
1st year	6.23 feet	5.35 feet
2nd "	2.91 "	2.3 "
3rd "	2.4 "	1.6 "
Total	11.54 "	9.25 "

The sprouts from stumps of seedling trees made a height growth during the first year of 16.45% and during the first three years of 24.7% greater than sprouts in the same situation from coppice stumps of good average quality. In comparison with the average growth from the predominating poor quality of 3rd and 4th generation coppice stumps, the sprouting capacity of seedling stumps becomes more striking.

Comparison of Height Growth of Chestnut and Associated Species.

(a) Chestnut and Red Oak (*Q. rubra*).

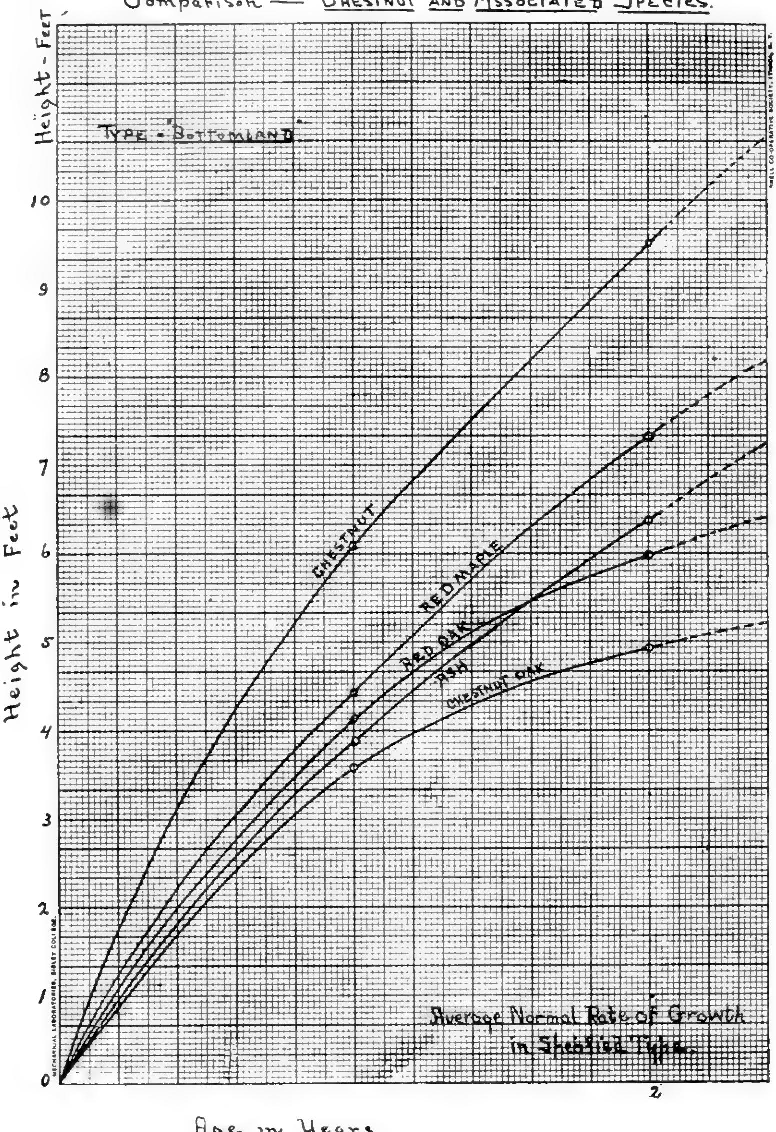
Because of their frequent association in mixture and general similarity in sprouting, a comparison of these species is of interest. The results averaged below were obtained from a long list of measurements taken on a number of different plots, all representing, however, practically the same conditions, viz., average hardwood type site II. Mixture of two species about equal and composing about 50% of the stand. Only the three dominant sprouts in each colony are considered.

Period.	*Chestnut.*	*Red Oak.*
1st year	5.69 feet	3.77 feet
2nd "	2.62 "	1.69 "
Two years (total)	8.31 "	5.46 "

During the first year the ratio of growth of Chestnut to Red Oak is 100:66; during the second year, the ratio is 100:64. The Red Oak decreases faster in rate of growth during the second year than does the Chestnut. The wide difference between these

Rate of Height Growth of Sprouts

Comparison — Chestnut and Associated Species.



species continues, although lessening somewhat in amount in later years.

(b) Chestnut, Red Maple, Red Oak, Ash and Chestnut Oak.

These species, excepting the last, associate freely in the Bottom-land type. These measurements were taken in Site I—deep soil and abundant moisture, with good drainage. The leaf canopy had been opened by a fairly heavy thinning, allowing entrance of abundant light. Density 4.

Growth in Height.

Period	*Chestnut*	*Red Maple*	*Ash*	*Red Oak*	*Chestnut Oak.*
		Feet.			
1st year	6.06	4.43	3.78	4.20	3.60
2nd "	3.41	2.83	2.36	1.79	1.35
Two years (total)	9.47	7.26	6.14	5.99	4.95

This being an optimum situation for the species, the difference in growth can be considered the result of inherent capacity. The relation of the amount of growth for the period of two years is: Chestnut, Maple and Ash, but much less for the Oak. In respect to the first year's growth, the Maple, Oak and Ash constitute a group widely separated from the Chestnut. In the second year, it will be noted, the Oaks become differentiated by a marked retardation in growth while the Maple and Ash agree with the Chestnut in preserving a relatively rapid upward growth.

Decimation of Sprouts by Disease.—The relation between the number of sprouts per colony and the degrees of soundness of the wood at the end of a rotation of 40-50 years is shown in the table given below. The data were taken from stumps on a plot of clear-cutting. Four grades of quality of soundness were made, based upon external appearances, *i. e.* the proportion of sound, diseased, or decayed wood on the lateral surface or in cross section; the thickness and integrity of the bark; and any other signs of infection causing weakened vitality and slow growth.

With a decrease in the number of sprouts composing an individual colony at the end of 40-50 years there was found a corresponding degenerate condition of its members. Or, as a corollary to this, the more diseased the colony of sprouts became during life as shown by the soundness of the wood after a clear-cutting, the fewer sprouts per colony reached merchantable size.

(Diameter of 4 in. at breast height). As early as the first season of growth, decimation by disease begins. The infection, mainly due to fungi of various sorts, spreads from the parent stump upward and was observed to be most in evidence at the base of the shoot. A large swelling at this point frequently occurs and the tissues within become honey-combed in appearance and disintegrate through the enzyme of the fungi. Death results from the severance of the vital connecting-vessels and tissues or by the mechanical forces of snow or wind.

There are two serious fungus enemies of the Chestnut, both attacking the heartwood of living trees. The Sulphur Mushroom *(Polyporus sulphureus)* eats out the heartwood causing "brown rot" and the Honey Mushroom *(Agaricus melleus)* sends it characteristic black mycelium into both the food conducting vessels, and the sapwood. It appears that young sprouts are practically susceptible to attacks from the latter, being killed by it in large numbers.

Decimation by Intolerance of Species.—Since the sprout does not depend upon light for its food supplies during the first year or two, it is relatively tolerant. When the stock of nourishment in the stump lessens appreciably this condition alters, and Chestnut sprouts, as already shown are highly intolerant. The change is both continuous and rapid. During the second year there is a thinning in the average colony, usually greatest when the sprouts are crowded so as to receive neither adequate food materials nor sufficient light for independent growth. In both good and poor situation a difference in the amount of height growth during the second and third years has been observed corresponding to full or partial light supply. The rate of decimation up to about the fifth year is very rapid, commencing to diminish however at about the third year; at about the eighth year the number of dominant sprouts to a colony does not usually exceed four to six. The chief factors which prevailingly influence the rate of decimation are health and age of parent stump, supply of light, and site quality. It is a common experience in a coppice growth of four to seven years in age to find frequently large clumps of Chestnut sprouts consisting mostly of a bunch of dead and dry sticks with the bark loose and clinging in tattered shreds. This may in part be the result of intolerance but likewise an explanation may be found in the inherent disposition to short life coming from an old-aged parent, or an incomplete attachment of the sprouts due to infection from a diseased parent stump.

It appears certain that the character of the later growth and both the quality and quantity of the final crop in the case of sprout forests depends to a very considerable degree upon the conditions under which the crop is started. These may be either natural or artificial. There are some of these influential factors in the early life making for the success or failure of the crop which can to a degree at least be controlled by man.

CURRENT LITERATURE.

HENRY S. GRAVES, *in Charge.*

Report of the State Forester of Wisconsin for 1907 and 1908. Madison, Wis. Pp. 133.

This report shows State forest reserves to the extent of some 250,000 acres being administered on an annual appropriation of less than $10,000. The policy behind the establishment of these reserves appears to be more the protection of headwaters of rivers for the conservation of water power than the conservation of timber lands. The state forester points out that as a lumbering state Wisconsin's power is fast waning, and that it must look to its manufacturing interests. In keeping with this, an act was passed authorizing a private company to construct and operate reservoirs on the Wisconsin River head-waters, certain control being by the law assigned to the State Forestry Board, and already there are in operation reservoirs with a storage capacity of some 4000 million cubic feet. The right is reserved to the state to take over and become the owner of all reservoirs and property of the company.

A policy of consolidation of reserve holdings is in progress, the forestry board having the power to sell scattering or agricultural reserve lands, and devote the proceeds to the purchase of absolute forest lands elsewhere. As these proceeds would result in a very slow consolidation, it is recommended that the state board of forestry be authorized to issue certificates of indebtedness on the reserve lands, payment to be by tax upon owners of water powers on streams whose headwaters are protected by the reserves. The conditions of sale appear not to be the best. The state lands were appraised before the formation of a forestry department, and although this department reappraises before any recommended sale, and may increase the price, it cannot, unfortunately, lower the appraisal, and consequently many lands cannot be sold. Further, the machinery is cumbersome, since the sales take place through the board of land commissioners on recommendation of the forestry board.

The educational policy consists in a course of 16 introductory lectures in forestry given in the winter at the University, there being no training school. A school for rangers is recommended.

As regards reforestation, where natural restocking is not taking place nothing is being done. The policy is to defer this till the forest reserves are blocked up so that fire lines can be constructed, and the organization is completely systematized. Private reforestation is encouraged by a tax exemption law, which so far has brought no results. The report contains information regarding the care of woodlots and planting methods, as well as notes on five species recommended for planting.

Considerable space is given to a discussion of the fires of 1908. Some 1435 fires were reported burning over 1,209,432 acres, and destroying some 500 million feet of merchantable timber worth $3,000,000 and young growth estimated as being worth twice that amount, to say nothing of other property. Over 11,000 men were employed in fighting these fires at an expense of $100,000. The magnitude of the fires is attributed to slash. An analysis of the causes gave 60% originating from burning brush and clearing, 15% due to sparks from locomotive, and 25% from various causes.

As a result of these fires the timberland owners appointed a committee to report on advisable measures to adopt for protection. The main recommendations were: (1) the enlargement of the town fire warden system to a patrol system under the management of the state board of forestry; (2) the imposition by the state of an annual tax of 2 to 2½ cents per acre on all wild and unimproved lands to constitute a forest fire fund; (3) provision for burning slash and debris; (4) permission of fire warden to set fires between April and November. (The committee's report is worth reading in full.) "The cost of 2 to 2½ cents per acre per annum is a low insurance, the loss from forest fires in 1908 alone is over $9,000,000 and this would pay all costs of such a patrol system for nearly fifty years."

Not only are the lumbermen in sympathy with the aims of the forestry board, but the railroads are coöperating, as is instanced by the fact that many of them arranged for meetings of their employees at which the state forester gave addresses on protecting the forests and explained the forestry laws.

With regard to the taxation of timber lands the state forester enters a plea for a more rational system to encourage forestry methods among the lumbermen—and annual land tax with the timber exempt until cut.

The report closes with an account of the Lake States Forestry Conferences and the State Conservation Commission and an appendix containing the State Forestry Laws.

J. H. W.

Seventh Report of the Forest Commissioner of the State of Maine, 1908. E. E. Ring, 103 pp., illustrated.

The biennial report of the Forest Commissioner of Maine shows a reported loss from forest fires in 1908 of $618,816, with 142,130 acres burned. Credit is given the system of state fire wardens for preventing a far greater loss, a statement substantiated by the fact that the loss in the organized towns not so protected was greater than in the unsettled and timbered portion of the State.

Professor W. J. Morse, of the Maine Agricultural Experiment Station, contributes an important article on White Pine blight, in which he shows that this trouble is coincident with and undoubtedly caused by unusually severe winter exposure and is therefore of a temporary nature.

The text of the recent decision of the Maine Supreme Court is given, upon the question of the right of the State to regulate by law the sizes of timber which an owner may cut from his own land. It is not generally understood that this decision was rendered under a constitutional provision which directs the Supreme Court to render decisions as to the constitutionality of proposed legislation of importance to the state, when formally requested to do so by the Senate. No such law has been passed in Maine, but the discussion of the constitutionality of a proposed measure limiting the cutting of trees to 12 inches on the stump gave rise to the above request and decision. The decision was rendered on the points as to whether the restriction of cutting or destruction of small trees by the owners thereof without compensation was constitutional, or was a taking of private property for public purposes and public uses for which compensation must be made. The court took the broad ground that the state had power "to prescribe regulations to promote the health, peace, morals, education and good order of its people, and to legislate so as to increase the industries of the state, develop its resources and add to its wealth and prosperity." Any law was constitutional which accomplished these results, if not contrary to the rights of property. The question of taking property without compensation was then discussed at length and the conclusions were, "Private property can only be said to have been taken for public uses when it has been so appropriated that the public have certain and well defined rights to that use secured, as the right to use a public highway, ferry, railroad and the like." This is recognized as a strict construction, but justified with respect to land by these significant words: first, "such property is not the result of productive labor but is derived solely from the state itself, the original owner; second, the amount of land being incapable of increase, if the owners of large tracts can waste them at will without state restriction, the state and its people may be helplessly impoverished and one great purpose of government defeated." Again, "while it might restrict the owner of wild and uncultivated lands in his use of them, might delay his taking some of the product, might delay his anticipated profits, it would nevertheless leave him his lands, their product and increase untouched and without diminution of title, estate or quantity. He might suffer delay but not deprivation. While the use might be restricted it would not be appropriated or taken." Based on this reasoning the court decided the proposed legislation constitutional and not taking of private property for which compensation must be made.

While the general principles supported by this decision are sound and progressive, foresters generally must admit that any law prescribing a rigid diameter limit of cutting is false in principle and would be sure to work injury to the owners of timber property, besides being a handicap in the proper management of a forest to secure new crops of timber. Many species can be reproduced successfully only by practically clear cutting. In such stands trees below the size limit would frequently be of stunted growth and should come out. In thinning a young stand, it is always the smaller trees that must be removed for the good of the stand, yet such a law would prevent thinning, and reduce the profits on plantations to a serious degree.

There are but two arguments to justify interference with private management of woods; First, the preservation of the productive capacity of the forest for growing wood crops; Second, the necessity for protection to the soil and watersheds. The first principle has never been powerful enough, even in European countries to bring about the control of private cutting. The second is always a sufficient reason, but the influence of the forests must be direct and noticeable. So we find regulation of private forests only on mountain slopes. But nowhere does this regulation take the form of statewide diameter limit regulations. Such forests as, for the good of the community must be regarded even though they remain in private hands, should be managed under a law compelling owners to accept such rules as are laid down for them by properly informed and properly empowered state forestry officials, who shall be guided by their knowledge of the laws of tree growth and the principles of forest production. It is earnestly to be hoped that state legislatures will avoid the folly of drastic legislation and will devote their energies rather to the acquisition of state forest reserves, and in regions needing forest protection, or to the adoption of plans by which the forest may be treated according to its needs.

Forest production is a business, and of a highly technical character. It cannot be conducted by rule of thumb or by state legislatures, but must be encouraged by creating favorable conditions for the practice of forestry, or by entrusting trained officials with discretionary power of enforcing restrictions.

The body of the report of the commissioner gives a history of the public lands of Maine and sets forth the times and manners in which a public domain of some eight million acres was allowed to pass into the hands of speculators and railroads with small returns to the state and public; a history which has been duplicated in many of our western states at a later day.

H. H. C.

Report of the State Forester of California for 1907-08.

This report is largely occupied with fiscal matters and urges larger appropriations, the most important of which is a State fund that might be used in coöperation with the counties to hire fire patrols.

Thirteen out of 53 counties have appropriated funds for payment of fire wardens and 128 wardens were so employed. Volunteer wardens numbering 322 were appointed by the State, their expenses being paid from private sources. With the U. S. Forest Service rangers, who are State wardens, the force numbers 721 men.

The care of the State Redwood park is outlined, no mention being made of an unpleasant difference which arose during the year between the State forester and certain advocates of the park over the policy of removing dead or firekilled timber. The conception of a park in the public mind is that of an area protected from the axe and preserved in its natural state. The fact that the State forester subjected himself to widespread criticism by allowing some fire scarred redwoods to be cut serves to illustrate the danger to forestry that results from a confusion of parks with forest reserves. The care of parks should not be laid upon the State forester, but if unavoidable, he should make every effort to distinguish such areas from forest reserves in the public mind, and should go to an extreme in avoiding all cutting that might arouse resentment.

It is evident from the report that the forest fire service in the State is making progress, but that much remains to be done. So far, the State has not shared in the expense of local fire protection and consequently it has very little control over the work of the fire wardens. The beginnings of a better system are seen in the arrangements made by the State forester for a coöperative patrol by certain counties and the U. S. Forest Service, each paying half of the expense, to protect the foothill regions from fires.

H. H. C.

Report of the Division of Forestry, Territory of Hawaii, for 1907. Pp. 84.

The fourth report of the Superintendent of Forestry sums up the year's progress thus: "On the part of the Territory itself the points of notable interest during 1907 in the history of forestry in Hawaii are a definite annunciation of policy in regard to the two main classes of Hawaiian forest; the extension of the forest reserve system, through the setting apart of additional areas and the completion of field work bearing directly on the creation of other new reserves; the establishment of a systematic exchange of seed with Botanic gardens and other similar institutions; and an amendment to the forest law by giving to the Governor more extended power in the creation of forest reserves."

On the part of private interests and corporations there is also much that is worthy of record. Particularly to be noted is the increasing interest in tree planting on waste lands; the extension of the rubber plantations on Maui; the beginning of cocoanut industry; and especially the real establishment of the lumber industry in the leeward districts on Hawaii through the signing of a contract between the Hawaiian Mahogany Lumber Company and the Santa Fe Railway System whereby there will be sent to the mainland during the next five years over 2,500,000 Ohia Lehua railroad ties.

J. H. W.

Third Annual Report of the Commissioner of Forestry of Rhode Island. Providence, R. I. 1909. 26 pp.

The Third Annual Report of the Commissioner of Forestry for Rhode Island indicates that progress is being made in educational lines. The state still lacks the first attempts at a fire warden system and the hope is expressed that needed legislation along this and other lines may soon be secured.

H. H. C.

Report of the Chief Conservator of Forests, Cape of Good Hope, 1907.

This report shows that forestry in Cape Colony is not on a very high level as yet. The area of state forests, after current additions and exclusions, remains about the same as in 1906, comprising some 1,000,000 demarcated and 390,000 undemarcated acres. The total revenue from all sources amounted to $175,000 (15 months) with an expenditure of about double that amount the bulk of it on salaries and nurseries and plantations. Some 1750 acres were planted, about half of this timber plantations, and the other half drift sand and tie plantations. Attempts to obtain natural reproduction are weak, owing to lack of funds, and grazing prevents regeneration on the unfenced reserves.

Some work was done on valuable surveys, yield and increment tables, and a working plan for the Pirie Forest of 7,000 acres was completed.

Over 1500 prosecutions for forest offences—mainly tree cutting, fire setting, and game hunting—resulting in $10,000 fines and $2,000 damages attest the departments' attempts towards protection of the forests from the natives. Fire protection is mainly by cleaned belts. 63 fires (44 from unknown causes) destroyed 98 acres during the year of report. The settlement of boundaries seems to demand a large share of the department's attention.

Some discouraging features in the past year have been the transfer of certain undemarcated forests from the control of the Forest Department to District Councils, the historic trouble with communal forests, the cutting of millions of saplings, annually for hut wattles and the lack of funds.

J. H. W.

Canada's Fertile Northland. A glimpse of the Enormous Resources of Part of the Unexplored Regions of the Dominion. Edited by Captain Ernest J. Chambers. 139 pp., 17 Half-tone Illustrations and 5 Colored Maps in Case. Published under Direction of R. E. Young, Department of Interior, Ottawa, 1907.

Contains the evidence heard before a Special Committee of the Dominion Senate during the session of 1906-07 and the report based upon it.

In the evidence heard before the Committee some striking facts stand out prominently, a number of which are summarized in the Introduction. Mr. A. P. Low, Director of the Geological Survey, for example, said that Ungava possesses a belt of iron-bearing rock, probably 100 miles long and 200 to 300 miles wide, which in the future will furnish a large supply of iron for Canada. He also said that in the region north of Lake Winnipeg is an area of 5,000 to 10,000 square miles of coutry adapted for agriculture.

Mr. W. F. Breden, a member of the Alberta Legislature, estimated the area of the available agricultural lands in northern Alberta and Mackenzie at 100,000,000 acres. Others testified that at a point some 400 miles due north of Edmonton splendid crops of wheat, barley, oats, peas, etc., have been regularly raised for more than twenty years, the product for 1906 being 25,000 bushels. The production of grain in these sparsely settled regions has resulted in the establishment of local grist mills of considerable capacity which manufacture flour by modern processes. Potatoes and other vegetables have for years been satisfactorily cultivated at Fort Good Hope, on the Mackenzie River, 14 miles from the Arctic Circle. Vegetation matures quickly owing to the long, sunny days of summer. The lakes and rivers teem with fish, there is an abundance of game and considerable mineral wealth, including coal, oil, copper, silver, gold, salt, sulphur, ochre, sand for glass making, etc.

In regard to the climate, the committee say in their report:

"Although in the north the thermometer in the winter season registers low temperatures, the cold is much more bearable than are far higher temperatures in countries where there is humidity in the atmosphere. There is said to be little or no difference between the climate at Lesser Slave Lake and that at Edmonton 250 miles to the south. The Chinook winds blow as far north as Fort Providence, and for 21 days during last January it was not necessary to wear overcoats there. West of Peace River Crossing, stockmen must feed their cattle about seven weeks in winter, but eastward the snow is deeper and cattle have to be fed a little longer. At Fort St. John on the Peace River they often sow wheat in March and last year began cutting the wheat on the last day of July."

The various witnesses also testified as to forest conditions.

These reports show that probably fifty per cent. of the forest cover is burnt up without much chance of recuperation.

The growth is quite variable, as indicated in the map and description, given in the article of Mr. Fernow in the QUARTERLY, volume VI.

A Biological Investigation of the Athabaska-Mackenzie Region. North American Fauna, No. 27. By E. A. Preble, U. S. Department of Agriculture, Bureau of Biological Survey, Washington, D. C., 1908. Pp. 1+575; figs. 16; plates 25.

The report before us gives a detailed account of the various species of plants and animals, their adaptations and variations, their geographic distribution and their economic relations. Such reports are available in more or less complete form for other sections of the continent, including Labrador, Hudson Bay, Alaska, etc., but the Mackenzie region remained the most neglected large area in North America.

An important part of the report relates to climate and physiography. Temperature summaries are expressed in tabular fashion; likewise the dates of seasonal events at various stations. Such events include the first thaw, and the appearance of the first migratory birds from the south in the spring, and that of the migratory northern animals like the Barren Ground caribou from the north in the autumn. Some instructive generalizations are made regarding climate in general. The Peace River valley, of importance on account of its wheat-growing possibilities, exhibits the peculiarity of having an upper trans-mountain section protected from the northerly and easterly cold winds, with a mild winter climate; and a low plains section with almost Arctic conditions in winter. The middle section is favorable to plant growth, the powerful warm though irregular chinook winds making the section one of considerable agricultural promise. The limit of the distribution of Balsam Fir seems to limit this favorable region. From the mouth of the Churchill River, Hudson Bay, the northern boundary of the great transcontinental spruce forest follows the shore closely for a few miles, then curves gently inland. Thence it extends northwesterly, crossing Island Lake, Ennadai Lake on Kansan River, and Boyd Lake on the Dubawnt. The next dividing point is just north of 60° on Artillery Lake. From this point the line curves southwesterly crossing Lake Mackay south of latitude 64°. The banks of the Coppermine are the boundary to 67°. Tongues of timber follow the northward flowing streams, with their warmer water, well into the Barren Grounds. The most remarkable case of this kind is that of the Ark-i-linik, a stream tributary to Hudson Bay. From a point near latitudes 62½°north, within the main area of the Barren Grounds, a more or less continuous belt of spruce borders the river to latitude 64½°, a distance of over 200 miles by river. A few species of woodland-breeding birds follow these extensions of the forest to their limits. Alders occur in more or less dwarfed conditions in favorable places well within the treeless area, and several species of willows, some of which here attain a height of 5 or 6 feet, border some of the streams as far north as Wollaston Land These are the only trees which occur even in a dwarfed state in the Barren Grounds proper. The principal trees of the spruce forest whose northern limit is thus defined are the White and Black Spruce, whose range is co-extensive with the forest limits, the Canoe Birch, Tamarack, Aspen, and Balsam Poplar, Banksian Pine and Balsam Fir are common in the southern part of the belt, terminating from south to north about in the order given. With these are associated generally in the form of undergrowth, a variety of shrubs. The tree limit on the western mountains in latitude 56° is at about 4000 feet. The head of the Mackenzie delta is marked by islands well wooded with spruce and Balsam Poplar. Lower down these trees give way to willows which continue to sea. The interesting observation is made that the trees of the swamp in their more northern fields seek the dry land.

The life zones included in the region comprise parts of three subdivisions—the Arctic, Hudsonian, and Canadian Zones. The boundaries of these zones are shown in a very useful map in considerable detail. Each zone is summarily described in a clear and comprehensive manner. B. E. F.

India-Rubber and its Manufacture. With Chapters on Gutta Percha and Balata. By Hubert L. Terry, 294 pp., 18 illustrations. D. Van Nostrand Company, New York, 1907. (Price, $2.00).

India rubber has become an almost indispensable commodity, and this circumstance has stimulated the interest of the public in its natural history and its manufacture. This volume is not a handbook for those engaged in the rubber trade. Its purpose is to supply to the general and the critical reader the latest information relating to the whole subject of India rubber. Mr. Terry has admirably carried out his design, and the fact that the story of rubber and its uses is of unusual interest has enhanced the readable quality of the book.

The author tells of the discovery of India rubber's characteristics and usefulness, describes its production, explains its chemical and physical properties, and deals with vulcanization and other processes. The chapter on India rubber plantations shows how widely and successfully American rubber plants, especially Para, and Castilloa have been introduced into Asia. There are chapters on "India rubber substitutes", "reclaimed rubber", "the washing of crude rubber", "the compounding of India rubber", "India rubber solvents", "gutta percha", "balata", and a series of chapters on the production of all kinds of rubber goods. The work is more comprehensive than any other in English on this subject.

(From Bulletin American Geography Society.)

Hints on Drawing Legislative Bills. By Ernest Bruncken, California Legislative Reference Bulletin, No. 1. Sacramento, 12 pp., Dec., 1908.

It is the contention of the reviewer that all professional men, foresters included, should know and be taught systematically at their schools or Universities principles of law, especially of the laws of contract, real estate, trespass, etc.

While the brief pamphlet of Mr. Bruncken's is evidently intended for the use of legislators it will be useful to such forest officers as the State foresters, who are called upon to draft bills, but also to others who wish to eke out their neglected education in this matter.

The pamphlet is written in simple clear style, and while the prescriptions are almost all self-evident, it is useful to have them systematically brought together. Mr. Bruncken could do excellent service in educational lines by following up this first issue by others, elucidating the principles of the various bodies of law as indicated in the same simple manner. B. E. F.

The Lumber Tariff in Relation to the Value of Farms and to the Property Interests of Farmers and Other Small Timber Owners. By James E. Defebaugh. Filed before the Ways and Means Committee, Washington, D. C., February 18, 1909.

This brief aims at showing from the U. S. Government statistics that the proposed change in the lumber tariff would injure a large number of small timber owners for each individual heavy stumpage owner.

The writer points out that the average saw-mill is a small enterprise, 25,267 mills out of a total of 26,934, in 1907, cutting less than five million feet each, or 20,604,500,000 feet out of a total cut of 40,256,154,000 feet—one-half. These small mills represent an average investment of $4,000, and seldom own their own limits but are run on currently bought lumber. Only some 2,000, the larger mills, own their own timber. The ownership of the standing timber of the United States is thus classified by the author: Government, 20%; lumber manufacturers and heavy owners, 35%; farmers and small timberland owners, 45%.

The timber for the small mills is bought from some two or three million farmers and small timber owners. A table is given of the prices paid these for logs for the last two decades showing that their stumpage prices have risen with the price of lumber. It is claimed that the removal or reduction of the duty would decrease stumpage values and so would injure not alone the few thousand large mill operators and timber owners, but likewise millions of small holdings. J. H. W.

The Book of Camping and Woodcraft. By Horace Kephart. Second Edition, revised. Toronto, 1908. 323 pp. 12°.

This is a delightfully written booklet, which every forester should read, and more than that: portions of it he should know by heart, or, if his memory is treacherous, he should carry it with him on his camping trips, for it is filled with good practical hints, recipes, etc.

The writer is broad enough to invite judgment and choice, giving good and bad points of various contrivances and behavior, and the whole book is pervaded by common horse sense. B. E. F.

Waldbau auf naturgesetzlicher Grundlage. Ein Lehr- und Handbuch. Von Heinrich Mayr. Berlin, 1909. Pp. 568. Price, *mk* 15.

This latest and most important sequel to Wagner's epoch-making silvicultural volume deserves and will find a fuller review in a later issue. We consider it, however, so important an accession to our silvicultural literature, that we do not wish to delay its announcement.

As one would expect, nearly half the stately volume is devoted to a discussion of the biological laws upon which silviculture rests, and this is its most important part. The second and third part, besides describing the existing practices tests them in the light of the biological laws developed, leading to some conclusions at variance with the practice.

The last six pages of the book contain the gist of the whole book in Professor Mayr's novel proposition of silvicultural management—the "small stand" management.

The principle of this management is to break away, both from the uniformity of the pure stands under clearing system which, while financially the best, are inviting dangers to stand and soil, and from the selection forest, which, while most conservative of soil conditions, is financially the poorest, and also from the mixed forest in regeneration system under nurses, group or otherwise, with long periods, which the author contends, have proved failures. He substitutes a form of mixed forest, in which each species appears in small stands of from three-fourths to eight or ten acres in extent, each of these enlarged groups or clumps of pure forest to be managed by itself, with a thinning practice which in the 40 to 50 year makes underplanting for soil cover desirable.

The reproduction, after having been once established by planting is to be done by shelterwood system within the small stand, which, under such management would permit a regeneration in five to six years, removing the main difficulties of natural regeneration, also securing the safety against the various kinds of damage for which the mixed forest is noted, and at the same time securing the greater financial efficiency of the pure forest.

The author, claiming the general applicability of this method, expounds: "In the American forest with its large number of species the small stand forest may be found the best form for preserving the important species, and to reproduce and grow them. Where thinnings (or improvement cuttings) would be necessary to preserve desirable species in competition against overpowering weed species, it may not be possible to apply the method because of the extensive areas involved, the large amount of weed trees left, the unsaleableness of the material, the high wages. *Here only the pure stand resulting from clearings followed by planting solves the problem,* (an attitude which we may as well subscribe to for many of our culled mixed forests!). The small stand management reduced the pure stand to the size biologically admissible, assures the preservation of the valuable species, and permits the needed thinnings, etc."

We hope to return to a fuller and more critical discussion of this most meritorious work at a later occasion. B. E. F.

A Manual for Northern Woodsmen. By Austin Cary. Harvard University Publishers, Cambridge, 1909. Pp. 250. Price, $2.00.

This manual is a very handy book, not only on account of its contents, but also in the make-up. It contains chapters on surveying, mapping, mensuration and estimating. The author does not lay claim to originality for much of the material, but has drawn together what he considers likely to be most useful. The result is a very handy pocket manual of information along the above lines most likely to be called for in woods work. A chapter of tables increases the usefulness of the book.

It might be suggested that the introduction of a chapter on silvicultural questions, rates of growth, etc., would not have been amiss, since the book will no doubt be read by many woodsmen who have no knowledge of forestry principles.

J. H. W.

Die Harze und die Harzbehälter mit Einschluss der Milchsäfte. By Dr. A. Tschirch. 2nd Edition, 1906. 1268 pp. Price, 32Mk.

This is the most exhaustive work on resins and resin ducts in existence, based on a life time of study, including all the known resins and milky juices of the world.

The author distinguishes a primary or superficial resinous exudation as a result of superficial injury, and a secondary more vigorous resin flow in the same species as a result of deeper incisions, including a flow richer in turpentine, and including also the formation of resin ducts where normally such are absent, as in firs, so that the wounding is really the cause of the resin formation. Full description of the various resins and balsams and of their commercial collection and use is given.

Here, however, weaknesses appear. How even a well informed author can go horribly astray is attested by his reference to *Abies balsamea* and *Abies Fraseri* as sources of *Canada balsam,* and *Abies Canadensis* and *Pinus Fraseri* are also cited as sources of supply.

The botanical part undoubtedly is the most interesting, especially as it furnishes a new explanation of the origin of resin formation. The author recognizes an amorphous resinogen layer which surrounds the resin duct, superimposed on the thin walled epithelium-like cells which surround the duct, and which were hitherto supposed to be the resin producers. This layer is not a part of cell contents, but rather of the membrane possessing the capacity of slimy excretion.

B. E. F.

Alpwirtschaftspolitik in Oesterreich. Veröffentlicht vom K. K. Ackerbauministerium. Vienna, 1908.

The wave of enthusiasm regarding the "conservation of resources" is not confined to this continent as this publication of the Austrian Department of Agriculture testifies. The object is to state precisely the policy of the government with reference to the Alps, of which about 3.5 million acres are located in Austria. The main principle in this policy is maintenance of the Alps for their purpose, which means maintenance of forest wherever found, and improvement wherever necessary. For this purpose there are created special commissions, executive local committees, conversant with local conditions—a truly democratic institution. Organization of all interests, strict segregation of forest and pasture and regulation of the existing servitudes is believed to be at the bottom of success.

B. E. F.

OTHER CURRENT LITERATURE.

Forest Taxation. A reprint from the Addresses and Proceedings of the International Conference on State and Local Taxation held at Toronto, October, 1908. Contains addresses on forest taxation by F. R. Fairchild, A. C. Shaw, and B. E. Fernow. Published by the International Tax Association, Columbus, Ohio. 42 pp.

Report of the Commission on Inquiry on Tax Lands and Forestry to the Governor and Legislature of Michigan. Lansing, Mich., 1908. 146 pp.

Report of the Oregon Conservation Commission to the Governor. Portland, Ore. 1908. 122 pp.

The Conservation Idea as Applied to the American Society of Mechanical Engineers. Presidential Address by M. L. Holman. Published by the Society, New York, 1908. 41 pp.

Douglas Fir. A Study of the Pacific Coast and Rocky Mountain Forms. By E. H. Frothingham. Circular 150, U. S. Forest Service, Department of Agriculture, Washington, 1909. Pp. 38.

Production and Consumption of Basket Willows in the United States for 1906 and 1907. By C. D. Mell. Circular 155, U. S. Forest Service, Department of Agriculture, Washington, D. C., 1909. Pp. 14.

Preliminary Report on Grazing Experiments in a Coyote-Proof Pasture. By J. T. Jardine. Circular 156, U. S. Forest Service, Department of Agriculture, Washington, D. C., 1909. Pp. 32.

The Future Use of Land in the United States. By Raphael Zon. Circular 159, U. S. Forest Service, Department of Agriculture, Washington, D. C., 1909. Pp. 15.

Our Wasteful Nation. The Story of American Prodigality and in District Offices. U. S. Forest Service, Department of Illustrated. New York, 1908. Pp. 134.

Manual of Procedure for the Forest Service in Washington and in District Offices. Forest Service, U. S. Department of Agriculture, Washington, D. C., 1908. P. 93.

Report of the Committee on Agriculture on Acquiring Land for the Protection of Watersheds for the Conservation of Navigable Streams. House Report No. 2027, Washington, D. C., 1909.

Special Message from the President of the United States transmitting a Report of the National Conservation Commission. Washington, D. C., 1909.

The Revegetation of Overgrazed Range Areas. By A. W. Sampson and F. V. Colville. Circular 158, U. S. Forest Service, Washington, D. C., 1908. Pp. 21.

The Lumber Cut of the United States: 1907. Department of Commerce and Labor, Bureau of the Census (in co-operation with the Forest Service), Washington, D. C., 1908. Pp. 53.

Pflanzengeographische Studien über die Bonin—Inseln, with chart. By H. Hattori. Journal of College of Science. Imperial University, Tokio, Japan, Vol 23, Article 10, 1908.

Pflanzengeographische Karten aus Sachsen. Three sheets. By Pof. Dr. O. Drude, Mitt. des Vereins für Erdkunde zu Dresden, No. 7, Dresden, 1908.

A Bibliography of Forestry in California. By Ernest Brunck-en. 1908. 16 pp.

Forest Mensuration of The White Pine in Massachusetts. How to estimate standing timber; log scales; volume tables; yield tables; financial rotations; growth tables; thinnings, etc. By Harold O. Cook, 1908. 50 pp.

Farmers' Bulletin No. 342. Experiment Station Work, U. S. Department of Agriculture, November, 1908. Washington, D. C. Pp. 32. Of interest might be mentioned: Conservation of Soil Resources, Fig Culture in the South, Mushroom Growing, Preserving Wild Mushrooms.

PERIODICAL LITERATURE.

In Charge:

Botanical Journals, ...R. T. FISHER, C. D. HOWE
Foreign Journals, ...B. E. FERNOW, F. DUNLAP
Propagandist Journals, ...H. P. BAKER
Trade Journals, ...F. ROTH, WALTER MULFORD

FOREST GEOGRAPHY AND DESCRIPTION.

Rocky Mountain Vegetation.

The localities studied by Mr. William Cooper are on the summit and eastern flank of Front Range of the Rocky Mountains and they lie between Mt. Tyndall and Stone's Peak, a distance of about fourteen miles. The areas are on the continental divide, and they have an average altitude of 12,380 feet. Physiographically the author divides the region into the flat summit of the divide and the slopes similar to it and the glacial canyons; and from the standpoint of vegetation into the alpine grassland and the forest.

The alpine grasslands are of two types, the dry meadows occupying the exposed slopes and ridges; and the wet meadows in the upper portion of the glacial canyons. The distribution of the two forest societies is determined by the soil water content. *Pinus flexilis* in almost pure stand covers the dry summits and upper slopes of the ridges between the canyons up to the limit of tree growth. The spruce—fir society (*Picea Engelmanni, Abies lasiocarpa*) is confined to situations where there is an abundant soil water content, that is in the canyons. The fir is more abundant near the streams, and seldom or never, in the region studied, ascends to the timber line.

At the timberline, *Pinus flexilis,* even in the most protected places, is irregular and contorted in habit, while *Picea Engelmanni,* even in the most exposed places persists in its upright habit. The altitude of the timberline is practically the same in the canyons as on the dry ridges, namely 10,900 feet. The author concludes that *P. flexilis* has reached its climatic limit on the ridges, being prevented from farther advance by dry winter winds, but that *P. Engelmanni* on the wet meadows is ascending to altitudes higher than its present limits.

The Alpine Vegetation in the Vicinity of Longs Peak, Colorado. Botanical Gazette, 1908, pp. 319-337.

Forest Practices in France.

Dr. Martin continues his valuable critical review of forestry practices in various countries on the basis of personal observation, France being the latest object of discussion. The statistics are briefly as follows. The total forest area occupies only 16%, the departments of Landes with 47%, Var with 42%, and Vosges with 35% being the most heavily wooded.

The State owns 2.5 million acres or 11%; municipal and other public corporations 23%; leaving 66% for private ownership. The latter is absolutely free of state control, the organic forest code of 1827 being silent on this point, except only on areas declared as protective forest, where clearing is forbidden. Corporation forests are administered by the State.

The management of State forests is extremely conservative, large accumulation of old stock and high rotations are characteristic, while the corporation forests are managed much more extensively.

This appears in the distribution of systems of management. In the State forests 40% are timber forest, 26% composite, 1% coppice, 9% under conversion from the latter to timber forest, the balance protective forest, except about 14% still without working plans. Of corporation forests only 20% are timber forest, 10% coppice, 3% protection forest, the balance composite, except about 15% which is still without system. While in the State forest about 15% of the timber forest is under selection system, in the corporation forest nearly 60% is under that system. Private forest appears to be mostly in coppice or composite forest. (Apparently, therefore, of the total of 23 million acres, only about 2 million acres are timber forest—a poor showing!)

The most prominent species in State and corporation forest is the oak with 29% of the area, beech follows on 19%, blue beech on 16%. Conifers are poorly represented; fir occupies 7%, especially in the lower and middle altitudes of the Vosges, Jura, Alps and Pyrenees; spruce occurs only in the high altitudes of these mountains excepting the Pyrenees, and has no commercial value. Larch, too, occupying the same range on about 2% of the area is of little economic value.

Scotch Pine is widely planted in the lowlands everywhere, but did not naturally exist except in the higher elevations of the Vosges, Alps and Pyrenees, not on the limestones of the Jura. Along the Mediterranean and Atlantic shores, in the nearly subtropic climate, an evergreen oak and *Pinus maritima,* which is also planted elsewhere, are of economic importance.

Oak forests, pure, or in mixture with beech, or the blue beech, is the prominent forest type. The areas visited in the watershed of the Loire, the author points out, do not represent the average but the optimum in every respect for oak, climate as well as soil are best suited, and the forest is here maintained on the best sites of all State forests. Hence, the results are far ahead of anything known in Germany. Straight form, clear boles up to 60 and 70 feet, with small crown diameters, resembling conifers in aspect, characterize the old stands. Correspondingly the product is astonishing. Stands of 180 to 220 years of age are seen with 80 trees to the acre (twice the number of German yield tables), with average diameters of 20 to 22 inches, height of 100 feet or more, 125 to 160 cubic feet to the stem, showing a cross section area of 640 square feet per acre, or 50 per cent. more than the German tables on the best sites, and 115,000 to even 140,000 cubic feet per acre—such stands as are impossible to secure in the German climate.

For the same reason, difference in climate and soil, the method of regeneration would not at all be suitable in Germany. Natural regeneration in 10 year periods is the general rule for which conditions are exceedingly favorable; a rich, humose, loose soil, full mast every 4 to 5 years, with intermediate partial masts often sufficient to produce full seeding and frost a rarity; hence, while, in general, Hartigs' prescription of three fellings, for seed, light, and final removal are followed, it does not matter much how quickly the fellings follow, for here the oak not only seeds plentifully, but can stand a large amount of shade, becomes positively shade enduring until 3 feet high and the progress of the fellings may be more or less rapid without much damage. These satisfactory conditions for natural regeneration make also the need of repair planting rare, which where necessary is done with 2 year seedlings.

On poorer soils the oak regeneration is sometimes completed by planting pine, which either acts as filler and is cut out earlier, or is allowed to grow into the main stand.

Natural regeneration forms altogether the fundamental principle of French silviculture, artificial planting is to be resorted to only for recovering mountainsides, waste lands repair planting or introduction of new species. While for France, with its mild and humid climate, the author agrees, that this is the best silvicultural policy, in Germany conditions are different, especially for the oak. Not only are climate and available soil less favorable but oak stands in condition for natural regeneration are rare. Artificial reforestation is here forced and is successful.

The same arguments hold for other species than the oak; whenever conditions of site and stand warrant it, natural regeneration is to be preferred, but soil and economic considerations may properly limit its use, as with spruce which on account of wind danger forces to planting; pine which with its exceeding light requirements on the poor soils to which it is confined forces to the same method.

While on paper the need of early and repeated thinnings for the proper development is accentuated in the French literature, in practice, the operations are often omitted. The well-known French method of *éclaircie par le haut* seems also more an academic tenet, than a practised operation except in mixed forest.

Notable is the longer interval in which thinnings are made, 8 to 10 years being the rule, and in the young timber 12 to 20 years. Two thinnings in the 24 year period is prescribed in the working plans of the oak forests visited. The degrees of thinning is according to German nomenclature *moderate;* in the 60 year old stands the best trees to be favored in the thinnings are marked with white paint. The underwood is carefully preserved for the sake of soil protection until the regeneration requires its removal.

The very long rotations, Martin thinks, could be considerably reduced by a more intensive thinning practice.

While otherwise the silvicultural practice of France in its technical execution in State and corporation forests is excellent, the forest regulation work or working plans leave much to be wished for. Indeed, real working plans are mostly absent, but the condition of the woods and the maps give an insight into the poverty of the methods employed, especially in locating the orderly progress of fellings and in the determination of the felling budget. The working block is called *series*—a series of annual fellings, to be managed as a unit and often coinciding with a forest ranger's beat *(triage)*. Besides, there is a division into *sections*—parts of a forest under one system of management *(taillis, futaie regulière, futaie jardineé, etc.)*, while the series is divided into periodic areas *(affectations)*, in the forest visited into 8 periods of 25 years each. It is a most characteristic principle of the French working plan, that these periodic areas should as far as possible be laid together (the opposite of the Saxon method where the dismemberment of the felling areas is most developed). To secure this arrangement great sacrifices have been and are being made by cutting unripe stands or leaving ripe ones, the schematic arrangement of the felling series being considered the most needful condition: the result is a collocation of large areas of the same age classes. In Germany, under Hartig's lead the same tendency existed, at least in the beech forests, but has long been abandoned as regards a severe adhesion to the rule. The results of such extensive regeneration and uniform age class areas are increased danger from insect pests, fire and especially windfall. This latter danger has, then, already begun to show itself in the French oak and fir forests: so extensive has been the wind damage in the fir forests of the Vosges that the windfirmness of the species as compared with the shallow rooted spruce is doubted. The oaks, too, which show a shallower root system than is usual, suffer on the regeneration areas. A discussion of the conditions of wind damage follows.

The determination of the felling budget and of the rotation is next discussed. In the oak forests visited, the rotation was found to be 200 years in 8 *affectations* of 25 years, with a felling budget of only 47 cubic feet total, of which 28 cubic feet workwood, a very modest amount, surely not equal to the increment. While the stands show a large number of trees and large volumes, the diameters are not what could have been secured under the excellent growth conditions. No tangible reasons for this long rotation could be given by the managers.

On paper, the forest administration declares the maximum average increment as avowedly the basis for determining the rotations after the example of Hartig. But the data for such determination seem scanty. A determination of the average increment of one of these 200 year old stands brought out 96 cubic feet, and counting in probably unbooked thinnings, 100 cubic feet may be assumed. The current increment was by a casual increment per cent. calculation found to be at about the same amount, so that here really the 200 year rotation seems to represent that of the highest average increment. In the latest German yield tables of Schwappach, this rotation lies on best sites at 100 years. It was, however, found that under the French conditions both current and average increment remain nearly alike for a century or more, so that the greatest uncertainty arises as to the proper felling age determined from this point of view of volume production.

The French Forest Administration admits the obligation of devoting its forests to growing stout sizes, hence value increment enters if not in calculation, yet in general judgment the question of ripeness. Stem classes formed by circumference measurements (200, 100-200, under 100 *cm.*) which, translated, correspond to 26, 13 to 26, under 13 inch diameters bring (the trees are sold on the stump) $13, $9 and $6 respectively. While these data are insufficient for an accurate value increment calculation, in connection with the diameter increment calculations they allow an estimate of at least 1 per cent. annual value increment. Other calculations show that from the standpoint of value increment the stands should still be left growing.

As regards the justification of the rotation upon the basis of a proper interest earning on the wood capital, while this is discussed in French literature, nothing tangible appears in the regulation work, but general considerations lead to the belief that such long rotations do not pay, and by proper thinning practice the same dimensions and values can be grown in much shorter time.

The French have thoroughly recognized the fact that timber growing is not a business for the private individual. Tassy says: "It is not to be hoped that private owners will ever find their interest in the management of their woods in the form of timber forest. To lead them to this, it would be necessary not only for money interest rates to sink considerably but, what is more difficult to attain, the 'unforeseeableness' of things, the needs of the present, the uncertainty of the future would have to cease playing a role in human affairs." This position is borne out in actual conditions, private forests are mostly not timber forests, rotations are short, stocks insufficient, the opposite of the State forests.

Yet, as the author contends at length, while the attitude of the State towards its forest property must be different, there is no good reason why it should forego any of the financial advantages from it, reducing cost of production and not lengthening time of production beyond the necessary. French forest management with high rotations, moderate thinnings and low interest earnings needs reform in this direction.

Even private owners in France are beginning to change their attitude. The profitableness of coppice and low rotations begins to become doubtful; rise in labor prices and lack of market for charcoal have depreciated the value of coppice; decrease in interest rate and increase of wood prices lead to accumulation of more wood capital and increase of rotation.

Composite forest *(taillis sous futaie, taillis composé)*, as we have seen, forms, with about 8 million acres, the most widely distributed system of forest management in France, often hardly to be distinguished on account of the scanty overwood, from the simple coppice with overholders. For 200 years and more this system has persisted on many areas without change.

A simple area division forms the felling budget, but characteristic is the holding over for reserve one-quarter of the area, to be used only in case of need; such need occurs regularly during the rotation of 25 years, so that no change of rotation results from this reserve. This reserve idea dates from Colbert's celebrated order of 1669.

Rotations vary from 10 to 30 and more years, the 20 to 30 year rotations prevailing, generally higher than in Germany, where the sprouting capacity of stocks rather than the character of the firewood is the foremost consideration.

The overwood consists of three classes corresponding to three rotations; *baliveau*—to hold for two rotations, *modernes* for three, *anciens* which are in the fourth rotation of the underwood. A very accurate statement of numbers of each to be held over is made, in one case under observation 50, 14, 6 respectively per hectar, a very open position, the overwood representing from 600 to 700 cubic foot per acre rarely up to 900. While in Germany the management of composite forest (of which there is little) is considered specially difficult, being most intensive, in France it is quite simple, due probably to the lighter overwood stand, and to the better climate which preserves stock in better sprouting capacity. Oak is the principle species involved. Old oaks are often grubbed out and such grubholes must be planted by the purchaser, or else he must pay for planting these, as well as of the spots which he has used for preparing his wood. He must also trim the overholders up to 18 feet in height. And all this is not on paper but actually and minutely and skilfully done. Thinnings are not made.

The yield of the composite forest is much more readily found out than that of the timber forest. It remains also very steady, in the case cited 52 cubic feet per acre and year, while the neighboring timber forest produced only 47 cubic feet.

According to the statistics of the Department of Agriculture for 1876 it was claimed that in the timber forest of the State the yield was only 42, of the corporations 24 cubic feet, while for the composite forest it was stated as 60 and 57 respectively. That this is not a difference due to system, which would make the composite forest yield so much larger, but due to other causes has been shown, especially by Tassy who figured out 85 cubic feet for timber forest as a moderate performance as against 60 for composite forest.

In price for the wood, the cubic foot of the composite forest with a little over 7 cents brings about half what the wood of the timber forest brings. The net acre yield in the Conservation of Tours brought for composite forest \$3.35, for stands in conversion \$3.60, for timber forest \$5.15 per acre. Of the 460 million cubic feet which the French composite forest furnishes annually only 80 million are workwood, surely a poor economic result for the area involved. While it must be admitted that for private ownership this system has its advantages, it is not proper for the State to carry it on. This has been recognized, and conversions to timber forests are under way.

Mitteilungen über forstliche Verhältnisse in Frankreich. Forstwissenschaftliches Centralblatt, 1908, pp. 468-485, 530-547, 655-665.

BOTANY AND ZOOLOGY.

Forest Types in Colorado.

Boulder County, Colorado, extends from the continental divide eastward to a distance of about 12 miles from the base of the Rocky Mountains. The topography of the region from its eastern boundary consists of plains; foot hills, broken by deep canyons, and attaining a height of 7,300 feet; a plateau region rising from the latter elevation to 9,750 feet and the mountain crests and ridges extending at their highest elevations to 13,000 feet. The climate of the region is semi-arid, the average rainfall for 9 years at the base of the mountains being 17 inches. The precipitation was 10 inches greater than this on the summit of the range during one of the years (1904) in which the study was made.

The author, Mr. Robert Young, divides the forests of the region into seven formations and he gives for each the temperature, relative humidity, soil water content measurements, taken during the two summers (1904-1905) of study in the field. Passing by two poplar-willow formations which occur along the banks of streams, one finds that the dry mountain slopes are occupied by three formations, namely, the *Pinus scopulorum* formation extending from the base of the slopes, at an altitude of 5,300 feet, to about 7,800 feet; the *Pinus murrayana* formation, extending from the latter elevation to 12,750 feet; the *Pinus flexilis* formation extending from 7,300 feet up to timberline.

The moister slopes and bottoms of the canyons support two formations, the *Pseudotsuga mucronata-Picea engelmanni* and the *Picea engelmanni-Abies lasiocarpa* formations. In the former, Pseudotsuga is far more extensive, *P. engelmanni* being confined to the cool, moist bottoms of the canyons where it forms only a straggling society. Pseudotsuga on the other hand extends up the drier slopes until it meets the pines. The area which this type dominates lies between 5,800 feet and 8,700 feet. The *Picea engelmanni-Abies lasiocarpa* formation occupies chiefly the canyons, although it may be found on ridges between 9,200 feet and the timber line.

The author does not state his reasons for making *P. engelmanni* one of the type trees of two formations. It would seem to one reading the text that the presence of the trees in the

Pseudotsuga mucronata-Picea engelmanni formation were due to the projection of its higher and more characteristic habitat into the area characteristic of Pseudotsuga and that, therefore, the author gives more prominence to altitude than to habitat in distinguishing the formations.

The measurements of temperature, relative humidity, and soil water content within these various formations are interesting, but they are not conclusive because of their short duration. For example, the most extensive records are those of air and soil temperatures. None of these records in any one formation extends through more than five days and yet the author concludes that mountain zonation is due entirely to temperature.

C. D. H.

The Forest Formations of Boulder County, Colorado. Botanical Gazette, 1907, 44, pp. 321-352.

Growth Energy of Trees.

A posthumous article by Hofrat Friedrich brings a series of measurements with one of his auxanometers (see description in F. Q., vol. IV, p. 52) on a number of species. The first and apparently hitherto only investigator of the growth energy of trees was Krabbe who came to the following results: 1. The force with which diameter growth takes place amounts in conifers to at least 10, in broadleaf trees 15 atmospheres. 2. At the time of summerwood formation this force is still 8 to 10 in conifers and 12 to 15 in broadleaf trees. 3. A limit of growth energy could not be determined.

A description of the apparatus is given: A spiral spring of tested capacity in a suitable framework and provided with a centimeter scale is attached tightly to the tree, and the pressure read off. The adjustment, it was found, was not quite simple, if the experiment was to be precise, but eventually all difficulties were overcome. As long as the elasticity of the spring is not approached by the growth energy the spring is compressed, and automatically a constantly increasing pressure exercised upon the wood. With increasing pressure the increment must become slower, and when equality of forces is reached, it ceases, the nonius, which is read off twice daily, does not move any more, the limit of pressure against which the cambial activity is able to work is reached, and the square washers in touch with the tree will be overgrown in the well known manner. A series of pictures of longitudinal cuts through the tested zone of the trees exhibits the result of the pressure.

It is interesting to note that in all species observed the growth, *i. e.*, the pressure, progressed evenly until the middle of September, then ceased quickly. In this connection, we recall the interesting observations of Professor Buckout recorded in the Quarterly, vol. V, p. 259, which seemed to make an exception for the European Larch as compared with the White Pine. The observations of Larch by Friedrich through three seasons show, at least for two seasons, a falling off of growth energy in July, as found by Prof. Buckout, authough this fact is not noted by the investigator. The White Pine, observed through one season, continued active at nearly constant rate, a Japanese Larch at an increasing rate, until the end of September.

The highest growth energy was noted for Basswood, which showed still cell division and growth under a pressure of 36 atmospheres, while a horse-chestnut showed a limit of 10, Larch of 12, and two maples ceased to grow under pressure of about 25 atmospheres.

To give an idea of the progress of the pressures through the season, and in different seasons, we condense some of the observed data, through the years 1904, 1905, 1906, in the following tabulation, the reading referring to the same date in the months, namely the 5th.

	Basswood.			*Spruce.*			*Douglas Fir.*			*White Pine.*		
Year	'04	'05	'06	'04	'05	'06	'04	'05	'06	'04	'05	'06
				Growth pressure in Atmospheres.								
May	...	11.1	21.9	...	3.2	13.8	...	8.3	17	...	3.2	12.9
June	7.4	13	25	...	6	17	3	10.4	17.8	...	6.5	15.3
July	8	16.4	29.5	...	8.3	18.1	3.7	12.7	18.8	...	8.4	15.1
Aug.	6	19.1	35	1.2	10.6	19.1	5.6	13.7	19.2	.7	10.4	15.6
Sept.	8	20	35.8	2.4	12.1	20.7	6.4	14.7	19.5	1.2	11.5	15.9
Oct.	11	20.4	....	2.6	11.9	....	6.4	14.6	....	2.8	11.5	....

It would appear from these and other records that generally speaking diameter growth in conifers is slower than in broadleaf trees which coincides with general experience.

Ueber die Dickenwachstumsenergie einiger Waldbäume. Centralblatt f. d. g. Forstwesen, 1908, pp. 482-498.

Symbiosis of Ambrosia Beetles and Fungi.

An interesting compilation of the existing knowledge regarding the cultivation of fungi by ants as well as of certain wood-infesting bark beetles and other woodborers is furnished by Dr. Knauer. Wood being poor food, the need of introducing other food materials is given, so-called ambrosia (first discovered in 1836 by Schmidberger) is an excretion of fungus mycelia which covers the bore holes. The idea of real cultivation is refuted and Hubbard's theory that the excreta of the beetles serves as fertilizer refuted. The observed practical fact that *Xyloterus lineatus* attacks wood felled in summer and immediately barked less than winter felled wood of conifers is explained because of the better substratum of the fungus in the pith ray cells filled with reserve material in the winter wood.

According to Neger there is no need of the teleological explanation by conscious culture on the part of the beetle. The fruit-body of the ambrosia fungus are either perithecia of the genus Cerastomella, or pycnidia of the genus Graphium from which the spores emanate as slimy drops. As the beetle leaves his nest it must pass the entrance hole of the mother beetles and cannot help brushing off the spores on his body carrying them to his new abode. The long-throated pycnidia and perithecia and the fact that the pores do not dust but are contained in a sticky mass would appear as phenomena of adaptation for the symbiosis of beetle and fungus.

Die Symbiose der Ambrosiakäfer mit Pilzen. Centralblatt f. d. g. Forstwesen, 1908, pp. 498-501.

Resin Vesicles in Englemann Spruce.

Mr. E. R. Hodson has recently called attention to the occurrence of resin vesicles, or "blisters," so typical of the genus Abies, in the bark of the Englemann Spruce *(Picea engelmanni,* Engelm.). His observation was first made near Bernice, Montana, in 1907, and later it was confirmed by other instances in Colorado. The vesicles are described as not so abundant or conspicuous as balsam blisters and lying deeper in the bark than in Abies. The only genus besides Abies hitherto described as having resin vesicles is Pseudotsuga.

A New Characteristic of Engelmann Spruce. Botanical Gazette, November, 1908, p. 386.

SOIL, WATER, CLIMATE.

Soil and Plant. In a study of the plant cover of portions of the Mississippi River Valley, Mr. Henry Hus enumerates the members of the various plant habitats, and from this enumeration one may get a good idea of the distribution of trees in passing from one bluff of the Mississippi River to the other. To one acquainted with their habitats in the north, the statement that *Quercus albo* and *Q. coccinea tinctoria* are "moisture loving" (p. 170) is interesting and supporting the general law, that in the northward distribution species seek drier soils.

The paper contains distributional and phenological tables of the 850 species of plants which were found in the twenty-four habitats studies. In the summary, the author makes the statement that for the majority of soils their chemical condition seems to be of the slightest importance in determining the presence or absence of a plant. After making an exception of the soils of salt marshes and alkali lands, he goes on to say that soils containing lime are also an exception to the above statement, for the presence of lime increases the amount of humus, causes the soil to assume a darker color, and aids in the germination of seeds. The basal rock of the region studied is limestone, and it influences chemically the soils of nearly all the habitats. Because of the general distribution of lime in the soils, its presence does not explain the diversity of the vegetation and the author concludes that such diversity is chiefly due to the varying soil-water content of the different habitats.

An Ecological Cross-section of the Mississippi River in the Region of St. Louis, Missouri. Missouri Botanical Garden, 19th Report, 1908.

Soil Preparation. A thoughtful exposition of the value of soil work in silviculture was given before the Hessian Forestry Association by Forstmeister Sellheim. While, according to him, the use of fertilizers is hardly practicable except in nurseries and possibly where on difficult sites it is necessary to help young plantations over the juvenile period, soil culture to im-importance of the physical condition of the soil and its influence prove physical conditions may be more widely employed. The even on the food materials is accentuated, its mechanical conditions having a bearing on the decomposition, the distribution and especially the leaching of the same. The size of the volume of the interstices in the soil and its granular structure are useful measures of the soil quality. Favorable conditions for the preserving of granular structure in the forest are the swaying of trees, work of the animal world, cover of foliage, litter and humus, protection against pattering raindrops by crowns. In the forest this works in the same sense as manuring in the fields. As means of improving soil structure, addition of lime, humus, and soil work may be employed. Water supply is the most important need; regulation of water contents, prevention of rapid drainage, of evaporation from dry soils and in dry seasons, promotion of penetration especially of gentle rains, as well as proper limitation of water supplies can be secured by correct and timely soil work.

In light sands avoid deep soil culture, it is either not necessary or is harmful by promoting the leaching of food materials. Depth to which soil work is to be done depends on the object to be attained. It is most desirable to work the soil over often: it needs time to secure the benefits of the work. In seed cuttings the preparation of a seed bed by the repeated use of the Danish roller-harrow is recommended, which costs $1.20 per acre and saves elsewhere, making a seed bed in which every seed comes to germination. Also in clearings followed by planting this working of the soil pays, promoting proper humification and making undesirable soils covers of huckle-berries, etc., innocuous, and mixing the raw humus with mineral soil.

Hessischer Forstverein. Allegemeine Forst- und Jagdzeitung, 1908, p. 406-407.

Making "Swamps" Available.

The Northern States and Canada abound in "bogs" or "swamps," which eventually will form an important area for farm and forest use. Indeed, for Canada, which in this respect is probably more generously endowed than the States, the problem of making the extensive bog areas more useful is probably to be solved in the not far distant future.

An article by Kathriner discusses at length procedure in Alpine bogs. The first requirement is a survey, and map on a scale of not less than 1:5000; but this does not obviate a close personal inspection of drainage conditions, and especially ascertainment of the cause of swampiness, as this may suggest the proper remedy. If, for instance, the surface and ground waters from a slope are subject to stowage by a change of angle to flat surface, and thus give rise to swampy condition, a simple ditch along the line of change of slope will remedy the trouble.

In most cases impenetrable subsoil and large precipitation are the cause, when a system of ditches becomes necessary. The density of this network is dependent on degree of wetness and character of soil; the distance of effective drains varying from 12 to 25 times the depth of the ditch. Hence, in very wet compact soil with a depth of ditch of 30 inches, the ditches would have to be 8 yards apart, while in a loose soil 18 yards might suffice. In order to avoid misjudgment due to accidental weather conditions, the flora should be used as an indicator of general moisture conditions. It is essential not to crowd the ditches. The depth of ditches may vary according to soil and circumstances from 2 to 3 feet with a width at base of 10 to 14 inches, wider in loose, narrower in compact soil, the slope of the sides being in loose soil made one foot per foot depth, steeper in stiffer soils, but it does not pay to save in this respect as maintenance becomes more expensive with steeper slopes.

The most difficult question is to what extent it is necessary to reduce the maximum water stage. In Alpine situations, where excessive rainfall is the main cause of swamps, there is little danger of drying out too much, and in most cases, even though species adapted to weather situations may be used, except in real peat bogs or high moors, the danger of over drainage is not great.

In peat bogs (which are the "swamps" to which we have referred above) there is danger of over drainage, because here, not so much as the author points out, is there a relative poverty of mineral constituents, but the physical conditions for water conduction and perhaps chemical conditions as yet unexplained are unfavorable.

It must, therefore, not be supposed that mere drainage of these bogs will improve them. The experience so far had points to the necessity of other treatment, liming or fertilizing, in order to secure satisfactory crops.

Entwässerung und Aufforstung nasser Flächen in Aufforstungsgebieten. Schweizerische Zeitschrift für Forstwesen, 1908, pp. 305-312, 333-341.

Influence of Deforestation on Climate.

Palestine is often cited as affording an example of the effect of deforestation on climate. Mr. E. Huntington in a paper dealing with the climate of ancient Palestine gives as evidences of the changes of climate the reduction in population owing to the diminution in fertility and resources of the countrty; the ancient routes of invasion, migration and trade, especially through Sinai and the Syrian deserts—which show more favorable natural conditions in the past than exist to-day; and the ruins of large cities, abandoned on account of lack of water. In explanation of these changes of climate he discusses the four hypotheses "of uniformity, of deforestation, of progressive change, and of pulsatory change." As regards deforestation, he finds that "forests were of limited occurrence in the time of the greatest prosperity of Palestine, and that there seems to be no evidence whatever that the cutting away of forests has had any appreciable effect upon the rainfall although it may have done harm in other ways. He comes to the conclusion that "none of the evidence conflicts with the hypotheses of progressive and of pulsatory changes with the probability on the side of the latter explanation.

Bulletin American Geographical Society, 1908, pp. 513-522, 577-586, 641-652.

Deforestation and Climate.

The forest area of Mauritus has been reduced from one-third in 1850 to one-tenth in 1880. After investigating the effect on the climate, Mr. A. Walter, Royal Alfred Observatory, concludes that the cutting of the forests may have had some effect, although a very small one, on the total rainfall, but that the effect has been greater in the case of the number of rainy days. The rainy days in the districts denuded of forests have been decreased by about thirty a year, but under such conditions that the amount due to these thirty days is only about 6 to 10 inches, whereas the annual variation of the total rainfall is often 60 inches. Before deforestation "rain fell on many calm afternoons, because the presence of the moisture transpired by the trees was sufficient, by increasing the humidity and decreasing the pressure, to cause slight showers." The rains thus caused are, however, very local, and the author of this paper does not recommend any great work or expense in planting trees with the idea of improving the climate generally.

R. DeC. Ward, in Bulletin American Geographical Society, 1908, p. 746.

SILVICULTURE, PROTECTION, EXTENSION.

Cultivation of Poplar.

It is stated that poplars furnish in France an annual wood product valued at $6,000,000, Paris alone consuming annually about 7 million cubic feet. Thus, according to Breton-Bonnard's volume *Le peuplier,* the poplar is next to oak, the most useful tree, and the only one which he who plants it may harvest. Dr. Thaler discussing the propagation of poplars advocates the use of seed rather than the customary cuttings. The seed ripens the end of May to beginning of June (*P. Canadensis* a fortnight later than *P. alba*). It should at once be sown in a seedbed thoroughly watered, the seeds in their wool being placed in thin layers on the ground, pressed in, and covered with very fine soil, so that the wind will not move them but the wool still remains visible. The seedbeds are shaded by placing beech brush along their sides, and are daily watered several times with a sprinkler, and this treatment is continued some time after the little two-leaved seedlings have appeared. A dose of lime dust protects them against snails and worms. Transplanted after a year the transplants made a growth of over five feet the first summer.

The male and female plants of *P. Canadensis,* grown from cuttings, show differences, the males having a gray bark, the female, yellow bark; the males have larger leaves, and at the tip for a foot, or foot and a half there are four diagonally opposite small cork wings which are lacking in the females.

Anzucht von Pappelsämlingen. Allgemeine Forst- und Jadgzeitung, 1908, p. 378.

Planting Under Spruce Cover.

An inquiry among Hessian foresters showed that the majority favors the planting of spruce under the cover of other trees, oak and larch, beech and alder being considered best. Pine was undesirable because it did not do enough to subdue weed growth. From one section it was reported that this procedure did not lead to good results, others thought, at least in higher altitudes cover could be dispensed with on account of the humidity in such locations. It is especially necessary not to keep the cover too long, particularly on poor soils, where plants require the most light.

The theory of the cover is explained in that the excessive stimulus of intense daylight is kept from the young plants, so that their growth is not more rapid or better, but quieter, steadier, surer. Under the protection of the cover the young plant, which has experienced a shock in its life function by the transplanting, finds time to establish itself and make new roots and shoots. The dangerous infantile stage is more readily overcome, the battle with grass and drouth made easier and shorter. Trying winds are kept off as well as the light, and yet the fresh air which suits the spruce is secured.

On dry soils, to which spruce is at any rate not adapted, planting under cover is not suitable, such planting is absolutely necessary only exceptionally; it is advantageous in all conversions with a soil cover of undecomposed foliage and litter and raw humus, in order to prevent drying out, and blowing away of the foliage cover, also on sunny slopes. It may be dispensed with in all protected situations, on north and east exposures, on small strips and other small clearings surrounded by timber.

Hessicher Forstverein. Allgemeine Forst- und Jagdzeitung, 1908, pp. 405-6.

Wagner's Strip Selection Method.

Upon the basis of personal inspection of Wagner's results with the so-called selection strip method, which has called forth so much comment, Eulefeld gives a description of conditions under which these were attained. The district, Gaildorf, near Stuttgart in Wurtemberg, is a private property, mountainous, about 800 feet altitude, located on Keuper formation, with heavy clay soils to fine and coarse sands and all intermediate classes. Spruce, fir and beech form the stands, mainly the first. The growth is good to very good. The soil in openings is inclined to weeds, in the close forest a light moss cover not inimical to seeding. The method hitherto pursued was clearing followed by planting with spruce transplants; in the mixed stands natural regeneration under shelterwood did not succeed. The fir which had made the stands windfirm vanished thus in the new crop. Owing to the drying east winds and hot sun the plantation suffered. Wind danger on the plain areas is great and, due to impenetrable subsoil, accumulation of spring waters add to the danger.

The observation that certain stands on the north side of the district were exposed by the cutting of a neighbor's stand and had readily and fully seeded the felling areas led to attempt to use this hint. Instead of beginning fellings as hitherto in the East, the northern side was opened up in narrow strip, half a tree height, *i. e.,* 10 to 15 yards broad, and this planted with stout transplants. In many places this planting proved unnecessary, a sufficient natural regeneration, even of fir, having covered the ground. Adjoining this strip, a strip of similar breadth is lightly thinned out; within 200 yards another such combination of bare and thinned strip is made, and so on. When a sufficient seeding of the bare strip has resulted, further thinnings until final removal take place in the neighboring strip and at the same time an opening up of another strip, progressing with the fellings from North to South. The results are a perfect success; conservation of moisture was the secret, as well as the favorable seedbeds. The difference in appearance of the regeneration on the north sides and the plantations open to the East and South is striking, the latter being yellow and sickly.

The soil cover and the weeds, too, indicate the difference not only in their development but in the species to be found under the two conditions. In addition to more favorable soil conditions, the author believes also that a greater seed bearing capacity is developed on the north sides of stands, than on southern exposure, because trees bloom later and are less apt to lose their flowers by late frost. If the tolerant species, fir or beech, are to be favored in mixture the opening is made less severe and the removal proceeds more slowly; the spruce regeneration vanishes if more light is not given soon.

That this consideration of growth conditions in regeneration tends also under other conditions to good results is attested by accounts from other sites and with other species. The saving in planting cost, if even only half covered by this method would be a great gain. The author figures planting (16 labor days) with transplants at $20 to $25 per acre; sowing in spots, strips or plats, $4 to $5; cutting out too dense sowings $2 per acre (3 labor days), so that sowing could be done cheaper, than planting, and natural regeneration still more so.

Die Waldwirtschaft von Professor Wagner. Allgemeine Forst- und Jagdzeitung, 1908, pp. 353-356.

Damage by Snow.

In a long article Flury gives account of the damage done throughout Switzerland by an unusual fall of snow, which occurred on May 23-24, 1908, which, it is estimated, broke some two million cubic feet. The largest previous heavy breakage occurred in 1885 with nearly nine million cubic feet.

The details, character and probable causes of the extraordinary fall of snow are discussed.

From answers to circulars, the following more generally interesting facts were elicited. Deciduous forests suffered the greatest damage, conifers only exceptionally, and pure stands more than those mixed with conifers. The more uneven crown development and hence uneven loading of the broadleaved trees is adduced as a reason for this difference in behavior. Curiously enough, the tough oak and ash, outside of the softer woods, suffered the most. As reason is suggested a difference of pliability of branches at different seasons. Our White Pine was noted as most resistant.

The damage was experienced in all age classes, in the older timber uprooting being most frequent, together with breakages, in the younger stands breakage and bending, more rarely uprooting. The greatest damage was concentrated on altitudes between 1,500 and 2,000 feet; the steepness of the slope increasing the damage. Exposure seems not to influence the damage.

Both, thinned and unthinned, quite young stands suffered alike, the former more by breaking of single stems, and the latter by group breakages, especially the stands that had been thinned a year or two before. But, on the contrary, older stands, several times thinned, made the best resistance. Open old beech stands suffered from branch-breaking much more than close stands. Otherwise, even-aged and evenly closed stands suffered more than uneven-aged with slightly open, group-wise distribution and wavy crown profile.

Stands with tall slender stems and high crowns naturally were more damaged than those in which crown length and shaft were in better proportions, hence, more damage was experienced on good sites than on poor, and of course, on shallow sites uprooting was more frequent than on deep soils.

As regards the causes of the damage the reporter notes that more or less accidental concomitant circumstances influence the effect favorably, such as the fact of more or less developed foliage, different conditions of soil and stands, steepness of slope, and the varying intensity of snowfall and character of snow in different altitudes.

Especially the quality of snow has more to do with the effect than the quantity. Although in two places cited at 3,000 feet altitude, the snowfall was 24 and 25 inches, there was no damage in the existing deciduous woods, while at another locality, in 1,500 to 2,000 feet altitude, with only 10 to 12 inch snowfall the greatest damage was experienced: the specific weight of the snow decreasing very rapidly from lower to higher altitudes, probably from .2 to .8 or .9. In the higher altitudes, to be sure, also the absence of foliage was helpful, while in the lower altitudes foliage had already developed, this year unusually luxuriantly, due to very favorable fall as well as spring weather.

Mixed forest, groupwise differentiations and age class distribution, a regular thinning practice in the dominant, are means to avoid this damage.

The treatment of damaged stands must, of course, vary according to their condition, but is altogether not a promising operation, especially in the middle age classes, between 40 and 80 years, where underplanting would appear the only method, there being little hope of an unassisted restoration of the crown cover.

Der Schneefall vom 23-24 Mai, 1908. Schweizerische Zeitschrift für Forstwesen, 1908, pp. 270-277; 299-302; 318-323.

MENSURATION, FINANCE, MANAGEMENT.

Working Plans in Baden

One of the most successful and most profitable of forest administrations is to be found in Baden, the results of which were briefed at greater length in volume VI, p. 199 ff. The method of regulating the felling budget was described at greater length at a recent meeting of the Badish Forestry Association, and as it appears to us the most rational of all the methods employed, we reproduce the account at length. It is based upon the normal forest idea and uses Heyer's well known formula to check the budget. This method has been applied on nearly one million acres of State and communal forest. Although older working plans exist, the more general making of working plans was begun in 1836, and it required twenty years before the communal forests, which are administered by the State, were all brought under working plans, while in the State forests 60 to 70 years passed before the final regulation. At first, an area and volume allotment method was applied, but in 1846, when the first revision of the original plans was had, the securing of a normal stock was made one of the problems requiring solution from the new working plans.

In 1849 it was realized that a circumstantial working plan for the whole rotation was useless because surrounded with too many uncertainties (interferences by windfall, snow pressure, fire, insects); the working plan was made by area allotment in detail for the next decade, otherwise showing merely a summary area control for the rest of the rotation, from which the areas allotted to the different periods could be seen. The budget was then determined from experience of felling results or by sample fellings. Finally in 1869, after 35 years of experience, the Heyer method was adopted. This requires the calculation of the actual (*as*) and the normal stock (*ns*) and the increment (*i*) during the period of regulation or equalization (*e*), in which the normal stock is to be established, when the admissable felling budget (*b*) is determined as $b = \frac{as + (i \times e) - ns,}{e}$ *i. e.*, the actual increment during *e* is cut, increased or diminished by the amount of difference between the actual and normal stock.

To obtain the data required by this formula, as far as they are not on hand from former estimates of stock and increment, which can be proved, the stock of older stands is ascertained by sample area method, in the younger stands it is estimated, basing the estimate on yield tables or otherwise. The period of equalization may be less, but not more than the rotation.

While theoretically the normal stock $ns = \frac{ir}{2}$, it was found that, if i was determined according to Heyer upon the basis of the highest average increment at felling age, measurements of normal stands develop only $.45ri$. It was also found that the normal increment is not an unattainable ideal but could be determined as the average increment at felling age of well stocked and well managed stands. For the communal fuelwood forests, the rotation was established on Heyer's basis, but in the timber forest size of the material desirable to be grown (a diameter control) is determinative.

The mathematically determined felling budget is however only used as a guide, just as Heyer had intended. Silvicultural considerations are primary, and especially when a comparison of actual and normal age classes shows that the older age classes are deficient, the establishment of these in normal quantity is a superior requirement, unless it can be shown that younger age classes could be without damage utilized in shorter rotation to eke out the felling budget. That is to say, a summary comparison of actual and normal stock is not sufficient, the comparison must be made by age classes.

There is then a careful selection made of stands to be cut within the next decade; in this selection there are chosen first old stands, then poor growing, damaged or unsuitably composed stands, and lastly stands below the normal felling age are considered, if necessary to approach the calculated permissible budget.

Since every ten years the whole working plan is again revised, any miscalculations or misjudgments are soon corrected.

Die Forsteinrichtungsfrage, etc. Allgemeine Forst- und Jagdzeitung, 1908, pp. 363-371.

Rotation for Spruce.

An exceedingly interesting article which gives an insight into the details of forest management in Saxony by Oberförster Pause is valuable especially in bringing definite data of results. Professor Wagner's volume *Grundlagen der Räumlichen Ordnung* (reviewed in Vol. VI, p. 160), which has stirred up multifarious discussion, has called forth this article. As is well known the spruce forests of Saxony, which have been so lucrative, are mainly managed under a clearing system followed by planting, the main silvicultural feature of which are the small felling areas and the careful location of felling series, while short rotations and special consideration of the maturity of each stand are the managerial characteristics.

To determine the maturity the special requirements of the Saxon wood market are considered, which takes and pays better for medium sized logs rather than stouter material. The aim of the management, therefore, is or should be, as was determined by Pursche, a fully stocked stand in which about 35 per cent. stem volume of over 9 inch log diameter in the middle, 40 per cent. of the total cuts being of such logs.

Pause is in charge of a typical spruce forest in the Erz mountains, of entirely uniform good site conditions and normal stands, which have grown up without much disturbances by storm, snow or insects, a rather rare case, catering entirely to local market, saw mills, pulp mills and other manufacturing concerns.

From felling areas (clearings) comprising 112 acres he secured the following results:

Age Stands, Years.	*Logs per acre with maximum diameter at small end.* Inches. *5*	*6*	*9*	*12*	*14*	*over 14*	*Total volume* including fuel wood.	
	*Cubic Meter.**							*Increase %*
61- 70	33	39	132	113	51	26	464	
71- 80	17	32	128	153	95	45	552	1.73
81- 90	15	30	125	181	106	52	606	.93
91-100	7	33	117	165	130	92	656	.79
101-120	8	14	77	134	145	147	614	
121-140	9	7	42	92	128	231	595	

*Multiply by 14.3 to get cubic feet per acre.

Percentically expressed.

61-70	8	10	33	29	13	7
71-80	4	7	27	33	20	9
81-90	3	6	24	36	21	10
91-100	1	6	22	30	23	17
101-120	1	3	15	25	28	28
121-140	1	1	8	19	25	46
Prices, averaged during 1897-1906, cents per *cubic foot.*						
	6.5	8.1	11	14	16	16.1

A calculation of the value obtained for these variously-aged stands, adding all materials at their market price, gave the following results.

	61-70	71-80	81-90	91-100	100-121	121-140
Total value per acre,	741	953	1056	1156	1150	1158
" " " cubic foot,	10.8	11.6	11.7	11.9	12.6	13.1
Value per cent. increase per acre,	2.5	1	0.9			

The decrease in material product in the older stands is accounted for by loss of trees by rot and storm; the sinking value per cent. shows that the use value of this timber does not grow with age, the wood merchant paying for 95 year old wood, the higher price for stouter material being merely called forth by lack of supply. The rapid change in price for logs from 6 to 9 inch, and still more from 9 to 12 inch and a smaller rise to 14 inch, while that over 14 inch does not rise appreciably, shows that the market prefers the sizes from 9 to 14 inches diameter. Between the 70 and 90 year evidently the most favorable distribution of sizes is found, 60% falling into the most desired classes, and 30% into the stouter full valued material, so that the 80 year rotation would appear most satisfactory. A soil rent calculation, in which the costs of stands is figured at $17 and annual administration at $1.20 would also warn against a higher rotation.

The author then elaborates the silvicultural advantages of the Saxon method of small felling acres and the managerial advantages of clearing followed by planting, both of which have been proved by long experience. Whatever may be said of other species as regards the preference of natural regeneration, the spruce in Saxony does not promise good results; the mother stand is endangered by winds; the soil before the crown cover is interrupted for regeneration covered with dense moss or with a deep layer of raw humus and litter; after opening, grass development, especially of Calamagrostis; the young spruce disliking shade above (although liking side shade)—these conditions must occasion endless difficulties to a natural regeneration.

Yet the author would advise at least a trial of Wagner's selection strip method. As to Wagner's declaration that the spruce is not a good transplanter, the author calls attention that 100 years' experience in Saxony has proved the contrary.

Ueber Hiebszugswirtschaft in Sachsen. Allgemeine Forst und Jagdzeitung, 1908, pp. 345-353.

Ultra Conservative Rotations.

We suppose that our readers realize, that whether they express their ideas of the maturity of a tree or stand in diameter sizes or values, they consciously or unconsciously discuss the time element in forest production—the rotation.

A lively and exceedingly important and interesting debate has lately taken place in the Bavarian Legislature, and in consequence in the daily press of Bavaria and elsewhere, as regards the propriety of reducing the existing rotations in the Bavarian State forests.

Of the nearly 2,000,000 acres, timber forest (91.4% of total forest area) of which 20% are oak and beech, 50% spruce and fir, 30% pine, a rotation of 96 years (the Bavarians follow a duodecimal system) is found on 22%, while the balance is over 108 years; indeed, beech, fir and spruce seem to be managed in a rotation of 140 years. Hence the old age classes, over 100 years, occupy over 20% of the area, as against a normal 16.7%. In demanding a reduction of these supposedly excessively conservative rotations it was pointed out that with 57 cubic foot per acre the felling budget falls behind the yield of Saxony, Baden and Wurttemberg, who work with lower rotations, by 15 to 24 cubic feet; that the result of thinnings, too, with only 15 cubic feet per acre was too low; that the net yield in Bavaria with $2.68 per acre compared unfavorably with Saxony and Wurttemberg whose administrations yield $5 and $5.60 respectively, that the work wood per cent. in Bavaria with about 64% was lower probably because of the frequent red rot in the old spruces; that in the market, trees of 10 to 14 inch diameter, which can be attained in spruce with rotations of 70 to 100 years, are more sought than stouter material.

Hence, a reduction of rotations, to, say about 100 years, was indicated with a consequent increase in felling budgets to net an increase in yield of over $2,000,000; but as it would take 40 years to secure the age class distribution now existing in Wurttemberg a more rapid extraordinary utilization of the old stock is indicated, say in 30 years, which should bring in the neighborhood of $5,000,000. The legislator advocating these changes asserts that a reduction of future forest rents was not to be expected from this over cutting, rather a rise was sure to follow (?). He charges the forest administration with seeking a sustained yield in reduction of felling budgets and preservation of old stock instead of regeneration and preservation of soil vigor.

Dr. Endres, now the leading forester at the University of Munich, in a severe criticism of the Bavarian Forest Administration, agrees that the felling budget might be readily increased by 15 cubic feet per acre and year resulting in an increased yield of 2.5 million dollars. He arraigns the administration for having slept for 30 years, for not keeping track of increment and yield conditions, stating that in thinning material and over mature rotting stands, annually a quarter million dollars worth of wood is lost in Bavarian State forests. Partly, however, the fad of a *natural regeneration* method forced in the last 20 years under Gayer's schooling is the cause of the low yield, giving rise to enormous losses in increment. "To secure a regeneration of a few acres an expenditure of labor and time of many years is needed, while the same result could be much better attained with a few marks spent on planting."

The result of the discussion has been the appointment of a commission of three higher forest officials to investigate and report.

The unnamed reviewer of these proceedings points out, that the extraordinary cut proposed would necessarily lead to clearing, since the time needed for natural regeneration would be lacking. The extensive plantation thereby necessitated would be difficult to make successfully; that the difference in sites in the Wurttemberg forest may account for difference in rotations. (He should have also accentuated that the Wurttemberg area comprises only one-eighth of the Bavarian and is, therefore, in much better position; it is also nearly everywhere close to market, while the old stands in Bavaria are probably to the largest extent to be found in distant and hardly accessible mountain districts.—Rev.)

It is also pointed out that the sudden increase of cut will influence prices and make the calculations untenable. It is stated that in the 20 years ending 1906 prices had advanced at the rate of 4.7% per annum in the average. The question is raised whether the wood merchants, who confirmed that the most marketable trees were those of 10 to 14 inch diameter, were not really "laying for the old stock" that was to be slaughtered. In opposition to the hotly contested proposition that natural regeneration is cheaper than artificial, the reviewer asks the question: Is the advantage of a method of reproduction to be measured only by the cost of plant material and labor? Do the advantages of the natural regeneration outside the cost count for nothing?

The reviewer refers to a similar onslaught on rotations which 30 years ago was waged in Bern, when a financial deficit made an extraordinary cut desirable, but better counsels prevailed, although later here and there rotations were reduced; yet 20 years later an increase was allowed without resistance.

The most significant outcome of these discussions is the declaration of the highest representative of forestry science in Bavaria, that he considers the return to natural regeneration a retrograde step and not a progress, because this method leads to large losses in increment.

Thaler investigates how such surplus of stock, if any, may be utilized without loss. He points out that neither the Bavarian nor most of the other German State forest administrations could tell whether they have a surplus of stock or not, since their organization is based on area or volume allotment methods, which do not determine the normal stock or necessary wood capital. Only in Baden and Hesse (lately) is the regulation of the budget based on the normal stock idea, at least as one factor.

In using up surplus stock the question arises how large an area may be cut without financial or silvicultural disadvantages. This, in Hesse, is answered by limiting the area to what with the means (nurseries) and labor at disposal can be reforested. This, for any one district has hitherto limited the felling area to 20 or 25 acres.

With a long time regeneration method it is almost impossible to control the size of felling area and of normal stock, ocurrence or failure of seed years preventing regular progress. Such long time regeneration methods (just as the selection forest) will not work into such a scheme of budget regulation.

For the utilization of large surplus stock a special working plan is suggested, in which the budget is so apportioned, that the market may not be overstocked, keeping in mind that new channels of trade do not open at once. The author cites an experience to show this difficulty which would to us seem incredible. Although Germany secures now one-third of her consumption of workwood, the author thinks it will take considerable time before it would be possible to dispose of large surplus masses of home product—probably price differences accounting for this.

At the present time several of the German administrators contemplate new forest regulation schemes.

A similar movement, namely, to increase the cut and reduce rotations was made in Baden, without any result. Here, Oberförster Fieser figured the average rotation at 140 years, and by reducing it to 110 years an increase in the present budget of 73 cubic feet by 15 cubic feet as possible. This would mean 140,000,000 cubic feet extraordinary cut and increase of annual budget by 8 cubic feet. In the legislature, however, the policy of the administration was in every point sustained as correct.

The administration claimed that the average rotation is 112 years, that the actual stock is by over 50 million cubic feet behind normal, while the age classes over 100 years showed a surplus, the next lower age class, 80-100 years, had a corresponding deficit. Hence a slow utilization of the old age classes was indicated. In 1902, the normal increment was calculated as 76 cubic feet, the actual increment as 70 cubic feet now increased to 73 cubic feet, and this, therefore, is set down for the main felling budget.

Dr. Hausrath discusses the yield capacity of the Badish forests in detail, attempting to answer two questions: Are the accepted normal rotations satisfactory? and are these rotations actually in operation?

In principle the rotations of Baden are based on silvicultural considerations and use value of material, hence, in the more densely populated districts lower, in the Schwarzwald higher rotations are indicated which furnish good saw material.

It must be admitted that the difference in the price of larger and smaller sizes has lately somewhat decreased, yet the sawmill industry still prefers the stouter sizes. For the future, it is just as possible that the difference may still further decrease, as that the price of stout material should rise disproportionately to the smaller dimensions. Mixed forest is the prevailing type in Baden; here the species most prevalent determines the rotation; yet, that does not exclude the cutting of areas earlier, if on the whole the stand could not remain advantageously through the higher rotation. In other words the normal forest formula is only a safety regulator, not a law, silvicultural considerations and needs of the owner allowing deviations.

Several tabular statements show the distribution of rotations among the species and localities, especially altitudes.

On poorest soils pine forest is managed in 80 to 90 year rotations; otherwise site quality does not influence the choice of rotation, but altitudes over 2,000 feet, where mostly spruce with fir is found, bring the rotation up to 120. A small acreage of less than 6,000 acres located in mild climate is managed in 140 year rotation with a view of growing heavy oak timber. A 120 year rotation for pine in mixture with oak and beech in low altitude is justified by the production of high priced quality "equaling the pitch pine" (our Longleaf). Some 25,000 acres of fir, largely mixed with pine and oak are also managed under 120 year rotation with a view of utilizing the "light" increment. A reduction to 100 years might be advisable but the data to prove this as well as the influence of thinnings on a reduction of rotation are wanting.

As to the actual existence of normal stock corresponding to the assumed rotations, it is admitted that the booked age class distribution shows deficits in areas in the first two (1-40 years) and the fifth age class (80-100), but this does not argue as to the volume of stock. Since most of the stocktaking is done by estimate, there is considerable uncertainty. Although estimates are usually below the truth very likely deficiency exists, since the snow damage of 1886-7 has made havoc even in the middle age classes. The author, however, thinks the data on hand are good enough to trust the increment statements as given above to be nearly correct *i. e.* a deficiency in *ni* and in *nv*.

And now comes a statement which our young foresters should consider specially and ponder: "From the private owner's standpoint it would perhaps be correct to manage each separate state forest as an independent unit, to regulate the felling budget entirely according to silvicultural considerations and to lay up a reserve fund against future lean years from present over-utilization."

When the government refuses to do this and prefers a saving and equalization *in nature,* the reason is probably first, that the capital made current is too easily disposed of for purposes of the present, when the future will have a smaller revenue. Moreover, an annual even cut is preferable from the standpoint of labor conditions. Again, some minor sortiments—firewood, etc., do not find a sufficiently large market to make an over cutting surely profitable. In forestal calculations, the danger lies in extremes, the formula may be correct, but the data for the calculation are uncertain.

Die Ertragsfähigkeit der badischen Domänenhochwaldungen. Forstwissenschaftliches Centralblatt, 1908, pp. 627-637.

Forest Finance.

Whoever prates glibly and knowingly on forest finance should be invited to read the sound, and what we consider epoch-making classical expose of the conditions of forestal finance calculation by the veteran Weise, formerly director of the forest academy at Munden.

Forestal Statics is to investigate which of several procedures is the more profitable, for instance whether it is more profitable to cut a 10, 12 or 14 inch diameter, whether a rotation of 60 years or 100 years, whether planting or natural regeneration produces the more advantageous balance sheet.

The trouble lies in the difficulty of ascertaining the data for the calculation. "Statical calculations which are to deserve credence, are possible only when the effect of silvicultural measures influencing soil and stand, volume and value production are known. This is, as we must admit, only rarely the case........ We have notions about it, but anything fixed and sure and especially expressed in numbers, as is required in calculations, we can hardly offer." (If this is true in Germany, what may we think of the cock-sure finance calculators in our country.—Rev.)

So far only wood volumes may be available, and those merely of relative value. The statics of the *bare ground* are perhaps the easiest, for here everything is supposition, and for this condition the methods of calculation at least are supposed to be well developed. These methods the author reviews critically. He points out first that in the usual formulas it is customary to place all yields free of harvest cost without making distinction between the cheaper harvest in clearing than in natural regeneration; that the incomes are supposed to repeat themselves forever in equal amounts; that interest rates are supposed to be eternally the same. "Rate of interest, thou art a rock, though you have more the nature of a nervous woman, who is subject to every mood."

The expenditures for administration and taxes are figured as annually equal and charged against all stands in direct proportion to the area. But (even in Germany) eight to nine-tenths of all this expense is chargeable to harvest only *i. e.* to the mature stands alone. Thus, a 25 year old spruce stand, which may have cost $10 to plant, and then required no attention whatever until now a thinning may be made, has already charged against it 36.46 times the annual administration and tax expense—an illogical procedure. Similar considerations show that the cost of planting or regenerating are for bare ground, properly placed at the year of calculation, but for ready forest belong to the harvest time and, indeed, are chargeable to harvest, for in a sustained yield management replacement is the primary condition.

No wonder that since the methods not only rely upon unsafe basic data, but declare variable quantities constant, charge where charges are not justified, and hence are faulty, many thinking foresters refuse to use them for practical purposes. All such calculations, it should be admitted, have no absolute, only relative value. The author then points out as unfortunate and misleading the use of the term "soil expectancy value", since the formula corresponding to it, expresses not a soil value, only a step towards the determination of such value, being merely a statement of the numerical result of a certain method of management. To make it a real soil value, there must be deducted the profit that a user of the soil (a buyer) would expect to make from his management.

Looking at the statics of the stand, the first question that arises is as to how to consider its value whether cost value, sale value, expectancy value. It is pointed out that the cost value may be often higher than the other two, and that as long as there is no actual sale value (felling value), the stand cannot be subjected to statical calculations. When a sale value has arrived, the main question is: Does the stand by its annual increment in volume and value make good the annual expense of administration and interest on its capital value? Is it ripe or not? Any compound interest calculations with 3%, the author declares, can give favorable results only as long as the stands are young; in old ones, no art will make the customary 100 year rotation profitable (except through unusual rise of prices.—Rev.)

The important point is made that the complicated calculations can be obviated, if, instead, merely the volume increment per cent. is ascertained. If this is found considerably under 3%, the stand is ripe, for the value increment can always (in stands near ripeness) be only a fraction of the volume increment per cent., since value rises only with increase of diameter, and that for a long time in direct relation, in old stands not even to that extent, so that, if the volume per cent. is small, it is nevertheless larger than the value per cent., for the volume depends on the annual ring area. Without volume increment no value increment need be expected.

Referring to Pressler's index per cent. which "to him who cannot see the forest for the stands" is a convenient means of calculating value increment $[(p=\frac{r}{r+1}(a+b+c)]$, the author points out that, if $a+b+c$ is to be at least equal to 3% as the expected business per cent., a stand would rarely be able to bring it when over 70 years old.

But the interest yield of a stand is an entirely different matter from the interest yield from a whole forest, which has other stands following in age class gradations, and is considerably higher than the single stand by itself. Here, in the statics of the forest quite special considerations enter. A forest, managed for sustained (not necessarily annual) yield, has to pay interest on soil value, (*s*) and value of normal stock (*ns*), and the latter should be put into the calculation at its *real* value, which can be secured by sale, (its wrecking value), while usually by forest financiers expectation values are introduced.

What uproar there would be, if in any other business at the annual stock taking, raw materials on hand were valued at what might be expected they were worth when placed into manufacture. On the contrary, depreciation is charged, while we foresters in our valuations overburden our young stands, our raw material, not only by charging against them the cost of their first production but interest and rent values and expectancy values, to determine the capital on which we demand interest. Only the oldest stands have a real sale value and can be realized on (Y), besides thinnings and accidental yields (T), against these alone should be charged all the costs (C) when the unsound compound interest calculation disappears, and the equation which inquires into the result of our management becomes simply a forest rent formula; $(s+ns)\ .op \underset{<}{\overset{>}{=}} Y+T-C$. No prolongations and discounts and expectations but the real, practical actual forest management is represented in this simple formula, which tells how far the management brings more or less than the interest on soil capital and stock value. And, if the manager wants to secure more than the usual interest rate (p) on his capital value, namely a profit, he may simply introduce this amount to be deducted on the right hand side of the formula.

What means do we have to postpone the time when the right side of the formula becomes smaller than the left? The principal means is to reduce the wood capital and thereby reduce the interest charge. This involves silvicultural operations and, in the first place, thinnings and improvement cuttings (where unsalable; girdling), by which stock is reduced but volume increment increased. A few simple prescriptions for thinning practice are given in which the author inveighs against the very severe opening up which for a short time leads to greatly increased increment but at the expense of wood quality.

Against the other means of making the equation favorable *i. e.* increasing the apparent income by reducing the interest rate, the author protests as illogical. Especially the proposition of varying interest rates for different time periods (originally proposed by Baur) he points out as lacking entirely a tangible basis or justification, indeed he characterizes this proposition as one of the most remarkable aberrations. Everywhere else he who saves, does so in the expectation to be paid for his frugality later on, yet this proposition requires that when he could get 3%, and instead of taking it he leaves and capitalizes some of the increment, say until the capital has increased by 50 per cent., he is not to have as in any other business 4.5%, but less. It is customary to assume a 3% rate in forest calculations but really a constant interest rate has no justification in any business. (Yet in life insurance the calculations are made on an assumed constant interest rate.—Rev.)

The author then concludes that an orderly forest management which furnishes satisfactory material for the arts is possible only for a people that has reached a stable civilization and has enough idealism to see in the forest more than a certain quantity of wood. It has taken much denial to bring for instance Prussia's forests to the present status admired by other people. All that forestal statics has done so far, has been simply *"to open our eyes, that we cannot find any management which will bring a high interest rate on the capital involved. A large margin from forest property can be made only by a purchaser who cuts everything that pays and puts it into cash."*

The state alone can afford to manage for the interest of the future.

Zur Würdigung der forstlichen Statik. Forstwissenschaftliches Centralblatt, 1908, pp. 432-448.

UTILIZATION, MARKET, TECHNOLOGY.

Time Tests of Strength.

Mr. H. D. Tiemann, in a paper read before the American Society for Testing Materials, presented some results of his investigations upon the effect of speed of testing upon the strength of wood. The author points out that the rate of strain, and not the rate of stress usually employed, should be used as the basis for strength tests, since the rate of strain can be controlled while the rate of stress cannot be determined in advance. He finds that the strength of wood varies with the speed at which the stress is applied, increasing more rapidly as the speed increases; that wet or green wood shows much more change in strength than dry wood. The speed strength modulus is the ratio of the relative change in strength to the corresponding relative change in speed.

The author proposes certain standard ratios of fibre strain in relation to speed for compression, bending and shearing tests.

C. D. H.

The effect of the speed of testing upon the strength of wood and the standardization of tests for speed. Reprint from Proc. American Society, Testing Materials. 1908.

Hardness of Wood.

Janka, of the Austrian Experiment Station, reports on a series of hardness tests with his improved ball test, (an improvement over Brinell's method with metals) in which one-half iron ball, the area of the largest of which is one square *cm,* hence its radius 5.462 *mm,* is pressed into the wood until fully imbedded, when the pressure employed is a direct expression of hardness. A parallel series tested with a cone impression gave invariably lower results, due according to the author to the splitting effect of the cone which called into requisition the cleavability and in part elasticity rather than hardness. Practically, however, this hardness test by cone corresponds to that of a nail or screw, but more important is the resistance to saw, file, plane, knife, axe, chisel, etc. The author thinks that owing to the impossibility of devising special tests for all these uses of tools, the "neutral" tests with ball as devised by him most satisfactory.

A tabulation of the comparative tests by cone and ball show no parallelism, but in general broadleaf wood was more resistant to the cone than coniferous wood, when tested on the cross cut face, not on length sections, the different cleavability in the first case furnishing the explanation. The hardness of spruce and fir, when tested with ball on the cross section was to that tested on the length sections, about as 100:60.

The law of relation between hardness and specific gravity which for the same species was well maintained, did not appear so well from species to species. This relation $\frac{H}{S}$ was considerably smaller in coniferous than broadleaf wood *i. e.* the latter in proportion to its weight is harder.

That the hard summer wood of the pine and larch in tests on length sections would increase resistance is only natural, hence the difference of hardness of cross section and longitudinal sections is in these smaller than in hardwoods. The tests on longitudinal sections is although unsafe, for here elasticity of fibers is a disturbing factor.

Some divergences from the relation of hardness and specific weight are met with the doubtful suggestion that wood from different localities does not follow the law as the author claims also to have established in regard to compressive strength.

The author claims, however, that, in general, his data show not only a direct relation between hardness and specific weight but also between hardness and compression strength. An attempt to relate hardness to bending strength was also made with unsatisfactory results.

That the technical qualities including hardness are a function of the summerwood per cent. are specially brought out in the tests of spruce, and altogether for spruce the proportionality of the different exhibitions of strength to the hardness are satisfactorily shown.

The simplicity of this hardness test, the author thinks should encourage its use to determine the relation of hardness to other qualities and perhaps eventually to substitute the hardness tests for all other tests.

The reviewer would point out that although the relation of the compression strength to cross bending and other strength is obvious and has been mathematically established by Mr. Neely from the tests of the U. S. Forestry Division, so conservative are the test engineers that they would not benefit from the discovery which would curtail much of their work both at the machines and in the computations.

Ueber Holzhärteprüfung. Centralblatt f. d. g. Forstwesen, 1908, pp. 443-456.

STATISTICS AND HISTORY.

Bavarian Budget.

The budget of the Bavarian State forest administration for the year 1909, which refers to the productive area of State forests, comprising 2,035,605 acres, was placed as follows, the detail being given to show how a large forest administration presents its budget to the legislature. We call attention in this connection to the controversy discussed on p. of this issue regarding the reduction of rotations, which formed part of the debates on the budget.

INCOMES.

Chap. I.	From wood.	
	Wood sales 49,810,000 Mk.	
	Bye products 1,270,000 "	
	Sundries, 275,000 "	51,355,000 Mk.
Chap. II.	From the chase	316,000 "
Chap. III.	From booms and woodyards	457,000 "
Chap. IV.	From rents of houses and grounds ..	158,000 "
Chap. V.	Other incomes	2,000 "
	Total	52,288,000 Mk.

EXPENDITURES.

Administration and Management.		
Chap. I.	Personal and office expenses	6,918,500 Mk.
Chap. II.	Allowances for moving	30,000 "
Chap. III.	Subventions to needy officials ...	156,000 "
Chap. IV.	Expenditures on houses	857,000 "
Chap. V.	Real management costs.	
1. Account of woods—		
	Wood choppers' wages, ...	6,850,000 Mk.
	Road maintenance building, ...	1,900,000 "
	Forest regulation, ...	125,000 "
	Plantations and nurseries, ...	1,860,000 "
	Camps and tents, ...	90,000 "
	Accounts of by-products, ...	320,000 "
	Prevention of forest insects, ...	160,000 "
	Other costs of management, ...	145,000 "
		11,450,000 Mk.
2. Account of chase, ...		79,000 Mk.
3. Account of booms and woodyards, ...		330,000 "
4. Account of assistance to sick and injured officials and workmen, ...		266,000 "
		12,125,000 Mk.

Chap.	VI.	In lieu of servitudes, ...	360,000 Mk.
Chap.	VII.	For canceling servitudes (funds provided elsewhere).	
Chap.	VIII.	Purchase of lands, ...	30,000 "
Chap.	IX.	Insurance of workmen, ...	1,349,000 "
Chap.	X.	Cashier's expenses in paying wages, ...	138,000 "
Chap.	XI.	Other expenses, ...	3,000 "
Chap.	XII.	Improvement of wages, ...	435,000 "
		Total Administration and Management, ..	22,401,500 Mk.

2. Forestry Education—

A. Aschaffenburg Forest School, ...	48,800 Mk.
B. Forest Experiment Station, Munich, ...	37,900 "
C. Silvicultural Schools, ...	39,900 "
	126,600 Mk.

For journeys, excursions, scientific work, ...	19,000 Mk.
For stipends to worthy students, ...	12,000 "
For maintenance of demonstration gardens, ..	1,900 "
For school buildings maintenance, ...	6,500 "
Total, ...	16,600 Mk.

Grand Total Expenditures, ...	22,567,500 Mk.
Grand Total Income, ...	52,288,000 "
Net Yield, ...	29,721,500 Mk.

This yield is Mk. 5,187,407 more than in 1906. Expenses are 43.1 per cent. of the income. Gross yield is 63.44 Mk. per hectar ($6.11 per acre); expenditure is 27.38 Mk. ($2.61 per acre); net yield Mk. 36.06 ($3.50 per acre), a very considerable increase over previous years.

Der Bayerische Forstetat. Forstwissenschaftliches Centralblatt, 1908, pp. 590-602.

POLITICS AND LEGISLATION.

Taxation of Timber Lands.

In the report of the Minnesota Tax Commission some very unusual and exceptionally well conceived recommendations are made relative to the timber taxation policy of the state.

The report is accompanied by a detailed estimate of the quantity of standing timber in the state by counties, the total being 20,968,902,000 feet. Of this quantity about 50 per cent. is White, Norway and Jack Pine, of an estimated value ranging from $45,000,000 to $95,000,000, and averaging anywhere from $5 to $10 a thousand feet.

On the question of the best method of taxing standing timber, attention is given to the present burden on timber lands. It is stated that interest charges are about 23 cents a thousand feet, making the total cost of carrying 38 cents, which naturally increases from year to year as the period of nonproductivity lengthens. The carrying charges naturally are compounded as a part of the cost and in time these charges, including the taxes, must be taxed. In ten years the taxes on a thousand feet of timber would be $1.50 and the interest compounded $2.37, making a total carrying charge of $3.87.

Consideration also is given to the suggested method of separating the value of the land from the value of the timber and it is pointed out that under the Minnesota taxing laws such a separation is not possible.

Commenting on the results of the present methods, it is said that an increase in local tax rates would impose a burden that the lumber industry might have difficulty in meeting.

The American Lumberman, 1909, p. 34.

Tariff and Location.

One of the strongest and most able reviews of the tariff question so far made public is supplied by J. A. Foster of the Hilton and Dodge Lumber Company, Savannah, Ga. It is pointed out that by reason of the tariff timber formerly of no value has since become a source of supply for a variety of forest products including low grade lumber, box shooks and similar products. The author states that land cut over years ago when merchantable products could be secured from only the best trees now are furnishing raw material of a character and quantity sufficient to keep many plants in operation. This change is attributed in large degree to the beneficial results of the tariff. A $2 margin, in the estimation of this practical operator, is sufficient to bring about this reconstruction of the affairs of lumber manufacturers in the Atlantic coast manufacturing district. It is a sufficient barrier to keep back a flood of low grade stock from Canada and to permit of wider distribution of the products of manufacturers who secure their raw supplies from the cutover lands.

Conditions in the southeast are somewhat unusual. The pine regions of the Atlantic coast states were the scene of the first lumbering operations in the country. Until within the last few years only the largest trees of the highest quality were cut. Owing to climatic and soil conditions along the Atlantic coast timber regions the growth is much more rapid than in many other parts of the country and instances have been reported where lands upon which cotton was raised prior to the civil war have since produced trees of a quality and size which makes their cutting profitable to the manufacturer. This growth was brought about in 40 to 45 years.

The timber of this section does not grow as thickly as in the north and west. The average cut probably would not exceed 7,000 feet, and the range is from 3,000 to 15,000 feet to the acre. The timber of this coastal slope is not greatly injured by fire. The relatively sparse stand renders the individual trees more dependent upon themselves and results in a sturdier growth with respect to root support than is found in northern pine and hemlock, or in the timber of the Pacific slope.

An old cruiser who had inspected the operations on certain of the reservations of Minnesota claims that a very heavy percentage of the seed trees that have been left had been blown down by the wind. Under the regulations governing the cutting of reservation timber a certain number of the finest trees, designated as seed trees, must be left standing with as little injury to them as possible in felling the other trees. Old woodsmen claim that to leave such trees, or even those of a younger growth, is impracticable because the individual trees can not stand the shock of heavy winds. The trees are flat rooted and the soil is loose, composed largely of leafy mould that has never been tightly packed. Pine grows to a height of more than 100 feet and after being rocked back and forth for months an extra heavy gust of wind will carry a tree to the earth.

In the western fir districts a very similar condition exists. On lands that have been cut over for years there is practically nothing left of any value, nor has there been any considerable second growth. The small trees and the large defective ones, from which no merchantable products could be secured at the time these tracts were logged over, have toppled to earth or become food for the flames. Where an average of 40,000 to 50,000 feet of timber is cut from one acre of land it is not possible owing to the density of the stand to protect the young growth from damage in felling the big timber.

The American Lumberman, 1909, p. 34.

OTHER PERIODICAL LITERATURE.

Indian Forester, 1908—

FIRE PROTECTION ON THE TICKET-PATROL SYSTEM. Pp. 653-657. Gives an account of a method of controlling fire-rangers by the carrying of tickets from one to another.

THE DANGER OF THE FORMATION OF PURE FORESTS IN INDIA. Pp. 665-669. Maintains the value of mixed forests with regard to insect and fungus pests, reciting specific examples.

FOREST ADMINISTRATION IN BRITISH INDIA FOR 1905-06. Also for Eastern Bengal and Assam for 1906-07. Pp. 671-675. Reviews progress and statistics.

THE COMING TIMBER FAMINE. Pp. 688-691. Discusses in detail the position of Uganda and Indian forest supplies in an encouraging manner.

AFFORESTATION IN SOUTH AFRICA. Pp. 692-693.

A PHILIPPINE SUBSTITUTE FOR LIGNUMVITAE. Pp. 717-720. This substitute, Xanthostemon verdugonianus, Naves, called commonly Mancono grows in abundance in almost pure stands.

FORESTS OF THE IVORY COAST. Pp. 747-749.

FORESTRY IN HUNGARY. Pp. 753-757.

USE OF TERMINALIA ARUNJA BARK FOR TANNING. Pp. 583-590. Discusses the value of the Koha Tree as a tanning material, and its depletion along water-courses influencing water stages.

FORESTS OF ASIA MINOR. Pp. 623-625.

INDIAN FAMINES AND INDIAN FORESTS. Pp. 633-652. Shows clearly the connection of famines in India and disturbance of water-supply, due largely to clearance of woodland, showing increase of famines.

Bulletin of American Geographical Society, 1908—

ACROSS PAPAGUERIA. Pp. 705-725. An excellent description of conditions in Arizona with special reference to vegetation.

THE FOREST REGION OF MOUNT KENIA, BRITISH EAST AFRICA. Pp. 745-746.

THE SOUTHERN CAMPOS OF BRAZIL. Pp. 652-662.

GLIEDERUNG AFRIKAS NACH PHYSIKALISCHEM UND WIRTSCHAFTLICHEM GESICHTSPUNKTE. (7 maps, numbering 5 being "Vegetation und Verwitterung.") Petermanns Mitt., No. 7, Gotta, 1908.

Canadian Forestry Journal, 1908—

A FOREST POLICY FOR CANADA. Pp. 82-92.

FOREST FIRES IN 1908. Pp. 126-137. A detailed list.

FORESTRY ON THE EASTERN SLOPE OF THE ROCKIES. Pp. 170-176. Gives a good account of conditions.

JAPAN'S FORESTRY AND HER TIMBER NEEDS. Pp. 211-217.

Forest Leaves, 1908—

THE FARM WOODLOT IN PENNSYLVANIA. Pp. 163-167.

WOODLOT FORESTRY. Pp. 173-174.

LOCUST PLANTING BY THE PENNSYLVANIA RAILROAD COMPANY. Pp. 167-168. Gives the history of this work.

CO-OPERATIVE FORESTRY. Pp. 169-171. Tells how the Ohio Experiment Station co-operates to enlist private enterprise in forestry work.

The Journal of the Board of Agriculture, London, 1908—

IMPROVEMENT OF WOODLAND. Pp. 502-505. Discusses management of Composite Forest for game preserves.

The Agricultural Gazette of New South Wales, 1908—

SOME PRACTICAL NOTES ON FORESTRY, SUITABLE FOR NEW SOUTH WALES. By J. H. Maiden. Running through the year. Discusses with fair illustrations, silvics of species from all parts of the world.

ELECTRICITY AND AGRICULTURE. By W. H. P. Cherry. A useful compilation of the status of the use of electricity for plant production.

Forstwissenschaftliches Centralblatt, 1908—

DER FORSTMEISTER WEBER'SCHE WALDGRUBBER. Pp. 335, 587-590. Gives an account of tests of a new forest plow which show that under certain conditions it does cheap and efiective work.

Centralblatt fur das gesammte Forstwesen, 1908—

BEWEISE FUR DIE UNRICHTIGKEIT DER REINERTRAGSELHRE. Pp. 456-465.

NEWS AND NOTES.

E. A. STERLING, *in Charge.*

The death of Mr. Edward Seymour Woodruff from typhoid fever at the home of his parents in New York City on January 15th, 1909, removes from the profession a young man who gave promise of a marked distinction in his chosen line of work, and who was unusually popular with his classmates and friends. Mr. Woodruff, youngest son of Mr. and Mrs. Charles H. Woodruff, was born in New York City December 23, 1876. He prepared for college at Phillips Academy, Andover, and followed this by a special course in biology at Johns Hopkins University. After a short period in business pursuits he entered the Yale Forest School, graduating with especially high honors in 1907. Following his graduation he accepted a position with the New York State Forest, Fish and Game Commission, where he won high approval. In addition to being a forester, Mr. Woodruff was a keen student in botany, entomology and ornithology, and in the latter particularly he made several valuable contributions to the scientific world. He was a member of several clubs and associations, scientific and fraternal, including the National Geographical Society, Graduates and New Haven clubs, the American Forestry Association, the American Ornithologist Union, Sigmi Xi, Robin Hood, Delta Phi, and the University and Country clubs of Albany, N. Y.

In order to encourage tree planting for commercial purposes, the New York State Forest, Fish, and Game Commission proposes to sell transplants and Seedlings from the Saranac Inn Nursery, New York, at low cost. The prices to be charged are as follows: White pine transplants, $4.25 per thousand; White pine seedlings, $2.25; Scotch pine transplants, $3.75; Scotch pine seedlings, $2.25. Residents of the State of New York, in making application for this material are furnished with a blank on which they are to note the topography, original growth, present growth, previous use of land, and kind of soil on the areas which are to be planted. In consideration of receiving the trees specified, the applicant agrees:

1. To pay the purchase price of the trees to said Forest, Fish, and Game Commission within ten days after the granting of this application.

2. That the trees hereby applied for shall be used by the undersigned for the sole purpose of reforesting lands within the State of New York.

3. That the said trees shall not be sold, offered for sale, or given away by the said applicant, or his agents, to any person.

4. That the said trees shall be planted in accordance with instructions furnished by the Forest, Fish, and Game Commission.

5. That the applicant shall furnish the Forest, Fish, and Game Commission from time to time, when asked for, reports in regard to the condition of such plantings.

Since the State of New York has an organization for the control of forest fires in the Adirondacks and Catskills, there have been two periods, namely, 1903 and 1908, when forest fires were very prevalent and the losses heavy. The period of drought in 1908 was more severe and considerably longer than in 1903, thereby making the fire danger much greater and producing the most favorable conditions for conflagrations ever known in the Adirondack region. The following comparative statement shows that although conditions were much worse in 1908, the acreage burned over was less than one-fifth of that in 1903, the loss one-third less, and the cost $15,000 less. In view of these results, the logical conclusion is that the fire wardens were better organized and more efficient last year than they were five years previously:

	1903.	1908.
Number of fires, ...	377	700
Acres of timberland burned, ...	312,590	30,400
Acres of wasteland burned, ...	187,928	147,000
	500,518	177,400

Fire Loss—		
Standing timber, ...	$695,282	$497,046
Pulpwood and logs, ...	153,391	136,920
Buildings, ...	34,443	10,020
	$883,116	$643,986
Cost of fighting fires, ...	$153,000	138,000

The forest product of the State of New York forms still quite a respectable amount, being for the year 1907 reported by the Forest, Fish and Game Commission as representing 1,266,754,365 feet B. M. In this total cut, spruce represents about one-third, hemlock and pine together one fourth, maple somewhat over one-tenth.

The other hardwoods range in relative contributions as follows: beech, birch, oak, basswood, chestnut, poplar, elm, ash, hickory and cherry.

The following legislation, proposed in a resolution passed by the Wisconsin Timberland Owners' Association notes a distinct advance in the attitude of lumbermen towards the need of more effective protection against fire:

SECTION 1. Any person who shall cut, or cause to be cut, any logs, bolts, pulp wood, ties, poles, posts, or other forest products, in any of the counties designated in section 4 of this act, shall pile the tops and refuse as the cutting proceeds, and shall, within one year from such cutting and felling, burn all such piles of refuse and tops, and in such burning all reasonable care shall be taken not to damage standing timber or adjoining property. The term "burning" shall be construed to mean the destruction by fire of so much of such slashings as would become easily combustible material and dangerous in event they were not so destroyed, but no burning shall be done during dangerously dry weather.

SEC. 2 Any person who violates any of the provisions in regard to the burning of slashings, refuse, etc., shall be guilty of a misdemeanor and shall, on conviction therefore, be punished by a fine of not less than fifty (50) cents, nor more than two dollars

($2.00) per thousand feet log scale for all timber; not less than twenty-five (25) cents, nor more than one dollar ($1.00) per cord for all bolts, pulp wood, cord wood or bark; and not less than ten (10) per cent. nor more than fifty (50) per cent. of the full cash value of other forest products cut and removed from such land.

SEC. 3. In case any person fails to properly pile and burn the tops and refuse, the state board of forestry may, in its discretion, cause the same to be done, and the expense thereof shall be a lien on the timber or other forest product cut from the land on which the tops and refuse are situated or cut, and shall also be a lien upon the land itself. Proceedings for the enforcement of such lien shall be instituted by the district attorney of the county in which the cutting was done, at the request of the state board of forestry and in the name of the state of Wisconsin as claimant; and costs shall be recovered in the usual manner. The claim for any lien shall be filed by the state fire warden, or under his direction by any of his assistants, inspectors, assistant inspectors, patrol or fire wardens, in the district in which the expense occurred, in the office of the clerk of the district court, in the county in which the claim arose.

At Mount Union, Pa., the Pennsylvania Railroad has put into effect another feature of its comprehensive forest policy. Late in 1908 ground was broken there for a one-cylinder treating plant, equipped to impregnate with creosote, zinc chloride or any other standard processes, 1,500 ties per 24 hour day. The track lay out for the plant is completed and the storage of ties is well under way. Five tracks, 76 feet apart have been laid and between them there is room for 500,000 ties piled 7 x 1. The plant will be in operation by May, 1909. In addition to its regulation equipment there will be installed a 3-tie cylinder for experimental use. Mount Union is located in a region which will produce quantities of red oak, maple, gum and beech ties for years. The oil for the treating plant has been contracted for and it will be delivered from Europe to Greenwich Point, Philadelphia, in tank steamers which will discharge their cargoes directly into two 500,000 gallon tanks which are being erected. Tank cars will carry the oil thence to Mt. Union. In connection with the experimental cylinder a fully-equipped laboratory will be installed for testing oils and studying the character of impregnation.

After neglecting her forests for hundreds of years, Great Britain has come to the front with the most far-sighted proposal for forest work and land improvement ever advanced by any nation in a single plan.

The recommendations just made to the British Government by the Royal Commission on Afforestation and Coast Erosion will make England self-supporting in the production of timber if successfully carried out.

The report embraces two separate proposals, involving the afforestation in one case of 9,000,000 and in the other of 6,000,000 acres. The former proposal calls for the forest planting of 150,000 acres a year for sixty years at an annual cost of $450,000 at the beginning, to over $15,000,000 at the end of the period. After the fortieth year, however, the forest would become self-supporting. After eighty years the forest would have a value of $2,810,000,000, which is $535,000,000 in excess of the cost of producing it, and would yield a net annual revenue of $87,500,000 or $9.73 per acre from land now barely producing 50 cents per acre. While these estimated returns are more than half again as much as the highly developed forests of Saxony yield, it is considerably less than the net revenue from the historic town forest of Zurich, Switzerland, the Sihlwald. In volume, the annual estimated wood production would exceed the present annual wood imports to England by 500,000 "loads."

An evidence of the enlightened administration of Santo Domingo's affairs which is being given by the Americans in charge of her customs lies in the application received by the Forest Service for a study of forest conditions on the island, with the idea of formulating a forest policy for it.

Mr. J. T. Bond, who had been an assistant forester with the Pennsylvania Railroad since he left the Forest Service, accepted on February 1 a position with the Wisconsin Lumber Company, at Deering, Mo.

Professor Austin F. Hawes has been appointed state forester for Vermont. Professor Hawes after graduating from Yale

Forest School was in the U. S. Forest Service for some time. After graduate studies in Europe he became state forester of Connecticut, a position he has held for the last four years.

With the opening of the British Columbia legislature Premier McBride announced that the government may establish a bureau of forestry with an expert at its head to look after the timber in this province and take up such questions as reforestation, etc.

The senior class of the Yale Forest School, numbering thirty students, will leave New Haven, Connecticut, about March first for Doucette, Tyler County, Texas, where they will study the lumber operations of the Thompson Brothers Lumber Company, secure final practice in surveying, map making and the estimation of timber, and investigate the possibilities of forest management in the region.

It has been the custom of the Forest School for several years to conduct the work of the spring term of the Senior Year on some large lumber operation. In 1906 the work was carried on at Waterville, N. H., on the lands of the International Paper Company. The spring term of 1907 was spent in southern Missouri on the lands owned by the Missouri Lumber and Mining Company. The class of 1908 was in Central Alabama on the holding of the Kaul Lumber Company.

The selection of Texas for the coming season's work is due to an invitation extended by Mr. J. Lewis Thompson, of Houston, Texas, Manager of the extensive Thompson Lumber interests in Texas and likewise an enthusiastic advocate of forestry. Mr. Thompson is a member of the Forest Conservation Committee of the Yellow Pine Manufacturers' Association and also is greatly interested in the formulation of a proper forest policy for the state of Texas.

Arrangements have been made for the construction of camp buildings near the center of one of the large timber tracts of the Company, where the students will live during the greater part of their stay in the region.

The trip wll be made from New York to New Orleans by boat and from thence to Doucette by rail. It is probable that one or more cypress operations will be visited while the students are en route to Texas.

The class will remain on the holdings of the Thompson Brothers Lumber Company until the middle of June, when camp will be broken and a committee of students will return to New Haven to represent the class at the University Commencement. The remainder of the class will scatter to various parts of the country for a short vacation. About July 1 the students will enter the employ of the U. S. Forest Service, State Forest Commissions and lumber companies or engage in private forest work.

The instruction in surveying, mapping and timber estimating will be in charge of H. H. Chapman, and the study of the logging and manufacturing methods in charge of R. C. Bryant, both members of the faculty of the Forest School.

In addition to the regular instruction there will be a number of special lectures by prominent lumbermen. Among the latter are Mr. Thompson, who will spend some time in the camp with the students and will give a number of talks on subjects relating to the lumber business, and Mr. George K. Smith, Secretary of the Yellow Pine Manufacturers' Association, who for the past two years has addressed the students on the subject of lumber associations, market conditions, etc.

The Forest Conservation Committee, of the Yellow Pine Manufacturers' Association, J. B. White, Chairman, Kansas City; J. L. Kaul, Birmingham; J. A. Freeman, St. Louis; J. Lewis Thompson, Huston, Texas; P. S. Gardiner, Laurel, Miss.; will hold a meeting at the Yale Forest School Camp, Tyler Co., Texas, some time during the coming spring.

Professor H. P. Baker, who is in charge of the Department of Forestry at Pennsylvania State College, has asked for leave of absence from July 1st, 1909, to December 31st, 1910, in order to take up a course of study abroad. Professor Baker plans to take two or three semesters' work at Munich, and spend six months on the return trip via India, the Philippines, and Japan.

Mr. Samuel N. Spring resigned from his position as Chief of the Office of Extension in the Forest Service on February 1st, to take up work as a consulting forester. Mr. Spring has had wide experience, particularly in the management of nurseries and the reforestation of open lands, and is well fitted to undertake this kind of work for private landowners. It is unfortunate that despite the extensive forest propaganda of the last few years so little has been accomplished on private lands, and it is to be hoped that the influence of men like Mr. Spring who take up the practice of private forestry will stimulate the more rational management of private forests.

Hofrath Friedrich, the director of the Austrian Forest Experiment Station at Mariabrunn, died September 26, 1908. Friedrich's specialty lay in the devising of forest instruments, among which a precision xylometer, a precision caliper measuring to 1/1000 millimeter, a dendrometer, and especially an auxanometer—an instrument to measure the growth energy in diameter (see F. Q., Vol. IV, p. 52), and a large number of others. The last work of the late author detailing some results obtained with the auxanometer is briefed on p. 75 of this issue.

Timberland Legislation is the title of an article written by Judge Judd, Professor of Equity Jurisprudence, of Equity Pleading, of the Law of Torts, Wills and Sales in Vanderbilt University. Judge Judd is known all over the South as a constitutional lawyer. This article is undoubtedly the first article of its kind. It shows the relation of Federal and State governments to timberland in hands of private owners—and the established legal principles that control the solution of the problem which the lumbermen will have to meet.

This article will be of especial interest to technical students as well as to lumbermen who are interested in the protection of our forests.

A forestry congress is being prepared for at Bologna under the auspices of the Society *Pro montibus et silvis* for the purpose of pressing a thorough and radical reform of forest legislation for Italy.

Germany has adopted forestry regulations for her Togo colony, owing to the destruction of timber and deforestation of the country by the natives. The latter clear new areas by fire and abandon their exhausted lands. The regulations provide for the protection of the remaining forests and the planting of 112 square miles annually.

The use of Yellow Pine for paper is no longer an experiment; it has proved succecsful. A paper plant at Orange, Texas, utilizes pine tops and stumps for raw material. The paper is brown and heavy.

Canada exported in 1907 $33,587,474 worth of forest products: $11,783,564 to Great Britain: $18,397,753 to the United States.

There were 100 active plants during 1907 engaged in wood distillation. The total consumption of wood, chiefly birch, beech and maple amounted to 1,219,771 cords. The leading states were Michigan, Pennsylvania and New York.

The durability of southern cypress is well established by the excavation of a coffin on which the date 1803 was found. The nails holding the wood were not rusted and the wood itself was in an excellent state of preservation.

At Burlington, Iowa, E. A. Florang has planted forty acres of willows or about 1,000,000 plants. This is the largest willow plantation in the United States. It is expected to use the material for willow ware.

A new firm of Consulting Foresters, Messrs. Appleton and Viles, have established themselves in Bangor and Augusta, Maine.

COMMENT.

It is about time a vigorous protest is made against the various "tree doctors" and pseudo-foresters who have sprung into existence during the past two or three years. Who they are or where they come from no one seems to know, but this would be immaterial if they would ply their trade of "doctoring" trees and catching bugs without labeling themselves "practical foresters." In one advertisement in a prominent magazine is displayed the seal of one of these companies, showing an open grown deciduous tree with forks and limbs almost from the ground up, while underneath the words "Scientific Forestry," with the company's name in the lower arc of the circle. Another "tree surgery" company actually claim to operate a "school of practical forestry" and have "skilled men at work everywhere under the direction of a specialist." To the profession this is merely ridiculous, but to the layman it has the bad effect of obscuring the relation between true forestry and arboriculture, as applied to the care of individual ornamental trees. To know the difference between an oak and a dogwood does not make a man a forester, and the number of technically trained foresters in this country is still so small that those who falsely advertise themselves as practical foresters will promptly be found out, but meanwhile their existence throws discredit on the profession.

Despite the assertion each time that the latest reorganization of the Forest Service would be the last for years, there were several changes during 1907 and 1908, but these were as nothing compared to the decided difference which 1909 dawned upon. The inspection districts which existed during the past few years were changed into Forest Districts and all the work connected with each district put in charge of the District Forest. This puts the National Forest business where it belongs, in the community where it is transacted. The saving of time will be considerable, to say nothing of the greater likelihood of more first hand knowledge of each case. The Washington headquarters continues organized practically as it had been, except that Organization and Engineering in Operation and Management and Extension in Silviculture are no longer distinct. The District organizations are duplicates of that in Washington with the natural addition of such offices as Timber Sales and Planting. This change greatly reduces the force in Washington, many of the clerks also having been transferred West. Although the District organization looks decidedly top-heavy on paper, the move is undoubtedly a wise and necessary one, destined to markedly increase the ultimate efficiency of the Service in handling its National Forest problems. For the sake of its *esprit de corps* it is to be hoped that the Forest Service will not be again reorganized for a long time.

Railroad companies in the East are coming in for a large amount of criticism in connection with the losses from forest fires during 1908. In Pennsylvania it is alleged that more than four-fifth of the disastrous fires are caused by the railroads, and Representative Creasy, of the State legislature, has introduced a measure to "require the railroads to use every precaution to prevent forest fires, and also compel the railroads to extinguish the fires which they cause." In New York state, it is stated that more fires were started by sparks and coals from railroad engines than from any other cause, and the patrol which was maintained along the line of the New York Central Railroad extinguished over 500 incipient fires. It is natural, therefore, that the states should attempt to pass drastic regulations against the railroads, and in New York we find that the Commission advocates that the railroads be made to pay the entire cost of patrol along their lines, the present arrangement being that the State pays one-half of this cost. The New York State Commission furthermore states that "danger from fire is so imminent, and the necessity for preservation so great, that, at whatever cost it may entail, railroad companies operating within the forest preserve of the State should be compelled to use some substitute for coal for fuel; something that will not create fire to be thrown from grates or stacks into the dry, powder-like growth that abounds along their rights of way.

This kind of legislation is characteristic of the narrow-minded attitude which legislators have adopted toward railroad companies during the past few years. No one denies the seriousness of the forest fire question, but it should be understood that the railroads are as anxious as anyone to have this menace to our resources controlled, since their prosperity depends largely on the well-being of the country through which they operate. To arbitrarily state, however, that the Adirondacks Division of the New York Central Railroad, for instance, should not use coal for fuel, is going beyond the limits of practical good sense. The use of crude oil as a fuel has not been found possible by any Eastern railroad, while to electrify such a mountain division would involve engineering problems and necessitate an expense which certainly are not justified without the most careful investigation. In the matter of protecting forest lands from fire, several Eastern railroads are doing everything which could reasonably be expected. The Pennsylvania, for example, makes every effort to keep the spark arresters in good condition, burns strips along the right of way where there is liable to be danger from fire, and its trackmen are active in extinguishing all fires which start along or near the tracks. The thanks they receive for this are to find that certain landowners look forward to a steady source of income from damage claims against the railroads from fires which they set themselves on their own land; one farmer went so far as to sue the company for damages from a fire which started one-fourth of a mile from the tracks, and which the trackmen, as a matter of kindness, helped to extinguish. As a matter of further encouragement, the Pennsylvania legislature at one time attempted to pass a bill making the railroads responsible on prima facie evidence for all fires which started on or near the right of way, thus making the railroads liable for fires started by tramps and other trespassers.

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FOREST PLANTING IN NATIONAL FORESTS.

1. Forestation in the Inter-Mountain Region.

JAMES M. FETHEROLF.

The region to which this article applies may be broadly defined as lying between Yellowstone Park and the Salmon River on the north and the Grand Canyon on the south; between the State of Colorado on the east and California on the west. Within these bounds there are at present 32 National Forests which cover 31,020,268 acres at this writing and embrace most of the ground that can properly be considered as forest land. Hence this article will deal only with the problem of forestation as it applies to the National Forests. Nursery work and planting have occasionally been discussed with reference to eastern conditions, less frequently with reference to western conditions. Not only are the topography, climate, fauna and flora, those factors which determine and influence kind and character of tree growth, different in this region, but the technical and economic problems are likewise different. While it might be possible in this article to consider the physical factors in their relation to tree growth at some length, it is the writer's aim to treat the subject from the standpoint of one who is interested in getting practical results and to take up the theoretical only in so far as it has direct bearing upon the practical.

During the past summer some criticism appeared against the policy of the Forest Service on the ground that large areas of grazing land had been included within the National Forests in this District, which the Forest Service was now improving as range property instead of stocking with trees and that the intention of reforesting denuded lands had been given up. While the contrary is true so far as the planting policy is concerned, such a statement from publications not especially friendly to the administration, would seem to indicate that the public welcomes a policy of forest planting even when it does not fully approve of some of the other important phases of forest work. Forest planting by States and by the National Government naturally appeals to the public; frequently for sentimental reasons. In this case, however, there is a substantial foundation for a favorable sentiment in the fact that there is a comparatively small acreage in actual forest land within the District and many of the important watersheds are in need of protection.

By referring to a Forest map of the District, it will be seen that the Forests in this District are scattered in groups over an extensive area. The best timbered are the Sevier, Powell, and Kaibab, in the southern part of the District, the Ashley and the eastern part of the Uinta in Utah, the Forests in northwestern Wyoming and those between Boise and the Salmon River in Idaho. Most of the best timbered Forests in the District are so remote that the timber on them is practically inaccessible on account of lack of transportation facilities. On the other hand, the more accessible Forests in the center of the District, like the Fishlake, Manti, Nebo, Wasatch, Cache, Pocatello, Minidoka, Caribou, and Targhee are poorly timbered.

The two principal products from National Forests are wood and water. At present the Forests of the District do not supply the local demand. Lumber is sent here from Washington, Oregon and California. In fact, the Pacific coast timber is shipped to the plains and prairies of the middle west and as far east as the cities on the Atlantic coast. Since these States are thus heavily drained of their timber supply the time must come when District 4 will have to depend more largely upon its forests as a source of supply. At present grazing is permitted and encouraged wherever it does not interfere with the water supply for cities and towns. The revenue from an acre devoted to grazing, however, is not equal to that which would be obtained from the same area if it were in forest. The production of forest trees is therefore a higher use than the use of forage. It may be well to remark here that with the increase in population, the area in forest, especially in the east, will be still further reduced through agriculture. On account of this reduction in the total acreage, it will be necessary to make the remaining forest land more productive by putting all of it to its best use. There is no better way to do this than through forestation and by extending it rapidly, for tree growth in this region is slow. We frequently hear the expression: "Thirty years to grow a tree and thirty minutes to cut it down." That, however, does not apply to this region. From numerous measurements made by the writer on the Wasatch National Forest in 1905, and by others, it appears that "Three hundred years to grow a mature tree and thirty minutes to cut it down," would be more nearly correct. Hence, if the country at large has "reached the point where the growth of our Forests is about one-third of the annual cut, and we have in store timber enough for only twenty years," there must be sufficient cause for action from the standpoint of timber production alone, not considering the fact that most of the National Forests are valuable watersheds in need of protection.

It is therefore evident that for the present a very conservative timber sale policy should be in vogue on the poorly timbered Forests and that everything possible should be done toward protecting individual stands from destruction by fire. For the most part, the existing stands of timber are uneven-aged and if properly handled can be culled indefinitely without becoming depleted as successive generations of young trees are usually springing up naturally to take the place of the larger and older trees removed. In these protection forests clear cutting with replanting will never become advisable. With the numerous burns which are scattered throughout the forests, however, the case is different. The fires which have caused them have fed on the refuse from lumbering and have destroyed not only the advance growth but all possibility of natural restocking excepting some instances in the case of Lodgepole Pine stands. Hence a system of forestry which aims at more than mere exploitation would naturally undertake first reforestation of the burns and the afforestation of as much of the other types of land as possible.

With reference to reforesting burns, one naturally concludes as follows: Where trees grew before and produced a stand of timber which was valuable enough to cut for lumber, they may be made to grow again and to produce even more valuable material. On the other hand, it may be well to note that where trees never grew, forest planting is often most eagerly sought by the public, and that foresters, out of a desire to meet these public demands, have not infrequently undertaken the difficult and questionable planting projects first. In the execution of such work, faith, hope and enthusiasm are necessary; but they are poor substitutes for suitable soil, moisture and temperature. Emphasis should be laid upon the fact that reforestation should precede afforestation and that all projects which involve purely afforestation should be considered as experiments until success has been demonstrated. However, I do not mean that there is no latitude at all in this matter, for favorableness is a relative term and there are various degrees from the optimum to the absolutely forbidding sites, and these grade from the one into the other. Then, too, the present distribution of a species is not necessarily an indication of its possible distribution. Drought, grass and stock frequently prevent the germination of seed and the natural extension of forests on sites upon which they can doubtless be successfully established by planting. If a species has not been particularly abundant in a certain locality, insects, birds, and rodents may have waged such a war upon successive seed crops that the particular species may in time have become extinct in the locality. Similarly a species suited to a region may be absent in it for geological reasons. The writer is of the opinion that Yellow Pine was eliminated from the Wasatch Mountains during the glacial age. Hence if one should find a good stand of this species upon a certain site, say in Colorado, and should upon investigation, find identical sites elsewhere without tree growth, it should be natural to suppose that that species could be safely introduced in the latter case and with equal or better results. If nursery practice can be taken as a criterion, the experience in growing this species at the Wasatch Planting Station is worthy of note. Here, at an elevation of 7,430 feet, it is particularly hardy and can be grown from seed, without irrigation, shade, mulching or "damping off." When transplanted at the age of one year, 95% of the plants live and thrive. Were ecology, the adaptation of species to sites, an exact science, it would only be necessary for the forester to study sites and requirements of species and to make the proper adjustments. In this way it might prove that the range of the native species could be extended and that valuable exotics are suited to sites which are not naturally timbered. The more one knows of the principles of ecology, the less he needs to rely upon blind experimentation. However, until it furnishes absolute knowledge, it is always necessary to be on the safe side, and thus to make reforestation the more important issue.

Of the hundreds of species native to the United States time has not granted an opportunity to study a forest plantation of any one species from seed to maturity. Hence we have no knowledge from actual practice of their relative value. However, since only species of high commercial value should be artificially propagated whatever the purpose for doing so may be, economic considerations eliminate the great majority of them. We must rely upon a few of the best, most widely distributed and most generally useful native species like Douglas Fir and Yellow Pine. All big projects should contemplate the use of one or both. We desire to know what Scotch Pine, Norway Spruce and numerous other exotic as well as native species will do and we have been growing a large number of species at the Planting Stations on a small scale to be used in permanent sample plantations where their behavior can be noted and compared. The superiority of some of the exotics may in time be demonstrated in this way.

Since all work which involves a large expenditure should be carefully planned, an extensive reconnaissance study was conducted on the Wasatch National Forest during the summer of 1905. This resulted in a plan which gave the location, area, and character of the planting sites, nursery possibilities, species, rate of growth, etc. Upon it, as a basis, the Wasatch Planting Station was established in the fall of 1905 and the spring of 1906. This, therefore, is the oldest forest nursery in the District. At the same time it is the largest, having an annual seedling capacity at present of 4,000,000 plants. At first this station was intended primarily to grow plants for reforesting the denuded watersheds of the Wasatch National Forest. One year later, 1906-1907, the Pocatello Planting Station was established on the Pocatello National Forest, for the purpose of afforesting the treeless slopes of that Forest. Its present capacity is 1,000,000 plants annually. The reconnaissance work has since been extended to other Forests. However, these two are the only planting stations in the District.

In order to grow additional plants and to give the Forest rangers experience in nursery and planting work, a number of ranger nurseries were established on some of the other Forests in the spring of 1907. In practically every instance they failed, not because of natural conditions, but because it was an attempt to do work which is naturally intensive in character through extensive methods and by inexperienced men. All but two of these were given up in the spring of 1908, and the better policy of centralizing nursery work in the planting stations was adopted. At these stations, work is now being conducted on such a large scale and has been so systematized and intensified that it may be considered as being on a sound practical basis. In the matter of forest planting, the stations are our basis of operation, our vantage points and our nursery experiment stations alike. Perhaps "Nursery Stations" or rather "Nurseries" would express the real significance of the stations better than "Planting Stations" for at them the central idea is to grow nursery stock not only for planting on the Forests on which they are situated; but largely for planting on other Forests in the District under the supervision of men who are not directly associated with the stations even though they may have been transferred there previously to gain necessary experience.

On account of the large and increasing annual production of seedlings at the planting stations, and the fact that plants have to be held 3 to 4 years before they are large enough for field planting; it will not be possible to transplant all the seedlings at the planting stations for lack of transplant ground. To relieve the congestion, plans are being made to establish "transplant nurseries" with an initial capacity of 500,000 plants on several of the other important Forests. The plants for these are to be supplied from the central planting station and are to be transplanted and cared for by an experienced Forest ranger.

A study of past nursery practice shows that wherever partial stands only were secured, this was due to one or several of the following causes: "damping off," birds, and rodents, covering the seed too deeply, and sowing too small quantities. "Damping off" rarely occurs. It can usually be checked by refraining from sprinkling the beds and by airing and cultivating them. Birds and rodents can be controlled by methods already in vogue. Considerable care must be exercised in sowing the seed, for it is mostly covered too deeply unintentionally. The most important factor, however, and the one that can be most easily controlled, is the quantity of seed sown. Too much emphasis can not be laid upon the value of intensive seedbed work, for it is by intensive and systematic methods that the cost per thousand of plants has been greatly reduced and can still be lessened. For instance, if 400 seedlings of Douglas fir are grown to a square foot of seedbed instead of 200, which appears to be entirely possible, the cost, not including the value of the additional seed, is reduced to one-half per unit of area, and a nursery of 2,500 square feet will produce one million plants instead of half a million. Whenever the seed is sown in drills, the drills should not be farther than 3 inches apart and should contain not less than 45 plants to a running foot of drill. In this way mulching will be unnecessary with such species as Yellow Pine and Douglas Fir. If the seedlings grown at the planting stations could be stimulated so as to be ready for field planting in 2 to 3 years instead of 3 to 4, the cost could be decreased. A number of experiments along this line have been conducted at both planting stations with various fertilizers. So far these have not proved beneficial, and it is not considered necessary to continue them until the native fertility of the soil has been drained.

While the planting stations have been quietly developing along technical and practical lines, different ideas about the whole matter have arisen. The more conservative express doubts about the possibility of reforesting even the most favorable sites with the best grown nursery stock. This, however, seems entirely possible and practicable. Hence the conservatives would have us proceed so slowly and on such a small scale that the cost of the work done would be excessive. Others, on the other hand, realizing the enormity as well as the importance of the work are impatient for direct results on a large scale. These are confident of effecting reforestation even by direct seedings. Between the two extremes, a "golden mean" seems to be the logical position to hold, *i. e.,* to build up the existing nurseries as rapidly as possible, and, in addition to carry on experiments in planting and seeding. There are several obstacles in the way of getting success with direct seeding. Weather conditions are usually responsible for success or failure. However, if it succeeds, it will hold out a hope of accomplishing results more nearly compatible with the needs. The planting stations can then supply stock for the less favorable sites while broadcasting may be practiced on the more favorable situations.

Seed collecting, nursery work, planting and seeding are all of a technical nature, and require knowledge, skill and experience to bring the best results. In view of the fact that all the work done on a National Forest must necessarily be done by or through the local Forest officers, the inexperience of most of the officers in such work constitutes one of the greatest drawbacks. However, the planting stations offer the best training school and plans have been made to detail one or several rangers from those Forests upon which planting is contemplated to the nearest planting stations for short periods while work is in progress there. It is expected that some of these will be put in charge of the planting and sowing on their own Forests as well as of the transplant nurseries to be established. However, the bulk of the labor at the planting stations, as well as on individual Forests, will have to be hired. Forestry students from the agricultural colleges have proven to be very desirable temporary laborers. The experience acquired in connection with their employment at the planting stations will be of further use to the Forest Service in case they become more permanently associated with the work on a particular Forest.

In conclusion, all forestation, whether afforestation or reforestation, whether effected through planting or direct seeding, should be regarded in the light of improvement work, as one of those functions of state which takes into account the public welfare rather than financial returns because these are shrouded in darkness, and it is not possible to prove pecuniary success because too many of the following factors necessary to the calculation are unknown and unknowable:

a. Minimum cost of establishing and maintaining plantations from seed to maturity.
b. Rate of growth of trees and time of harvest.
c. The protective value of Forests reduced to tangible terms.
d. Final sale value of product at maturity, and,
e. Rate of interest at various times.

In this, as in all other important undertakings, there are necessarily elements of uncertainty. Were it necessary to wait until there are no more risks, this work would never be started, and the Service would be comparable to a young man who fails to take upon himself some of the active duties of life because he cannot know beforehand to what extent reasonable ventures will prove successful.

2. The Pocatello Planting Station.

CLINTON G. SMITH.

From an economic standpoint, this Station is one of the most promising Planting Stations in operation by the Federal Government. It is located in Southeastern Idaho, upon the Pocatello District of the National Forest of that name, which was proclaimed as a Forest Reserve by President Roosevelt, September 3, 1903.

This area was formerly included within the Fort Hall Indian Reservation, which was partially opened to settlement June 17, 1902.

Immediately after the opening of the Reservation, sheep and cattle, which had been previously excluded, were driven upon this area in large numbers, with a resulting pollution of the water supply of the City of Pocatello, and threatened shortage of water as a result. Cause and effect were obvoius and this Forest was created in response to the urgent petition of the citizens of Pocatello.

On assuming charge of this area of 50,000 acres, the Forest Service began a protective administration, to exclude stock and to prevent forest fires, and more than this, active forest extension on this important area has been planned and actually begun. A small nursery was established in 1905, and continued to the opening of last season, when this was made a permanent Planting Station. The results of the first three years showed that it was technically as well as economically, possible to raise seedlings and to make plantations thrive, but it was not practicable to do so without the constant attendance of a practical nursery man, during all periods of growth of the seedlings. In order to make this worth while, the capacity of the nursery, first rated at 500,000 plants, was increased during the coming season to 1,000,000 plants.

The success of this nursery seems assured from an economic standpoint, owing to its accessibility, as it is but 13 miles from the shipping point, Pocatello, with which it is connected by a fair wagon road and telephone line. The growing season is long—from April 15 to October 1, in ordinary years, and plant material may be readily transported in time to be used elsewhere in the State before the season is too far advanced. Labor supply is above the average as to skill and availability during the busy season. Wages paid are $2.50 per day, without board, which costs the laborers 50 cents a day.

The nursery is located in a narrow valley on the main fork of Mink Creek, one-half mile below one of the intakes of the city water supply, which area it is proposed to reforest. The altitude of the nursery is 5,200 feet. The surrounding hills rise to nearly 6,000 feet within a mile of the stream. The soil of the seed beds is a rich argillaceous loam, whose mechanical texture has been somewhat improved artificially. The nursery lies on a slope with southern aspect. The sloping character has been corrected by leveling the individual beds, retaining the proper level by means of four inch strips of boards on the lower sides. A new seed bed is located 300 feet distant upon the creek bottom, which is a flat about two acres in extent. The soil here is alluvial, and is quite largely of organic origin. Good garden crops have been raised upon this flat during the past three years, and it is anticipated that it will meet the requirements of seedlings even better than the present seed bed.

Seed beds are of two sorts, according to the height and nature of shade frame. Two seed beds, called "lath houses," of 2,500 square feet available seed area each, are covered with lath screen, made as a woven wire fence, in strips 70 feet long and 4 feet wide. These are supported upon a frame work 8 feet above the ground. The spacing of the lath is such that 40% shade is given. The sides are protected in the same manner by lath fencing, and protection from rodents is secured by the placing of wire netting, 2 feet wide, with 9 meshes to the square inch, about the bottom of the inclosure, 6 inches being below the level of the ground. These lath houses are 50 feet by 70 feet in size and are provided with walks, and are made into beds, four feet wide. The aggregate seed area of these beds is 2,500 square feet. They are suitably provided with iron piping, faucets and hose attachments for watering.

Low shade frames, of the same mesh as that used for the lath houses, 12 in number, are made 4 feet by 12 feet, for a seed area of 48 square feet each. They are placed 12 inches high above ground. These screens are made of lath nailed on two pieces of wood extending from end to end of the frame. They are designed to be handled by one man. We calculated to shade 50 per cent.

The soil is reduced to a suitable depth for seeding by spading and raking. The seeds are sown broad cast, about 24 ounces of Douglas Fir seed to 100 square feet of seed bed. This is designed to produce 375 seedlings per square foot.

The seedlings remain in the beds two years, receiving timely watering, weeding, mulching during the winter, and other care.

They are, at the beginning of the third year, transplanted into transplant beds, where they are spaced 1½ inches in rows by 6 inches between rows. Ordinarily two men will transplant 8,000 to 10,000 plants of this species per day, by means of a transplant board. Watering and weeding are required during the season for these plants also.

Field planting is best accomplished by dividing the force into crews of five men each, one man carrying in a bucket transplants which have been "puddled," and handing them to the planters. The soil is "wounded" by men with mattocks. The transplants are spaced 6 feet, the distance being slightly varied to suit the more favorable conditions as to soil and cover.

Plantations will be begun this spring systematically, on an area above the intake of the city water supply mains. An area has been selected near an altitude of 6,000 feet that is evidently potential forest land. The soil is a loam of moderate texture and fertility. It now bears a scattering stand of sage brush. Each year the plantations will be marked in a permanent manner, and plotted upon the map of the district. In all there are about 8,000 acres of potential forest land upon this watershed, at present devoid of tree growth, which will be reforested as funds permit.

Aside from the actual nursery operations, field sowing is being tried experimentally, in an effort to devise a satisfactory substitute for the expensive planting.

Experiments along the lines of preventing and curing damping-off have also been made and will be made as needed in an effort to determine the best local methods for producing plants of maximum vigor at a minimum cost. The relative merits of high versus low shade was tested last season, with the result of 50% better germination and immunity from fungus, under the high shade lath house as compared with the low shade frames.

The plant now at this station exclusive of the seed bed structures consist of an office building of one room, a three roomed dwelling house, a bunk house, barn and tool house. The first two named buildings are made of D sawn logs and present a very neat and attractive appearance besides being very comfortable dwellings.

The Pocatello planting station will occupy a definite place in the future management of this and other National Forests in southern Idaho. From it as a source, plant material will be shipped to other portions of this Forest, and to other National Forests, where local conditions demand intensive forest management.

LOGGING IN THE REDWOODS.

NILES B. ECKBO.

Humboldt County is situated on the Northwest coast of California. It is 108 miles in extent along the ocean with an average width of approximately 35 miles, making a total area of about two and a quarter million acres.

It is calculated that originally there were about 540,000 acres of redwood forest in the county of which some 70,000 acres have been cut. The known amount of lumber taken from this cut over land justifies the average estimate of 100,000 feet board measure per acre, which makes a total of 7,000,000,000 feet. Many claims of 160 acres will yield 40,000,000 feet, and certain acres have yielded as much as 1,300,000 feet. One tree cut by the Vance Redwood Lumber Company in 1902 yielded over 165,000 feet of lumber tallied from the saw. The annual cut of lumber (exclusive of shingles, shakes, etc.) in Humboldt County is now almost three hundred million feet, which is the output of the 11 large sawmills operating. The income from this has reached as high as $6,000,000 yearly.

The redwood belt of California reaches its maximum of perfection in Humboldt County, and it is not strange that lumber in its various forms should be the dominating business interest.

The redwood occurs mostly in pure stands; but is mixed sometimes to a small extent with Douglas and White Fir, (which are both generally known as pine) oaks, madrona, and various other trees.

An excellent stand of almost pure redwoods can be found on Bull Creek, which is specially wonderful on account of its uniformity in sizes and the flatness of the ground. It is considered the best redwood timber in the country. Trees from 10 to 16 feet in diameter are not rare, and the timber appeared to be straight, not badly defective; but with quite a few windfalls, that no doubt yet can be utilized to a great extent. There are also fine stands of redwood on Eel River, South Fork and Mad River and others.

One of the largest redwoods left in this section of the country grows on Simpson Creek, which is a tributary to Mad River. It measures 22 feet in diameter at the butt; it is approximately 200 feet high and has a bark of an average thickness of 9 inches. A trail, which is tramped entirely by interested sightseers, leads to it from the county road.

The redwood does not grow very fast, and a few stump analyses showed that a tree 5 feet in diameter was about from 600 to 700 years old, while a tree 8½ feet in diameter showed the age of 900 years.

The redwood reproduces itself by seeds and sprouts, and the latter are of most importance on the cut over lands. Frequently as many as 20 sprouts may be seen coming forth from the neck of the roots, and occasionally a few sprouts come out from the top or the sides of the stump itself. It is claimed by lumbermen, that the material in the second growth redwood is of inferior quality, and will only make second grade of lumber.

The stumpage price of redwood has gone up greatly in late years, and is still increasing at the same rate. The present price varies usually between $2.25 to $3.25 per M feet board measure; but most of the land is already in the hands of large lumber concerns, and is never known to be for sale.

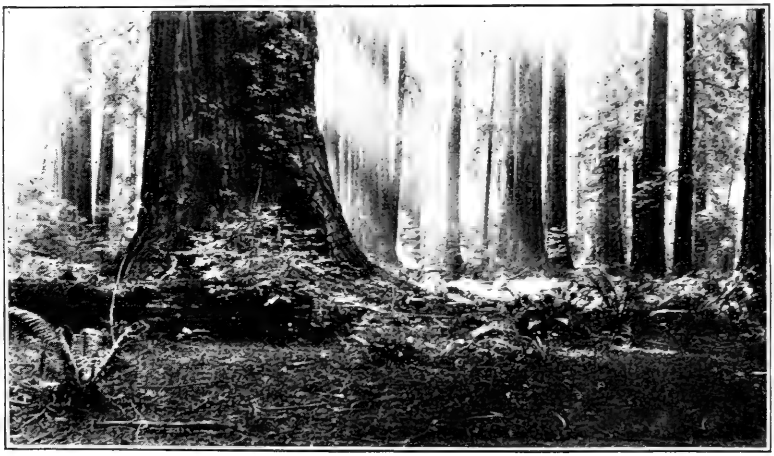
The logging of the redwood differs somewhat from the logging of other species on account of the large sizes that have to be handled. It seems an immense task to undertake to cut down trees of such enormous diameters; but the fallers seem to go at their giants with the same ease as the choppers do with their 16 inch trees in the East. The fallers work two and two together, and have nothing else to do but fall the trees properly. This requires some skill in these dense forests, where a tree lodged may mean days of extra labor. The fallers stand on a horizontal platform when felling a tree, which is made of two drivers and two boards for each man. The undercut is often made with ax and saw, which is easier than cutting alone. It is made in one of two ways, either by cutting off part of the first log to the sawkerf, or by cutting off a slant on the stump.

To be sure that a tree is going to fall in a certain direction a gunstick is used. This stick is about 12 feet long, and is usually made of four pieces of wood, which are jointed together so as to form a parallelogram, when opened, the opposite corners will be on a line perpendicular to the undercut.

It takes from 2 to 2½ hours to fall a tree 6 feet in diameter,

A Tree That Possibly Dates Back to the Time of Christ.

Bull Load on the way to the Landing.



A Typical Redwood Forest.
(Sunrise)

and nearly 5 hours to fall one 9 feet in diameter; but this depends a great deal on how curly the wood is and how it leans, and so forth. When the tree is felled a "ringer" comes and cuts rings around the tree at about 10 foot intervals to make it possible for the "peeler" to get the bark off easily.

When all the trees are peeled on a certain area, they are "fired"; which means that a fire is started among them to consume all the debris. The fire is either started the same or the next season after cutting. It chars the trees to some extent, and consumes all the rotten part and probably a little more in some instances.

When the area is burnt over, the trees are sawed into log lengths by regular "sawyers." The length of the logs depends on the orders to be filled. The logs over 10 feet in diameter are usually split in two with a black powder. There must necessarily be some waste in doing so; but in many cases it would not be practicable to get heavy enough machinery on account of a few large logs, and in other instances the sawmills would not be able to handle them.

Years ago, oxen were commonly used for hauling the logs; but steam has superseded them. One of two methods is commonly used here to get the logs to the landing. The first method is to have a main skidroad running through the timber, which by a cable, running in a closed circle, is connected with a 40 to 50 horsepower "bull donkey" at the landing. From this main road are built skidroads out into the timber, and preferably along the small gulches. At each of these branch roads is a "logging donkey" from 12 to 16 horsepower, to haul the logs down to the main road; where they are chained together in a long row, called a "bull load," and hauled to the landing by the bull donkey. In a bull load may be as many as 30 logs, when the timber is fairly small.

In the second method the bull loads are handled the same way as formerly; but the great number of branch skidroads are practically done away with. This is due to the powerful bull donkeys that are placed along the main skidroad instead of the logging donkeys, and these are able to haul the logs without skidroads. and with a less number of pullies. While the machinery in the second method is much more expensive, it is supposed to save labor enough to more than pay for itself.

Formerly a number of horses were used to carry water on their back to supply the skidroads; but now if water cannot be found near by, it is pumped up with separate engines. Besides water in the skidroads, the skids are greased by the "skid greaser" to make the logs run smoothly.

Along the main skidroad are usually strung two electric wires, that, when brought in contact with each other, will ring a bell at the bull donkey. One ring of the bell means "start"; and "stop" when the donkey is running. Two rings mean "back up," and this will pull the cable in the opposite direction. It is essential to have this system, in order to bring the bull load to a stand still on any part of the road, or to start it.

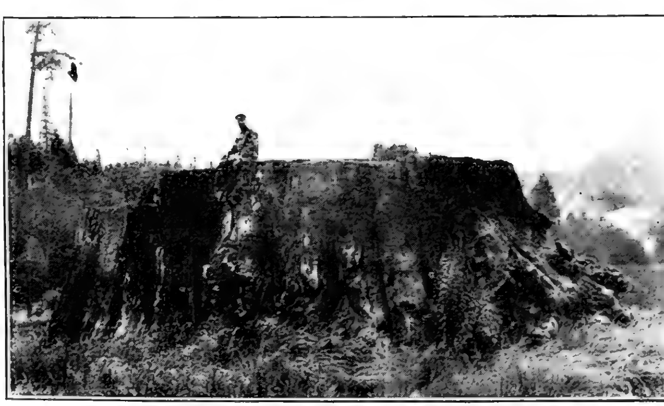
At the landing the bull donkey may also handle the loading on the railroad cars, or there may be a separate "loading donkey." The loading is done by bringing the cable several times around the log and hooking in, and then rolling on skids upon the car. The logs are fastened to the car with two "grab hook chains" at each end of the load. These chains are long enough to pass each other on the top of the load and are fastened a little distance down on each side. This is a simple and very efficient means, but of course leaves a few hookmarks on some of the logs. The logs are carried to the mill-pond by railroads and dumped into the mill-pond by loosening the chains and running the cars over a tilted track.

The sawmills are naturally somewhat more heavily constructed than sawmills in general. The largest logs are usually taken into the mill on carriages, and are often split in two on an exceptionally large band-saw before they are cut into smaller sizes. The redwood is sawed into boards, planks, dimension stuff, shingles, lath, and is used for turning, sash and doors, boxes, etcetera.

The wood takes a good polish, and the curly wood especially makes an elegant and handsome finish. Burls often occur 5 feet through, and are frequently utilized for fancy furniture. The lumber is mainly sold on the coast and shipped to the Orient.

The enormous waste in lumbering that formerly took place, has now been reduced considerably; but there are yet large quantities of good material that is not utilized. While now the stumps in most places are supposed to be cut very low, several hundred feet of lumber could be saved from many of them. The wood near the stump is usually of better quality than the rest of the tree, and is certain to make first class shingles, box-

An Undercut.



Cut Over Land.

boards and so forth. There is one factor that makes the waste in logging not as serious as it might be. The redwood has a wonderful capacity of withstanding decay, and when the redwood supply is getting shorter and the stumpage prices go up, it may yet be time to come back and get what may have been left 10 to 20 years ago. This has already taken place in several localities. It is the waste in the sawmills that is the most serious consideration, and it is difficult to reconcile oneself to the amount of good lumber that is consumed in many of the various roundhouses for fuel. The reason for this consumption is, that it takes a good deal of labor and expense to sort out the small material, which could be used for various purposes, and the profit in so doing is comparatively small. Naturally most men think of the large profits and disregard the small ones.

Strict economy may not be essential at the present time, as much as it would be advisable; but there is no doubt it will come later when the supply of redwood becomes more limited.

RECENT LOG RULES.

Henry S. Graves.

It has been the custom in this country for a good many years to express the contents of round logs in board measure, a unit originally designed for manufactured lumber. Log rules are constructed to show the board contents of logs of different sizes. These rules show really the amount of lumber, expressed in board feet which it is *estimated* may be manufactured from logs. The factors determining the amount of lumber that may be secured from logs are exceedingly variable and hence it has not been possible to construct a log rule that will satisfy every manufacturer. The result has been the production of a large number of log rules, most of which have been used in actual business transactions.

From time to time there has been an agitation toward uniformity in log measure. These agitations have usually resulted in the production of more rules. In 1900 the Woodsman's Handbook was published by the U. S. Bureau of Forestry. In that book the writer brought together 43 different commercial log rules for board measure used in this country and Canada. Perhaps that work added to the interest in the subject. At any rate the presentation of the great array of rules with their many variations and deficiencies has not stopped the production of new rules. Mathematicians have taken a hand and worked out rules based on sound mathematics rather than on rules of thumb. The Champlain Rule of Professor Daniels is a case in point—a rule which seems thoroughly adaptable to practical conditions, but so far very few manufacturers have adopted it, as far as the writer is informed. This and Professor J. F. Clark's International rule have been discussed in the writer's Forest Mensuration. Since the appearance of that book in 1906 a number of new rules have appeared whose review may be of interest.

Massachusetts' Rule. In 1905 Mr. R. C. Hawley, then Assistant State Forester of Massachusetts, made a local study of the volume of White Pine. The investigation comprised the construction of a log rule from mill tallies. Over 1200 logs at 12 mills were measured, followed through the mill, and the product ascertained. The results were tabulated in the form of a log rule which has recently been published in "Forest Mensuration of the White Pine in Massachusetts" by Harold O. Cook, Boston. The Massachusetts log rule is supposed to show the actual product in inch boards which the average portable mill can produce from white pine under the present conditions in Massachusetts. It has been tested at nearly 200 mills and gives satisfaction.

Clement's Log Rule. This rule was designed by Charles J. Clement, of Portland, Oregon. It was published in 1904 in a small pocket booklet entitled "Clement's Rule and Table for the Measurement of Logs." It only recently came to the writer's attention and was not noted in "Forest Mensuration." The claim is made that it is the *only* rule which gives the exact amount of board measure, etc., a statement which prejudices one against it at the outset. The rule is as follows: Multiply half the diameter by half the circumference, then subtract half the circumference, the remainder will be the total amount of feet, board measure, in a 16 foot log. Or if the circumference is unknown, multiply the diameter by 3.1416, then divide the product by two and multiply by half the diameter and subtract as above mentioned. If the log is more or less than 16 feet, divide the amount of feet by 16, then multiply this remainder by the number of feet in the length of the log.

Click's Log Rule. This rule has been devised by Mr. A. G. Click, of Elkin, N. C. The general rule is as follows: From the square of the diameter deduct two and a half diameters and multiply the remainder by one-half the length of the log and cut off the right hand figure.

Calcasieu Standard Log Rule. This table is based on the following rule of thumb; Multiply diameter by diameter, that product by length, divide by 32, and add one one-hundredth.

As seen in the comparison table below the results are absurdly small for large logs. This rule is published by Irvine & Irvine, 725 Ryan St., Lake Charles, La.

COMPARISON OF LOG RULES.

SIXTEEN-FOOT LOGS.

	Diameters.										
	8	10	12	14	16	18	20	24	30	36	40
	Board Feet.										
Scribner, ...	32	54	79	114	159	213	280	404	657	923	1204
Mass., ...	51	79	115	158	205	256					
Clement, ...	37	62	94	131	175	226	282	414	659	961	1193
Click, ...	55	60	91	129	173	223	280	413	660	965	1200
Calcasieu, ...		50	73	99	129	163	201	290	453		

Cubic Foot Rules. One of the most encouraging steps in advance in log measurement is the agitation in Maine for a cubic foot rule for the measurement of pulpwood. A committee appointed by the Legislature to investigate the subject of log measurement has reported in favor of the cubic measure.

A cubic feet rule has just been issued by Mr. Halbert G. Robinson, of Patten, Me. This is described in "The Measurement of Logs" published by Thomas W. Burr Printing Co., Bangor, Me. Robinson's table is based on the careful taper measurements of 4398 logs. The cubic contents of each was computed and then a table of averages constructed on a basis of the middle diameter of the logs and the length. It was found that the taper of spruce averaged one inch for every 7.5 feet of length, for logs up to 40 feet long. Longer logs had a more rapid taper, so that the log lengths were limited to 40 feet in the table. After arranging a table by curves the author worked out a formula to express the values and to aid in interpolating where the original data were insufficient to permit of constructing curves. The formula is as follows:

$$V = B\tfrac{1}{2} \times L \times 1.049 = \frac{3.1416 \times D^2 \times L \times 1.049}{4} = 0.824 \quad D^2 \quad L \text{ in}$$

which $B\frac{1}{2}$ is the sectional area at the middle, D is the diameter at the middle, L the length, and 1.049 the average taper of the log. The author has presented the table in the form of a diagram which may be used in constructing a caliper scale. A table is also given showing the allowance which must be made for bark.

RANGER COURSES.

Julian Eastman Rothery, M. F.

One of the important and typical institutions in Old World forestry is the training school for Forest Rangers. The Indian School at Dehra Dun and the several famous academies in Europe are established on certain factors in the forest policies of their respective countries.

The progress of American Forestry has hardly included the creation of schools of this kind, until, independently, some of the Western colleges have started Ranger Courses of two or three months duration in the winter season. The need and value of these courses is only just beginning to be realized; their systematic development has not yet been undertaken.

I should like to draw attention to two points concerning primary forest instruction. First, the demand for and value of such instruction; second, the most feasible manner of building up ranger training schools.

There are probably very few government positions of equal rank which require so many different qualifications and such a wide scope of knowledge, both in the field and in the office, as the position of Forest Ranger. He must have certain natural abilities, and in addition a certain special training. As he deals directly with the forest users, from his competency the Service is often judged. Frequently he is a man of wide field experience, but of limited understanding along practical forestry lines, concerning which he is expected to have so much and applicable knowledge. However, when it comes to range and stock problems, he has a keen and almost incredible perception and knowledge, an intimacy that can never come to any, except the man born and raised on the range.

This, then, is the typical Forest Ranger to-day, strong in the grazing lines developed by years of contact, but hampered by lack of conceptions of the elements of handling timber and often of surveying and other subjects, which fundamentals may be given in a comparatively brief period, fully enough for a general basis in every day work.

Yearly the demands on the Ranger have increased in variety and degree until now, many are exercising more judgment, and shouldering more responsibility, than did the Forest Supervisor five or six years ago.

To meet these demands, there are usually but two methods of development: instruction from headquarters, and profiting by past mistakes; these are cumbersome, inaccurate, and costly in time and money. Or else, systematic teaching in ranger schools may be substituted. One Ranger, after taking a winter course in a Western college, made the statement to me that he had learned more about timber sales and the silviculture governing them, by two months application in class, than he had in two years work on the Forest. He added he could see the mistakes he had made in marking timber, and that his district would look differently now had he obtained his fundamental principles earlier. His is a case of rapid development. If he intelligently puts into practice his conceptions, it will benefit himself and the Forest Service.

The value of a Ranger Course will, I believe, be appreciated and acknowledged by all in contact with National Forest problems of to-day.

In regard to the second point, the most logical manner of building up ranger training schools, little has been attempted. Several considerations which must be given weight are the location of the school, the time and duration of the course, subjects of study, the instructor, and last but not least, the policy of the Forest Service towards such schools.

The various state and agricultural colleges throughout the six Administrative Districts offer certain advantages: *i. e.* fair proximity to the District Office and the Forests from which Rangers would be drawn, a faculty which could give instruction in allied subjects, and often some equipment at least, along biological and engineering lines.

A thorough canvass of a class of nearly twenty men who attended a course this past winter showed that three months, January, February, and March, could usually be spared from work, and was not too long to cover the ground which they felt needed to be covered. It also disclosed the rather surprising fact that the men were nearly unanimous in believing that Silviculture, Dendrology, and Timber Physics were of more importance and benefit than Surveying, which one might suppose would appeal to them because it is practical. This denotes a wholesome eagerness to acquire some elements of well balanced forestry, a non-temporizing spirit which is one of the essentials of forest work.

The Forest Service has always done its share in furloughing or assigning men to give instruction in applied forestry. With this broad attitude I heartily concur, and am convinced that in short courses, particularly, it is indispensable; for a man familiar with government work is far better able to realize the needs of both the Service and the men, and to emphasize the salient points and the necessary details. Without loss of time and from the viewpoint of experience, he is able to link together the theory and practice which is paramount in a short course, and in a manner impossible for one not familiar with Forest Service requirements.

But further than this the Service has not yet gone. When the government needs specially trained men for the Army or Navy, it enlists them as students, under pay, and educates them to fill the specialized duties of officers. Some corporations and municipalities do the same for their employees, and find that they are thus able to build up a corps of experts, obtainable by no other manner.

Any money that the government could spend in reimbursing the expenses of a promising ranger would most certainly make good return in the higher efficiency of the man.

To attend a ranger course may involve an almost prohibitory sacrifice in many cases; two—three hundred dollars loss of salary, and about half that for expenses, is a fair estimate based on actual figures. A furlough on part pay might readily make the difference between attendance and non-attendance, and this small encouragement is insignificant in comparison to the results obtainable from it. The expenditure for a single incorrect survey may run as high as forty dollars; yet a man, after even a three months' course, should be able to check his work by latitudes and departures before ever leaving the ground.

The cost of a small, poorly managed timber sale may be excessive, considered in the light of future demands on the Forest, but a ranger should be well fitted to handle such a sale after conscientious application at some good school.

It is not the object of this article to attempt to outline a system of study, for the application of the principles would vary somewhat with the locality and nature of the school and the region furnishing the men. But one small matter concerning the presentation of studies ought to be noticed, *i. e.* Practicability. To keep up interest and to work at the highest efficiency, the students, and particularly the older ones, must see how they can put in practice their newly acquired knowledge. It should be emphasized by many and familiar examples that the foundations of American Forestry are broad and enduring, but that the practical application is real and possible, that Silviculture is not merely a theory, but a reality that can be undertaken on each Forest and in many ways, from cleaning up an old burn to the proper administration of a large timber sale. Show, for illustration, that sound elements of wood preservation may be called forth as certainly in the construction of a mountain telephone line, as in more complicated work.

Ranger Instruction is bound to play an important part in National Forest administration, as the quickest method of training men to new and varied duties. If the Forest Service can coöperate with one institution in each of the Six Districts, and assign or furlough instructors, and financially encourage the best rangers to attend, then the institution may profitably take up the systematic development of a ranger course, possibly planning for two winters of progressive work for the more competent, and the first great stride in establishing an American counterpart of the Old World Academy will have been taken.

A PLEA FOR ABOLISHING THE DUTY ON EVERGREEN SEEDLINGS FOR FOREST PLANTING.

ELLICOTT D. CURTIS.

Forest planting at the present time in the United States is confined almost entirely to lands unsuited for agricultural purposes, and especially to lands which have been abandoned as farm lands and are now growing up to brush. This type of land is extensive in all the states in, and east of, the Appalachian Mountains. Almost every farm of any size in these states includes a certain amount of this sort of land.

The plants used for re-foresting are almost entirely evergreens, and the sizes which have been found most suitable are two-year-old seedlings and three year-year-old transplants. One year old trees are hardly ever large enough for planting out, and four-year transplants have too slight an advantage over the three-year-old trees to justify their use, except in special cases.

The most approved method in New York and New England is to plant these trees at the rate of about five by six feet, making nearly 1,500 trees to each acre. The labor cost of setting out trees of this kind under favorable circumstances, is about $2.25 per acre. The largest item in the cost of reforesting is, therefore, the cost of the trees. In general, it may be said that experience in New York and New England proves that two-year seedlings can be used for this purpose when they do not have to be shipped far, but in general, three-year-old transplanted trees are much better and are well worth the additional cost.

With two-year seedlings there will be a larger proportion of re-planting necessary, which will increase the labor cost considerably, while with transplanted trees the loss should not be greater than 10%, which will make no material difference in the future forest.

I have prepared the following table showing the cost of trees both in Germany and in this country, together with the cost of importing, and the per cent. of duty at the present rate.

The prices given below are per thousand trees.

	2 Year Seedlings.					3 Year Transplants.				
	White Pine.	*Red (Norway) Pine.*	*Scotch Pine.*	*Norway Spruce.*	*Europ. Larch.*	*White Pine.*	*Red (Norway) Pine.*	*Scotch Pine.*	*Norway Spruce.*	*Europ. Larch.*
Average Cost in Germany, (J. Heins, 1908-9).	$0.95	$1.90	$0.55 (1 yr.)	$0.40	$1.90	$2.50		$1.50 (2 yr.)	$1.57	$2.20
Freight & charges to New York, about, ...	0.50	0.50	0.50	0.50	0.75	0.75		0.75	0.75	0.75
Duty, ...	1.15	1.30	1.08	1.06	1.30	1.40		1.23	1.23	1.35
Cost in N. Y., duty paid, ..	2.60	3.70	2.10	1.95	3.95	4.65		3.50	3.50	4.30
Per cent. of duty on cost in Germany, ...	121%	68%	103%	265%	68%	56%		82%	82%	61%
Per cent. of duty on cost of trees f. o. b., New York, .	44%	35%	51%	55%	33%	30%		35%	35%	30%
Expense of raising similar trees in U. S., ...	0.90	1.10	0.85	0.80	0.90	2.80	3.00	2.75	2.70	2.80
Catalogue price of similar trees (1) from D. Hill, Dundee, Ill., Fall, 1907, ..	8.		7.	5.	8.	50.			120.	18.
Do. R. Douglas' Sons, Waukegan, Ill., Spring, 1908, ...	6.		5.	4.		120.		80.	17.	
Do. Harvard Nurseries, Harvard, Ill., Spring, 1908,	5.	60.	4.	3.50	6.	40.	50.	35.	25.	
Do. Evergreen Nursery Co., Sturgeon Bay, Wis., ...	6.	16.	8.	3.		18.		26.	12.	
Spring, 1908, ...	9.		10.	6.		25.				

American catalogs list their trees by sizes rather than ages. The prices given in the above table are always the lowest price at which any seedlings are offered in the respective catalogs. In the case of the Evergreen Nursery Co., two prices are sometimes given, in which case the first price is believed to refer to one year seedlings.

For the expense of raising similar trees in the United States the figures have been taken from a bulletin in course of preparation by the Division of Forestry, and they are corroborated by information which I have obtained from independent sources.

The species of trees which I have selected for this table are the ones which are most used in this work in almost every part of the country.

From the above table it will be seen that the cost of re-foresting one acre of land with white pine seedlings imported from Germany and planted at the rate of 1500 per acre, will amount to $3.90, and if three-year transplanted trees are used, the cost will be increased to very nearly $7.00 per acre.

For the spring of 1908 white pines could be obtained in Germany for $1.51 per thousand, and could be delivered in New York at a cost not exceeding $3.50 per thousand, which reduced the cost of plants per acre to $5.25, at which price the work can be satisfactorily done. It is very doubtful whether the ordinary farmer or land owner can be induced to re-forest his waste land where the cost of material is over $5.50 per acre, for the labor cost will increase this to a total per acre cost of $7.75 which is often considerably more than the land is worth.

A point particularly to be noticed about the above table is, however, that even with a duty of from 68 to 265% on German seedlings, they can yet be sold in this country at a less price than American-raised seedlings, and a specific duty of $2.00 per thousand would not change this result.

It should further be noticed, and this is the most important fact to which I desire to draw attention, that transplanted trees upon which the ordinary land owner or farmer without forestry experience must place his chief reliance, can practically not be bought in this country at any reasonable price. It is impossible to use White Pine, the most important lumber tree in this country for re-foresting land, when the transplanted trees cost $18 per thousand, the lowest price at which they were offered by any nurseryman in this country in the spring of 1908. The nurserymen mentioned above are among the best in the United States, and the prices which I have given are all from their printed catalogues sent me in the spring of 1908 in reply to my request for quotations on stock for forest planting.

I desire further to call attention to the fact that the raising of trees for forest planting is a comparatively new industry; that very little capital has been invested in it, and that the entire removal of the duty on this class of trees will be attended with no great loss to anyone.

The statement in Mr. Hill's letter to the Tariff Committee given on page 6,166 of the record, that he has 200,000,000 evergreen seedlings for forest planting, is evidently a typographical error. These trees for forest planting will not average over three years old, so that if the statement were true, Mr. Hill would be selling about 70,000,000 seedlings per annum, or enough to forest about 45,000 acres. It can be positively stated that no re-forestation is being done on this scale. Probably no concern is planting more than the State of New York in its Adirondack forests, and the total area planted by them in 1907 was about 300 acres. Less than 500 acres were planted in 1907 in the whole State of Connecticut, and it is doubtful if in the whole United States 10,000 acres of evergreen forest seedlings have ever been planted in any one year. Mr. Hill's statement therefore is, as printed, not correct.

It should further be stated that comparatively few importations of forest seedlings are made by the consumer, most of this business being in the hands of nurserymen who make a specialty of importing the stock. Further than this, it is doubtful whether European stock can be successfully shipped very far from the Atlantic Seaboard, as the trees will not stand a longer journey. It would seem, therefore, that any tariff on evergreen seedlings is a burden on the Eastern consumer and does not affect the Western market of the Western producer to any appreciable extent.

When we consider the large sums that the National and State Governments are spending on forestry propaganda, and that the land owner must wait some forty years for his crop, it seems both unwise and unnecessary to put any additional burden on the cost of planting forests. It is only the very wealthy who will use planting stock at a cost of $4.65 per thousand, which is the cost of white pine transplants delivered in New York this spring. The elimination of the duty will bring this cost down to $3.25 per thousand, placing the trees within the reach of every farmer. The continuance of the duty will restrict planting to persons of wealth or to large corporations who will raise their own plants. The status of the American grower of seedlings will not be affected by the removal of this duty, while forestry will at least be made possible to many millions of land-owners.

NOTE ON THE TREES IN THE PHILIPPINE ISLANDS.

One cannot realize the richness of the tree flora of the Philippine Islands until he is told that there have already been found over two thousand kinds in the Philippine Islands. This means more to the average person when it is known that here there are probably three times as many varieties as have been found in the United States. When all is known concerning the tree flora of the Philippines, it is probable that this number will reach three thousand. Of course, it must be stated that all of these are not used commercially. It is estimated that one hundred and fifty of them are on the market at the present time. Many of the two thousand are too small to ever be of any great importance commercially.

About one-half the area of the Philippine Islands, or 60,000 square miles, is in public forest. Of this 60,000 square miles, more than one-half is in mountainous region, and will not yield, at the present time, much wealth to the Philippines. Indirectly they are of very great importance, for upon them will depend the conservation of moisture, so necessary to extensive irrigation schemes. Less than half of the 60,000 square miles can be classified as forest which will yield commercial varieties of timber. A rough estimate will place the yield of this forest close to forty billion board feet. If this could be placed on the market to-day, at the price of our cheapest timber, it would bring a total of two and a half billion pesos. Of this two and a half billion pesos of wealth the Bureau of Forestry is the guardian. It is the object of this Bureau to have the wealth utilized as rapidly as it can be without danger to the forests. It is believed that about four times the present amount used can be exploited without endangering our forest. This would bring the annual amount of timber put on the market, from one hundred million board feet, the present amount, to four hundred million board feet. This would leave three hundred million board to be exported from the Philippines, and thus bring to us considerable wealth.

Included in the eighteen hundred or more comparatively unknown woods now reposing on herbarium sheets in Manila, and bearing scientific names but no information of commercial importance, are many which will in time, and after investigation prove valuable.

The rating of the relative values of this assortment of trees; the distinguishing between those commercially desirable, and the others, the testing of those which have been selected as commercially valuable, to ascertain their strength and fitness; the supplying of merchants and engineers with specimens and information, and the directing of all concerned how to obtain the maximum good with the minimum waste from our wooded lands—these are a few of the problems which daily confront the Bureau of Forestry of the Philippine Islands.

CURRENT LITERATURE.

Der Lichtgenuss der Pflanzen. Von Professor J. Wiesner. Leipzig. 1907. K. 10.80.

In connection with the highly interesting data furnished by Cieslar in regard to tolerant and intolerant species, briefed on another page, we may appropriately refer to the same author's review of Wiesner's special work on the light requirements of plants in general, a synopsis of 15 years of study in this field in which he is undoubtedly leading authority. The subject is treated in eleven chapters, and brings, besides references to previous work of the author and of others which in the photometric direction began in 1877 with a forester, Theodor Hartig, also the results of entirely new investigations.

The first chapter treats of photometric methods; the second analyzes the daylight, direct and reflected.

A spectroscopic investigation of the light at the exterior and in the interior of densely shading crowns revealed that down to a decrease of the light in the crown to 1/80, *i. e.* down to practicable limits, a change in spectral composition could be discovered by Wiesner's method.

Every plant adapts its organs to the light conditions surrounding it, either by defending itself against surfeit or by preparing for full utilization. This adaptation he calls "Lichtraumnutzung"—utilization of light space. Thus, a tangential plane laid around a tree crown, which Wiesner calls the maximum light plane, is the measure of the light which is available to the plant. According to Wiesner, under natural conditions the total leaf surface of a tree is as a rule smaller than this plane—a rather astonishing fact. For beech, a tolerant species which has a minimum light sufficiency (*Lichtgenuss-minimum*) of 1/60, the leaf surface is .8 of the plane; for spruce with a light sufficiency of 1/30, it is .5, for larch with 1/5 light sufficiency, .2.

The *Lichtgenuss* is the relation of the intensity of the light reaching the plant to the intensity of the total daylight—a photic ratio—and is expressed in any convenient photometric unit. In the fourth chapter this *Lichtgenuss* which we may render into "light sufficiency"—the intensity of light satisfying the needs of the plant—is discussed for various plant types in their habitats and also with reference to trees. The author makes a series, according to light sufficiency, closely resembling the series from tolerant to intolerant usually given in textbooks of silviculture. The light intensity in forest shade and conditions under it are discussed most interestingly, bringing scientific support for many silvicultural practices.

The dependence of light sufficiency on altitude and latitude is discussed in the sixth chapter. Wiesner has shown, that between the temperature of the medium (air, water) and the light sufficiency there exists a relation in that a part of the light which reaches the plant means a gain in temperature which is the greater the lower the surrounding temperature. Hence, in warmer latitudes a plant will show a lower minimum of light sufficiency, in cooler, more northern latitudes a higher one; the needed light supply increases towards the northern limit of the species,—a fact which explains many phenomena of plant distribution and has a bearing on silvicultural operations.

The relation of light sufficiency and leaf fall, of light sufficiency and mycorhiza formation—the mycotrophy increasing the lower the minimum light sufficiency—and of its influence on the color of leaves are dealt with. The foliage of summer-green plants changes color as long as it grows, while in evergreens even after they are full-grown the leaves darken for two or three years.

Each species or variety exhibits a certain stationary tone of green in the mature foliage, but the exterior and the innermost foliage of the crown pale by and by, the first on account of excess, the latter on account of deficiency of light, only the leaves under medium light preserve their stationary tone of green.

A physiological analysis of light sufficiency is attempted in a suggestive chapter. Below the minimum of light sufficiency, the formation of chlorophyll is retarded, and finally leaves die. As Cieslar has experimentally shown (see pages 180-185 of this volume), with plants requiring high light intensity etiolation begins even under quite intense light. Assimilation ceases as a rule at the light sufficiency minimum. The light under which the birch ceases to assimilate still produces good assimilation in beech.

How the study of light relations by photometric methods can be of service to plant culture is the subject of the last chapter in a book full of interest to any plant grower.

B. E. F.

Joseph Wessely's Berufsbiographie. Herausgegeben von Karl Petraschek. Vienna. 1908. 319 pp.

It is a rare case that a forester has a statue dedicated to him, at the same time that his autobiography is brought out in an elegant volume. This rare honor was accorded last year to Austria's most noted forester, Joseph Wessely, in the park of the Hochschule für Bodenkultur at Mariabrunn near Vienna.

The biography is really an inside history of the early development of forestry in Austria, to which the writer devoted his life from 1835, when he became assistant at the forest school, until 1898, when this real master of forestry died in his 84th year. What Hartig was for Prussia, Cotta for Saxony, Wessely has been for Austria, the reformer of its forestry, and he had the good fortune to see the fruit of his work and to receive the appreciation of his colleagues without stint during his lifetime.

He became a member of the incompetent Ministry for Soil-culture in 1849, which he left before its collapse to become the Director of the private forest school of the Maehrish-Silesian Forest Association in 1852. Three years later he cast his fortunes with a private corporation, which had extensive forest properties in Hungary, as their manager, but only for three years, when in 1858 he undertook the re-organization of the forest academy at Mariabrunn over which he presided for 12 years laying the basis for its development into the School for Soil-culture in 1875. After retiring, in 1870, he remained in private life, devoting himself to literary work, in which he was most prolific, with over 300 titles, among which 16 monographs, of which best known is the classical work on *Der europäische Flugsand.* The occasion of his 81st birthday gave opportunity for many expressions of appreciation on the part of the forestry world of Austria. B. E. F.

Die Besteuerung des Waldes. By Dr. Heinrich Weber. Frankfurt A. M. 1909. 555 pp. Mk. 10.50.

This is the first independent comprehensive publication in book form regarding the subject of forest taxation, which has lately in Germany as well as in the United States called forth much discussion. The author, professor of forestry at Giessen, keeping in view practical questions, discusses the principles of forest taxation in use in German and other States and investigates how far these principles are correct and just, or where they need reform in view of the peculiarities of the forestry business.

B. E. F.

Forest Finance. By Dr. C. A. Schenck. Asheville, 1909. Pp. 144.

This is primarily a syllabus of Dr. Schenck's lectures on the subject in the Biltmore Forest School. It is however something more than mere headings of topics, for the subject matter is presented in the form of statements covering the most important points in the theory of Forest Finance. H. S. G.

Interpretations of Topographic Maps. By Rollin D. Salisbury and Wallace W. Atwood. Professional paper No. 60. U. S. Geological Survey. Washington, D. C., 1908.

This very valuable volume describes the topographic work of Geological Survey, with special reference to the interpretation of the maps. It is a work of great value to foresters who have occasion to use Government maps or who have themselves to do topographical work. H. S. G.

Forest Service Atlas. Extracts from the statistical volume of the Forest Atlas for the year 1907. U. S. Forest Service. Washington, D. C., 1908. Pp. 30.

This book contains maps and tables showing statistics regarding the National Forests and the work of the Forest Service. Not only are there shown the areas of the Forests, but there are colored maps and diagrams, which show at a glance the most important information regarding their condition and management. This information includes statistics regarding the administration of the Forests, forest fires, construction of roads, trails, telegraph and telephone lines, permanent improvements, grazing, timber sales, etc. One map shows the classification and proportion of tree species within the forests, enabling a ready conception of the character of the distribution of the different trees.

The Atlas contains also information by diagrams of the progress of the work of the different branches of the Forest Service. These include the coöperative work with private owners in handling woodlands, the progress of the work in forest products and the distribution of the publications of the Service. There are also very valuable diagrams showing the amount of forest products consumed in the United States.

This volume will be of great use, not only to officers in charge of National Forests, but also to forest schools, and to all others who wish to keep in touch with the latest information regarding the forest work of the Government. H. S. G.

Maryland's Forest Resources. By F. W. Besley. Forestry Leaflet No. 7, State Board of Forestry, Baltimore, Md. 1909. Pp. 5.

For the past three summers a detailed forest survey, county by county, has been in progress, to obtain reliable information as to resources and conditions. So far ten counties—one-half of the State—have been studied, and completion of the work is expected in two years more.

This leaflet embodies, in a condensed form, the results of the detailed survey of the one-half, and of a general investigation of the other half. Thirty-five per cent. of the State is woodland (two million acres) and the estimated stand is nearly three thousand million feet B. M., (trees over 10 inches), one-quarter of it coniferous, worth eight million dollars. The cut of lumber in 1907 was two hundred and fourteen million feet, so that the cut was 30% greater than the growth. A comparison with the cuts of previous years shows that the maximum production has been passed. The warning is plain. J. H. W.

Forestry Working Plan for the North Watuppa Watershed for the City of Fall River. By the Massachusetts Forest Service, Boston, 1909. Pp. 29. Map.

The city owns some 60% of the 5,000 acres concerned, and wishes to take steps to protect its water supply. After a short account of the relation of forests to water supply, and a description of the basin, the report recommends thinnings at a net cost of $4,000 to $7,000, planting at a cost of $4,000 to $5,000, and fire protection $4,000, distributed over five years—this outlay on stumpage worth $25,000. Exception may be taken to the statement (speaking of the superintendence of the work) that "foresters do not come high; an active young man with a college training can be secured at a salary of $1,000—one-half of which represents the value of his manual work."

J. H. W.

Proceedings of the Conference of Governors held at the White House, Washington, D. C., May 13th to 15th, 1908. Edited under the direction of Governors N. C. Blanchard, J. F. Fort, J. C. Cutler, J. O. Davidson, and M. F. Ansel, and of Dr. W. J. McGee, Recording Secretary of the Conference. Government Printing Office, Washington, 1909. Pp. 451.

This volume contains a complete record of the Governors' Conference on the Conservation of Natural Resources. Many of the addresses of that conference have already been published in various periodicals, especially in Conservation, the organ of the American Forestry Association. It is of great value, however, to have the full account of the conference in one volume for ready reference and permanent record. H. S. G.

The Future Use of Land in the United States. By Raphael Zon. Circular No. 159. U. S. Forest Service, Washington, D. C., 1909. Pp. 15.

In this circular Mr. Zon discusses in a broad way the problem of the lands of the United States in the future. He takes up the general classes of land from the standpoint of their present use, and discusses the problem of how large areas will be available in the future for different purposes. It is his belief that in a half a century the area devoted to agriculture will amount to 50% rather than 20% of the total area as at present. About 25% will be devoted to grazing, about 2% will remain forever a desert, while the area of forest will, in Mr. Zon's judgment, shrink to about 450,000,000 acres or approximately one-fourth of the total land area of the country. In addition to these there will be about 2% classed as intermediate land which is neither exclusively forest land or agriculture land, but which may be devoted to either purpose according to local conditions.

Mr. Zon discusses the problem of meeting the timber supply in the future on a basis of 150,000,000 population. He makes an interesting comparison with other countries where one may conclude that in order not to disturb the natural balance the proportions of the forest land to other kinds of land must be not less than from one-fifth to one-third of the total area of the country. Countries with about 100 acres per 100 inhabitants produce more wood than they actually consume, while countries with 85 or less per 100 people produce less wood than their consumption. The conclusion is that there must be an area of about 180 acres of forest land for every 100 inhabitants if a country is to be sustained. But in this country the per capita consumption is much larger than in Europe, so that at the present rate of use the United States would soon be unable to supply the demand from its own resources. In as much as it will not be possible to import a great deal of timber from abroad it is obvious that the rate of consumption must decrease and also the rate of production increase. In case our per capita use should be reduced from the 260 cubic feet which it is now, to 150 feet and if the annual growth of our forests were increased to 50 cubic feet, the 450,000,000 acres which it is estimated will comprise the forests of 50 years hence the demands of the people may be met.

These are a few of the more important conclusions. The paper is an exceedingly interesting one and should be read by everyone interested in the problem of conservation.

H. S. G.

Instructions for Reforesting Land. By C. R. Pettis. State of New York, Forest, Fish and Game Commission. Albany, N. Y., 1909. Pp. 22. Plates 18.

In this pamphlet Mr. Pettis sets forth some definite, concise instructions regarding the establising of forests by planting in the State of New York. The directions given relate to how best to secure stock for planting, what to plant, when to plant, where to plant and how to plant. A brief discussion of the financial results of planting is also presented.

The forestry department of the State of New York is not only equipped for growing the nursery stock required for its own planting, but also grows seedlings to distribute at a nominal price among land owners of the State. Instructions are given regarding the regulations that the land owner must comply with in order to obtain forest stock from the State. The inference is that it is less expensive for the land owner to obtain the stock required for planting direct from the State than to grow it himself. For coniferous stock this is in most cases true, the chief exception being when stock is required in large quantity.

The instructions regarding what and when to plant are so brief that they convey but little information of importance to the planter. Early spring is recommended as the best season for planting.

The portion of the pamphlet dealing with the handling of the stock after its receipt by the planter and the method to follow in planting is concise and if followed should assure the farmer or other forest planter success in his planting operations.

The tables and other matter relating to the value of planting are interesting, but not based upon sufficient experience and data to be entirely convincing. The plates illustrating the State nurseries, forest plantations and planting operations are excellent.

J. W. T.

Forest Survey of Litchfield and New Haven Counties, Connecticut. By A. F. Hawes and R. C. Hawley. Forestry Pub. No. 5, Conn. Agricultural Experiment Station. Pp. 50. Plates 6.

The chief object of this pamphlet is stated to be the awakening of "interest in the forest lands of these two counties, which may lead to the adoption of better methods of treatment, resulting in a steadily increasing production by the forest." It is the first step in a comprehensive study of the forests of Connecticut which will eventually cover the other six counties of the State, and furnish the data for a forest map.

Of Litchfield County, 55% is classed as forest lands, while only 46% of New Haven county is so classed, the latter being more largely a manufacturing community. The total acreage of the two counties is 521,726, and the amount of standing timber is estimated at 7,800,000 cords, or 488,000,000 feet of lumber, and 5,168,000 cords of wood, with a total stumpage value of $7,468,-000. The average annual cut is given as 26,000,000 feet of lumber; 401,700 ties; 20,600 poles and piles; and 235,500 cords of wood, with a total stumpage value of $418,696.

Mr. Hawes discusses in detail the local market conditions of Litchfield county showing that there is a constant demand for ties, poles and piles, and that the many small factories use large quantities of home-grown lumber. It is, however, only in the vicinity of the larger towns and industrial centers which consume considerable quantities of cordwood, that it is possible to make improvement thinnings profitable. This is a large factor in preventing the increased use of systematic forestry methods in handling the woodlands of the county and to a considerable extent throughout the state. At present thousands of cords are wasted annually in the country towns for want of a profitable market.

For New Haven county, Mr. Hawley answers the question: "Can the present rate of cutting be continued indefinitely without exhausting the wood supplies of the county?" He estimates the annual cut for 1906-7 as 120,000 cords; the annual average growth as 70,000 cords; and the present stand of merchantable timber as 1,200,000 cords. The conclusion is obvious that the local supply of merchantable timber will be practically exhausted in twenty years if the present cut and growth are maintained, and although a large amount of standing timber would remain, it would not be of the most profitable size for cutting.

As the demands for wood are increasing throughout the country, and the prospect of a reduced output from the chief timber regions is certain in the near future, the local supply is bound to be more and more heavily drawn upon. Hence the annual cut for the county must necessarily show a tendency to increase during the next twenty years. As Mr. Hawley points out, the exhaustion of the local timber supply can only be prevented by increasing the annual growth of the forest lands. His recommendations to this end include more intelligent treatment of already existing woodlands, planting of open and partially stocked lands, and protection of all against fire and grazing. He further states that fire protection is the most essential at present.

Although intended primarily for the people of the state, the survey will be of great interest to the professional forester as a practical study of regional conditions.

W. O. F.

Eighth Annual Report of the State Board of Forestry of Indiana. Indianapolis, 1908. Pp. 211.

In this report there are a number of papers. One of the most important is an account of the influence of deforestation along the Wabash River by Messrs. F. A. Miller and E. E. Davis. There is also an account of the work done during the year on the State Forest Reservation and a general discussion of different trees suitable for planting in Indiana. About one-third of the book is made up with reprints of circulars of the United States Forest Service. H. S. G.

Report of the Michigan Forestry Commission for the years 1907-08. Lansing, Michigan, 1908. Pp. 126.

The bulletin contains the biennial report of Prof. Filibert Roth, in his capacity as State Fire Warden. This report is very illuminating in regard to the difficulties of forestry in Michigan. In as much as the state reservation is very largely cut-over land the problem of protection is and will be for a good many years most important. Prof. Roth has been very successful in the matter of forest fires, and considering the difficulties under which he is working, the areas injured are remarkably small. The protection during the five years of administration has cost 2c. per acre per year. A certain amount of planting has been done on the reservation, altogether 440 acres having been completed. The report is especially interesting to foresters having administrative charge of state reservations.

Mr. W. B. Mershon, a member of the Commission, has a paper on Private Forestry in Michigan. There is also a full account of the Lake States Forestry Conference and a description of the work of the Michigan Forestry Association for the year.

H. S. G.

Annual Report of the Director of Forestry of the Philippine Islands for the year 1907-1908. Major G. P. Ahern, Director. Manila, 1908. Pp. 26.

This report is especially interesting as showing the progress of the actual work of organization of the Philippine forests. In the pine forests of northern Luzon where fires are particularly dangerous the experiment of employing Igorot natives as fire wardens has been tried and very successfully. The development of a native force of foresters is one of the most important problems in the Philippines. Sir Dietrich Brandis early recognized the necessity of a native service in India and the success of the plan he inaugurated is well known. It is encouraging that the problem of education in forestry has been taken up in the Philippines. A practical school of instruction for rangers will be started in Bataan on the logging operations of the Cadwallader Company. Theoretical instruction will also be given at Manila. In the future, candidates for the position of ranger will have to pass an examination in forestry.

Forest maps have been completed for most of southern and central Luzon and the Zamboanga Peninsula of Mindoro; also isolated parts of other Islands. Working plans have been made for at least one large concession in Mindanao. The research section of the Bureau shows the same excellent progress.

H. S. G.

Proceedings of the Connecticut Forestry Association. Publication No. 6. Hartford, 1909. Pp. 43.

This bulletin contains a number of papers read before the various forestry institutes held throughout the State under the auspices of the Association. Mr. Austin F. Hawes has a paper on Government-owned forests in which he gives an account of what is accomplished in different countries abroad. He draws a parallel with this country and pleads for State forestry and for reservations owned and operated by the States, particularly in the East. In a paper entitled American Forestry, Professor Graves discusses the general problems of forestry in this country and how they may be worked out. These two papers are general in character. Other papers by Mr. E. M. C. Eddy, Elliot B. Bronson, and Ellicott D. Curtis contain discussions of specific Connecticut problems. They are of special interest to owners of woodlands in southern New England. H. S. G.

Report of the Minister of Lands and Forests of the Province of Quebec for 1908. Quebec, 1909. Pp. 216.

According to this report, last year some 70,000 square miles were under license, yielding nearly one million dollars in stumpage dues, ground rents, etc., the lowest revenue in eight years. The cut on this area was about 690 million feet B. M. with some 600,000 ties, 250,000 cords of pulpwood and 6,000 poles.

As regards forest reserves, the province is fortunate in possessing 19 of these, aggregating 111 million acres—almost one-half of its total area. So far little has been done beyond partial organization for fire protection. A nursery has been established near Berthier for the reforestation of sandy soils, the leading species grown being the White, Austrian and Scotch Pines, European Larch, and Norway Spruce.

The most striking fact in the report is the extensive settlement last year in the province. Some 300,000 acres were sold by the Government to settlers, in lots of 100-200 acres, nearly half of this amount in the eastern boundary counties where the land is more suited to tree growing than farming. There is strong indication that these "farms" serve chiefly for lumbering, without, of course, any dues accruing to the crown. A comparison of the quantity of lumber cut by the large companies on their own licensed limits in 1907-08 and the quantity they bought from owners of lots shows the latter to be 43% of the total—a significant percentage. Moreover, of the 720,639 cords of pulpwood exported from Canada to United States last year (largely from Quebec) only 147,159 cords were cut from Quebec Crown Lands under license, the bulk of it evidently being supplied by settlers.

Quebec forests suffered heavily from fires last year, but the loss was mostly to private owners. The carelessness of settlers, and locomotives are given as the most frequent sources.

A lecture delivered by Mr. G. C. Piche at Laval University on the protection of forests is given in full.

The report contains 55 appendices giving much interesting detailed information. J. H. W.

Report on the Reforestation of Waste Lands in Southern Ontario. By E. J. Zavitz. Ontario Department of Agriculture, 1909. Pp. 28.

The waste areas of Southern Ontario are mostly sand lands, and comprise some 8,500 square miles, in large contiguous areas. The report advises the gradual segregation of all such non-agricultural lands to be managed as provincial forests, on the grounds of wood supply, protection of headwaters of water systems, use as game preserves and recreation grounds, and object lessons in forestry. Many areas need only protection from fire, on account of the presence of scrub growth, but calculations are given to show the financial success where planting is necessary.

A beginning has been made in this direction, the Government having purchased 300 (!) acres last year.

The report is extremely well illustrated.

J. H. W.

OTHER CURRENT LITERATURE.

Guide to the Trees and Shrubs of Minnesota. By Frederick E. Clements. Minnesota Plant Studies II. University of Minnesota, Minneapolis, October, 1908.

A key to the woody plants, native and introduced, in Minnesota. It is based upon flower, fruit, and leaf character and it enumerates 213 species.

The Evergreen Trees of Colorado. By B. O. Longyear. Colorado Agricultural Experiment Station, Bulletin 130. Fort Collins, Colorado, 1908.

A general description of the coniferous trees of the State, accompanied by Keys and references to commercial and ornamental uses.

Plant Geography of the Balkan Peninsula. By L. Adamovic. Published by the Vienna Academy, 1908.

The flora of the region is divided into eight vertical regions and each region is divided into four horizontal zones.

Key to New England Trees, wild and commonly cultivated. By J. F. Collins and H. W. Preston. Preston and Rounds Co., Providence, R. I., 1909. Price 40c., pp. 42.

This is a handy key to 190 species based primarily on leaf characters.

Proceedings of the Society of American Foresters. Vol. III, No. 1, October, 1908.

Contains the following articles: Some Further Considerations Regarding the Tolerance and Intolerance of Shade, by Herbert A. Smith; The Silvicultural Results of Marking Timber in National Forests, by Edward E. Carter; Condition of American Silviculture, by Henry S. Graves; Managing a National Forest from the Business Standpoint, by Theodore S. Woolsey, Jr.; Sir Dietrich Brandis, by Gifford Pinchot; Influence of Lumbering on Forestry, by Austin Cary; Silvical Notes on Lodgepole Pine, by E. R. Hodson; Some Forest Problems in the Middle West, by Hugh P. Baker.

Hearings before the Committee on Agriculture of the House of Representatives on the White Mountain and Appalachian Bill. Washington, D. C., 1909. Pp. 143.

This report contains an account of the hearing before the House Committee on Dec. 9, 1908. It contains also the report of the Committee to the House, recommending favorably the Weeks Bill.

The Function of Chemistry in the Conservation of our Natural Resources. By R. T. Bogert. Reprinted from a journal of the American Chemical Society.

Value of Eucalyptus Trees. Bulletin No. 5 of the Forestry Society of California. Los Angeles, Cal., 1909. Pp. 7.

Conservation of Hawaii's Natural Resources. Honolulu, 1909. Pp. 21.

This pamphlet contains addresses delivered before a joint meeting of the two branches of the legislature of Hawaii, March 1, 1909, on the subject of the Conservation of Natural Resources.

Report of the State Fire Warden of the State of Washington for the year 1907-08. J. R. Welty, State Fire Warden. Olympia, Washington, 1908. Pp. 30.

Short Special Report on Forest Fires in Minnesota. Published by the Forestry Commissioner, St. Paul, Dec., 1908.

The report states that during 1908 the total damage by forest fires in Minnesota, exclusive of the loss in the village of Chisholm, was over $500,000. If the loss in Chisholm is included there is a total of over $2,000,000 direct damage from forest fires. A total area of over 400,000 acres was burned over.

Special Message from the President of the United States Transmitting a Report of the National Conservation Commission. Senate Document No. 676. Washington, D. C., 1909.

Laws of the State of North Carolina Relating to Forest Protection and to Forestry. Forest Fire Laws. Press Bulletin No. 25 of the N. C. Geological and Economic Survey. W. W. Ashe, Forester. Chapel Hill, N. C. 8 pp.

Report on Condition of Land of North Carolina State Board of Education. By W. W. Ashe. Raleigh, N. C., 1909. 4 pp.

Forests and The Cost of Textile Production. By W. W. Ashe. 11 pp.

Forest Problems of the United States, 1907. Forest Products No. 10 Compiled in co-operation with the Forest Service. Bureau of Census. Department of Commerce and Labor. Washington, D. C., 1909. A compilation of statistics issued previously as circulars.

The Measurement of Logs. By Halbert G. Robinson. Bangor, Me., 1909. Pp. 14. See article on Recent Log Rules.

Forest Working Plan for Land Belonging to the City of Fall River, Mass. By the Massachusetts Forest Service, Boston, 1909. Geo [illegible]29.

Cruiser's Tables Giving the Contents of Sound Trees and Their Dependence on Diameter, Number of Logs in the Tree, Taper of Tree and Efficiency of Mill. Compiled by C. A. Schenck, Biltmore, N. C. Pp. 61.

The Evergreens. By Clarence M. Weed. Published by the State Printers. Boston, 1908. Pp. 30. An elementary account of the common evergreens for use in the public schools.

Fifth Annual Report of the State Forester of Massachusetts, for the year 1908. Boston, 1909. Pp. 46.

Economic Problem of Forest Taxation. By Prof. Fred R. Fairchild. A reprint from the Yale Review, Feb., 1909.

The Control of Forest Fires Platform adopted by the American Forestry Association at its annual meeting in January, 1909. Published by the Association at Washington, D. C.

Thirty-fourth Annual Report of the Ontario Agricultural College and Experimental Farm 1908. Ontario Department of Agriculture, Toronto, 1909. Pp. 288.

Schlich's Manual of Forestry, Volume V: Forest Utilization. By W. R. Fisher. Bradbury, Agnew & Co., London, 1908. Second edition, 12 shillings. Pp. 840.

The Dominion Forest Reserves. By A. Knechtel. Bulletin No. 3, Forestry Branch, Department of the Interior, Canada, 1909. Pp. 19.

Report of the Superintendent of Forestry for 1907-8. Department of the Interior, Canada, 1909. Pp. 58. Illustrated.

A Philippine Substitute for Lignum Vitae. By W. I. Hutchinson. Bulletin No. 9, Bureau of Forestry, Manila, P. I., 1908. Pp. 8.

A Few Pertinent Facts Concerning the Philippine Forests and Needs of the Forest Service. Circular No. 3, Bureau of Forestry, Manila, P. I., 1908. Pp. 21.

Tenth Annual Report of the Canadian Forestry Association, 1909. Pp. 165. Illustrated.

Eighth Report of the State Entomologist of Connecticut for 1908. New Haven, Conn., 1909. Pp. 86, plus 18.

Annual Report of the Entomological Society of Ontario for 1908. Ontario Department of Agriculture, 1909. Pp. 152. Illustrated.

Report of the Minnesota State Forestry Board. December 15, 1908. Pp. 5.

Report of the Commission of Inquiry, Tax Lands and Forestry. Michigan, 1908. 146 pp.

Fifth Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii for the year 1908. Honolulu, 1909. 163 plus 53 pp.

Report of New Hampshire Tax Commission of 1908. Concord, 1908. Pp. 336 plus 300.

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La Cote Nord du Saint Laurent et le Labrador Canadien. Par E. Rouillard. Department of Mines and Fisheries, Quebec, Que., 1908. Pp. 188. Illustrated.

Bulletin of the New York Botanical Garden. Volume V, No. 18, February, and Volume VI, No. 20, March, 1909.

PERIODICAL LITERATURE.

Forests of Crimea.

The non-official part of the report of the Imperial Institute contains an interesting account of the forests of the Crimea which are of value mainly as protection forests on the calcareous mountains.

Out of the plain rises a mountain range up to 5,000 feet with heights to 5,600 feet. In the foothills the lowest belt to 1,000 feet is grass land, here and there with oak brush, to be followed by another 500 feet of rounded tops with a variety of deciduous chaparral. On the northern slope of the mountains proper a forest of low oaks, blue beech, maple, ash, elm, aspen, "silver pear," *Cornus mas, Rhus cotinus,* Hazel and Thorns is found up to 4,000 feet. Another narrow forest belt, located between 2,000 and 2,500 feet on fresher soil consists of high stemmed oaks with basswood, ash, beech, and other broadleaf trees. The forest is open with a grassy and shrubby vegetation.

A third belt above this consists of excellent pure beech forest, between 2,500 and 4,000 feet; 3 feet diameter being no rarity. Only on steep and stony ridges is to be found *Pinus silvestris* and *Juniperus excelsa.* Above the beech region up to 5,000 feet, there follows chaparral of *Juniperus sabina* and *depressa* or open stands of broad-crowned maple, blue beech, basswood, oak, and beech. The top of the range is a treeless plateau, the so-called Jaila, covered with a thin grass cover, here and there showing a remnant of the Taurian Pine. The cause of the treelessness is not known, undoubtedly in part due to man.

On the southern slope the beech belt between 1,500 and 3,000 feet is less satisfactorily developed and towards the East gives way to *Pinus laricio* and *silvestris.* On the stony ridges often a truly northern forest type appears of birch, aspen, pine.

Below the beech belt, oak and Crimean pine appear, the former occupying more the eastern, the latter the western end, the pine everywhere mixed with oak, except in the higher altitudes of its field, where it becomes pure with varied undergrowth and develops excellent form.

The southern shore region can be divided into three belts. The upper 1,000 to 1,500 feet, grassland with occasional deciduous trees; the middle belt of walnut, down to 500, with *Quercus pubescens,* the characteristic *Pistacia mutica, Juniperus excelsa* and *oxycedrus, Carpinus duiensis, Cornus mas,* and with orchards, tobacco plantations and grain fields; the lower belt with evergreen broadleaf species, Cupressus, Olive and Laurel trees. At the eastern end, the three oaks occur with Pistacia, etc., and occasionally the peculiar *Pinus Pithyusa,* short and poor, not more than 25 to 30 feet high and 24 inch diameter in 300 years.

Most of this forest is private property and not fit for anything but firewood, even the beautiful beech furnishing only poor timber. Ash furnishes the best wood, pine is unfit for saw timber.

The Crimea has been highly cultivated from oldest times, being the highway of the wandering tribes to Europe. But for three or four centuries the country was left unused and old ruins may be found in the forest which has grown over the old civilization. No virgin forest, which evidently used to be more coniferous, is anywhere to be found, and goats and sheep are accountable for the scrubby condition of the present forest.

In 1884 the Russian government began to prepare for the management of its small holdings here, but no tangible results are visible.

Mitteilungen des Kaiserlichen Forstinstituts, 1908. Zeitschrift für Forst-u. Jagdwesen, February, 1909, pp. 105-109.

Forest Changes in Europe.

Dr. Cieslar, in a popular address, traced the changes of forest cover in Europe through geological ages and in modern times; from the archaean and palaeozoic era with Sigillarias, Lepidodendron, tree-like Equisetae and Ferns, and in the Permian with the tree ferns and the beginnings of conifers to the mezoic era in which during the Cretaceous period the first broadleaf trees appeared. In the eocene period, during the Tertiary formations central Europe had palms, sequoias, aralias, laurel, figs, evergreen oaks, bamboo, together with poplar, elm, birch, etc., in the make-up of its forest flora. Then a slow cooling process progressed, northern forms were pushed forward, a colder snowy and rainy period ushered in the glaciation in the Diluvian which covered nearly all of Great Britain, all of Scandinavia, northern Russia and northern Germany as far south as Vienna, besides the Alps, a wavy line from Calais to the middle Ural forming the southern limit. During this period probably all forest growth vanished except possibly in the lowest plains of South Germany, northern end of the upper Rhine valley, the lowest Elbe valley in Bohemia, lowlands of Moravia and lower Austria.

In Western Europe the glaciation reached to the Arctic Ocean; at the southern limit it seems that plains were adjacent to the ice sheet, and on the southern boundary of the plains region there was found forest country. The lower elevations of the Carpathians and the Transylvanian Alps remained forested, as well as the eastern base of the Alps and the Bohemian mountains. The forest country proper of Europe during the ice age was the Mediterranean portion south of the Alps. This portion since then has been gradually deforested, while the glaciated area to the North had reforested itself. The migrations of plants and especially tree species, which have been studied by palaeobotanists, came in part of old tertiary floral elements from West and South, in part of Eastern elements from Central Asia. Denmark was occupied by the former, Scandinavia both from the South and from the East by way of Finland, whence spruce and White Alder came, while middle Europe was entirely reforested from the south. The studies of peat bogs have revealed layers with typical tree remnants; at the bottom the tundra flora is found, *Dryas octopetala* and various *Salices* as characteristic plants, then follows birch, aspen and soon pine, then oak and alder and lastly beech. Supposedly this is the sequence of re-occupation.

It is interesting to note, that while pine in prehistoric times formed extensive stands in Denmark, since historic times it is here entirely absent. During this domination of the pine, broad-leaved shrubs and trees came in, such as Sorbus, Wild Cherry, Snowball, Alders, then denoting warmer climate, Hazel, Elm and Linden. Gradually the pine was replaced by Oak accompanied by Ash, Maple, Elm, denoting further improvement of climate, and across the then existing land bridge, it progressed as far as middle Sweden, where it met in competition with the spruce. The beech, with its tolerance a dangerous competitor of the oak, came in at the end of prehistoric and the beginning of historic times crowding out the oak, until it met the spruce at a lower latitude—being a later comer than the oak. Later the climate became worse, this deterioration being indicated for instance by the southward withdrawal of the hazel.

In Germany for a long time and into historic times the oak remained in possession, but finally the beech crowded it back. The spruce which used to be indigenous to northwest Germany, did not return even into Denmark, coming into Sweden from the northeast.

The portions of Bohemia, Moravia and Lower Austria which were not glaciated, and hence retained a relatively mild climate, show, soon after the ice age, beech, oak and hazel, with which pine, spruce and fir were associated.

In the Alps the same change took place as in the northern areas except that the forest of the oak period remained decidedly a mixed forest and that the periods were of shorter duration.

During the stone age, as the rubbish heaps show, the flora of North and Middle Europe consisted almost exclusively of broad leaf types and most of the charcoal consists of oak (74%) while the beech did not yet exist in Denmark. Here it is found with assurance not earlier than the iron age, perhaps in the time of the Romans. The stone age, then, and the oak period cover each other, and it would appear that man did not exist in Northern Europe for thousands of years after the ice age. Before, the climate was too rigorous, the soil mostly swampy and unfavorable for man's existence.

The pile buildings in Switzerland exhibit all the species now existing excepting larch, *Pinus Cembra,* and spruce, although the latter existed, but fir seems to have been most common; the larch immigrated later. The stone age here coincides with the beech period, the beech establishing itself here earlier than farther north.

The prehistoric changes are then characterized by the fact that the more frugal intolerant species were gradually displaced by the more demanding which by their shady character improved the soil, while during the time of man the opposite has been the result of his interference.

A more detailed account of the phenomena described above in Cieslar's article may be found in the works of Axel Blytt, Nathorst, Rekstad, Gunnar Anderson, Sernander, A. Schulz and others.

These works have recently been reviewed by Jens Holmboe and are restated again in Harshberger's article on "Bogs," February number of the Plant World.

Holmboe recognizes ninety species of plants which have been discovered in the bogs of Norway. After a critical study of the remains as found in situ in the peat deposits, Holmboe recognizes the following successive strata: (a) dwarf birch, polar willow (*Salix herbacea*) and water plants; (b) birches (undoubtedly *Betula odorata*) which formed the primeval postglacial forest, similar to the forest which is represented to-day at the northern limit of trees together with aspen, tall willows, juniper, bilberry, white water-lily (*Nymphaea alba*); (c) pine stratum with alder, hazel, raspberry, twin-flower (*Linnaea borealis*) and twig-rush (*Cladium mariscus*), while in the lowest parts of this stratum with the pine are found remains of dwarf willows and avens (*Dryas octopetala*); (d) the layer of the oak with the ash, Norway maple, hazel and winter linden (*Tilia parvifolia*), these trees being found in a broad belt during the warmest postglacial period, forming in many places extensive forests; (e) the layer of *Pinus silvestris* (Fichtenzone) which occurs only in a few places in Kristiania and Trondjemsfjord and represents the latest fossil layer of peat; (f) then comes last, the heath stratum characterized by the heather (*Calluna vulgaris*), which exists in great abundance on the treeless west coast of Norway, replacing the earlier forests as the most important formation plant. Similarly K. R. Kupffer found just above the clay bottom of a bog in Russia, a layer of sand ten to fifteen cm. thick, filled with the remains of characteristic alpine plants, such as *Dryas octopetala* and willows (*Salix arbuscula, hastata, herbacea, polaris, myrsinites, phylicifolia* and *reticulata*) besides other flowering plants. twenty-eight species in all.

Europa's Wald in Grauer Vorzeit. Centralblatt f. d. g. Forstwesen, February, 1909, pp. 60-69.

Bogs, their Nature and Origin. The Plant World, February-March, 1909, pp. 34-41; 53-61.

BOTANY AND ZOOLOGY.

Tolerance of Species.

Referring to Fricke's article on "Tolerant and Intolerant Species, a dogma scientifically unproved" (see Quarterly, vol. II, p. 226), Dr. Cieslar publishes the results of investigations of this question carried on for eighteen years. Fricke denied the existence of varied tolerance of species but recognized tolerant and intolerant forms in the same species; whether this adaptation was habitual or secured through the life of the individual he did not state.

It has been generally accepted, and demonstrated by Hesselmann through exact investigation, that every species can endure more shade on fresh sites, but if compared on the same site a graded difference of this capacity among the species can be asserted.

In 1890 Cieslar started 10 beds, each sown in drills with Spruce, Black and Scotch Pine, and Larch, eight of the beds being shaded with lath screens of varying closeness so as to secure from 25 to 75 per cent. of shade. One of the remaining beds was covered with moss between the drills without shade, the other left entirely open. While for most beds laths of 1 cm. were used, one was covered with a screen of 2 cm. and another of 3 cm. lath, which was found afterwards to give different results from those covered with the 1 cm. lath screens, namely, relatively better ones, for here the actual light passing through is larger than the theoretical 50 per cent. The results of the denser, darker shade are also influenced by the fact that the soil here is kept moister. The effect was determined by very accurately measuring with Friedrich's precision xylometer the volume of 100 seedlings and comparing the volumes percentically to those of the moss covered bed; also comparing the length of the plants percentically with those of the least shaded bed.

The results are given in tables from which we bring an extract.

	Spruce.		*Austrian Pine.*		*Scotch Pine.*		*Larch.*	
	vol.	*lgth.*	*vol.*	*lgth.*	*vol.*	*lgth.*	*vol.*	*lgth.*
Unshaded, ...	58	79	145	100	146	108	68	120
" with moss, ...	100	116	100	163	100	154	100	135
Shaded .25	79	100	101	100	69	100	67	100
" .33	92	103	78	110	70	103	44	109
" .40	90	106	74	109	68	118	56	122
" .50	80	111	73	131	41	140	46	143
" 2 cm.50	76	109	62	125	34	148	31	134
" 3 cm.50	87	108	67	113	53	115	44	125
" .66	64	121	34	162	21	169	21	151
" .75	54	133	27	155	19	184	13	176

The author argues: If the product of the different conifers with decreasing light decreased in equal proportion we would have to give up the terms "tolerant and intolerant species;" if, however, with the same degrees of shade the product of some were more and that of others less, then the distinction has silvicultural justification. Thus, if the Larch can, when three-quarters shaded, produce only 13 per cent. of the volume attained when unshaded, while the Scotch pine produces still 19 per cent., and the same relations are found persistently with other degrees of shading and with other species, then the proof seems incontrovertible that tolerance is a specific quality. The smaller the depression of volume production in a species with a given degree of shade, the smaller is the need of light by that species, the more shade-enduring or tolerant is the species.

The variation of the beds covered with broader lath is striking, and a hint for nursery practice.

Another interesting result is the influence of the shade on length growth. All species show increase in length with increase of shade—the well known etiolation influence—but the shade- enduring respond less to the stimulus than the light-needing. While Spruce increased its length under the densest shade only 33 per cent., pine and larch increased it by 55, 84 and 76 per cent. respectively, the plants of the last two beds of these being very spindly and weak, absolutely useless. This is another proof of the specific character of tolerance.

The excellence of the growth on the unshaded, moss-covered bed is specially noticeable, and argues for this method of nursery practice and also for the relation of tolerance to moisture conditions.

Check tests instituted in 1894 and 1896 with all species under same conditions confirmed the findings of the original experiment more or less strikingly.

A series of beds of Fir, the most tolerant of all the European conifers, showed entirely different behavior, the decrease of production decreasing but slightly or not at all with the degree of shade, but the decrease of moisture in the least shaded produced decreased volume. Beginning with the moss covered bed as 100, the beds with wider lath in parenthesis, the series was:

Volume of yearlings, ...	100,	80,	104,	104,	84	(84	84),	84,	84
Volume of 3 year olds, ..	100,	80,	72,	65,	40	(46	55),	25,	14
Length of 3 year olds, ...	100,	99,	108,	107,	89	(100	105),	89,	76

This series shows also that with continued shading the unfavorable influence of shading becomes more pronounced; while in the first year the most shaded bed still produced 84% of the unshaded, after three years the production had fallen to only 14 per cent. The influence on the length was with this highly tolerant species of small amount.

The 3 year old firs were transplanted and kept without shade for another 3 years. These showed that having their root system and their assimilating apparatus adapted to the shade conditions, they required years before adapting themselves to the new light conditions. Those densely shaded, after 3 years, had made a length shoot of only 4.3 cm. as compared with 14.7 cm on the part of those who had never been shaded, or only 29 per cent.; and in volume only 9 per cent. of those grown without shade. (A matter for practical consideration for the friends of selection forest—Rev.)

The effect of continued shading was also observed on the other species, and was of a similar nature. With .75 shade, all except the spruce were shaded out in the second year, and larch even with .66 shade; for the rest, the denser the shade the smaller the product. Even the spruce, although still showing 24 per cent. of the weight of the plants in the unshaded bed, showed that it would not have survived a third year of shade.

Other tests under raised screens of varying shading quality led to the same conclusions.

Interesting is the observation that the firs on the unshaded beds formed rather short branches, while the crowns of the more shaded ones spread out with long branches, evidently trying to secure more light.

Tolerance and intolerance, then, graded from species to species, and reduced volume production with decrease of light, the light—needing reacting more than tolerant to withdrawal of light, are well-established facts.

To establish more precisely the relation between soil moisture and light requirements a few investigations were made. In a stand of Douglas Fir, 21 years old, three plats of about 7 square feet were planted with 8 or 9 yearlings each of five species besides acorns and beech nuts. On two plats, the soil of the plats was isolated by cutting through all roots of the Douglas Fir and placing boards 16 inches deep as sidewalls. After planting and sowing in the spring, all three plats were thoroughly watered, and again one of them only whenever three days without rain occurred, keeping it well watered through the season.

During July and August of the same year all the plants on all three plats died, the two kinds of pine first, then the spruce and finally the Douglas and Nordmann Firs.

At the same time two plats, leaving out the watered one, were located and planted similarly in a 21 year old pine stand of normal density, (one-seventh of total daylight) on fresh soil. At the end of June the condition of the plants on both plats was satisfactory, especially of the firs. At the end of September both firs, Scotch Pine and oak were in excellent condition, of spruces 4 on each plat had died, of Austrian Pine on the isolated plat all 8 were green; on the non-isolated plat, one had died, that is to say, no difference in the two plats was noticeable.

In the following spring by the middle of May the firs and the oaks showed excellent condition and remained so through the season. Three spruces were alive on the isolated, 4 on the non-isolated plat, the living plants on both plats showing no difference while the two species of pines looked hopeless, and by the end of September on the isolated plat they were all dead; in the non-isolated 3 and 4 were still hanging on, but died the next year. Yet the water contents at 8 to 10 inches, after it had not rained for 11 days, was found on the isolated plat as 23.2, on the non-isolated as 16.8 per cent. showing the pumping capacity of the roots.

The pines then, which are less demanding as regards water supply perished because not receiving enough light, while the firs, highly dependent on moisture, found enough light and corresponding to it sufficient soil moisture.

The third year (1908) the spruces still hung on, while the firs and oaks were thriving. Douglas Fir and Oak grew better in the isolated, Nordmann Fir showed no difference, spruce did worse in the isolated plat.

Practically, the influence of varying soil moisture on increment can exist only within the limits of light supply required by the biological character of the species.

A further check test was made in the Douglas Fir stand, replanting the old plats and treating them the same as before, but adding a fourth one in an opening with only top light, which admitted one-eighth of the full daylight. At the end of the year the plants on the last plat showed better than on the other plats. In July of the second year, the difference was still greater, the tolerant firs could not persist in the shadier plats, even though watered, while in the opening a number of pines even had persisted.

Finally a last test was made in the Douglas Fir stand by placing 4 boxes 16 inches deep, the bottom consisting of narrow-gaged wire netting, filled with the same kind of prepared soil and planted with a number each of nine species; after the boxes had been kept well watered in open light, two of these were placed, sunk into the soil in an opening, the two others, 25 feet from the first, in dense shade. One box in each set was kept well watered whenever it had not rained for three days. By the end of June all larches had succumbed in both boxes in the shade, the pines being sickly; by the end of September all the plants in these boxes watered or not, were dead or dying. Those in the other set, outside of Scotch, White Pine and Larch which had mostly succumbed, were in good condition, no difference between watered and unwatered box being visible. The next year merely accentuated the relation. In the opening all larch, all pines, except one White Pine had died, firs, beech, and oak remaining in good condition, less so spruce and Douglas Fir, the watering making no difference.

This last step, then, also demonstrated that an optimum of soil moisture can be of use to an undergrowth under the crown cover of an old stand only when there is a light intensity, which exceeds the minimum of light requirement of the species. Hence, soil moisture and light supply must work together for best success.

In this connection it should not be forgotten that with decreasing light intensity the amount of transpiration is also depressed, hence with small amount of light the plant cannot utilize a full supply of moisture, *i. e.* a smaller supply produced the same result as a more ample one. On the other hand an excess of light supply may produce weedgrowth on the soil, which would rob the surface soil in a greater degree than the roots of the mother trees.

The author then concludes, that not only a difference in light requirements distinguishes the species, but a relation between light supply and volume production, the tolerant species within certain limits of light supply suffering less loss of increment from a lack of light than the intolerant. An optimum of volume production can be secured only when the two factors, light and moisture, are at an optimum. An increase of production by providing the most favorable soil moisture conditions can be secured only if the light supply is above the minimum light requirement of the species; hence soil as well as crown conditions must be considered in natural regeneration.

In stands of tolerant species, since only top light and hardly any side light is secured by an opening of the crown cover, this must be made larger for the same light effect.

For nursery work it should be noted that the best results are attained not by shading (except where frost danger exists) but by covering with moss between the rows weighted with lath.

Licht- und Schattenholzarten Lichtgenuss und Bodenfeuchtigkeit. Centralblatt f. d. g. Forstwesen, January, 1909, pp. 4-22.

Ecology of Calcareous Soils.

A well illustrated study of the influence of forest use on soil conditions on the limestone rocks of the island of Gotland, one of Sweden's possessions, is of general interest.

The whole island is a limestone formation, but of varying character, giving rise to three types of soil and corresponding plant formations, namely, naked rocks, rocks with drained diluvial soil, rocks with undrained diluvial soil.

On the naked rocks a decidedly calcophil flora of xerophilous structure is found, mainly in the fissures and depressions. Here a miserable growth of pine, of 10 to 12 feet height and with stout branches is found, which sometimes, where fissures are frequent, forms open stands. But, if only 10 to 20 inches of soil cover occurs, the stands close up and the soil underneath is occupied by grasses and herbs and the shrubby *Arctostaphylos Uva ursi.* Here the height of the trees increases to 30 feet and more, furnishing short sawlogs and especially railroad ties which owing to the narrow rings and high resinous contents are specially valued. Here and there spruce comes in, the branches of this tree hugging the ground and striking root, and occasionally developing from these layers upright branches which can develop into independent trees, forming thickets.

Along the coast the well drained calcareous gravel bears good pine stands, but on the undrained diluvial soils the vegetation is entirely different. Here, during the spring and fall a surplus of water is found, while in summer the soil dries out severely. In freezing, the undrained soil experiences considerable mechanical changes, the water is withdrawn from the clay which forms an important part in the composition of these soils, and the ice formed exerts considerable force, moving good-sized stones, and lifting out or breaking stout roots of the Juniper here found. This feature of the soil is inimical to tree growth and indeed to any vegetation. Here, therefore, the "Alfvar" type—treeless areas with sparse vegetation—is found. In the worst places only the stout rooted or otherwise protected forms can exist, like *Galeopsis Ladanum globosa, Cirsium arvense ferox, Daucus carota contracta.* The few pines that have maintained themselves show peculiar "heaved" roots.

In deeper depressions, where the water stands in spring and fall but in summer dries up, the soil is then powdery, consisting of amorphous calcium carbonate, and bears a very scanty vegetation of calcophile hydrophytes like the Characeae and species of Amblystegium, and no trees.

The influence of man on the changes in vegetation are noted. A considerable industry in burning lime used to call for fuel supplies. But in spite of the fact that this occasioned considerable clearings, the forest is not destroyed and in the neighborhood of abandoned lime kilns is as good as away from them. The forest returns, though slowly, and even the lower vegetation is little influenced by the clearings. The re-establishment of the forest progresses, of course, at varying rates on the different soils. Where areas, formerly wooded, are now bare, the cause is not found in the forest use, but in the extensive pasturing of sheep, which was carried on in commons. Since pasture grounds have become individual property and sheep herding has decreased, returns of the forest progresses.

Skogsvardsföreningens Tidskrift, March, April, 1908, pp. 93-199.

Ecology of Vegetation on Sea-Shores.

Olsson-Seffer has made a careful study of the factors influencing the vegetation of sandy sea-shores in many parts of the world. He has visited many regions in both Temperate and Subtropical zones, regions varying greatly in climatic and geological characters. Some of his conclusions may be of interest to those engaged in the work of reclaiming sandy areas near the sea.

He states that the atmospheric conditions are the most important factors owing to their influence on transpiration. Sandy vegetation differs from inland flora in being subject to great fluctuation of diurnal temperatures, owing to easy radiation of heat from the sandy surface. The large amount of heat absorbed by sand and reflected from its surface, the intensity of illumination direct and reflected, and the exposure to winds have been very important factors in modifying plants in these localities. Another factor is the intense salinity of the air near the sea-shore. This factor is according to Olsson-Seffer of greater importance than the salty character of the soil. In fact he states that the strand flora is not halophytic. The reason for this is that beach sands, although supposed to be thoroughly saturated with salt, are in reality only salt where inundated. The saline character is found at the surface, but the sand of lower levels where the roots extend is not salt, being kept fresh by a flow of fresh water. Further inland where the salt spray condenses the salt is either washed out by rain or remains at the surface.

The amount and distribution of precipitation throughout the year plays an important part in binding sands and aiding the growth of vegetation, as do the texture and chemical composition of the sands.

R. T. F.

Relation of Soil and Vegetation on Sandy Sea-shores. The Botanical Gazette, 1909, No. 2.

Races of Trees.

In continuation of the inquiry of the Swedish Experiment Station as regards races of trees, a whole stand of so-called serpentine spruces *i. e.* with irregular and pendulous branching—a stand of two and a half acres near the village of Orsa—was found composed of a great variety of these misshapen, irregularly branched specimens (395), a number of which are pictured. Another smaller stand of 100 specimens was found not far from here; both growing on abandoned pastures. Elsewhere only single specimens or small groups have been found, a number of which occurrences are noted from other parts of Sweden, Switzerland and Bohemia.

It seems that these variations occur either on pastures or open places, not in denser stands. A great variety of shapes is noted, reduced branching, variety of form, size and arrangement of needles and of cones. A number are described in detail. They may be grouped in three classes, namely, serpentine spruces (*Picea excelsa virgata*); pendulous spruces (*P. excelsa virninalis*); and intermediate forms (*europaea, femica, acuminata, etc.*).

The question of the hereditariness of these forms awaits solution. Their occurrence in stands would argue for heredity, but other reasonings are possible. The more prononunced serpentine forms have a teratological character and are by a series of transition forms connected with the normally branched spruces. Moreover, they exhibit great lability. In a serpentine spruce branches with normal arrangement occur, or the lower part of the tree may be normal, the upper serpentine.

Skogsvardsföreningens Tidskrift, December, 1908. Pp. 401-460.

Sand Binding Plants in India.

The first recorded attempt to fix shifting sand dunes in India by planting dates back to 1849, and since then from time to time, the process has been successfully employed on various Indian coasts as well as upon interior sands. V. Seebramania Tyer in a recent article, describes the ecological adaptations of numerous native sand binders. The underground stems and branches of some extend to enormous lengths. For example, *Cyperus arenarius* sends out branches to a length of fifty feet with innumerable side branches and branchlets, while those of *Ipomea bilboa* and *Canavalia obtusifolia* may extend forty-two and thirty-five feet respectively. It seems that the families represented are practically the same as those found on American sand dunes.

C. D. H.

Indian Forester, February, 1909, pp. 82-97.

Ecological Studies in Colorado.

Reference has already been made in this Journal (F. Q. VII p. 74), to studies on the vegetation of Colorado, under the title of Studies in Mesa and Foothill Vegetation. This is the first of a series and includes Geology and Physiology of the Mesas near Boulder by Gideon S. Dodds; Climatology of the Mesas near Boulder by Francis Ramaley; Distribution of Conifers on the Mesas by W. W. Robbins and Gideon S. Dodds; Distribution of Deciduous trees and Shrubs on the Mesas by W. W. Robbins.

The Mesas studied are Horse Mesa and Long Mesa about two miles south of Boulder, Colorado. They have been carefully mapped with reference to geology, topography, soils and the distribution of woody species. Soil moisture seems to be the most important physical factor affecting plant distribution on the mesas. The upper stratum of soil on the top of the mesas is coarse in texture and dries rapidly after a rain. The slopes are dry except in the bottoms of ravines and along seepage areas.

Pinus scopulorum is the dominant tree of the foothill and mesa region. The woody species on the slopes of the mesas, however, are chiefly deciduous shrubs and small trees. The pines on the mesa fall into three well-marked age-classes. The oldest (150-200 years) are distributed on the higher portions of the mesa top and are relatively few in number and far apart. The middle class (80-100 years) is found among the oldest trees and its members extend farther out toward the end of the mesa. The youngest (20-30 years) are the most abundant and grow farther out than the preceding groups but do not extend entirely to the end of the mesa. The outermost parts of the mesa have sparse growth of small trees of various sizes.

In accounting for these well-defined groups of age classes with few intermediate ages, the author points out that the trees are in the tension zone between forest and grassland where seedlings in particular are sensitive to slight changes in environmental conditions. Favorable conditions for growth are not present every season. Thus during some seasons and even for a series of years, the climate may be comparatively mild and moist. If this period happens to coincide with an abundant seed year, trees will be established on the mesa far beyond their ordinary range. Then may follow a series of dry and cold winters in which only well established seedlings, those that are at least five years old, can persist.

The pines do not invade the plains below the mesas because the soil may be too dry for the seedlings to get a start. On the mesa the seedlings often establish themselves under the protection of a rock and regeneration is most abundant on the north slopes where the soil moisture is most favorable. Competition with the grass is another important factor. The coarse soil of the mesa does not lead to such complete control of the grasses as does the fine-grained soil of the plains and the trees establish themselves on the mesa in the open places where the seeds can get down to the mineral soil. While the mean temperatures of mesas and plains do not differ greatly, yet the daily extremes are considerably greater on the plains. It is very probable that tree seedlings on the plains are killed by late spring frosts.

A bibliography of Colorado botany is appended which contains references to twenty-nine papers relating to the forests of Colorado.

The thoroughness of the preliminary work in Geology, Topography and Climatology as well as the method of treatment of the distributional studies make this work a model which future plant ecologists would do well to follow.

C. D. H.

Studies in Mesa and Foothill Vegetation. I. The University of Colorado Studies. Vol. VI, No. 1.

Ecology of Birds.

Charles C. Adams, University of Illinois, has disclosed a new and interesting field of study in his paper upon "The Ecological Succession of Birds." His thesis is that just as there is a succession of vegetation, so there is a succession of birds on a given area, dependent upon the successive changes in vegetation. For example, on Isle Royale in Lake Superior, the author observed that certain birds accompanied the invasion of open bogs by Tamarack, Black Spruce and Arbor Vitae. These birds are the Red-breasted Nuthatch, Yellow-bellied Flycatcher, Golden-crowned Kinglet, Cedar Waxwing, Chickadee, Canada Jay, White-winged Cross-bill. Where alders abound the conditions are favorable for the Redstart and the White-throated Sparrow. But later as the bog-conifer forest becomes continuous and dominant, the Waxwing, Redstart and White-throated Sparrow diminish in numbers and finally disappear. Still later as the swamp becomes eliminated by the Spruce-Balsam forest, the Yellow-bellied Flycatcher is excluded and various species of woodpeckers come in. In a similar manner he traces the changes in bird life which accompany the successive stages in the reforestation of burned areas.

While birds from their nature are more mobile than plants in their occupancy of an area, yet in the breeding season, pairs of birds tend to space themselves and to become relatively sedentary and thus they react to the laws of invasion and succession in a manner similar to plants.

C. D. H.

The Ecological Succession of Birds. The Auk, Vol. 25, No. 2, April, 1908.

Longevity of Seeds.

It appears from recent investigation according to Wm. Crocker, that delayed germination in seeds is generally due to the character of the seed coats rather than to the so-called dormancy of protoplasm. The prevention of germination is due to the fact that the seed coat shuts out for a time conditions favorable to the growth of the embryo. This is accomplished by the exclusion of water or oxygen, or perhaps chemical compounds necessary for germination.

Growth may be started artificially by removing the integuments or by modifying them so that they no longer exclude the essential substances. Thus in the case of Mesquite, *Prosopis juliflora,* ether dissolves the oily deposits of the seed coat and allows germination to take place. The application of heat, while soaking seeds, hastens germination, but its effect is very variable in different species, in the same species in different parts of its range, or even in different parts of the same crop.

R. T. F.

Longevity of Seeds. The Botanical Gazette, 1909, No. 1.

SOIL, WATER, AND CLIMATE.

Forest and Nitrogen Supplies

A resumé of the present knowledge as regards nitrogen supply to tree growth points out that, according to Schroeder, atmospheric precipitation carries annually 10 to 11.5 lbs. of nitrogen per acre to the ground; that the annual consumption for wood production by beech, spruce, fir, birch, is 9.3, 11.9, 12, and 6.5 respectively, while the litter returns to the soil annually 40 lbs. per acre under beech, 28.8 under spruce, and 26.1 under pine. The litter then plays an important rôle.

Professor Henry of Nancy (See Quarterly, Vol. II, 173, etc.) who has for years studied the question and assigned to bacteria living in the litter nitrogen gathering capacity, publishes additional material in the Journal d'agriculture pratique, 1907.

On a sand dune planted in 1850 with *Pinus maritima,* in 1906 a fine forest was found, the soil of which in a sample taken to a depth of 6 inches developed over 7 tons of organic substance, with nitrogen contents of 1.5%, *i. e.* 248 lbs. per acre or 4.5 lbs. of accumulation per year. In another case, under a specially made plantation of pine, after 9 years the accumulation was 7.2 lbs. per year.

Under an old oak stand the conditions were found still more striking. In the soil layer

down to 4 inches,	1545 lbs.
4 inches to 12 inches,	2610 lbs.
12 inches to 24 inches,	1642 lbs.
24 inches to 32 inches,	732 lbs.
	6529 lbs.

per acre were found.

Lately it has been found that frost reduces the nitrogen-gathering capacity of soil bacteria, hence, clearing is liable to bring damage in this direction. Thomas slag and phosphoric fertilizers increase it.

That plants may take up nitrogen directly through the leaves has been held by various botanists. Lately, Jamieson had found various trichomes on foliage to be organs specially adapted to this purpose. He found such hairs of various shapes in *Acer campestre, Tilia, Ulmus, Sorbus, Fagus, Abies concolor;* the presence of nitrogen in these organs and their presence in the youngest parts, which are richest in nitrogen, is the argument for their functions.

Last year, two Hungarians, Zemplen and Roth, of the Forest Experiment Station, have published, illustrated by many colored plates, their findings in Erdeszeti Kiserletek, Heft 1 and 2, which seem to confirm Jamieson's claim.

A long series of deciduous leaved trees showing these trichomes in a variety of shapes, mostly on the leaf stems and nerves, but also on youngest shoots and fruits was investigated. Conifers also were found to have these organs, but the nitrogen reactions were weaker. The life and function of the hairs on deciduous leaves is shorter and, therefore, perhaps more intensive. On the fruit of *Juglans regia* the hairs are especially rich in nitrogen.

The question remains open whether this nitrogen comes from the air or other parts of the plant. Against the latter assumption argues the fact that the albumen reaction does not begin until a certain stage of development of the trichome is reached, and then always in its head, only later in the foot.

Centralblatt f. d. g. Forstwesen, February, 1909, pp. 89-92.

Migration of Mineral Salts.

We take from the Experiment Station Record for September, 1908, the following: Deleano finds that there is a double movement of mineral matter during the life of a plant, one from the soil to the plant, the other from the plant to the soil. He found that under certain conditions plants could return to the soil mineral matter equal to 50 per cent. of the plant's weight. While the nitrogen content of the plant remains fairly constant after once attaining a maximum, and the carbohydrates increase and are stored up, the mineral matter gradually diminishes until the death of the plant. The explanation of this is that this mineral matter is not actually assimilated by the plant but is held by the plasma of the cells through its semi-permeability. When the vitality of the cell becomes reduced or the cells are dead, the plasma becomes permeable and the mineral matter escapes by simple diffusion.

A study of the Role and Functions of Mineral Salts in the Life of a Plant. Inst. Bot. University of Geneva, 7 ser., 1907, No. 9, pp. 48. Abstract in Bot. Centralblatt, 107, (1908), No. 1, p. 4.

Vegetation and Altitude.

The Plant World for March contains an article by Charles H. Shaw on vegetation in relation to altitude, particularly with reference to light intensity and evaporation. He calls attention to the fact that in making calculations of light intensity from the sun's altitude there is not one varying factor but several, namely, variation according to sine of angle of incidence; disproportion as to variation of diffuse light; diminution with decreasing elevation of the sun due to increasing length of path of light through the atmosphere; disproportionate absorption in the lower layers of atmosphere; local conditions quite beyond calculation. In reference to the latter error, he points out that from measurements in Buitenzorg, Java and in Cairo, Egypt, light diminished rapidly between 11 and 12 o'clock on a clear day. The greatest intensity found anywhere in the world is not in the tropics but in the Yellowstone Park.

In regard to evaporation at high altitudes the writer refers to his results from a series of porous cup atmometer records in the Selkirks. The results as a whole seem impossible to harmonize with the idea that total evaporation increases with altitude. The maximum evaporation was shown by the instrument at the second station, 1,100 meters altitude. Above that a gradual and irregular diminution was shown. It may be that the influence of temperature on evaporation over-balances the effects of diminished pressure and air movement. His records, however, refer only to weekly totals, and throw no light on what might happen during a certain portion of the day.

C. D. H.

Vegetation and Altitude. Plant World, March, 1909.

Evaporation Tests.

The United States Weather Bureau established, under the direction of Prof. Frank H. Bigelow, five towers 40 feet high about the Reno, Nevada, reservoir in order to obtain data in regard to evaporation. On these towers evaporating pans were located at different points on the reservoir. Evaporation from 29 pans was measured every three hours for six weeks. Prof. Bigelow found that the rate of evaporation at the different altitudes seemed to be controlled by the invisible vapor blanket which always overlies any body of evaporating water. He states that in dry climates this vapor blanket above the water will be from 300 feet to one-fourth mile deep, according to the size of the sheet of water. In moist climates it will be deeper and more extensive. In the arid regions of the West it seems probable that this vapor blanket conserves about three-eighths of the water that would otherwise be lost by evaporation.

C. D. H.

Monthly Weather Review, Washington, February, 1909.

SILVICULTURE, PROTECTION AND EXTENSION.

Obstacles to Natural Regeneration.

Professor Wagner, whose book (see F. Q. Vol. VI, p. 160) has stirred up a lively discussion on silvicultural subjects, feels called upon to further explain and defend his pet scheme of the strip selection system, which consists in securing natural regeneration in narrow strips located on north sides by a kind of selection cutting. He discusses here various difficulties which are urged against natural regeneration in general.

The first difficulty is that of hampering the cutting of a given budget, which was lately accentuated, when an increase of the budget for the Bavarian forests was demanded (see F. Q. Vol. VII, p. 91). Wagner claims that the opposite is true, provided that not large areas, but small strips as he proposes are regenerated, permitting any number of attacks and hence any increase in budget.

The second difficulty is found in the rare occurrence of seed years, which either delays progress of fellings or requires change to artificial means. This is also overcome by the strip selection system, the author having observed, that for this system full seedyears are not required; partial seed years are not only sufficient but welcome, because the regeneration will then not be too dense. The author claims that in this system all the seed is utilized, and that in a partial seed year, and especially in mixed forest these occur yearly, almost all is good seed, besides finding best conditions for germination. Moreover, artificial aid by sowing is here readily given.

The objection that natural regeneration furnishes often too dense stands, the author finds curious. Even if it should become necessary to thin out, dense stands are an optimum condition. Such dense crops occur readily in his system in full seedyears on account of the favorable conditions for germination. Here, the thinning must take place early and is best done in spruce and other shallow rooted species by handpulling when 8 to 12 inches high. This is to be done only once; the loss of plants by pulling out roots of neighboring plants is meaningless in the face of plenty.

The great Spruce Snout beetle is believed under such conditions an assistant, as it is known to attack only the sickly, the vigorous young growth and plantings with ball of earth resisting this pest sufficiently.

Drouthy periods which often cause the loss of a regeneration, the author finds to have no terror for the selection strip system, the opening being made towards the North, where the dews suffice to keep the young growth alive. Although some of the plants here suffer, and may loose their root system, as soon as the rains set in they throw out new roots and shoots, and revive.

"Here the thought occurs, that in the natural habitat of the spruce in regions of variable humidity, the capacity of deep and shallow rooting may be differentiated in early years, so that in regions of long drouthy periods by close selection the surviving individuals are those which have the ability to root deeply at germination; those that did not have this capacity succumbed. In regions with high humidity and frequent precipitations this differentiation would not take place, a large number would be shallow rooted, hence *sowings with seed from such localities in dry climate and in the open, would be apt to dry up.*

On the East and South sides the sun diminishes the effect of the dews, hence even in the North strips the East ends suffer in drouthy periods, and hence a turn to North—Northwest is advisable, especially on East slopes. This, however, increases the wind danger. In the end, the direct North exposure appears the most satisfactory from all points of view, as the author has observed with all species on all sites in the North of Germany as well as in the South.

The ideal of natural regeneration is to carry the soil from the old to the new stand without letting it become grassy. This is best attained by the strip selection, which secures the best light conditions, and can progress more or less slowly.

On all soils which are inclined to weedgrowth the progress of fellings, *i. e.* full opening of the crop should not be made until full regeneration is secured and the young growth is knee-high.

Sometimes weeding may become necessary, which if not done too carefully does not cost much.

The main difficulty is lack of personal knowledge and ability of manager and his personell.

The author acknowledges that to carry on a system of natural regeneration requires almost a gift, like that of a musician. Hence such divergent views and divergent success. The strip selection makes least demand on judgment, success and failure are soon recognized in their causes, hence, even he with little interest soon learns and becomes interested. Moreover, since always only small areas are involved, failures are sooner corrected.

Hence, the author recognizes no difficulty to natural regeneration, if only his system is adopted, which in its final analysis lays main stress on the proper location of felling areas.

Hindernisse der Naturverjüngung. Forstwissenschaftliches Centralblatt, March, 1909, pp. 123-140.

Selection Versus Timber Forest.

The same author, Wagner, in another polemic article, defends his position as regards the value of timber forest when compared with selection forest. He accentuates that while the ideal of the selection forest may fill the soul of the young forester, when he comes into the practice he finds that this ideal meets too great difficulties in German forestry practice, that it is a picture of the imagination, a phantom, not realizable in the German forest, but, the author reiterates, he is speaking only for Germany. He stands on Gayer's dictum: "If then the selection form cannot any more claim the significance of a regular forest management, it remains an inexhaustible source for the study of the forest and its laws."

He then discusses three points, namely, the technical quality of wood grown in the selection forest, the site as producer of results ascribed to the system, and the question as to whether an economic judgment of the system can now be had for Germany, or whether the basis for such judgment is still lacking.

He comes to the conclusion, that the *average* quality of the selection forest product is inferior to the timber forest product, which is so often overlooked by citing extraordinary quality. Damage to the timber in the fellings is largely responsible for this average result. While the selection form undoubtedly preserves soil conditions, the strip selection form does the same, and it is still to be proved that regular timber forest does not do the same.

The difficulty of the harvest without damage appears the most important objection to selection form; another difficulty is that it prevents economic oversight and order, a sufficiently sure weighing of results. Hence for the German economic world this form in most conditions is undesirable.

Blenderwald oder schlagweiser Hochwald. Forstwissenschaftliches Centralblatt, January, 1909, pp. 23-39.

American Species in Schleswig.

Dr. Schwappach reports on the condition of plantations of conifers made on waste lands of Schleswig-Holstein. Scotch Pine and Norway Spruce have not done well. Old stands of the first named species are rare. The author knows of only one 60 to 80 years old in prosperous condition. Pine suffers from Schütte until the sixth year, and later dies off. Spruce also declines after reaching polewood stage first the older needles fall, then the younger, until the tree is leafless and after once more shooting out it dies. As cause is suggested, the salt air, the drouthy winds and raw humus formation, and secondarily, insects. So extensive has been the loss that the growing of spruce will have to be abandoned. Northern seed has lately been imported with doubtful results.

On the other hand trial plantations of *Picea alba, sitchensis* and *pungens* and of *Pseudotsuga taxifolia* have proved successful. The first existing in 50 to 60 years specimens is only objectionable because of its slow growth in volume. *Picea pungens* for the first 10 years grew as tall as Norway Spruce. *Picea sitchensis* has proved the best, an excellent grower, overhauling the Norway on peaty heath soil, and shows in 20 to 25 years no sign of the disease of the latter. In the sea climate it is in its proper element.

A plantation of about two and one-half acres on fresh humose loamy sand, planted with Norway and Sitka spruce in rows, showed the following relations per hectar, the figures being in metric measure.

	Picea sitchensis.	*Picea excelsa.*
Age,	25.	25.
Number,	1946.	1198.
Average height,	12.9	11.6
Average diameter,	13.3	11.9
Cross section area,	13.10	113.33
Volume, timberwood,	77.5	75.
Thinning yield		
Number,	426.	470.
Cross section,	2.41	3.24
Volume,	7.2	15.4

Sitka Spruce is ahead, healthy, well developed with less taper, the native spruce is less vigorous and shows signs of deterioration, while not a single exotic spruce is diseased.

Pseudotsuga succeeds excellently in protected situations, and, as conditions for Sitka Spruce improve, they prove less satisfactory for Douglas Fir.

Pinus rigida has proved a failure.

Deutsche und fremde Nadelhölzer in Schleswig-Holstein. Zeitschrift für Forst-u. Jagdwesen, January, 1909, pp. 27-34.

Value of Exotics.

The introduction of the European Larch from the Tyrolese mountains to the plains of Silesia dates back to Frederic the Great, and now stands of this species in mixture with pine and spruce are coming to harvest. In 1906, according to Guse, a stand of about 3 acres was felled, the larch being 110, pine 105-110 and spruce, probably volunteer growth, 80-100, years old.

The yield of timberwood was 9652 cubic feet, in which pine represented 28%, larch 34%, spruce 38%. The workwood per cent. for larch and spruce was 94, of pine 89; diameters up to 24 and 30 inches; average height of larch 100 to 114 feet, occasionally 130, of pine 85 to 104, spruce 65 to 114 feet. The total money yield per acre was $1,087, in which the larch represented nearly 44 per cent, although its volume was only 34%, the price per cubic foot being 14.4 cents as against 10.1 and 9.4 cents for pine and spruce. Thinnings in former years, which had furnished probably not less than 25% of the final yields had brought as much as 21 cents and more per cubic foot.

Reference is also made to the results of the celebrated larch plantations near St. Petersburg, from 105 to 170 years old, the oldest grown from broadcast seeding, showing maximum diameters of over 30 inch and 130 feet in height, with 9,767 cubic feet per acre.

In the same district in Silesia some 30 to 40 acres of White Pine of magnificent development and over 100 years old are to be found, 80 feet in height and 20 to 24 inch diameter, cylindrical and with the crowns high up. Strangely enough, however, there is no market for the material and even to-day the price paid for it lags behind even that for fir, which is lower than for spruce.

Lärche und Weymouthskiefer in Oberschlesien. Forstwissenschaftliches Centralblatt, February, 1909, pp. 84-88.

Natural and Moss Cover Regeneration.

A series of experiments and observations, carried on by Böhmerle for some twenty-five years in the Great Pine Forest near Vienna had shown (see Quarterly Vol. IV, p. 161) that the dense moss cover has undoubtedly a prejudicial influence on the increment, since in times of continued drouth the moss keeps dew and small rains from reaching the soil; it also may cripple and lead to the death of old trees, where the moss cover is very dense, so that in raked areas a much better condition was observed.

Since 1906 moss covered and moss free areas have been specially inspected as regards the establishment of natural volunteer growth, the investigation being favored by an unusually full seed year in 1906. The counting of plants was made by the method of quadrat sample areas of 1 m side, 20 such on each four sample plots, thinned in different degrees, namely, I light, II moderate, III severe thinnings, and IV severe opening.

The results rounded off are laid down in the following table:

Year.	*I.*			*II.*			*II.*			*IV.*		
	Moss free.	Moss covered.	Total.	Moss free.	Moss covered.	Total.	Moss free.	Moss covered.	Total.	Moss free.	Moss covered.	Total.
	Thousands of Plants.											
1906, ...	80	7	87	112	60	172	122	62	184	166	38	204
1907, ...	20	5	25	48	13	61	57	38	95	89	16	105
1908, ...	10	6	16	30	14	44	30	29	59	28	31	59

The observations of 1906 show, if no differentiation of moss cover is made, an increase of plants with increased light supply. But, if the differentiation is made, in each case very considerable reductions occur in the moss covered parts which is, of course, explained by the difficulty of germinating in the moss cover especially of the more open stands.

In the counting of 1907 a decrease in the number of plants is found everywhere, but the differences between moss covered and moss free plats is not as pronounced.

In 1908, which proved a very dry year the difference between the two conditions is still further lessened and in the open positions has practically vanished.

Percentically expressed in relation to the plant number of 1906 there were still left in 1908:

	I	II	III	IV
On moss free soil, ...	12	17	17	14 per cent.
On moss covered, ...	7	8	16	15 per cent.

In the open stands the moss cover is more favorable than in the denser stands, and even on the moss free plats of the denser stands. This is explained by the possibility of the shallow roots of young plants in the moss cover to secure some moisture from the moss, especially in drouthy years.

The author concludes that (1) moss cover under otherwise equal conditions is not favorable to germination. (2) In drouthy conditions the moss cover has a favorable effect as long as the roots of the plants can still participate in the moisture absorbed by the moss. (3) Since this beneficial effect can be only a passing one, it cannot be of moment, especially as the moss free area will support a sufficient number of plants.

Moosdecke und natürliche Verjüngung. Centralblatt. f. d. g. Forstwesen, January, 1909, pp. 22-27.

Density of Spacing of Plantations.

A controversial article by Dittmar is directed against the propositions of Frömbling (see Quarterly, Vol. IV, p. 48) to return to the use of larger quantities of seed and more plants in plantations, such as used to be employed in former times. Dittmar points out that the use of 15 to 20 ℔s. of pine and spruce seed sixty years ago as against 3½ and even 2 ℔s. per acre now is to be explained by the low germination per cent., which, due to poor methods of gathering and keeping seed, prevailed in olden times, namely not more than 60 per cent. as against now mostly 90 per cent. Haack has shown that 100 grains of 90 per cent. seed is equivalent in practical results to 317 grains of 60 per cent. seed, accordingly the 3½ lbs. of to-day are equivalent to the 15 ℔s. of 60 years ago.

Of interest are a few samples of results of dense and open position.

In a good natural regeneration of Scotch Pine (to be compared with our Shortleaf, or Norway Pine) some 16 sample areas showed 10,400 plants, 7 and 14 years old. In a number of sowings and plantings of about the same age, a considerably larger average of plants was found. In a 15 year sowing of pine with 5½ ℔s. in rows 4 feet apart 10,320 were found, in an eight year sowing with 2½ ℔., 3 feet apart, 67,900, while plantations made 3 x 1¼, 4 x ½, 4 x 1½, varied from 9,100 to 21,200, or in the average of five positions over 24,000 plants, showing that the modern practice furnishes sufficient numbers. The better development of plants in the more open position in the nursery (less than 25 lbs. per acre) as compared with denser sowings is pointed out as argument for opener stands in the field. Examples of results, showing for relatively open stands larger cross section area and height, than in denser stands, are adduced.

The proposition to plant in plats several 1-2 year old pines in one plat seems like combining the disadvantages of sowing with that of a poor, wide spaced plantation.

Dichte oder weitständige Kulturen. Zeitschrift für Forst-u. Jagdwesen, January, 1909, pp. 34-48.

Variability of Seed Supply.

The Swedish Tidskrift collects every year information regarding the seed crops of pine and spruce in different parts of Sweden and publishes it in maps which by varied shading shows the character of the seed crop. The scale used is as follows: no yield, when no cones to be found; small yield, when cones sparse on single trees in the open; better yield, when cones general on trees in the open or on forest borders; good yield, when cones general also in middle aged and old stands; ample yield, when large number of cones on most trees of middle aged and old stands. The seeding in the fall of 1908 was generally poor, especially for spruce, but while the latter varied from none to poor with only 4 of the 90 districts having a better yield, the greatest variety was found in the seeding of pine, of which districts with good yields adjoined not only districts with better but also with poor yields, apparently without any demonstrable reason, as far as climatic influence is concerned.

For pine, one-year cones as well as two-year cones are reported, and it is interesting to note that the favorable reports of the one-year cone crop in 1907 was not by any means always realized as a good two-year cone crop in the following year, and vice versa, when an improvement occurs; this is supposedly due to a difference in the reporter's observations.

Tillgangen pa tall och grankott i sverige hosten, 1908. Skogsvardsföreningens Tidskrift, January, 1909, pp. 39-42.

Extirpating Weeds.

A warfare against weeds is aided by a leaflet of the Biological Section of the Imperial Health Department at Berlin, in which, besides the usual mechanical removal, prevention of seeding by cutting weeds at the proper stage, clean culture, etc., there is recommended the use of a copperas solution, which has proved effective. The copperas must be fresh, made into a 15 per cent. solution in a wooden cask, preferably using warm water to expedite the solving. For 1 acre about 15 to 20 quarts are required, or 60 to 75 lbs. copperas. Spraying pumps may be used, the spraying must be done neither too early when it would require repetition, nor too late when it would not kill the weeds. Unfortunately not all cultivated plants can resist, like the grain does, this treatment. Whether this means can be used in nurseries is still in question.

Forstwissenschaftliches Centralblatt. February, 1909. Pp. 118-120.

MENSURATION, FINANCE AND MANAGEMENT.

Universal Dendrometer.

Adolf Sterbik at Ferchenhaid, Bohemia, offers for 144 Kr. ($36) an improved Winkler-Grossbauer dendrometer, for which he claims that it will measure heights to $\frac{1}{4}$—$\frac{1}{2}$% accuracy; diameters to 1/400; can be used to cube according to various methods; can be used to measure and locate lines and angles; measure and locate areas; can be used with a tripod as levelling instrument. A description with illustration is given.

Allgemeine Forst-u. Jagdzeitung. Dec. 1908, p. 450.

Growth Relations.

The activity in forestry matters of Sweden should be of interest to our Northeastern States and Canada, since they are dealing with similar northern conditions. A careful investigation of volume and form of pine and spruce by Maas in Darlekarlien laid down in 14 tables brings rather interesting and new general results of growth relations.

The author points out that volume tables arranged only by diameter and height, or even by age, diameter and height do not permit their use for single stems, since they represent only averages. To permit closer approximation to single stem volumes the form quotient should be introduced when tapering as well as cylindrical stems may be determined more accurately.

To avoid making the tables too cumbersome, the author does not give the form factor for each form quotient.

A comparison of form factors for spruce and pine shows that the form factors in the same form class approach each other closely. For heights from 30 feet upward the differences are at most 2%. Hence, since an error of 2% in estimating may be neglected, the *volume tables for pine may also be used for spruce.*

A comparison with the form factors established for pine and spruce in Austria by Schiffel brings out the interesting fact of a remarkable similarity, so that, if the form quotient is taken care of, it is not necessary to recognize growth regions. Such volume tables may be employed for extensive areas.

The results of the author show that age does not have a definite influence on form; nor does a regular rise or fall of the form factor occur with rising b. h. d.; but the form factor sinks or rises with the form quotient; and in each form class the form factors decrease with increasing height (contrary to Fricke's opinion, see Quarterly, Vol. VI, p. 303). For instance, for pine:

Form Class.	*Average Height.*
.65	16.8 m
.70	14.5 "
.75	13.8 "
.80	12.5 "

Since a higher stem is mostly older and stouter than a lower, it follows that the form quotient sinks with rising age and diameter.

The form quotients for pine and spruce move mainly between .575 and .825.

In using the volume tables diameters are measured, height and form class estimated, the latter from the relation between breast high and middle diameter, which relation is given in a special table. Other relations are discussed.

A small series of measurements shows that the bark alone shows for pine from 18 to 10% of the total volume with bark, decreasing uniformly with increasing height while spruce shows 24 to 12%.

Kubikinnchollet och formen hastallen och granen. Skogsvords förenıngens Tidskrift. December, 1908.

Increment in Selection Forest.

A "friend of the selection forest," Oberforster Christen, points out that careful investigations of the current increment in typical selection forest would show that it exceeds that of even-aged forest on similar sites. Only the difficulties of ascertaining with precision the increment under the constantly changing conditions of the selection forest are in the way of establishing this fact.

In the French *methode du controle,* which consists in determining the current increment by measurements at two different periods of time, (I = V — V + N), the increment on N, which is the budget cut between the two periods of time, is neglected, which may make a very considerable difference. The author does not overlook that portions of the increment occurring due to the influence of light on remaining trees may be offset by the damage done to the young growth by fellings. He finally develops a very complicated formula which is to take care of all the varied influences, and connect the usual discrepancies of calculation.

Measurements in four different localities 3,000 to 4,000 feet above sea level, carried out with this care brought out increments of 114, 133, 137, and 173 cubic feet per acre. In even-aged spruce stands in Switzerland in the hill country up to 2,500 feet bring in 80 years an average increment of 274 for best and 133 for poorest sites which on higher altitudes is reduced to 266 and 114 respectively, including brushwood, while in the computations for the selection forest these were neglected.

Zur Ermittlung des laufenden Zuwachses speziell im Plenterwalde. Schweizerische Zeitschrift für Forstwesen, February-March, 1909, pp. 37-41, 82-87.

Practical Yield Tables.

The carefully collected normal yield tables of the German Experiment Stations were, according to Ostwald, to serve two objects: first, to give an insight into the laws of growth, which they have done satisfactorily; secondly, to furnish practical aids in estimating for purposes of working plans.

In this last respect, the author claims, the yield tables in their present form do not fulfill their function, because the data are insufficient. As regards grouping the data in relation to time no fault is to be found, for intervals of five years, as used in the best tables, are for practical purposes sufficient. But when the data for older stands are compared from site class to site class, there being usually five site classes made, the differences become eventually too great for practical purposes, since for a felling age position of, say, 100 years, the difference from site class to site class may be 1,500 to even 3,000 cubic feet, leaving too wide intervals without data. Hence, the author proposes supplementary tables at least for older stands above sixty years, which he illustrates by such tables worked out for Scotch Pine from data furnished in Schwappach's tables.

Table I gives the range of average heights in each site class in relation to age. Table II gives with five year intervals the timberwood in relation to the average heights. Table III gives for age classes in periods of 10 and 20 years the periodic loss in each site class by thinning. Table IV does the same for different average heights. Table V is an increment table. In Table VI also increment relations to age and height are elaborated in such a manner as to permit an estimate of present and future yields. Tables VII and VIII serve for diameter estimates, the first giving actual diameters related to age and height, the second expressing the same percentic progression for various growth periods.

This may be illustrated by an example.

The average diameter of a 70 year stand, with average height 60 feet, hence according to table I belonging to site class III, is, according to table VII, 8 inches. If the aim of the management is to produce 12 inch diameters, then the diameter increment required to the felling time must be 50 per cent. According to table VIII, this will require 50 years; and from table II it can be found that the cut will be 5,700 cubic feet.

Die Normalertragstafeln im Dienste der Forsteinrichtung. Zeitschrift f. Forst-u. Jagdwesen, January, 1909, pp. 14-27.

Dangers of Diameter Limit.

In 1894 the forest law of Gotland, the calcareous island of Sweden, described on p. 185, was amended to forbid the cutting of conifers below 8 inches diameter at the base. The result has been the opposite of advantageous, for, as a rule, the trees left are suppressed, poorly developed runts, which had best been removed; true forest devastation has been the result. The new forest protection law of Sweden, enacted in 1903, which required the owner to replant if by the cut the regeneration had been imperiled, did not improve matters. Owing to climate and inimical conditions, with the forest once so deteriorated the difficulty of reestablishing it by planting or natural regeneration is so great that success by general prescription is rarely attained.

A new law is proposed to establish a forest preservation committee, which is to supervise all cutting and make suitable conditions fitting the particular case. The Committee is to employ competent experts.

Skogsvardsföreningens Tidskrift. March, April, 1908.

Timber Forest Production versus Composite Forest.

As is well known, in France conversions of composite forest to timber forest have been going on for some time (See F. Q. Vol. VI, p. 157 and 183). Viellard, a private forest owner, brings a comparison of results in yield between three different stages of development, showing the superiority of production of the timber forest:

1. French composite forest with few standards (160 trees).
   110 ha., 30 year rotation, net yield per hectar, 22.20 Mark.
   181 ha., 25 year rotation, net yield per hectar, 21.68 Mark.
2. Alsace stands, still in process of conversion.
   257 ha., with felling budget of 3.50 fm., net yield 28.16 Mark.
   86 ha., with felling budget of 3.23 fm., net yield 32.31 Mark.
   69 ha., with felling budget of 4.22 fm., net yield 40.10 Mark.

3. Alsace stands, already of timber forest character.
   409 ha., with felling budget of 5.70 fm., net yield 42.47 Mark.
   244 ha., with felling budget of 4.50 fm., net yield 41.86 Mark.
   317 ha., with felling budget of 4.84 fm., net yield 43.30 Mark.

The reporter, Kahl, remarks that the preponderance and fine development of beech and high price for fuelwood of same, namely $12 to $14 per cord, may have influenced the favorable outcome of the latter positions.

Mittelwald Umwandlungsfrage. Allgemeine Frost-u. Jagdzeitung, January, 1909, pp. 112-113.

Conservative Budgets and Growth.

In discussing propositions for the improvement of the methods of making working plans in Prussia, Dr. Martin points out that true conservatism does not consist in reducing felling budgets or holding on to old timber, but in keeping the soil in best productive capacity, in careful regeneration and care of the young growth. To show how, under good management, increment can be effectually stimulated, he cites the conditions of the Saxon forests. Here the felling budget and stock on hand per acre for the last 50 years increased as follows:

	1854-63	1864-73	1874-83	1884-93	1894-1903
Budget, Timber,...	49	61	67	70	72 cu. ft.
" Total, ...	60	75	85	86	86.5
Stock, ...	2275	2530	2700	2595	2700

In Prussia, the author contends also, that in spite of the constantly increasing budgets, namely, from 40 cubic feet in 1870 to 70 cubic feet in 1900, the actual increment is hardly cut. According to the newest yield tables for pine III class the current increment runs

Age:	40	60	80	100	120	140
Increment,	131	101	77	66	54	23 cubic feet.

And according to various yield tables the following total yields at the end of the named rotations are normal.

Species	*Rotation*	II	III	IV	*site class.*
Beech	110	127	105	85	cu. feet.
Spruce	90	172	145	114	" "
Timberwood		151	114	82	" "
Pine	70	121	86	72	" "
Timberwood		103	82	57	" "
Pine	120	100	83	63	" "
Timberwood		88	71	51	" "

These figures would indicate that further increases in the budgets are still to be anticipated.

Die Organization des Forsteinrichtungswesen. Allgemeine Forst-u. Jagdzeitung, February, 1909, pp. 49-62.

Making Working Plans in Prussia.

Anyone who wishes to know in detail, how the practical work of "forest regulation" is sometimes carried on in Prussia, also what the official relations are and how officialdom is sometimes inimical to good plans will find an interesting account in reminiscent style of the work on one of such working plans in an article by Forstrat Kaiser, in which he also refers to the historical development of this class of work.

The various districts of the province Hesse-Nassau were during 13 years newly surveyed and regulated under a special organization with a crew of 55 assistants, which were specially drilled for the work. A road system was made the basis of subdivision.

The cost of topographical survey, laying out and partially building the road system and opening division lines, was 27.8 cents per acre, of which 12% went for survey, 33% was used for reconnaissance and provisional laying out of roads, 27% for definite location of lines, and 28% for marking the system with stones, etc. In simple topographic conditions the cost was reduced to as low as 15.2 cents.

The working plan work averaged 10 cents per acre. In 1908 a new ordinance declares the making of working plans a matter of the current work of district managers.

Against this proposition Kaiser argues, that only specially trained men, organized for this work, can do justice to this class of work.

Ein Stück Preussischer Forstgeschichte. Zeitschrift für Forst-u. Jagdwesen, February, 1909, pp. 71-104.

Meaning of Statics.

In an address, which Dr. Martin delivered upon assuming the directorship of the Forest Academy at Tharandt, he defined forestal statics as "the art of weighing" forestal operations.

Lately this subject has been raised to a special course at this and the Prussian academies. Martin accentuates the practical importance of this discipline and points out various statical problems lately discussed; the strictures made in the Bavarian legislature regarding the surplus of old age classes (briefed in the last number of the Quarterly) could be answered only on the basis of statical calculations; the question of profitableness of the composite forest is a problem in Alsace-Lorraine; the long rotations in France and in the pineries of Prussia, and in Saxony the question of species mixture, manner of reforestation and thinnings, call for statical investigation.

He refers to Heyer as having laid too much stress on the mathematical methods and too little on purely economic considerations. He admits that the foundations of forest management cannot be laid on generally applicable mathematical data, nor can yields and costs and interest rates be determined with precision. Yet, are we, therefore, to give up the calculations which underlie a well-planned management? If we make such undertakings dependent upon exact calculations, we could not pursue a colonial policy, could not build railroads and ships or build factories or conclude commercial treaties, because these things too withdraw themselves from exact mathematical demonstration as regards their profitableness. Yet the results of increased cost of production or of increased or reduced stock can be weighed without precise algebraic formulae. The calculation is only one of the guides, and judgment in the direction of natural history and of economics must supplement the calculation. History and experience in combination with biological, mathematical and economic principles must guide the progress of forestry.

Although similar bases and ideas underlie forest valuation, in the latter, which is done for purchase or sale, more precise calculations are necessary than in statics; moreover the former deals with the single stand, while the latter weighs measures to be taken with reference to large aggregates; hence the propriety of making it a special discipline.

Zur Würdigung der forstlichen Statik. Forstwissenschaftliches Centralblatt, January, 1909, pp. 9-23.

UTILIZATION, MARKET AND TECHNOLOGY.

Forest By Products.

The harvest of berries, mushrooms, etc., plays not an unimportant part of some of the German forest districts, both as regards an addition to the income of the district and of the poor population, as will be realized when it is stated that the buyers of huckleberries in one of the districts in Pomerania, according to the size of the harvest pay from $18,000 to $30,000 and more annually. In the forests of Eberswalde 5,600 permits are sold at only 1.5 cents, giving rise to an income for the gatherers estimated at over $20,000.

The gathering of these forest by-products is regulated in the different districts in the same manner as the wood harvest. In the dukedom of Anhalt, for instance, a permit to gather certain fruits must be obtained, which for hazelnuts costs from 25 to 50 cents, for mushrooms and the different berry crops each to 7 cents for "favored," 12 cents for ordinary, and 36 cents for "unfavored" gatherers. The "favored" are the regular laborers in the forest, and notoriously needy persons or such living within the forest, the "unfavored" are strangers.

The management of this resource is otherwise in the discretion of the district officer, who can also exclude from benefits persons convicted of various forest crimes or repeatedly disregarding ordinances, and children under 14 years except when in company of their parents. They may also be withheld from laborers who without good reason refuse to work in the forest. The permits may be restricted to certain days or even hours, and must be shown to the forest guard when demanded. In the discretion of the district manager permits may also be given free of charge, if the harvest would be of no moment to the treasury.

Even in this direction rights of user, old rights to gather berries without restriction, exist, sometimes to the great detriment of plantations and young growth.

Das Sammeln von Beeren und Pilzen in den preussischen Forsten. Zeitschrift für Forst-u. Jagdwesen, January, 1909, pp. 49-54.

Value of Rights of User.

The city of Eberswalde has just succeeded in buying off the rights of user in its city forest, which gives an insight into the baneful effects of these old servitudes on forest management. There were 316 house owners who had rights to secure their fuel from the communal forest. These rights have been bought off for $125,000, and it is estimated that through improved utilization, i. e. increased use of wood as building material instead of fuel, this capital investment will pay 6½ per cent.

Silva, April 16, 1909, p. 268.

STATISTICS AND HISTORY.

Results in Brunswick.

It is of interest to learn something about the smaller forest administrations of Germany, which by the fact of their smallness show often relatively better results than the larger ones.

The forest area of the dukedom of Brunswick under State control comprises 202,180 acres, which in 1905-6 brought a net yield of $638,715 or $3.15 per acre, the expenditures having been $2.60. That even on this small area conditions must be quite varied appears from the fact that the acre yield varied in different districts from 57 cents to $8.94.

The total cut was 456,000 cubic feet of workwood of which 73 per cent. coniferous, besides 8.74 million cubic feet of fuelwood, altogether 7.8 cubic feet per acre. Prices for workwood, ranging from 15.4, for larch logs to 2.2 cents for spruce poles, averaged 10.2 cents or $1.47 per acre; the cost of wood cutting, etc., was 1.2 cents per cubic foot. Around $25,000 were received for by-products.

Plantations, including nursery expenses, required a round $50,000, or 23.4 cents per acre of forest, and road building nearly the same, namely, 24.7 cents. There were employed 4,029 persons with 439,032 labor days.

Mitteilungen über die Wirtschaftsergebnisse der Herzoglich Braunschweigischen Forstverwaltung für das Jahr 1905/6. Zeitschrift für Forst-u. Jagdwesen, January, 1909, p. 57.

Results in Mecklenburg.

Another of the smaller forest properties is that of the dukedom of Mecklenburg Schwerin with 244,410 acres, two-thirds coniferous, the total gross income of which was in 1905-6 $962,000, the net income $527,000 or only $2.15 per acre. The total cut was 15,690,000 cubic feet or 65.5 cubic feet per acre, of which hardly one-third was workwood. Wood prices, which for the total cut had averaged 7.8 cents, were in 1906, 8.3 cents per cubic foot. The by-products alone, among which peat and pasture play a prominent role, brought nearly $70,000. The chase, in addition netted $21,000 or, including some 24,000 acres of meadows, peat bogs and fields, over 7 cents per acre.

The enumeration of the game and wild or other animals killed on these 268,000 acres under conservative management should make some of our game preserve owners envious; 823 stags, 2,157 roebuck, 187 boar, 13,074 hares, 8,573 rabbits, 193 geese, 3,996 pheasants, 3,286 ducks, 868 woodcock, 20,240 partridge, 14,017 thrush, 1,181 other game birds, 1,594 foxes, 301 martins, 552 minks, 399 ferrets, 1,933 cats, 1,037 dogs, 5,482 squirrels, and a large number of rapacious birds.

Wirtschaftsergebnisse der Grossherzoglich Mecklenburg-Schwerinschen Kameralforsten, 1905/6. Zeitschrift für Forst-u. Jagdwesen, February, 1909, p. 121.

Sweden's Wood Exports.

According to the German General Consul, wood export sales from Sweden in 1906 and first months of 1907 were active at high prices, then falling off and forcing low prices in the fall, the average result being however, better than the previous year, although quantities were less. Twenty Mark per Petersburg standard (= 165 cu. ft. sawed or 120 cu. ft. round wood), say 3 cents per cubic foot, seems to be the average price.

During the four years from 1904 to 1907 the total export averaged per year:

Planks, Battens, Boards, 884,000 standards.
Planed Boards, 118,000 standards.
Staves, 13,000 standards.
Wood ends, 63,000 Kubik faden.
Beams and Spars, 292,000 loads.
Hollander Beams, 17,000 standards.
Mine props, 240,000 standards.

This represents about 220,000,000 cubic feet of wood, nearly equal to the entire year's cut of the Prussian State forests of that description of wood. In addition, an export of 500,000 tons of pulp (in 1908, 114,000 tons more than the previous year) and two and a half million dollars worth of manufactures bring the value of the total export to around $52,000,000. It is said that the pulp industry is working without profit to the manufacturer.

Holzausfuhr Schwedens im Jahre 1907. Allgemeine Forst-u. Jagdzeitung, 1909, p. 115.

MISCELLANEOUS.

Forest School in Russia.

The Imperial Forest Institute at St. Petersburg in 1907 had, according to the official report, 686 students inscribed, being thereby by far the largest forest school in the world. Of these 22 were graduated as foresters of first order, 50 as such of second order. The maintenance of this institution, outside of student fees, required $101,260.

Game in Africa.

In 1900 an agreement was made between Germany and England to institute a close season for some of the big game in Africa, and forbid in certain districts the shooting of some species which were threatened with extinction. This treaty was, however, not ratified by England on the ground furnished by Dr. Koch, who held that this big game, bear, buffalo and antelope, was the carrier of the dreaded Tsetse fly, which occasions the sleeping sickness of the negroes and the dying of Zebu cattle. He, therefore, advocated extirpation of the game. Now the zoologist, Prof. Matschie, has pointed out that this fly occurs where there is no game and also that it is absent in some regions where this game thrives. Deep shade is the needed condition for the development of the fly. Dr. Sanders also points out that not only big game but all other animals are hosts of the Tsetse fly, including the cold blooded crocodiles, lizards, perhaps also birds. Even if it were practically possible to extirpate the game, it would be a great loss from the standpoint of meat supply for expeditions.

Centralblatt für Jadg-u. Hundeliebhaber, 1908. No. 25.

OTHER PERIODICAL LITERATURE.

The Indian Forester, 1909,—

Appointment of Probationers for the Indian Forest Service. Pp. 1-9.

New regulations provide for the appointment in 1909 by the Secretary of State for India of 12 stipendiary students (£240 each) to take a Science Degree and Diploma of Forestry at Oxford University. The effect upon the status of forestry as a science in English Universities in the future, and upon the efficiency of the Indian Service, will be interesting to watch.

Notes on the Torrent Training-works and Reboisement of Mountain Slopes near Interlaken. Pp. 14-28.

Describes the former conditions and their causes, the difficulties met with, and the methods pursued.

Match Manufacture in the Philippines. Pp. 28-9.

Gives a promising outlook for this industry.

Lac in the Eastern Dun. Pp. 31-33.

Gives additional facts from local investigations on this insect.

The Future of Cutch and Katha Manufacture. Pp. 68-82.

Discusses the whole question and gives a new method of combined manufacture of the two.

The Allapilli Monorail Tramway. Pp. 133-148.
Gives a description of the plant, traffic capability, and financial aspects.

Rod and Gun, 1909,—
British Columbia's New Game Preserve. Pp. 964-965.

Forest Leaves, 1909,—
Inequitable Taxation of Standing Timber. Pp. 181-182.

What is Practical Forestry? Pp. 183-189.
A plea for tree planting.

Plant World, 1909,—
Bogs, Their Nature and Origin. Pp. 34-41, 53-61.
A general discussion of succession on bogs in various parts of the world, but chiefly on certain bogs in Monroe County, Pennsylvania.

Some Mexican Fiber Plants. Pp. 25-34.
Gives the methods of making rope, matting and so forth from fiber obtained from certain species of Agave. Yucca and Samuela, as well as the distribution of these species in Mexico.

Ohio Naturalist, 1909,—
Distribution of the Woody Plants of Ohio. Pp. 469-474.
Two hundred and seventy-eight species are grouped according to their frequency and distribution.

Canadian Forestry Journal, 1909,—
The Toronto 1909 Convention. Pp. 1-17.

A Western Problem. Pp. 18-22.
Describes the conditions in the prairie regions of Alberta and Saskatchewan, and outlines the investigations necessary to solve the problem of wood and water supply.

Some Notes on Forestry in Ontario. Pp. 23-26.
Game and Forestry in Canada. Pp. 27-30.
The Dominion Forest Reserves. Pp. 31-47.
Great Britain's Afforestation Scheme. Pp. 48-54.

Bulletin of the American Geographical Society, 1909,—

The Relation of Geology to Topography. Pp. 138-142. Shows the importance of geological knowledge for guidance in constructing maps.

Quarterly Journal of Forestry, 1909,—

Planting on the Weald. Pp. 5-13. Gives the results of the writer's experience.

Effects of Overthinning and Ground Moisture upon the Growth and Value of Plantations. Pp. 13-21. Shown by tables.

Recent Progress in Afforestation. Pp. 21-31. Describes some work done by the Midland Re-afforesting Association.

The Journal of the Board of Agriculture, 1909,—

Report on Afforestation. Pp. 853-858.

A full summary of the conclusions and recommendations in the second report of the Royal Commission.

Afforestation of Waste Lands in Denmark, Holland, France, and Belgium. Pp. 858-863.

A brief summary of information regarding the policies and methods.

Afforestation of Waste Lands in Germany. Pp. 942-944.

Schweizerische Zeitschrift fur Forstwesen, January, February, March, 1909,—

Ueber Lawinenverbauungen an der Gotthardbahn. By Burri.

Elucidates in detail and with illustrations the methods and means used along the St. Gotthard Railway to prevent and make harmless avalanches. This has been mostly done by mechanical means, but reforesting in part has been undertaken, and with success.

NEWS AND NOTES.

The University of Wisconsin is rejoicing over the decision of the United States Forest Service to locate there its new experimental laboratory station. It means much to the University as the laboratory will be available both to staff and students for investigative work, and lectures will be given by the station staff. To the paper, lumber and railroad interests of the state it is of great importance owing to the character of the investigations contemplated. These will include woodpulp experiments, timber tests, wood preservation tests, experiments in wood distillation, etc. To the people of Wisconsin its economic value is evident. The University will erect a suitable building, while the Forest Service will equip the laboratory at a cost of $14,000 and provide for the staff ($28,000 yearly).

The School of Forestry in the University of Georgia has added to its curriculum two summer terms for Junior and Senior years, which are to be held in a woods camp for two months. For this purpose a tract of 2,000 acres has been placed at its disposal. It appears that only afternoons are given up to practice work and excursions, and that the camp work is to be done by the students. Others than students are admitted, but are expected to submit to the same discipline as the students.

Waste Land Planting in Prussia progresses at a rapid rate. During the six years 1901-1906 Prussia bought or exchanged 300,000 acres of waste lands partly wooded together with 57,000 acres farmland, spending altogether $9,500,000. In 1907 20,000 acres, in 1908, 13,000 acres were added to those holdings and around 25,000 acres were planted in these two years at a cost of over $100,000.

By the first of October, 1908, the government had waste lands still unplanted of over 70,000 acres.

The Pennsylvania Railroad is planning to set out this spring more than 1,000,000 trees. This will make a total of 3,430,000 trees which have been planted in the last three years to provide for some of the Company's future requirements in timber and cross ties. This constitutes the largest forestry plan yet undertaken by any private corporation.

Heretofore the Company's forestry operations have been confined to a limited area between Philadelphia and Altoona. This year, however, 65,000 trees are being set out on tracts of land near Metuchen and New Brunswick, N. J. In addition, there are to be planted within the next month 207,000 trees near Conewago, Pa., 186,000 in the vicinity of Van Dyke, 334,000 at Lewistown Junction, 7,000 at Pomeroy, and 205,000 at Denholm.

The bare places in the locust tree plantations, which were started some years ago are being filled in with new seedlings, in order that these may follow as a second growth after the older trees have been removed for fence posts and other purposes. Of the trees that are to be set out this spring, 893,000 are red oak, 40,000 Scotch pine, 29,000 locust, 14,000 hardy catalpa, 14,000 pin oak, 5,000 European larch, 3,000 chestnut, 3,000 yellow poplar, 2,000 black walnut, and 1,000 white pine.

The policy of encouraging reforestration on the part of the public has been actively pursued this spring. Some 151,000 trees have been furnished practically at cost, to private corporations and individuals. In addition, 8,000 privet hedge plants have been supplied to private individuals. Privet hedge plants to the number of 7,000 are to be set out to ornament boundary lines along the Company's right of way.

A special effort has been directed this season to growing ornamental shrubbery for use in parking the lawns around stations and unoccupied spaces along the roadway. To save the time required to grow these from seed, 6,000 plants have been imported from France. They will be placed in beds, at the Company's nursery at Morrisville, N. J. Part of them will be ready for transplanting next year and the remainder in 1911.

Indicative of the scope of the forestry plan of the Company this year is the fact that at the Morrisville nursery alone, approximately 1,250,000 trees have been dug, bundled and shipped to places along the railroad. The area occupied by these trees has been plowed, fertilized and is to be re-planted with about 200 bushels of acorns. Half a million coniferous seedlings, which were grown last year, are being set in transplant beds, to remain for a year before being set out permanently. In addition to the above, there will be planted this spring about 100 pounds of pine and spruce tree seed, which should produce about a million plants. These in time will be transplanted in permanent locations.

According to the recently published report of the Royal Commission appointed to inquire into the timber resources of New South Wales, the total quantity of commercial timber at present standing in the State, excluding timber growing on private lands, is estimated at 23,116,000,000 superficial feet, consisting of: Hardwoods; Iron-bark, 1,335,000,000 superficial feet; other hardwoods for milling, 8,668,000,000 superficial feet; for other purposes, 11,788,000,000 superficial feet; total, 21,811,000,000 superficial feet. Soft woods; cedar, 5,000,000 superficial feet; hoop pine, 230,000,000 superficial feet; other brushwoods, 150,000,000 superficial feet; cypress pine, 920,000,000 superficial feet; total, 1,305,000,000 superficial feet. The commissioners state that, at the present rate of consumption, the quantity of hardwood timber suitable for commercial purposes, estimated to be at present standing on the forest reserves and other Crown lands of the State, will not last more than about 36 years and that the supply of soft woods will be consumed in a little more than 20 years. Amongst other things the commissioners recommend that the present royalties on certain timber should be increased and that the export of iron bark and tallowwood beyond the Commonwealth should be prohibited for a period of ten years. Recommendations are also made for the replanting of the most valuable timbers and for the protection of timbers at present standing.

In an article on "Toronto Lumber Trade Thirty Years Ago," printed in Canada Lumberman and Woodworker, the following interesting price list of White Pine occurs. These are taken from an old memorandum book dated 1876:

	Cost at Mill.	*Retailed at*
Mill culls,	$4.00	$7.00 to $8.00
Shipping culls,	5.00 to 6.00	9.00 to 10.00
Good common boards,	10.00 to 12.00	14.00 to 15.00
Dimension stuff,	11.00 to 12.00	15.00 to 16.00
Dressing pine,	14.00 to 15.00	18.00 to 20.00
No. 1 cuts and better,	28.00 to 30.00	34.00 to 38.00
Matched flooring,	....	16.00 to 20.00
Shingles XXX pine,	2.00 to 2.25	2.50 to 3.00
Lath, No. 1,	1.50 to 1.75	2.25 to 2.50

As a building material hemlock had not yet come into general use. While grades have changed so that direct comparisons are impossible, an idea of the change can be had, from the price lists on cargo lots in the same trade paper, which runs from $12.50 for the lowest culls to $54 for the best 2-inch cuts.

The growing interest of Southern pine manufacturers and stumpage holders in forest conservation and forest education is strikingly exhibited in the coming meeting of the Forest Conservation Committee of the Yellow Pine Manufacturers' Association that was to be held on May 10 and 11 in the camp of the Yale Forest School, in Tyler county, Texas. This committee is composed of J. Lewis Thompson, President Thompson-Tucker Lumber Company, Houston, Texas; J. B. White, Manager Missouri Lumber and Land Exchange Co., Kansas City, Mo.; John L. Kaul, Kaul Lumber Company, Birmingham, Ala.; J. A. Freeman, Freeman Lumber Company, St. Louis, Mo.; and P. S. Gardiner, Eastman-Gardiner Co., Laurel, Miss. The object of the meeting is to discuss means for furthering the conservation of the yellow pine forests of the South and the prominence of the men who are to be present insures a very successful meeting, and the action taken by this committee will have much weight with the stumpage holders of yellow pine.

Mr. S. S. Sadler, who will graduate from the Forestry Department of Pennsylvania State College in June, has been appointed Forest Assistant with the Pennsylvania Railroad Company, to take charge of the Forest Nursery at Morrisville, Pa. The position which Mr. Sadler is called upon to fill will eventually include, in addition to the nursery work, the field planting operations and landscape gardening along the right-of-way.

The English steamship "Balakani," discharged a cargo of 1,030,000 gallons of German creosote oil at Philadelphia, April 30 and May 1st. This oil is for the Pennsylvania Railroad Company, and is the first steamer cargo of creosote to be brought into Philadelphia; it is also the first large shipment for the use of an eastern railroad company in the preservation of their timber.

The office of the Superintendent for Suppressing the Gypsy and Brown-tail Moths has, by an Act of the Legislature, been combined with the office of the State Forester, who thereby secures the handsome salary of $5,000.

COMMENT.

At last patriotism in holding on to the established and antiquated is to be supplanted by common sense. The Legislative Commission of Maine appointed to investigate the methods of scaling logs and lumber, have made their report, and state in substance the following:

"The board foot is not the proper unit for log measure since it is relevant only in case of lumber manufacture, but entirely irrelevant in pulp, staves, veneer, and other industries.

"The cubic foot should be the unit of measure and each manufacturer should calculate the product he could manufacture in board feet, pounds of pulp, number of staves and square feet of veneer, and fix the price accordingly.

"The contract logger, figuring in cubic feet would then be paid according to the weight he handles, whether the logs are large or small. In contracting by the thousand board feet, as is now done, he handles a larger weight of small logs per thousand than of large logs.

"The commission recommends the substitution of a cubic foot caliper rule as the legal rule for Maine, arguing that, besides applying to all industries involved, it would aid economical logging and full utilization of material."

To a forester, there is no need of pointing out the soundness of this conclusion. He knows that the logs always did grow into cubic feet, and, if the irrelevant and tedious translation into board feet, which is dependent entirely upon the judgment and practice of the scaler and the miller, is avoided, his fate will be a happier one.

It is very evident that if log measurement is to be standardized for the entire country, the cubic foot caliper rule applied at the middle of the log will be applicable for all states, all industries, all species, whatever their taper, and for long logs as well as short logs. While the volume by the middle diameter method is not entirely exact especially for very long logs, the error is very small in favor of the buyer. But it gives by far the better result in comparison with end diameter measurement, even when the latter method makes allowance for taper. In this connection the briefs on cubing timber on pp. 262-265, vol. II, of the QUARTERLY should be re-read.

Utopia is surely coming earlier than we had expected, if, besides the North American Conservation Commission, the International Conservation Commission should become a fact before the display of Dreadnoughts may put a damper on the enthusiastic altruists who are engineering the movement.

There is nothing in the declaration of principles issued by the North American Conservation Commission to which a forester will take exception, for, where forestry is practiced, these principles have already been recognized and acted upon long ago.

The one new and apparently practical proposition, namely, the stocktaking of resources, if it is to be executed over the whole world, strikes us as somewhat chimerical, and the difficulties still for a long time insuperable. Even in such highly civilized and organized countries as the United States and Canada, this would be a tremendous undertaking, while in South American Republics, Asia and Africa, it is hopeless. Moreover, what would be the meaning of a statement of forest areas, even if we were to approximate them more closely than we can with present information? Even, if we could more closely state the merchantable available supplies on hand, would we have grasped what the resource itself means with reference to future supplies? We do not want to discourage the undertaking but we do not regard the proposition as easy, practicable, or likely to lead to tangible results.

The only value we see in the whole movement is that sluggish democratic governments, which cannot be moved by reason, may be moved by display of aroused popular interest to a realization of their duty.

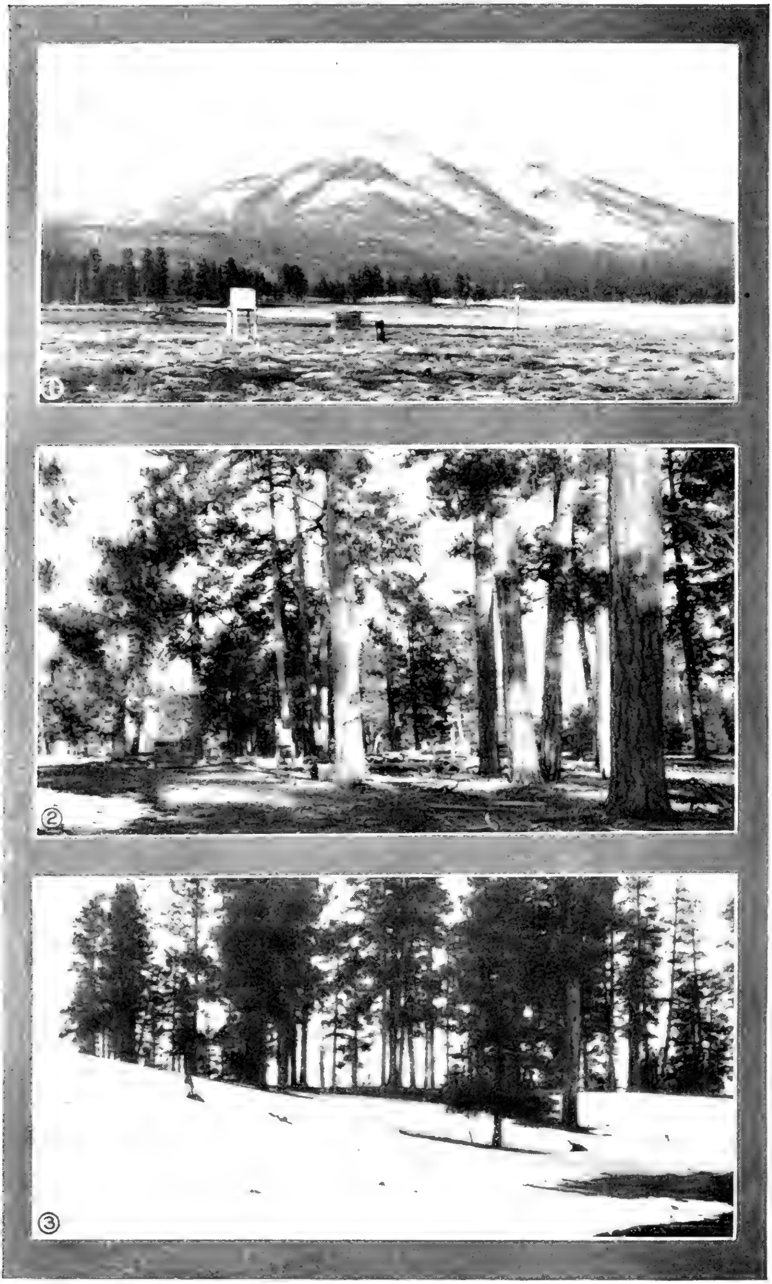
It is interesting to note in the Principles the paternal note, the absence of which once distinguished American policies from German or French.

Is true democracy, after all, going to be found in direct government activity for the good of the people?

No doubt, at least the political difficulties have been recognized by the Commission as may be learned from the wording of the letter of the Canadian Commission accompanying a copy of the Principles sent to people interested in the subject.

"The Canadian Commission to the North American Conference on the Conservation of the Natural Resources of this Continent held last month in Washington have the honor to respectfully invite your consideration of the enclosed 'Declaration of Principles.'

"This Declaration was drawn up by the representatives and unanimously adopted after careful consideration and thought. It is not in any sense a treaty between the governments or countries taking part in the Conference. It does not in any way bind those countries to particular action. It lays down principles on which authorities having control over natural resources may act in their future treatment of their resources, either by legislation or by grants. While the Federal Government of Canada took part in this Conference there is no thought or idea of any infringement or interference with the rights of the Provinces within the Dominion. The Declaration fully recognizes provincial, state and national authorities. It is hoped, however, that the principles enunciated will commend themselves to all authorities in relation to the future disposal and use of the natural resources of the continent."



MEASURING EFFECT OF FOREST COVER ON SNOW WATERS. CONDITIONS ON APRIL 15

I. Station in open "park." The light ground effect due to sunlight on grama grass.

II. Station in virgin Yellow Pine Forest. Scattered drifts and banks of snow over level surface.

III. Deep banks of snow on northerly aspects near measuring station. The gulches and narrow canyons filled with snow.

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THE WHITE PINE BLISTER RUST.

By C. R. PETTIS.

It is very much to be regretted that another disease of a very serious nature has been imported into this country. This time it is a rust, which attacks White Pine. Its most common name is the White Pine Blister Rust (*Peridermium strobi* Klebahn), called, in Germany, Weymutskiefernblasenrost. It is a member of the order of Uridineae (rust fungi), and like many of that order is heteroecious, *i. e.* requiring two hosts for its complete development. This particular rust has the genus *Ribes* as its second host. The alternate form on the *Ribes* is called the European Currant Rust (*Cronartium ribicola* Dietr.) which is most commonly found on black and red currant, more rarely on gooseberry.

This disease is not indigenous to this country, and this species of *Peridermium* has not been reported as found in North America until this summer. The *Cronartium* was originally described in 1856 from specimens collected in western Russia, while the *Peridermium* was first described by Klebahn in 1887 as a distinct species; but later through inoculation experiments by him and others, they were found to be only different forms of the same disease. The disease has been reported from Belgium, Denmark, Switzerland, Norway, France, Austria, England, common throughout Germany. Epidemics have occurred in Sweden, and in some localities of Holland it is so prevalent that the culture of White Pine has been abandoned.

The *Cronartium ribicola* Dietr. has been reported only twice in this country. In September, 1906, Prof. F. C. Stewart discovered it at the Agricultural Experiment Station, Geneva, N. Y., but could not determine how it was introduced. In order to prevent the disease from becoming established drastic measures were taken and the entire currant plantation of the station was destroyed. Since that time no signs of the disease have been found at Geneva. This outbreak of the currant rust has been fully reported in Technical Bulletin, No. 2 of that Station.

As already stated, the disease has two forms of spores which are produced on the two different plants. The spores which are produced on the underside of the *Ribes* leaves appear during the summer and autumn (probably in August and early September) as orange-colored powder having somewhat the appearance of coarse yellow plant hairs. These spores (uredo-spores) when mature may be carried by the wind to adjacent White Pine trees. There they germinate, and the mycelium grows in the soft inner bark of the pine. The period of incubation in the White Pine is not complete the first spring after infection, but often during the coming summer infected stems or branches show a thickening and apparent swelling. The following spring (probably middle of April, or May and early June) the disease breaks through the bark and the light orange-colored fruiting bodies, which are about one-eighth inch thick, project from the diseased pine branch or stem. These spore cases soon rupture and the spores are desseminated. The spores from the pine (aecidio-spores) may infect any *Ribes* leaves with which they come in contact. The period of incubation on the *Ribes* is much shorter (varying from fifteen to forty days) resulting in the breaking out of minute, yellow pustules, the uredo-spores, which on opening emit a yellow dust, which may again infect either other *Ribes* or White Pine, while the aecidio-spores which are produced on the pine can infect only *Ribes, i. e.* the disease can not be transmitted direct from pine to pine. Toward the end of the summer the yellow spots on the currant leaves become darker, and hornlike outgrowths are found on them. On these horns new spores are formed. These "teleuto-spores" germinate and produce small bodies called sporidia, and it is only these sporidia which are again capable of germinating on White Pine and producing the blister rust.

Some facts in regard to the discovery of the disease may be of interest. Last spring the Forest, Fish and Game Commission of New York received a large consignment of trees from J. Heins' Söhne, Halstenbeck, Germany, in order to satisfy the demand for reforesting stock. When these trees were being unpacked one of the foremen noticed a peculiar coloring of the stems and soon after referred the matter to the writer. Some three-year old transplants which showed evidence of the disease were secured and at the same time an examination was made of some white pines, which had been imported from Germany as two-year old seedlings the previous year, and transplanted in a nursery at Lake Clear Junction. In this nursery several specimens, which showed typical forms of the disease, were found. Dr. Perley Spaulding, of the Bureau of Plant Industry, was present and identified the disease as *Peridermium strobi.* Later, specimens were sent to Prof. Arthur, of Purdue University, Prof. Stewart, of the Geneva (N. Y.) Experiment Station, Prof. Jones of the University of Vermont, Dr. Metcalf of the Bureau of Plant Industry, also Professors Farlow and Thaxter of Harvard University, all of whom confirmed the previous identification.

A casual examination by Dr. Metcalf and Dr. Spaulding, assisted by the various state forestry officials soon located the disease in Vermont, Massachusetts and Connecticut.

As soon as Commissioner Whipple became acquainted with the situation he immediately called a conference of the forestry interests, inviting representatives of state and private work, from Maine to Maryland and west to Ohio, also of the Forest Service and Bureau of Plant Industry. This Conference met in New York City, June 28th, and was attended by the following persons: Mr. W. O. Filley, State Forester, New Haven, Conn.; Mr. A. F. Hawes, State Forester, Burlington, Vt.; Mr. Alfred Gaskill, State Forester, Trenton, N. J.; Prof. F. W. Rane, State Forester, Boston, Mass.; Mr. C. R. Pettis, State Forester, Albany, N. Y.; Dr. Perley Spaulding, Bureau of Plant Industry, Washington, D. C.; Dr. Haven Metcalf, Bureau of Plant Industry, Washington, D. C.; Mr. Raphael Zon, Forest Service, Washington, D. C.; Hon. R. A. Pearson, Commissioner of Agriculture, Albany, N. Y.; Hon. James S. Whipple, Forest, Fish and Game Commissioner, Albany, N. Y., Prof. Austin Cary, Superintendent State Forests, Albany, N. Y.; Mr. George G. Atwood, Chief Nursery Inspector, Department of Agriculture, Albany, N. Y.; Prof. J. W. Toumey, Yale Forest School, New Haven, Conn.; Mr. H. R. Bristol, Superintendent of Woodlands, D. & H. R. R., Plattsburg, N. Y.; Hon. George Aiken, Forest Commissioner, Woodstock, Vt.; Mr. John Foley, Assistant Forester, Pennsylvania Railroad, Philadelphia, Pa.; Prof. F. C. Stewart, Agricultural Experiment Station, Geneva, N. Y.; Mr. S. N. Spring, Consulting Forester, New Haven, Conn.; Prof. C. C. Curtis, Professor of Botany, Columbia University, New York City; Hon. Robert P. Bass, Forest Commissioner, Peterboro, N. H.

Commissioner Whipple acted as Chairman of the meeting. The nature of the disease was fully explained by Prof. Stewart and Dr. Metcalf, after which followed a general discussion, and a statement to the general press was prepared. It was finally decided that further importations of German White Pine were undesirable, because the most careful inspection on the docks, is unable to exclude infected stock unless it happens to have the conspicuous spore bodies. A resolution was adopted advocating the passage of a law giving the Secretary of Agriculture the same power to exclude fungus diseases as he now has in relation to insect diseases. It was also agreed that each state should take prompt measure to prevent the spread of the disease.

The following plan for eradicating the disease was adopted for New York State, the State Department of Agriculture and the Forest, Fish and Game Commission working in coöperation:

1. Procure as complete a list as possible of every place where Heins' White Pine stock has gone during the past two years. It is our desire to extend this list to include all other stock imported from Germany and France.

2. Inspect all such premises and destroy all *Ribes* plants wild and cultivated within one hundred yards from such trees, and even a further distance where practicable. The *Ribes* plants should be pulled up or cut out in such a manner as to prevent sprouting. For example, the skunk currant should be pulled up because it spreads by underground stems, while gooseberries and cultivated currants difficult to pull up may be cut off below ground. Burn all such plants found as explained under section 4.

3. Keep close tab on cultivated currants and gooseberries in all districts of the state where suspicious pines are located, and after July 15th keep closer watch than heretofore on currants and gooseberries throughout the state.

4. Destroy by burning all infested or suspicious pines or *Ribes* plants. This is especially important in 1909, for *Ribes* may be expected to show signs of the disease, if at all, after July 15th.

When plants are to be burned it should be done where they are found or at a place to which the plants can be carried in bags made of closely woven heavy cloth, such as canvas or factory, and all such bags should be thoroughly boiled or sterilized at the conclusion of each job.

5. Suspicious plantings are to be thoroughly inspected during the last two weeks in May and the first week in June (between May 10th and June 10th probably best time). This will be very important in 1910 and should be repeated in 1911, the thoroughness in that year depending largely upon 1910 findings.

Eighty-four different shipments of German stock have been located in New York State since the conference, and in every case where any stock more than two years old was thought to exist the plantation was visited either by the State Department of Agriculture or the Forest, Fish and Game Commission and the *Ribes* destroyed before July 20. All those places where two-year old seedlings are known to have been shipped will be visited this fall and the *Ribes* eradicated. Through the coöperation of the two above State Departments very effective work has been accomplished in New York State, and the method outlined above has proved very practical.

This disease has been the subject of much investigation and writing abroad, but probably Klebahn is the most authoritative and *Die Wirtwechselnden Rostpilze* his best work. Horticultural Bulletin No. 2 "Emergency Bulletin on the Blister Rust of Pine and the European Currant Rust," prepared by Mr. George G. Atwood, has been issued by the State Department of Agriculture, Albany, N. Y. Circular No. 38 of the Bureau of Plant Industry, Washington, D. C. "The European Currant Rust on White Pine in America" by Dr. Perley Spaulding has also been published since this disease was discovered in this country.

It is certainly fortunate that such a timely discovery was made and that some opportunity was given to eradicate the disease. Nearly all of our northeastern states are planting public lands or assisting private land owners in their reforesting work. The discovery of this disease may check the progress somewhat, but if the work is delayed until our American grown stock can supply the necessary planting material the future of White Pine planting will not be in doubt.

Mr. Raphael Zon adds the following notes to the above statement:

In Europe, *Pinus cembra* Stone Pine, is the only representative of the group of five-needled pines to which our white pines belong. *Pinus cembra* has occasionally been found to be affected with the blister disease, but within the large region of its natural distribution (Switzerland, Tyrol, and the Carpathians) no fructification of the fungus has ever been observed. Only in the Ural Mountains of Russia, where the Stone Pine is also a native tree, does the fungus occasionally produce spores. This fact would indicate that *Pinus cembra* is so resistant to the attacks of the rust that, although the fungus can gain an entrance into its bark, it only seldom reaches the spore-producing stage. Until the introduction of the American white pines into Europe, this rust was not, therefore, considered of great danger. As soon, however, as the American white pines were introduced and planted on a somewhat extensive scale, the fungus found more favorable conditions for its work, which is only another demonstration of what usually happens when a certain disease comes in contact with new victims which have not had time to become resistant to its attacks. White pine rust, which could do but littl harm to *Pinus cembra,* proved extremely fatal to *Pinus strobus* and *Pinus monticola.* Its attacks are especially destructive to young trees. Old trees, protected with thick bark, through which the fungus cannot enter, are more resistant. In the case of old trees, the fungus attacks, therefore, chiefly the tops of the trees and the younger branches. The young seedlings, however, are attacked both through the stem and branch, and therefore are killed off entirely.

In Europe, according to Prof. Somerville, the disease is so much on the increase that the outlook in that country for *Pinus strobus* and other five-needled American pines is almost hopeless. There are estates in Britain, like Murthly in Perthshire and Woburn in Bedfordshire, where hardly a living young *Pinus strobus* or *Pinus monticola* is left. The disease has played havoc also with the white pine in the Crown woods near Ascot and Windsor.

In Denmark and in some places in Russia, as near Moscow, for instance, the raising of white pine had to be given up entirely on account of this rust.

While *Cronartium ribicola* discolors the foliage, otherwise it is not considered very destructive to the currant bushes.

The means of combating this fungus, while very simple, are not always practical or effective.

The fungus can live for several years in the pine, and may be present for a year in the stems of white pine seedlings before appearing on the surface as a blister. This fact makes the detection of the fungus by means of even a careful inspection or fumigation at the port of entrance of more than doubtful effectiveness.

All the seedlings affected by the fungus must, of course, be at once pulled up and burned; all currant bushes in the vicinity of the plantation should be destroyed, which, if effectively done, would starve out the fungus. The most effective way, of course, would be to prohibit any importation of white pine stock from regions where the fungus is known to be prevalent. In our present unpreparedness for furnishing planting stock of the desired quality, cheaply and in large quantities, this measure would prove, however, a considerable drawback to the planting movement, which has shown so much vigor within the last few years. The situation demands immediate and careful action, which, without checking the interest in planting in this country, would, at the same time, remove the possibility of introducing and spreading a dangerous enemy of our native white pines.

RESTRICTING THE FREE USE OF TIMBER ON OUR NATIONAL FORESTS.

By L. L. White.

Nearly every National Forest that has been created has been looked upon by the people living adjacent with considerable doubt and dissatisfaction in the early stage of administration. This feeling of mistrust, due to misconception and lack of knowledge of the real purpose of the Forests, was inevitable in many communities. It was therefore early apparent that certain administrative provisions must be made which would assist in dispelling the misguided ideas of the public, and in bringing about a realization of the benefits which the Forest policy was intended to subserve. Several measures were adopted for this purpose but probably the most effective has been the adoption of a liberal policy with regard to the free use of National Forest timber.

Under the present regulations a permittee is entitled to $20.00 worth of timber per annum, or more in case of unusual need. The exact amount depends on the current local valuation of timber and various materials. The only restrictions placed upon the business to those entitled to it is that all material shall be used by the permittee and none of it shall be sold or used as a commercial commodity. It is further required that all green saw timber shall be logged by the permittee unless he is physically incapable of doing this work, and that all logging operations shall conform to the rules and regulations governing regular timber sales. Or in other words, the work shall be, from a forester's view, economically and silviculturally well done. In the use of dead timber the operations require but very little supervision, but it is obvious that all green timber should be marked for cutting and the logging should receive careful supervision. When the magnitude of this business is considered, there being more than 2,000 free use permits issued annually on some individual Forests, the difficulty of supervising the work with a limited ranger force can readily be seen. It is a matter of general knowledge among Forest officials that the standard of the free use timber work in such Forests as have a large amount of this business is unsatisfactory and below that which is obtained in regular timber sales. This is exceedingly unfortunate since bad "free use" operations are often referred to by regular timber purchasers as exhibits, and it is not uncommon to see the bad influence such "free use" cuttings have upon adjacent sale operations. The bad features of this free use business cannot be remedied materially under the present liberal policy without greatly increasing the administrative force on the Forests, and the necessity of economic administration for a long time to come will in many cases prevent the available ranger force from properly handling this work. It is, therefore, apparent that in order to secure the desired results in these operations some restrictive measures on free use must be adopted to enable the available field force to properly handle the work. There is no doubt that sufficient restrictions on the cutting of green timber would obviate the present bad silvicultural methods resulting from the free use business. The difficulty would naturally be in formulating and carrying out such restrictions in a manner satisfactory to those concerned. The value of the past liberal "free use" policy in bringing public sentiment to favor the National Forests has undoubtedly been more than commensurate with the sacrifice made silviculturally, and it should therefore be clearly understood that the writer has no criticism to make on whatever poor timber work may have resulted. Since, however, the purpose of the policy has been well served and public sentiment has become generally favorable, it might now be well to give less consideration to sentiment and to find out just how much our liberal policy is actually benefiting the people who exercise their free use privilege.

In considering the material used under free use it is found that the amount of supervision necessary varies almost directly with the value of the timber. The cutting and logging of saw timber is in most need of a close supervision, while on the other hand operations for fuel and dead timber can be managed at a very small expense to the Service. It is, therefore, apparent that the most valuable materials are the ones which should be first considered in a restrictive free use policy whose object shall be primarily to greatly improve the proper management of free use cuttings. This object alone might be insufficient as a basis for free use restriction provided the benefit derived by Forest users through a liberal policy were sufficient to offset what we must sacrifice in proper Forest management. There are, however, economic reasons for discontinuing the permits for free use of green saw material to individual permittees. In the first place the cost of logging his own timber is much greater for the average permittee than it is for a regular timber sale operator who understands the business and is equipped for it. This additional cost is hard to determine but from a few specific cases it has been found to exceed $2.00 per M over that of an adjacent timber purchaser operating under the same conditions. The most apparent lack of economy in the free use business, however, is in the high cost of milling by so-called custom work. The mill operators who do custom work in District 4 are almost without exception small timber purchasers. The amount purchased depends chiefly on the local market, consequently if this market is largely supplied by free use permits, as is often the case in newly settled communities where no large towns are located, there is very little revenue from timber sales. The free use permittees always get their saw timber as close as possible to mill sites and since most of them are not equipped for logging they are continually annoying the mill operators by borrowing tools, etc. The operators naturally do not overlook this point when charging for the mill work, and, since the expense of milling out each special order and piling it separately for the permittee is expensive, this too is an item not over looked. The result of this additional milling expense and bother to the operator adds not less than $2.00 and in many cases as high as $6.00 per M in excess of regular milling costs. These figures are based on the practice in the Forests in District 4 where mill operators charge from $5.00 to $9.00 per M for custom work with an average of $7.00 per M, while the actual cost of milling in regular timber sales by portable circular sawmills seldom exceeds $3.00 per M. It can, therefore, be readily seen that the free use permittees pay an average excessive cost of about $6.00 per M in logging and milling fees while the only economic consideration granted by the Government is in free stumpage, which in District 4 would average about $2.00 per M, still leaving a loss of $4.00 per M to the permittee. It has been argued that many of the permittees can do their logging in the winter when there is no other occupation for them and their teams, and that the difference between the milling fee and the actual cost of the operator's lumber at the mill represents the economy of the free use timber. If risks and breakage were eliminated and other employment impossible this would be true. In actual practice, however, there are very few localities in which a permittee cannot work at some other business more profitably than at doing his own logging. Even most mill operators would rather hire men who are unable to buy lumber and take their pay for lumber in exchange for labor, rather than be bothered with custom mill work. In this District, over eighty per cent. of the mill operators approached on the subject were decidedly in favor of eliminating free use custom work. This is especially interesting in view of the excessive rates they receive for custom work. It goes to show, however, that these rates are not considered commensurate with the annoyance, extra costs and disorganization to which operators are put. This latter factor is perhaps the greatest inconvenience to mill operators, since it leaves them a very uncertain market for the timber they have purchased and is very discouraging to business-like logging and marketing.

It has sometimes been suggested that if free use of saw material is discontinued it will give mill operators a chance to charge exorbitant rates. Perhaps this will be done in a few cases until competition adjusts it. The operators now have the same opportunity to charge exorbitant rates on custom "free use" work, and the opportunity is even better, for the possibility of an advance on stumpage rates by the Forest Service at each increase in lumber rates would easily convince operators that high priced lumber would add nothing to their profits. On the other hand, high priced lumber at the local mills would in many cases interfere greatly with sales by bringing it, along railroad points, into closer competition with the general market, and also by encouraging the people to use "house" logs and other building material which is granted under free use.

The final result of discontinuing the free use of green saw material to individual permittees would be to consolidate timber operations and have lumber supplied to communities through regular mill operators and timber purchasers. This would enable the administrative force of each Forest to have close supervision over the work which is the essential item to proper forest management; and lastly, in most cases lumber supplied by regular timber purchasers would be an economy to the permittees as well as a source of revenue to the Government. In District 4 over $25,000.00 worth of saw material is given away each year.

This restrictive policy has already been successfully adopted on several of the Forests in the district where the supply of such material is very limited. Considering the abuses and benefits of a liberal policy there appears to be no reason for not eliminating green saw material from the free list on every Forest.

In connection with this point it is worth noting that this policy has been adopted on the Weiser Forest, where the supply of timber is quite large and the free use business was formerly very extensive and impossible to handle properly. The result has been first class supervision of the timber work without the expected dissatisfaction of the forest users. The present difficulty in adopting this policy on many other Forests in District 4 is due to adjacent Forests persisting in a liberal policy. There is no doubt in the writer's mind that a uniform restrictive policy along this line would work admirably in this district and to a certain extent in other administrative districts.

Since free stumpage conveys the idea to most individuals of an apparent economy, the important point is to educate forest users to the lack of financial benefit they are receiving under a liberal policy. This can be successfully done if the policy receives the proper support from the Forest officers on the ground who deal with the people.

THE COCONINO RANGER SCHOOL.

By Theodore S. Woolsey, Jr.

The interesting article on "Ranger Courses," in this volume of Forestry Quarterly, on page 147, by Mr. Rothery, emphasizes the need of training rangers, in order to secure successful field work in the Forest Service. This has been keenly felt and it is now recognized that upon an efficient ranger force rests, to a great degree, the success or failure of the Service. This is particularly true in timber sales where much of the routine for some time to come must be left to the ranger force, owing to the scarcity of technically trained men. As the writer has observed in British India, one of the chief reasons for the successful forest administration there has been a force of technically trained rangers. These officers trained at Dehra Dun are given a training that compares favorably with most of the Forest Schools in the United States, and is much superior to many of them.

One solution of this educational problem has been educational co-operation with local and State universities. Instructors have been temporarily detailed on furlough and rangers have been given every opportunity to attend. Another solution, which was approved by the Forester on June 14, will be the establishment of a Ranger School on the Coconino National Forest, Arizona, in District 3.

The advisability of having a Government training school for rangers, to correspond with the schools of instruction maintained by the Army and Navy, has been often recommended during the past few years, but the definite project of a school on the Coconino Forest during the coming summer, originated and was planned, I think, chiefly by District Forester Ringland.

The object of the school is to give technical and practical training to rangers and possibly practical training to new Forest Assistants fresh from Forest Schools, who are not familiar with western conditions. This will replace former ranger meetings, where it was customary to discuss the "Use book" regulations, as well as office and field procedure and methods.

The school will be held during September and October on the

Coconino Forest; instruction will be given chiefly by officers detailed from the district and will be in charge of the Chief of Operation. The Forest Service will provide for the transportation of all officers detailed, but the cost of subsistence while attending the school will be borne by the rangers. They will be detailed, however, on full pay. The following outline of courses is particularly interesting:

Silviculture: Mensuration, stem and stump analysis; reconnaissance, estimating; timber sales: marking, scaling, grading, woodswork, reports; botany: identification and life history of plants; management: systems of management—planting, silvics, working plans (simple).

Operation: Engineering, land surveying; use of instruments, mapping; permanent improvements; location of roads and trails.

Law: Principles, appropriations; land law, mining claims.

Grazing: Control, development; carrying capacity of range; classes of range and stock.

Camp Practice: Pitching tents, cooking; care of horses, riding; packing, shooting.

Field Work: Silviculture, botany; management, engineering; examination of mining claims; use of range and carrying capacity; wood utilization; first aid to the injured.

Office Procedure: Grazing; operation; silviculture; timber sales; planting; silvics.

The officers in District 3 feel very strongly that a ranger school with the opportunity for practical field work, suited to local conditions, is the proper solution of the problem. The results of this school will be closely watched and its success will mean a great deal for the future of the Forest Service. It is in many ways one of the most important steps in the development of the Forest Service, and its significance will no doubt be recognized in American forest history.

MEASUREMENTS OF THE EFFECTS OF FOREST COVER UPON THE CONSERVATION OF SNOW WATERS.

By W. R. Mattoon.

The large treeless openings or "parks" in the western yellow pine forests of the southwest, which form a well known characteristic, afford an excellent opportunity for a comparative study of the effect of a forest canopy upon local snow conditions. During the late winter and spring of 1909, the writer had an exceptionally favorable opportunity for observing the progress of snowfall and subsequent melting in a virgin stand of western yellow pine near the base of the San Francisco peaks on the Coconino National Forest in northern Arizona.

The observations include the measurement of each successive snowfall, and the total depth of snow at intervals of seven days under two entirely different forest conditions, namely, in a virgin stand of mature timber and on an adjacent treeless park, covering an area of several square miles. The observations were taken during the period from February 26 to April 25, at an altitude of approximately 7,500 feet.

On March 11, the average depth of the snowfall from a two days' storm was 4.0 inches in the park, as compared with 5.0 inches in the forest, a difference of 25 per cent. in favor of the forest. A snowfall on March 23 measured 10.8 per cent. deeper in the forest. These may be taken as fair examples of the difference under the two conditions. As an explanation, it seems probable that the sweep of wind across the park carries along a certain excess amount or *load* of snow from the snow gauge, which under the quieter atmospheric conditions prevailing in the forest is ordinarily deposited—a phenomenon corresponding in many respects to the well known laws governing the deposition of silt by water currents. Over a forested area broken by parks the maximum deposition occurs at the margin of the parks, the normal deposition in the forest body, and the minimum over the parks and larger openings.

Contrary to the usually accepted fact, during the *early* spring, melting commences earlier and progresses more rapidly in the forest than in the open treeless areas. This is due to difference in radiation. Records taken in both situations show a much higher average temperature in the forest, due to the fact that the night temperatures are from 5 to 15 degrees warmer than in the adjacent parks. Early in March it was noted that the soil beneath the snow in the forest generally contained no frost and consisted of soft mud. The origin of the soil is from decomposing "malpais," a basaltic lava bed. At this time, however, a thick ice layer had formed beneath the snow in the open park and was constantly thickening, due to the low daily minimum temperatures. By April 1, the ice layer had reached a thickness of 3 to 6 inches, and it is safe to say that during the month of March a relatively small amount of water from the surface melting reached the soil throughout the park.

On March 17, the average depth of snow in the forest was 11.5 inches, and of snow and ice in the park 19.5 inches, with water equivalents of 5.2 and 9.4 inches, respectively. The figures are significant, when it is recalled that the measurements show considerably less snowfall in the park than in the forest. The disproportion of the ratio caused by the high water content in the park will be noted.

The distribution of snow was uniform in the smooth, open park, while in the forest the ground surface was exposed in many places and snow banks from 2 to 4 feet deep occurred in the natural openings and lanes between tree groups. The depth for the forest was obtained by averaging measurements taken at ten snow stations spaced about 50 feet apart on a due north and south line. A similar line of stations was established and used in obtaining the park measurements.

The surface run-off in the two situations is interesting from the standpoint of water conservation. By April 1, bodies of water overlying the ice sheet had collected in the depressions in the park, and a good-sized stream was flowing at the outlet. No perceptible surface run-off from the forest (over the locality under consideration) occurred during March. The days of April 1, 2 and 3 were unusually warm and quiet, and resulted in the only run-off from the forest during the entire spring. The amount was insignificant compared to the total water content of the snow mass. It is well to state, incidentally, that the writer made daily trips between the two measuring stations, which afforded an opportunity for noting the conditions.

A spell of warm weather occurred during the first half of April. By April 8, the depth had decreased to an average of 8.5 inches in the park (6.5 inches of snow and 2.0 inches of ice), and 3.8 inches in the forest. In the following five days, of high temperature and strong southwest winds, practically all of this snow and ice disappeared from the park, accompanied, it is needless to state, by an excessive run-off which continued for a few days after the period. On April 15, no snow existed in the park, while throughout the forest there remained considerable snow distributed in banks and ridges over the north slopes and level surfaces as well. Photographs shown on the frontispiece give a good idea of the appearance on this date of the measuring stations in the park and forest, and the remaining snow, banks of snow, on northerly slopes in the mature timber. In the timber throughout this region there remained on April 25 a considerable quantity of snow in sheltered situations favorable for late melting, while the last trace of snow had disappeared from the park by April 12.

The progress of accumulation and later melting of snow in the two comparative situations may be *summarized* as follows:

(1.) The total snowfall in the forest is somewhat more than over the open parks, due chiefly to accelerated wind velocity over the parks, resulting in a lighter deposition of snow, a case similar to the deposition of silt in stream courses.

(2.) Due to protection afforded by the forest cover against extremes of cold resulting in a higher average temperature, the process of melting during the spring commences considerably earlier in the forest than in the adjacent open park.

(3.) The low minimum daily temperatures in the park account for the formation of a thick layer of ice at the base of the snow during the early spring. This in turn serves to retain the moisture above the soil.

(4.) During the month of March, the park remained almost entirely covered with a deep and quite uniform layer of snow and ice, while in the forest the snow cover was much broken along rock ledges and banked high in the natural tree avenues, and the total amount of snow and water content above the soil surface was decidedly less per unit of area in the forest than in the park.

The condition strongly suggested an apparent advantage of a treeless over a forested area in conserving the winter snowfall and storing a supply of moisture for distribution in the late spring when most needed.

(5.) With rising spring temperatures and absence in the park of protection against extremes of heat, a point is reached—the usual "warm spell"—when the layer of snow and ice in the park "breaks up" very rapidly and the water goes off with a rush, resulting in a very small underground storage, and the further consequence of a rapid drying or baking of the soil.

(6.) In the forest, due to the high efficiency of the tree canopy in modifying surface temperatures, and of the forest cover in checking the velocity of the winds which at this season of the year are strong and from the southwest, and blow with the regularity of the "trades," the progress of melting proceeds more uniformly and is prolonged into late spring or early summer with a minimum loss of water by surface run-off and evaporation and a relatively high storage in the forest soil.

COST OF EVERGREEN SEEDLINGS.

By D. Hill.

Dundee Nurseries, Ill.

Referring to the article in the current volume of the Quarterly (pp.151-154), entitled "A Plea for Abolishing the Duty on Evergreen Seedlings for Forest Planting," by Mr. Ellicott D. Curtis, I feel called upon, in justice to myself and to your readers, to correct some very grave errors in the statements which the gentleman makes.

In his table of comparison showing the difference in price between American and foreign stock, he is misinformed regarding the prices which are charged for evergreen seedlings by American growers. I have before me our regular price lists for the years 1907, 1908 and 1909, and the prices quoted for White Pine seedlings for the three years in question are as follows:

		100	1000	10000	100000
1907—					
White Pine seedlings	4-6 inch	$1.00	$6.00	$55.00	$500.00
" " "	3-4 "	1.00	4.00	40.00	375.00
1908—					
White Pine seedlings	6-8 inch	1.00	7.00		
" " "	4-6 "	1.00	5.00	45.00	400.00
" " "	3-4 "	.75	4.00	35.00	300.00
1909—					
White Pine seedlings	4-6 inch	1.00	6.00	55.00	500.00
" " "	3-5 "	1.00	5.00	47.50	425.00
" " "	2-4 "	.75	4.00	40.00	350.00

By carefully noting the above you find that in not one single instance have I quoted White Pine seedlings for forestry planting as high as $8.00 per 1,000. In the fall of 1907, it is true, we issued a list which listed White Pine at $8.00 per 1,000, but that was a list got out principally to send to small jobbers who occasionally

The Quarterly desires to open its columns to a free discussion of any and all strictly technical and professional, not personal, matters, without, however, assuming any responsibility as to statements of fact or opinion by its contributors. It takes pleasure, therefore, in printing the rejoinder of Mr. Hill to the statements of Mr. Curtis, who has also been given an opportunity to reply in rebuttal, this ending the controversial character line out a few hundred of the different varieties of seedlings each fall. We prefer not to cater to this trade, because in removing small quantities of seedlings from the seed beds in the fall of the year those trees adjacent to the ones removed are often spoiled or injured and consequently in filling an order at that time of the year for a thousand White Pine seedlings we would perhaps spoil three or four hundred other trees to get them. This is the reason for charging an advanced price in the fall.

It would then appear that in putting us on record as charging $8.00 per 1,000 for White Pine seedlings for forest planting, when in reality our prices average less than 50 per cent. of that figure, Mr. Curtis is doing us a gross injustice and is misleading the public and legislators.

I also wish to take exception to the statement he makes regarding the expense of raising two-year White Pine seedlings in the United States. On a basis of actual cost per 1,000 plants, from data gathered during an experience extending somewhat over half a century on our grounds here, I know it to be an actual fact and am also advised to that effect by other growers, that 90 cents falls a long way short of covering the expense of raising White Pine at the age of two years. It costs between 32 and 28 cents alone to shade 1,000 plants and then you have to pay for seed; for preparing the beds and planting the seed; for keeping them free from weeds for two years; for waging the continual warfare against the birds and other animals, such as gophers and moles, rabbits, etc., which at all times seek to destroy the tender young seedlings. Added to that you must figure in the interest on your investment and taxes on your land and many other items. Although the gentleman may be very conscientious in making the statement referred to above, still I think he is misinformed, or inexperiencel, or, on the other hand he must be a propagator of extraordinary ability. Many of the leading foresters in the country, who have had experience in growing these seedlings, in the east as well as the west, have told me their experience in growing this material, and the figure most of them estimate as their cost prices is in most cases from 150 to 200 per cent. above what Mr. Curtis states.

Regarding the planting which is being carried on in this country at the present time, no doubt Mr. Curtis is aware of what is being done in that line in New York and Connecticut, but I do not think he is aware of the enormous quantities of plant material which are being used by the farmers in the large States west of New York, such as Ohio, Michigan, Indiana, Missouri, Kansas, Nebraska, Iowa, Wisconsin, Illinois, Oklahoma, Texas and New Mexico.

For every large concern making extensive plantings in the States he mentions, there are hundreds of farmers in each one of these other States who are planting each year several thousand trees on their farms, around their fields and pastures, houses and sheds and transforming waste land into wood lots. These farmers are carrying out the idea and teachings of true forestry just as much as the large lumber concerns who replant the areas from which they have cut off the timber.

Mr. Curtis states that the raising of trees for forest planting is a comparatively new industry. There are firms to-day growing this material who were engaged in the same business many years before our Government ever thought of advocating conservation or reforestation. He states that the removal of duty from this class of stock and the assured destroyal of this industry would be attended with no great loss to anyone. I beg to differ with him in that respect. There are many firms who are more or less engaged in this business and the capital invested would run up into the millions. To destroy this industry would bring untold hardship to thousands of families whose breadearner has spent his life in this work and knows no other.

Regarding the cost of reforestation material in general, it is true of ourselves and I am sure also of other growers, that for many years we maintained experimental grounds and have devoted much time, energy and money to the end of being able to lower, if possible, the cost of production of this material, by studying the method of treating seed to get higher per cent. of the germination, the combating of disease, etc. The most critical period of a seedling is during the first four weeks after it has pushed through the ground. Numerous diseases are liable to attack them, the most serious being called "damping off." It is only recently that we have been able to combat this disease at all. In all cases where we have been able to lower the cost of production, by attaining success in getting better germination percentage, we have been quick to lower the price on our stock. To cite a specific case, by referring to our annual price lists for three years back, the quotations on Jack Pine seedlings, a species which is used largely in western States, will be found as follows:

1907	Jack Pine 2 year seedlings	4-6	inch	$4.00	per 1000.
1908	" " " " "	4-6	"	3.00	" "
1909	" " " " "	4-6	"	2.50	" "

It has been our policy in the past and will be in the future to furnish such material at the lowest possible price and we expect to be able, as a result of our recent experiments, to materially lower the cost of several other varieties which are used largely for reforestation purposes.

To seek legislation which would certainly destroy this industry—an industry which you have built up—does not appear to us to be in exact harmony with the broad policy with which you started out, and is an action which we firmly believe, is not in accord with the wishes of your leaders.

In conclusion, I wish to state, that our grounds will be wide open, as in the past, to any National, State and private estate foresters, who may wish to carry on any investigation or experiments that he may choose, to the furthering of forestry interests, and it is our hope that, in co-operation with them in this manner, we will be doing our part and shouldering our share of the burden which former generations by their reckless waste have put upon us.

The above strictures having been submitted to Mr. Curtis, he has made the following rejoinder:

The "very grave errors" which Mr. Hill finds in my article are apparently three: 1. I have misrepresented his prices for seedlings. 2. I have understated the cost of growing such seedlings. 3. I have minimized the amount of forest planting now being done, and the amount of capital invested in the business of supplying that demand. Let us discuss these points in turn.

1. That I have misrepresented Mr. Hill's prices. Unfortunately for him, Mr. Hill is forced to admit that this charge is not entirely untrue. I should not have ventured to mention names in my article if I had not been sure of my facts, and I therefore stated that I was quoting from Mr. Hill's fall catalogue of 1907. I have

personally used in each of the last three years, between forty and fifty thousand seedlings, chiefly White Pine. I must make arrangements early for obtaining my planting stock, and Mr. Hill's catalogue was sent me when I was looking up quotations for my 1908 supply. The first page of that catalogue states: "The fall gives us plenty of time in which to handle your business. Therefore we can afford to sell your stock at a better figure than in the spring of the year, when the season is short and we are forced to go at a terrific pace to keep up with the work. When fall planting is employed all is changed. We can go ahead and take care of your orders as they come, and give them our best and most careful attention." Under these circumstances, it seemed hardly worth while to write for lower quotations than $8.00 per thousand for White Pine. I do not think that I ever had another price list from Mr. Hill. If his general scale of prices has been incorrectly given, the fault would seem to be his own in sending out lists with different scales.

2. That I have understated the cost of growing seedlings. Here I have also given my authority, viz: a forthcoming bulletin of the Division of Forestry. If Mr. Hill disagrees with the Division, his quarrel must be with it and not with me. I have no doubt that your paper will be glad to have from Mr. Hill a careful and detailed statement of the items making up such cost. I may say, however, that I have recently received a letter from Mr. C. R. Pettis, State Forester of New York, in which he says that the figures I quoted "are those I prepared for the Bulletin which I have written" for the Division. Mr. Pettis may not have been growing seedlings as long as Mr. Hill, but his figures will probably be accepted as authoritative by most of your readers.

3. That I have minimized the amount of forest planting now being done, and the amount of capital invested in the business of supplying that demand. Upon this subject Mr. Hill is undoubtedly a much better authority than I, and it is to be regretted that he did not see fit to give more definite figures in his reply to my article. Did he, or did he not, for instance, as stated in his letter submitted to the Ways and Means Committee of the House of Representatives, have on hand 200,000,000 evergreen seedlings for forest planting? Shortly after the date of that letter, I find his advertisement in the *Rural New Yorker* (January 30, 1909), stating: "We have 50,000,000"—evergreens. In the absence, there-

fore, of more definite, as well as more consistent, figures from Mr. Hill, I think that there is no room for doubt that forest planting and the demand for seedlings for that purpose is comparatively new, and as yet comparatively undeveloped. Mr. Hill will hardly deny that much the most important part of his business is in ornamental stock; he will certainly not deny that his hundreds of farmers, each of whom is planting several thousand trees in the middle west, will be most unlikely to import their trees from abroad. The effect of such importations on Mr. Hill's business would seem, therefore, to be almost negligible.

May I further say that my article, which was written for submission to the Ways and Means Committee, was called forth by the effort of Mr. Hill and some other nurserymen to increase the duty on evergreen seedlings from one to two dollars per thousand. Their effort seemed to me but one more indication of the utter demoralization fostered in the business world by a tariff system which is enacted largely by the protected interests for their sole benefit. Fortunately, more powerful interests than mine were at work in this particular matter, and evergreen seedlings are now on the free list. What effect the discovery of blister rust on this year's stock will have on future importations cannot now be foretold, but it is fairly certain to cut down the area of new plantations for a few years.

COST OF MOUNTAIN LOGGING IN WEST VIRGINIA.

By Henry H. Farquhar.

The following data, designed to give the costs of setting up and running a team camp, with brief descriptions of the methods of logging employed, in the Allegheny Mountain region, were gathered in the fall of 1907 while working in a camp of the Otter Creek Boom and Lumber Company, of Hambleton, West Virginia.

This is one of the largest lumber companies in the State, using one band and one circular saw and sawing about ninety thousand feet per day. A planing and a lath mill are under the same roof. The logs are furnished by six contractors.

Before selecting the particular camp for the study, inquiry was made as to the largest and most up-to-date, and the following descriptions and figures may be taken as typical of the team logging in this (the Spruce-Hemlock) type, throughout the region.

The logging for the Otter Creek Boom and Lumber Company is all done by contract. The camp from which these figures were taken is situated about twenty miles southwest of Hambleton, the contractor being Grant Dickson. Of the daily output of the company's mill of ninety-thousand feet, over forty thousand feet are furnished by this camp, the remainder being supplied by five other contractors.

The region and woods will first be described, the contract, the cost of setting up camp, then the methods of logging, wages and board, and finally the summary of the whole.

The Woods.

Lying on the western slopes of the Southern Appalachians, the region has the usual rugged mountain topography. A narrow-gauged railroad winds in and out along the bed of a small stream, between the high mountains on both sides, rising from Hambleton, at an elevation above sea level of 1,700 feet, up to Dickson's camp, which is about 3,300 feet, or a rise of 1,600 feet in twenty miles. At frequent intervals along this road are seen great bald mountains, entirely destitute of trees, with only burnt and blackened trunks keeping guard over the huge boulders, left white and shining after man has uncovered, after fire has burned, and rain washed them. What little growth can find a foothold here consists of Cherry, Birch and Scrub Oak, with quantities of laurel and rhododendron.

But as we approach camp we gradually enter a dense virgin forest, of mixed conifers and hardwoods, Hemlock *(Tsuga canadensis)* and Spruce *(Picea rubens)* forming 90% of the whole. Hardwoods form the lower story and are most abundant and best developed on the moist, richer soil of the valleys, seldom extending to the tops of the mountains. The species making up the forest are found in about the following proportions: Hemlock, 45%; Spruce, 45%; Birch, 5%; Beech, 3%; Cherry, 1%; Maple, .5%; others, .5%.

The reproduction is, in most cases, rather poor. In places the laurel is so dense as to be nearly impenetrable, making impossible any reproduction of the above species. But where this is not the case, as where an open space has been left by logging, or fire, or where the crown density is sufficiently open, good reproduction is found, especially that of hemlock and spruce. These two species are very thick to fill up any open spaces in the woods, which fact must be taken practical advantage of in any plan for management of these lands.

Contract.—The logging contract specifies that the logs be placed upon the skidway beside the railroad track, ready for loading, and paid for according to the log scale of the company's scaler, using the Doyle rule. The price paid per thousand varies with the topography of the country and the distance from the railroad. Dickson was paid $5 per thousand, which is a little more than the average price. If the contractor loaded the cars, as was usually the case, fifty cents per thousand additional was paid, making a total of $5.50 per thousand for logs loaded on cars in the woods. The company owns three steam log-loaders, anyone of which may be rented by the jobber for $25 per day.

The company pays $4 per ton, which is approximately equal to a cord of 128 cubic feet, for hemlock bark, in four-foot lengths, loaded on the cars.

Spruce pulpwood is cut in 8 and 12-foot lengths and down to four inches at the small end. The jobber is paid $3 per cord on the cars.

The cost of all lumber and other building materials, of the labor, of the supplies, and in fact the entire cost of setting up and running camp, exclusive of railroad transportation, is borne by the contractor.

The company's employees, such as inspectors, scalers, train crew, etc., are boarded at the jobber's camp free of charge whenever their work requires them to be there, in return for which the company hauls all supplies for the jobber.

Setting up Camp.—As stated under contract, the entire cost of building camps, exclusive of railroad transportation, is borne by the contractor. The company furnishes lumber and other building materials at wholesale rates, and delivers these materials to the camp site.

Dickson's buildings, planned to accommodate about sixty-five men and twenty horses, are situated in the valley on a moderately level stretch of ground, on the south side of a small stream and right beside the company's railroad. The timbered hill-sides slope up at an angle of about 40 degrees from both sides of this stream. The buildings consist of the following:

Bunk house, 66'x24', 21' high, the first floor of which is divided into kitchen, 18'x24'; dining room, 30'x24'; lobby, 18'x24'. Office 16'x14'; meat house, 14'x14'; filing shack, 16'x12'; smithy, 18'x18'; stable, 60'x34'; hay shed, 16'x16'; coal shed 16'x8'.

On the second story of the bunk house, extending over the lobby and dining room are the sleeping quarters, 48'x24', containing 31 wire-mattress beds.

The lumber for these buildings, consisting of mill culls, cost $584.32.

Camp at this place was set up in May, 1907. An entire outfit was bought at that time. Exclusive of the lumber mentioned above and exclusive of wages and all food supplies, the cost of setting up and running camp from May 1st to September 30th, including cost of horses, harness, all logging supplies, etc., was $5,023.92.

Logging Operations.

Roading and Swamping.—The mountains being in all cases very steep, and in places even precipitous, swamping and road-making form a large proportion of the expense of getting out the timber. Hemlock is cut in the spring, before many of the logging roads have been made, the trees being thrown in the most convenient place for peeling. Such areas are locally called "slashings," and greatly increase the work and cost of swamping, due to the brush and undergrowth being pinned down beneath the large logs and tops.

The main roads are cut to a width of one rod. The buck swamper goes ahead selecting and blazing out the best route for the roads, the swampers following and removing all trees and bushes of whatever size, all stumps, and as many of the large stones as is necessary. The buck swamper sees to it that the swampers clear out around each individual log so that the team may get at it easily, the side roads of course in this case being narrower than the main roads. In case the swampers cannot break or move the large rocks, two men are sent with drill and dynamite to blow them to pieces. Anything approaching a smooth road is of course impracticable in these mountains, but a great deal of care and expense is put upon them in order to reduce to a minimum the danger of injury to the horses. It takes ten men, on the average, a little over three days to swamp out one-quarter of a mile. Taking these men's wages at the rate of $1.70 apiece per day, and their board at 60 cents per day, we find that it costs nearly $300 per mile of road one rod wide. This figure agrees closely with Mr. Dickson's experience that swamping costs nearly one dollar per square rod.

For each skidding road—two teams hauling on one road—there is one road man with axe and grub-hoe, whose duty it is to bridge or corduroy all boggy places, to remove any stones or stumps left by the swampers, and generally to keep in repair the roads as they are worn by hauling. For, besides the very large rainfall there are, as a result of it, upon the sides of the mountains innumerable springs, and this water, in many cases flowing directly down or across the skidding road, makes constant repairing and bridging necessary. In most cases corduroying does not have to be resorted to. Usually the soil is quite compact, and it is only necessary to "bridge" the boggy places—that is, to lay cross pieces in the mud, say about 1½ feet apart, so that the horses may step between them, the logs sliding over the top, and thus being prevented from plowing the hole deeper.

Taking the operations of swamping, roading, blasting and repairing, requiring the labor of about sixteen men, the cost amounts to 87 cents per thousand.

Roading and Swamping:		*Per M.*
1 Buck Swamper	a $40 per month	$0.04
10 Swampers	" 340 " "	.34
4 Road men	" 160 " "	.16
1 Blaster	" 40 " "	.04
16 men at 60c board per day		.29
		.87

Sawing.—Three saws are usually run, except from the first of May until the first of August, when only the hemlock is cut and the bark peeled, during which time contracts are let to from twenty to thirty men. During the rest of the year the sawyers first go through the woods, cutting what spruce and hemlock has been left by the bark peelers, afterwards going over again and taking the hardwoods. This is done to avoid loss through logs splitting and breaking if they are felled across each other.

Everything ten inches on the stump, and any straight log twelve feet long that will measure eight inches in diameter at the small end, is cut. In the case of pulp wood sticks, the limit is four inches at the small end. Stumps are cut as low as possible, averaging about twenty inches. Two men with a chopper who goes ahead selecting the trees, makes the undercut and afterwards fixes the lengths of the logs, and the two knotbumpers or limbers who cut off the limbs from the logs and nose or point them, make a crew, which saws from fifteen to twenty thousand feet per day, the spruce and hemlock averaging 4.5 logs to the thousand board feet.

No care is exercised in the felling of the timber so as to prevent injury to the young growth, the only object being to get it in the best possible position for skidding. As many as possible of the trees are felled across or alongside of the main stem of the road.

The spruce and hemlock trees will often cut seventy-five to eighty-five feet, linear measure, of merchantable logs each. The woods furnish ideal fifty-foot spruce and hemlock bridge timbers, as straight as a line and free from branches for this whole length. These sticks must square 15 by 9 inches, which requires that they be not less than 18 inches in diameter at the small end. After this fifty-foot log is taken out, frequently two additional logs are cut from the same tree.

Simond's saws are used exclusively.

The cost of sawing is about 95 cents per thousand, as follows:

		Per M.
6 Sawyers	a $240 per month	$0.24
3 Choppers	" 120 " "	.12
6 Knot Bumpers	" 210 " "	.21
1 Filer	" 90 " "	.09
16 men at 60c board per day		.29
	Total	$0.95

Skidding.—One of the most difficult and dangerous operations in the whole work is snaking the logs, often five or more at a time, down the steep sides of the mountain.

In this operation Langham grabs are used, which consist of two five-inch dogs, attached to opposite ends of a short chain, which are driven into the abutting ends of two logs. For use in large logs, where one grab or grapple would be apt to pull out, double grabs, or "four-paws" as they are called, are used, thus having two dogs to each log.

There is one grab-driver to each two teams, who is provided with an axe, a sledge, a canthook, a block, two chains and several pairs of grabs. Where there is a particularly steep place, the grab-driver drives the grab into a log, the stretcher is then caught just back of the small knob on the grab, and the log started. When it is in the road and has got fairly under way, at a word from the driver the horses step quickly to one side, the stretcher slips from off the knob on the grab and the log goes sliding down hill at a tremendous rate. This operation is repeated until sufficient logs are got to a less steep place. The coupling up of the logs for the drive to the skidway at the bottom of the mountain then proceeds as under ordinary circumstances, and is as follows: Beginning usually with the log farthest up the hill, the grab-driver places a grab in the end, the team hitches on and drags the log up till the back end of it is just even with the front end of the next log. These two logs are then fastened together with single or double grabs as the case may be, and are then pulled on down to the next log, which is similarly fastened on behind. In order that the logs may not be continually catching against projecting roots and stones on their trip to the skidway, the forward end of each log is rounded off, or "nosed," by the knot-bumpers. From one to five or even six logs may be taken at a trip with two horses in this way, the number of course depending on the size of the logs, on the horses and driver, on the condition of the skidding road, etc.

But even after this string of logs is well on its journey toward the skidway, the danger is not over. On a steep descent some of the grabs may pull out, when a part or even all of the logs come sliding pell-mell down upon team and driver. But this is seldom the case, and with well trained horses, experienced drivers and the best roads possible, accidents are extremely rare. Where there is danger of such a slide, one or two of the logs are bridled by wrapping a chain around them several times, to prevent their slipping too freely. The usual load is about one thousand feet, log measure. The teams average six trips per day where the haul is not much over one-fourth mile, as is usually the case, although from the streams to the tops of the hills is quite often nearer one-half than one-fourth mile.

The outfit per team consists, besides the harness and stretchers which cost about $65, of the following, which cost from $4.50 to $6.50—fifteen sets of grabs, a twenty-foot chain, a sixty-foot chain and a pulley, to be used where the team has not room or foothold to work close to the log.

The cost of skidding per thousand averages about $1.76.

		Per M.
8 teamsters	a $480 per month	$0.48
4 grab drivers	" 160 " "	.16
12 men at 60c board per day		.22
20 horses at $1.50		.90
Total		$1.76

Loading.—a. By Hand: The railroad track is laid alongside the small streams that run down the river valley. As the mountains slope abruptly to the edge of the streams, advantage is taken of this slope to build up the end of the skidway or deck nearest to the track, just high enough to allow the logs to be rolled off on the cars alongside. The back ends of the two logs on the skidway are placed at a slightly higher elevation than are the ends nearest the track, so that a gradual incline from the skidding road to the track results, thus enabling the logs to be loaded cheaply and with little difficulty by hand. Russell cars are used. The bunk load (or bottom layer of logs on the car) is first put on, then short spiked skids are rested upon these and the skidway, when the next layer is rolled up, and so on.

Two men work on each skidway when loading cars except in the case of bridge sticks, where more men are required. Cars are usually loaded at two decks. Two men load on the average ten cars per day. The cars carry very close to 2,650 feet log measure each so that each day for two skidways twenty cars, or over 50,000 feet, are loaded ready for transportation to the mill. As explained elsewhere, owing to the excessive rainfall only about twenty days per month are put in at work except in the case of the steam loader. But, taken together for the year, and logs loaded by hand and by the steam loader, the output runs very close to 50,000 per day for each working day, or 40,000 per day for a month of twenty-six working days, or approximately 1,000,000 feet per month.

The cost of loading is 50 cents per thousand, namely:

	Per M.
Cost of building skidways	$0.15
6 Canthook men at $240 per month	.24
6 Men at 60 cents board per day	.11
Total	$0.50

b. With Steam Loader: The steam loader (American Log Loader, Model C) and crew, which the jobber may rent for $25 per day, works from daylight until dark, six days in the week, regardless of weather conditions. For work with this loader, temporary skidways are placed above a deep gully, the logs are rolled indiscriminately over the bank down into this gulch until it is filled, forming what is locally called a "rough-and-tumble landing." When several of these piles of logs are ready, a switch is laid into each and the loader and crew are hired from the company.

Three men, the engineer, the hooker-on and the top-loader, load with this machine about thirty cars per day. This means about seventy-five thousand feet put on the cars for $25, of less than 34 cents per thousand. Thus it is seen that where it is possible to use the steam loader, it is cheaper than loading by hand, even after allowing the same cost per thousand for building the short railroad switches, as for building the skidways used in hand loading. But larger loads may be put on with careful hand loading, and for most of the time this is the method used.

Scaling.—Logs sawed during the bark peeling season, are scaled in the woods by the jobber's clerk, and a deduction of from 5 to 10% is made for hidden defects. All logs are scaled by the company's scaler after being loaded on the cars, this scale being frequently checked by the jobber's clerk. The Doyle rule is used. No deduction is made for any defects in spruce, and but little is necessary in hemlock and other logs grown in the virgin forest where fire has not entered.

The mill scale overruns the log scale by from 10% to 15%, between eight and nine hundred feet as scaled on the cars cutting about 1,000 board feet at the mill. An experienced scaler and millman says that in using the Doyle rule in this region, the mill scale will overrun the log scale up to about twenty inches diameter at the small end.

The spruce and hemlock logs average very close to 4.5 to the thousand board feet. The fifty-foot bridge sticks average nearly one thousand board feet each. They are scaled as two sixteens and an eighteen-foot length.

Bark.—Bark is loaded at any time that suits best with the number of men available at the time. For this reason, and because the bark operations last only a short time, it is here treated as a separate operation, except that the items of office, blacksmith, etc., are entered under timber, and the cost of handling the bark is calculated without these items of expense.

The peeling season is from May 1st to August 1st, when contracts are let to from twenty to thirty men.

Two men work together, peeling about three cords for the two. A cord is 128 cubic feet or 2,000 pounds, and is produced in proportion to about 2,500 feet of lumber.

The contractor pays $2 per cord for bark peeled and $1 per thousand feet for timber cut. Two good men working together and cutting three cords between them may thus clear $6.75 per day apiece. But this is more than most of them do.

One man and two horses haul eight to ten cords per day, depending on the distance and roads. One car holds from six to seven cords, depending upon the care of the packers. With the bark beside the railroad, seven men load four cars per day. The Otter Creek Boom and Lumber Company pays the contractor $4 per cord for bark on the cars.

Cost of Bark.

		Per Cord.
Peeling:		$2.00
Hauling:		
1 Teamster at	$2.00 day	
1 Teamster board at	.60 day	
2 Horses board at	2.00 day	
2 Horses labor at	1.00 day	
	$5.60 for 9 cords	.62
Loading:		
7 men at $1.70 day	$12.00	
7 men board at 60c	4.20	
	$16.20 for 25 cords	.65
Total		$3.27

—to which must be added a small share of the expense of the office, etc.

Pulpwood.—Spruce pulpwood sticks are cut down to 4 inches diameter at the small end, 8 feet and 12 feet long. No figures were obtained for itemized costs here. The contractor said it cost about $3 per cord (128 cubic feet) to get it out and load it on the cars. Only a little pulpwood was got out at this camp.

Wages, Board, etc.

Board and lodging is furnished free to all the men. The scale of wages for the different jobs, and the average number of men at each is seen from the following table. Those marked (x) receive straight time, the rest losing bad weather days.

No. of Men.	*Per Day.*
1 Cook (x)	$3.00
1 Blacksmith (x)	2.50
1 Carpenter	2.50
1 Filer (x)	2.00
6 Sawyers	2.00
3 Choppers (Undercutters)	2.00
8 Teamsters (x)	2.00
4 Grab-drivers	2.00

6 Canthook men	2.00
1 Shooter (Dynamiter)	2.00
4 Road men (Roadsters)	2.00
1 Buck Swamper	2.00
6 Knot Bumpers (Limbers)	1.75
10 Swampers	1.50—1.75
2 Cookees (x)	1.50
1 Chore boy (x)	1.50
1 Scaler and Clerk at $60 per month	
1 Foreman.	
58	

In calculating the wages per month for those on a per diem wage, it must be remembered that taken throughout the year, the excessive precipitation of the region (it being second only to the Puget Sound region) reduces the work days to about twenty per month. Those paid by the month are paid for a month of thirty days. With these facts in mind, it will be found that the monthly wage totals $2,505, as shown below.

WAGES PER MONTH.

No. of Men	*Per Month*	*Total per Month*
1 Cook	at $90 per month	$90
1 Blacksmith	" 75 " "	75
1 Carpenter	" 50 " "	50
1 Filer	" 60 " "	60
6 Sawyers	" 40 " "	240
3 Choppers	" 40 " "	120
8 Teamsters	" 60 " "	480
4 Grab-drivers	" 40 " "	160
6 Canthook Men	" 40 " "	240
1 Shooter	" 40 " "	40
4 Road men	" 40 " "	160
1 Buck Swamper	" 40 " "	40
6 Knot Bumpers	" 35 " "	210
10 Swampers	" 34 " "	340
2 Cookees	" 45 " "	90
1 Chore boy	" 45 " "	45
1 Scaler and Clerk	" 60 " "	60
57	Total Monthly Wage	$2505

Board.—The board furnished the men is remarkable. The contractor very truly says that it costs but little more to feed well than to feed poorly, and that much better results are obtained by giving the men good, clean, wholesome food. The following list of supplies for one week was taken at random from several others, and is fairly representative of the kinds and amounts of supplies purchased, except that at the time this particular list was taken there were only about forty-five men in camp instead of the usual sixty or over. Of course the prices of these articles vary, as is also the case with the horse feed given below, but they average up pretty closely during the year.

To Run Camp of Forty-five Men for One Week.

1 tub lard	$6.50
1 sack turnips	1.85
1 sack onions	4.50
1 crate "	3.50
1 box yeast	.90
1 case cream	5.50
1 barrel sweet potatoes	4.50
7 sacks potatoes	14.35
1 case pears	3.60
1 case peaches	4.80
2 case eggs	16.80
1 case tomatoes	2.88
1 basket tomatoes	1.75
2 baskets tomatoes	1.50
1 barrel apples	4.50
1 case apples	2.25
11 2 ℔ cabbage	2.24
1 case corn	2.40
22 ½ ℔ cakes	3.38
11 basket cakes	1.75
10 ℔ tea	4.00
2 cases strawberries	4.80
2 barrel P. B. flour	14.50
10 baking powder	5.00
5 baking powder	2.50
1 box washing powder	6.00
Total	$116.35

Fresh Meat For One Month.

1907	Sept.	4,	300 ℔s. beef at 8 cents	$24.00
"	"	7,	295 " " " " "	23.60
"	"	11,	240 " " " " "	19.20
"	"	14,	240 " " " " "	19.20
"	"	18,	295 " " " " "	23.60
"	"	21,	230 " " " " "	18.40
"	"	25,	290 " " " " "	23.20
"	"	28,	215 " " " " "	17.20
"	Oct.	2,	65 " " " " "	5.20
			Total	$173.60

The above list gives an insufficient idea of the character of the meals served. As seen from the scale of wages, the cook is paid $3 per day, and must of necessity be a good one. He is given two helpers, or cookees, each at $1.50 per day. These three men are the first to rise in the morning and the last to bed at night. No pains or expense are spared to have plenty of everything, and everything of the best. For instance, there is Shredded Wheat, Grapenuts, and Force on the table all the time, and in addition, oatmeal is served for breakfast. Tea, coffee, milk and cream for every meal. Fresh and salt meat for nearly every meal, with eggs two or three times a week. Fresh vegetables all the time. Various kinds of pickles and dressings, wheat bread always, and either hot corn bread, hot biscuits, or hot rolls for dinner and supper every day. Apple sauce, preserved pears or peaches, and jelly is always on the table, while a barrel of apples is always open to anyone. Mince, apple, strawberry, huckleberry, apricot, raisin and peach pies take their turn for dinner and supper, with often some kind of pudding besides. Cookies are always before you, while about twice a week the cook bakes a layer cake—jelly, icing or chocolate, as the case may be. Indigestion was not an uncommon malady!

The cost of boarding, including the wages of the cook and cookees, averages fifty-three cents per day per man. This is for a working camp of fifty-five men. But there are three crews or parts of crews to every camp—those coming to camp, those at work, and those leaving camp. For, the lumber jack is restless and above all, a critic, and if things are not to his liking he is very brief in "histeing his turkey." These men, then, the comers and goers, increase the cost of board to the contractor about seven cents a day for each of the fifty-five or sixty-five men at work, so that in cost accounting it is necessary to figure board at sixty cents per day per man.

Feed.—The following is the average monthly consumption of twenty horses:

8 tons hay at	$26.00	$208.00
500 bushels oats at	.67	335.00
20 sacks bran at	1.50	30.00
Total		$573.00

Thus it is seen that the cost per day for the twenty horses is $19.10, or taking into account medicines, wear and tear, etc., approximately $1 per day per horse.

MISCELLANEOUS.

Each man's name, the number of days worked, the rate per diem, and the supplies which he purchases, all time checks issued, the number, the amount, to whom and when due, are kept by the contractor's clerk; also the number of logs loaded, the number of cars and the scale of each, the number of cars of bark and of pulpwood and the costs of these various operations. The report of each day's output in board feet, bark and pulpwood is sent in the following day to the company's office at Hambleton.

The regular pay day is the Saturday following the fifteenth of each month. On this date, upon request, time checks are issued, and are payable for work done up to and including the last day of the preceding month. If one wishes his money for work done since that time, he is given a check which is not due until the pay day the middle of the following month, but which he may have cashed at any time before then at 5% discount. These checks are payable at the company's office in Hambleton.

A collection at the rate of 75 cents per month is made from all men who work in any of the company's camps for four days or longer. Fifty cents of this goes to pay the company's doctor, and, in case of injury where hospital service is not necessary, to furnish all medicine, board and lodging until recovery. If the patient has to go to the hospital, he is sent to the best one in Elkins, West Virginia, and 25 cents of the above goes to the company toward a fund for the payment of these hospital dues, which run from $10 to $15 per week. The other 25 cents is set aside as a reserve fund to pay the expenses of any one hurt who has not worked as long as four days for the company.

The payment of this medical fee is not required of the men. But if they do not pay it and are injured, they have to pay the company $10 if an engine has to be sent to the woods for them, besides the $10 to $15 per week while in hospital.

Every Wednesday and Saturday the company delivers provisions to the camp. Mail is also brought at these times from the postoffice at Hambleton, and any supplies which may be ordered. The company runs a mercantile store at Hambleton, the various jobbers ordering clothing, tobacco, etc., from there and selling at cost to the men. The merchandise account being then deducted from their wages.

Summary.

Below is found in condensed form, the cost of each operation in getting out the timber, the cost of bark operations, and of pulpwood:

Timber:

	Per M.
Roading and swamping	$0.87
Sawing	.95
Skidding	1.76
Loading	.35
Office	.08
Extras	.24
Total	$4.25

Hemlock Bark:

	Per Cord
Peeling	$2.00
Hauling	.62
Loading	.65
	$3.27

Spruce Pulpwood:

	Per Cord
Sawing and Skidding	$3.00

As supplementary to the foregoing, the following summary as given at the Hambleton office, of the total cost of manufacturing the lumber, is added. This was for January, 1907, the total for this month being $2,205 per thousand higher than the cost per thousand for all of 1907.

Stumpage for spruce and hemlock in most cases is about $3.50 per thousand; for hardwoods, about $4 per thousand.

COST PER M. OF MANUFACTURED LUMBER.

	Per M.
Logging (including stumpage)	$7.60
Railroad construction	.86
Yarding	.89
Yarding expense (repairs, new track, etc.)	.12
Milling	1.64
Log train	1.67
Office	.15
General expenses, attorney, taxes, etc.,	.03
	$12.96

MARKING WESTERN YELLOW PINE.

By Theodore S. Woolsey, Jr.

When the Forest Service first took over the administration of the National Forests, little detailed attention could be given the marking of timber by executive officers; it was left almost entirely to green, untried technical assistants, and more frequently to the rangers themselves. Too heavy cutting resulted, and the need for detailed instructions and marking rules was keenly felt. Now there are general instructions for marking for every forest in the United States, divided according to the silvicultural regions. Western Yellow Pine naturally falls in the Western Yellow Pine region, southern division.

But now that these instructions have been drawn up, it seems that the next progressive step will be personal marking by executive officers; plans are being formulated for sample marking on each National Forest in the Third District. Of course, this cannot be done all at once and must come about gradually. Before any large sale commences, however, it is planned to have representative areas marked by the Chief of Silviculture and the District Forester in connection with the local officers. In other words a marking board has been formed, in order that the results may bear the consensus of approval of the officials in the district most directly concerned. In the past, local rangers have complained that one visiting officer advises one method, while another suggests something else; naturally this has resulted in considerable confusion. By having the marking commenced by a board of officers it is thought that this subsequent confusion and criticism can be done away with to a large extent; gradually, instead of referring to paper instructions, reference can be made to representative areas on each forest. For example: a supervisor will be instructed to mark the John Doe timber sale in accordance with the methods employed on Sections 3, 4 and 5, T 22 N, R 6 E, Coconino National Forest. Of course, this may properly be supplemented by a brief and specific reference to the existing marking rules, but in the main, the technical assistant and supervisor would follow the actual marking that has already been done which has proved satisfactory. Those of the Forest Service who were engaged in the early co-operative work will remember that similar methods were gradually introduced in advising the forest management of private woodlands; the first few years there were merely paper instructions which were supposed to be followed out by the owners; then, gradually, these instructions were supplemented by actual marking on the ground. This latter method, I believe, was found to be by far the most satisfactory and productive of actual results.

In Europe, where the art of marking is far advanced, detailed instructions on paper would be more or less a matter of amusement to the officers in charge. The marking policy of each silvical type is, of course, well understood, but the actual choosing of trees still, and always will, demand the direct supervision of the officers in charge, although it may be executed by particularly well trained rangers, where there are no complications. It is well recognized, I think, in Forest Service work, that the actual selection of individual trees can lose or save many hundreds of dollars in each million feet marked. This statement, I feel sure, will be borne out by subsequent inspections, particularly as soon as the results of marking can be more thoroughly investigated. Detailed observations by means of sample plots will be instituted in order to get an accurate line on whether present methods are satisfactory.

The general silvical principles of marking, as laid down in the 1909 "Use Book," are well known. These may be summarized:

Mature, over-mature and defective trees should be marked unless needed for seed; thrifty, rapidly growing trees of desirable species should be reserved; mark lightly where windfall is probable, or where timber is needed for watershed protection,* or to prevent erosion.* Each tree should be left with its crown free enough for vigorous growth. Suppressed trees should be marked. Even if reproduction is present for safety in case of fire, seed trees must be left. Trees on the edge of openings should be left on the side from which the prevailing winds blow. Isolated trees of desirable species should be left. "If in doubt whether a tree is needed for either seed or protection, leave it. If in doubt whether a defective tree should be classed as merchantable, mark it."

* The practical value of forest cover in these directions has been questioned.

In addition, the following instructions which supersede the old diameter limit methods have been issued for the Western Yellow Pine type. For convenient reference, these have been divided numerically into a number of paragraphs in order that each one may be referred to specifically.

Pure Western Yellow Pine Type.

(1.) "Yellow Pine stands are naturally open and on much of the land included in this type, the ground is now but partly and insufficiently stocked with young timber. In many cases the forest maintains itself as against chaparral with difficulty, and reproduction depends largely upon the protection against evaporation. This makes a selection system of marking obligatory. A conservative policy is especially advisable since the areas of forest are constantly becoming more accessible to market and there is every indication of a strong future demand at greatly increased prices.

All marking, then, should be by a conservative selection system. But the exact form of cutting must be decided according to the nature of the stand. Two conditions ordinarily present themselves:

(2.) Where there are young trees present and a second cut can be obtained in about forty years, sales should rarely be made. In such cases at least one-third of the trees at present large enough to be merchantable must be left for a future cutting. This means that at least 1,500 or 2,000 feet should be left to the acre, and, in heavy stands, more—up to one-third of the total stand. No sales should be made in stands so open that 1,500 feet can not be left and the logging be done at a profit. Leave all "black jacks" unless plainly undesirable from serious unsoundness or overcrowding, or so misshapen that they will not develop into valuable timber trees. In general, leave all thrifty trees which will plainly be much more valuable at the time of another cutting.

(3.) Where the stand is composed wholly of mature or overmature timber, or with only very scattering "black jacks" or healthy young yellow pines, it will be necesary to start a new crop from seed, and consequently in any cutting enough seed trees must be left to seed up the area amply. Before marking any tree for removal, therefore, be sure that it is not needed for seed, for the best trees for producing seed, irrespective of size, must be left. Young, thrifty yellow pines or large thrifty "black jacks" with full crowns make the best seed trees. "Enough seed trees" usually means from two to five to the acre, the number varying with the seed-bearing capacity of the trees. If young trees that are just beginning to bear cones are left, at least five are needed to the acre. From two to four seed trees are enough if they are old and have large, spreading crowns and are wind-firm. The trees left should, wherever possible, be distributed in small groups. This makes them more secure against windfall, and conforms to the grouping tendency of the western Yellow Pine. Leave enough seed trees even where the seedling growth is good, in order to ensure reseeding in case of fire. This method is, at best, unreliable, and should be used only in extreme cases.

(4.) These two conditions grade into each other, and the exact method of marking to be used will require nice adjustment on the part of the Forest officer. Arbitrary rules are useless. It is well, however, never to make an opening for more than one-quarter of an acre in the forest, nor to enlarge a natural opening to a greater size, even if the trees left are mature and partially unsound, unless good reproduction is already well established.

(5.) On all of the drier portions of this type, slash should be lopped and scattered over the openings on the cut-over area. This material will aid reproduction by protecting the soil from evaporation and by gradually forming humus. Where there is danger from fire, the brush should be piled and burned on a strip approximately 200 feet wide, around the area where the brush is scattered. Where the danger from fire is extreme it may be necessary to pile and burn all the brush."

The necessity for conservatism in marking Western Yellow Pine in the southwest is well known on account of the drying influences of the wind and sun, and the open character of the stand. It has been particularly emphasized where the Western Yellow Pine borders the woodland type. Here definite rules are in effect that no cutting be allowed where the virgin forest amounts to less than 2,000′ B. M. per acre. In addition, a general rule has been promulgated that at least one-third (see paragraph 3) of the present stand be left for seeding, second cut, and protection of the soil. At present the only criticism of a very conservative policy is from the lumberman's viewpoint; in order to have a successful sales administration it is vital that the legitimate interests of lumbermen be recognized, consequently, where a very light cut would yield only a loss on account of the expense of building roads, the necessary reduction in stumpage rates should be provided for. This is certainly preferable to sacrificing silvical methods.

A selection system is certainly advisable, if not followed too literally. Some officers have erroneously secured the impression that seed trees should be distributed over the cutting area with absolute precision. In other words, the quality of the seed trees obtained has been in some cases sacrificed in order that the distribution may be uniform, and it is often at serious cost that this uniformity is secured. It seems to me far better to secure the proper quality of seed trees, even if distributed in groups and even if small openings have to be made. Sacrifice uniformity in order to secure quality.

Where there is an excellent stand of "black jack" (Western Yellow Pine usually under 150 years old with typical black bark) marking is comparatively simple. It is often sufficient, in stands of this character, to cut most "yellow pine" and leave all "black jack," except those that are defective or in need of thinning. This often means that only half the stand is actually removed, but the mature trees yield a far better profit to the lumberman, and the young, thrifty "black jack" that are bushy, costly to trim, and hence expensive to log, are not desired by the average purchaser. On the Coconino Forest, an actual exchange of mature "yellow pine" for "black jack" has been arranged between the Forest Service and two local companies controlling all timber on certain railroad sections which had been deeded to the Government with timber rights reserved. In this case the Service gives fully mature "yellow pine" rapidly declining in value and in vigor, and receives in return healthy, rapidly growing "black jack" of equal scale that are rapidly increasing in value.

The marking problem in stands composed wholly of mature or over-mature timber, with only scattering "black jack," is much more difficult. Here the question arises whether to sacrifice present receipts, or possible reproduction from the seed of over-mature trees, protection of the soil, and a second cut forty or fifty years hence. Without taxes to pay, and with a large per cent. of over-mature timber, it is naturally more profitable to the Forest Service to cut rapidly virgin stands, and to leave sufficient for a second cut. Here, again, the lumberman would complain that his own immediate profits are being sacrificed to a problematical cut forty or fifty years from now. In these mature stands, however, the vital problem of detail has been the determination of the number of mature and over-mature trees to leave. There have been two arguments: one school of markers claims that trees plainly over-mature, possibly stag-headed, or with signs of decline in the crowns, should never be left. They fear that the seed from these trees has not the same vitality as the younger growth, that windfall is invited, insect attack encouraged, fungus growths given an advantage, and that reproduction will not be increased; that the protective value of these tall, over-mature trees is slight, and that much better natural reproduction would be secured by felling these over-mature trees, scattering the brush, and thus encouraging reproduction from neighboring stands. Seed in the southwest can be distributed great distances on account of the snow crust which enables the winged seed to be blown until it finds a resting place, possibly in the scattered brush. It is agreed, however, that on the edges of the parks and where windfall is likely, that apparently healthy, mature trees should be left in groups; particularly where they have proven windfirm by past isolation or exposure. The other school feels that where an opening of an acre or so will be made that even stag-headed, over-mature Western Yellow Pine should be reserved for the protection of the soil, to secure possible reproduction, on account of preserving forest conditions, and because officers on the ground cannot be trusted to discriminate in marking. This policy would, of course, reduce legitimate receipts from National Forests which should not be lessened without good cause. Can a problematical chance of getting reproduction be considered "good cause?" Can the lumberman's profit be fairly reduced by saving such over-mature seed trees of doubtful character? A Bavarian forester who recently visited this district, and who discussed this problem quite thoroughly, believed that the reservation of over-mature and partially stag-headed trees should under no condition be permitted. He applied the German word "Unsinn" (nonsense) to marking of this kind. He felt that the receipts secured from the sale of these over-mature trees could more properly be employed in actual planting; that in the end far better results would be secured. Personally, I agree with the Bavarian forester, except that natural reproduction be given a trial under conditions made more favorable by the proper scattering of brush, provided the fire danger is not too great.

The literal enforcement of the rule that at least one-third of the stand must be left has not worked well. The poor results from such an arbitrary rule have been plainly emphasized by recent windfalls on the Coconino. Long-boled Western Yellow Pine with scanty crowns were necessarily left under a strict adherence to this rule. Naturally the result has been disastrous windfall and consequently material losses in receipts. This seems to emphasize the impossibility of making ironclad rules, even if prompted by the necessity of emphasizing the need of great conservatism in marking.

A recent seed test has further emphasized that the seed from over-mature trees has not the same germinative power as has the seed from young, healthy trees, and this is recognized in European marking. According to comparative seed tests between "yellow pine" and "black jack" 68.4 per cent. of the seed from "yellow pine" (11 trees) germinated, while 83.3 per cent. germinated from "black jack" (9 trees). Although the number of trees is too small to give conclusive results, yet it indicates a difference of 14.9 per cent. in favor of seed collected from "black jack" at the end of twenty days' germination. The "yellow pine" from which the seed was collected averaged approximately 330 years, and the "black jack" approximately 131 years.

An arbitrary rule that "an opening of more than one-quarter of an acre in the forest should never be made" cannot be followed on the ground, but might be justified on paper, in order that rangers should be taught to be conservative.

The writer heartily endorses the scattering of slash as a matter of protection to reproduction, and in the southwest special care should be taken to scatter it *densely enough,* so as to give *real protection.*

The writer feels that the solution of the marking problem will be accomplished chiefly by personal marking by the very highest officials in the Forest Service, and that paper instructions are, at best, a poor substitute. This belief is gradually becoming universal.

BRIEF NOTES ON MEXICAN FORESTS.

By Max Rothkugel.

On a trip through Mexico and Central America the writer had a chance to spend two weeks in the timbered section of the Sierra Madre in the State of Durango. Along the Mexican Central Railway between El Paso and Mexico City one passes through a barren arid country without any tree growth. The timbered area is confined to altitudes above 8,000 feet which, in the Sierra Madre, lie between the Pacific Coast and the Mexican Central Railway.

The Sierra represents a mountainous high plateau. The first tree growth commences in the foothills of the Sierra at an altitude of about 6,000 feet, and consists of Huitzache, a small scrubby tree with leaves like cypress, which gives these foothills the appearance of an old apple-tree orchard. Above this scrubby forest commences the Pino-Longleaf pine type at an elevation of about 8,000 feet. It was rather surprising to find longleaf pine forming a type with Piñon Pine. The Piñon pine reaches the size of one and two logs per tree. At an elevation of about 9,000 feet commences the commercial timber consisting mainly of Western Yellow Pine* and a white pine not identified. Interspersed are Shortleaf, Western White Pine, and also, I believe, Loblolly Pine.* Douglas fir occurs in cañons. The ordinary pine stands average about 3,000 feet B. M. but there are large areas of pine where they cut up to 9,000 feet per acre. Such a locality of a good pine stand is near Salto where a new railroad is under construction from Durango to tap this rich timbered section. This timber has been bought by Americans, probably for $1.00 gold per acre (which is $2.00 Mexican money). The timber tracts for sale in Mexico are usually very large, from 100,000 acres up, belonging to estates or Spanish land grants. The prices of tracts already in the hands of American speculators are held at from $1 to $4 gold per acre.

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* These pines are undoubtedly improperly identified. The classification of Mexican pines is still somewhat uncertain, but *P. Montezumae* and *P. Arizonica* are probably the most common.—Editor.

Generally speaking, the Mexican pine forests are what we would call here still inaccessible or in other words, not yet ripe for profitable logging under present market conditions. For an immediate logging proposition I do not consider the requirements of large Mexican timber holdings as a very splendid investment on account of the great amount of money needed at the start for railway construction to reach the timber, and on account of labor conditions and present market prices of lumber, as long as American lumber can be sold as cheap as Mexican. But if stumpage can be secured for 30 cents gold or less, and then be left alone for 10 or 15 years, a good investment may be made. Ground fires are frequent but do not do much damage to old timber in those altitudes; the damage being done to the reproduction only, which makes the investment on the old timber comparatively safe.

These pine forests extend in larger bodies on high altitudes through the southern part of Mexico and Central America. Around the snow clad mountains of the Popocatepetl and Iztaccihuatl (18,500 ft. high) the timber line seems to go as high as 16,000 feet. When the writer passed these mountains there were three different forest fires raging. In the interior of the Republic of Honduras is another larger body of pines more or less of interest for lumbermen.

Outside the pine forests of the high altitudes in the interior, which offer, a very pleasant temperate climate, are the tropical hardwood forests with mahogany, *Cedrela odorata* and many other valuable species, situated on the bottomlands and coast region. There are also large white oak forests between Mexico City and the Pacific coast which have been explored quite recently.

In general, the exploitation of the Mexican pine forests is just commencing. The market of these forests lies east of the Sierra Madre, which is fortunately the more accessible side. The largest lumber company is the Sierra Madre Timber & Land Co., which has concessions of 2,300,000 acres east of Chihuahua, with a mill of a daily capacity of 500,000 b. f., located 300 kilometers west of Chihuahua at the terminal of the Chihuahua al Pacifico R. R. The mill has never been operated to its full capacity but the output has averaged about 100,000 b. f. per day. This company has been newly organized this spring and is owned by Americans. Aside from this large concern, there are a few other small lumber companies. A very interesting logging operation is conducted with a permanently located overhead cable construction such as is used in modern mines in Peru to transport ore and people across cañons. In this case the logs and supplies are transported from the rim of the Sierra towards a point situated 1,500 feet lower, the terminal of the logging railroad. This length of the cable works is 2½ kilometers at a cost of $22,000. This lumber company is located about 200 kilometers north of the city of Durango at the terminal of the International R. R. in the Sierra de la candela. The logging itself is done in a very wasteful manner. The stumps are cut very high. The cuttings spread all over the area, leaving many places unfinished. The laborers are all Mexicans, receiving from 40 to 60 cents gold per day. At least half the amount of the wages must be spent at the commissary, but the most of them spend all their wages, and little cash money is handled on a pay day. The discipline in those camps so remote from civilization appears striking to an American. Any disobedience or drunkenness is punished at the camp by tying the man to a tree with his arms behind his back and making him stand on his toes, or else he is put into the camp jail. The foreman is a deputy sheriff and wears a pistol and a long sword (not to be confused with a machete).

The traveling on the Mexican Central from El Paso to Mexico City is very pleasant with Pullman facilities; the meals are served in the Pullman cars. The trip lasts three days without changing cars, and costs, including Pullman, $36.00. The trip from Mexico City over Vera Cruz to Salina Cruz on the West Coast of the Isthmus of Tehuantepec can be made in two days and costs, including Pullman, $21 gold. In a year from now, one will be able to travel from Mexico City to Guatemala City in Pullmans, a most interesting cosmopolitan city with about 100,000 inhabitants and a splendid climate. It is located 5,000 feet above the sea, which makes its climate very pleasant. During the evening one can wear an overcoat, although located 15 degrees north latitude.

Two hours ride on the railroad brings one into the land of real tropics with all its beautiful scenes and plantations. I recommend every reader to make a trip through Mexico. It is not necessary to know Spanish if one travels only to Mexico City as the conductors speak English, but further south without knowing the Spanish language, traveling may become uninteresting.

EUCALYPTS CULTIVATED IN THE UNITED STATES.

By C. Westergaard, Jr.

The following descriptions of the species of Eucalyptus mostly cultivated in the southwestern United States may satisfy the growing popular interest manifested in Eucalyptus culture. They are intended as a guide for the prospective Eucalyptus grower, and it is hoped that the information thus condensed will prove to be useful for quick and practical reference.

The descriptions are based on the work of recognized authorities in both this country and Australia, including such writers as A. J. McClatchie, Von Mueller, Abbott Kinney, and Elwood Cooper. Such other sources as experiment station reports, government reports, and leading newspaper and magazine articles have been freely consulted. Direct information has also been obtained by visits to different regions incidental to travel in connection with Farmers' Institute work.

1. E. amygdalina.

GIANT EUCALYPT, PEPPERMINT TREE.

Identification: *Leaves*—Varying from very narrow to lance-shaped. Said to have a distinct peppermint odor when crushed. *Flowers and Fruit*—Flowers small, 8 to 15 in compact clusters. Seed cases small and nearly top-shaped. *Bark*—Quite variable; being either rough and persistent or flaking off.

Growth: Among the tallest trees in the world. Reaches 400 feet in height and 18 to 35 feet in diameter. Second only to Sequoia gigantea. Very variable. Does not seem to do as well in California.

Wood: The timber not as valuable as that of some others. Not valued for fuel. *Durability*—Does not last well under ground. *Uses*—Said to be used for shingles, rails, and planking. An important source of eucalyptus oil. (Maiden)

Requirements: *Climate*—Prefers moist cool ravines. Does not thrive in interior valleys. Endures low temperatures, but not dry heat.

Places Grown in the West: Berkeley (?), Pasadena, Santa Barbara, Chico.

Facts of Special Interest: This tree yields the highest percentage of oil of all the eucalypts. Most abundant and largest growth in West Australia.

2. E. botryoides.

BASTARD MAHOGANY.

Identification: *Leaves*—Horizontally placed, rather large and thick, dark green shiny surface. *Flowers and Fruit*—Flowers stemless, 4 to 10 in cluster; stout flattened stalks; seed cases cup-shaped, or goblet-shaped; rather large. *Bark*—Of stem of young tree quite smooth. Bark of lower trunk of adult tree rough, usually persistent, grayish or brownish in color. Bark flakes off branches.

Growth: Reaches 75 to 100 feet in height. Grows rapidly while young.

Wood: Reddish color and close-grained. *Durability*—Posts 14 years old showed no signs of decay. (Mueller). *Uses*—Useful as a forest cover and for shade. Authorities disagree as to its value for timber.

Requirements: Climate—Prefers sandy situations close to sea coast. Does not thrive in a dry climate and will not stand low temperatures.

Places Grown in the West: Santa Barbara, Montecito, Los Angeles, Pasadena.

Facts of Special Interest: Said to do well at Santa Barbara and Montecito. Said to present a fine appearance.

3. E. calophylla.

Identification: *Leaves*—Broad, horizontally placed. *Flowers and Fruit*—Flowers unusually large for the genus, cream colored and in large clusters. Seed cases, urn-shaped, the largest of any eucalypt. *Bark*—Rough, grayish or brownish in color, persistent, deeply furrowed.

Growth: A moderate sized tree. (A specimen on the University campus at Berkeley seems stunted). The young seedlings hairy for some time.

Wood: *Durability*—Not durable under ground. *Uses*—Timber valuable in Australia, takes place of hickory. An important source of nectar for bees. (In California seed cases are sometimes polished and used for pipe bowls).

REQUIREMENTS: *Climate*—Thrives best in moist tropical climate. Does not endure a dry hot atmosphere. Very sensitive to extremes of heat and cold.

PLACES GROWN IN THE WEST: Santa Monica, Berkeley.

FACTS OF SPECIAL INTEREST: In California has succeeded only in warm coast regions. A specimen at Berkeley does not seem to do well.

4. E. citriodora.

LEMON-SCENTED GUM.

IDENTIFICATION: *Leaves*—The stem and leaf stalks of young seedlings, rough with short brownish hairs; pleasant odor resembling lemon. *Flowers and Fruit*—Flowers abundant, conspicuous, in compound clusters; flower buds nearly pear-shaped, the covering being nearly hemispherical. Seed cases egg-shaped or somewhat globular. *Bark*—Light colored, mottled by indentations where it has peeled off.

GROWTH: Handsome, tall, slender, fast growing. 60 to 100 feet in 10 to 15 years. Foliage mostly at summit.

WOOD: Grayish, brownish, or yellowish; flexible, strong, and durable. Value due to strength, elasticity, and beauty. *Uses*—Said to replace hickory in coach factories. Valuable for bees.

REQUIREMENTS: *Climate*—Thrives in frostless coast region. Not suited to dry interior valleys. Very sensitive to low temperatures.

PLACES GROWN IN THE WEST: Santa Monica.

FACTS OF SPECIAL INTEREST: Best adapted to low lying tropical and semi-tropical regions.

5. E. coryacea.

DROOPING WHITE GUM.

IDENTIFICATION: *Leaves*—Principal veins run lengthwise of leaf. *Flowers and Fruit*—Medium sized flowers in compact clusters. *Bark*—Smooth and grayish. Twigs and flower clusters sometimes adorned with a bluish white bloom.

GROWTH: Of medium size, rarely 75 feet high and 3 feet in diameter.

WOOD: Timber comparatively soft, splits fairly well but is rather brittle. On account of frost resistance it should make good forest cover. *Durability*—Said not to be durable under ground. *Uses*—Makes good fuel.

REQUIREMENTS: *Climate*—Will not endure drought or dry atmosphere even when watered artificially. Said to be somewhat resistant to frost.

FACTS OF SPECIAL INTEREST: In Australia it is reported to extend up to the permanent snow line. Grows from base to top of mountains.

6. E. cornuta.

YATE.

IDENTIFICATION: *Leaves*—On young tree oval, becoming longer as the tree grows older, thin in texture. *Flowers and Fruit*—Flowers large and conspicuous; deciduous covering of flower buds is very long and conspicuous. *Bark*—Of trunk never deeply furrowed, usually persistent but small patches may peel off. Color drab.

GROWTH: Tends to grow rather low and to be profusely spreading.

WOOD: Very heavy, hard, tough, and elastic. *Uses*—An effective low windbreak. Used also as a shade tree in California.

REQUIREMENTS: *Climate*—Endures hot summers of California and Arizona if roots are supplied with water. Also endures more rain than most eucalypts. 110° to 116° F. and 23° to 26° F. *Soil*—Prefers rich moist soil. Will make fair growth in poor soil.

PLACES GROWN IN THE WEST: Thrives on the coast. Endures hot interior if supplied with sufficient moisture. Berkeley, Santa Monica.

7. E. corymbosa.

BLOODWOOD.

IDENTIFICATION: *Leaves*—Leathery, varying from oval to lance-shaped. Frequently mottled with red; veins numerous, spread like a feather in characteristic manner. *Flowers and Fruit*—Bloom profuse; flowers white or cream color, above average size. Large seed cases, urn-shaped or egg-shaped, etc. Different from any other eucalypt. *Bark*—Grayish, or brownish and rough; wrinkled and persistent; upper branches smooth cream colored or reddish.

GROWTH: Of moderate size; may reach 100 feet. Reported as sometimes being stunted and shrubby.

WOOD: Easily worked when fresh, but very hard when dry, unsuited for lumber on account of Kino. *Durability*—Well adapted for underground work. Posts reported as 40 years old. *Uses*—Suitable for fence posts, useful for bees. Not considered a very good fuel.

REQUIREMENTS: *Climate*—Seems to do well near the coast. Does not thrive in hot interior valleys. Supposed to be sensitive to both severe frosts and high heat.

8. **E. crebra.**

NARROW-LEAVED IRON-BARK.

IDENTIFICATION: *Leaves*—Narrow, green on both sides, thin. *Flowers and Fruit*—Flowers very small; seed cases very small goblet-shaped, or cup-shaped; valves minute. *Bark*—Rough and persistent, hard, dark, and deeply furrowed.

GROWTH: A slender tree reaching 100 feet in height and 2 or 3 feet in diameter.

WOOD: Reddish with interlocked fibres, hard, tough, and elastic. *Durability*—Said to be durable under ground. *Uses*—Used for posts, ties, piles, bridges, and wagon work. High timber value; a valuable wood.

REQUIREMENTS: *Climate*—Endures a greater variety of climate than other iron-barks. Survives temperatures 18° to 20° F. and 110° to 118° F. *Soil*—Is reported to get along well in poor soil.

PLACES GROWN IN THE WEST: Fresno, California; Phoenix, Arizona.

FACTS OF SPECIAL INTEREST: Supposed to be well adapted to hillsides.

9. **E. corynocalyx.**

SUGAR GUM.

IDENTIFICATION: *Leaves*—On young trees oval or round; on mature trees nearly lance-shaped. *Flowers and Fruit*—Blooms profusely and at an early age. Flowers conspicuous. Produces flowers during several months of the year. *Bark*—

Left smooth by continuous flaking off; deep cream color on main stem, darker on branches; quite red on young twigs.

GROWTH: Grows a straight trunk with slight taper. Attains 50 to 100 feet in height, and a diameter of 5 to 6 feet.

WOOD: Very hard when dry. Warps very little in drying. *Durability*—Post set in ground reported sound at end of 15 years. *Uses*—Valuable for posts, ties, and timber, and for underground situations. Useful for felloes and naves of wheels. Valuable for bees.

REQUIREMENTS: *Climate*—Likes moisture but will endure a great amount of drought. One of the best trees for a desert region, but sensitive to frost. 20° to 25° F. and 110° to 115° F.

PLACES GROWN IN THE WEST: Wide range. Santa Monica, California; Glendale, Arizona; Sierra Madre.

FACTS OF SPECIAL INTEREST: Considered one of the best all around eucalypts. Very popular in Australia.

10. E. diversicolor.

KARRI.

IDENTIFICATION: *Leaves*—Attractive foliage, dark green above, paler below. *Flowers and Fruit*—Flowers, 4 to 8 in clusters with rather slender, somewhat flattened stalks. Seed cases egg-shaped or goblet-shaped. *Bark*—Grayish, commonly persistent.

GROWTH: Reaches a height of 400 feet. Grows faster than E. amygdalina. It is the second tallest tree in Australia. Basal diameters up to 20 feet. Trunk usually straight.

WOOD: Light color; bends freely, straight grain. Timber superior to blue gum. Authorities differ regarding value of the wood. The wood seems to vary. *Uses*—Grown for forest cover. Used for masts, wheelwright work, ship-building, spokes, shafts, felloes, and rails.

REQUIREMENTS: *Climate*—Thrives in a moist climate. Does not endure dry heat well. Said to be resistant to considerable frost.

PLACES GROWN IN THE WEST: Los Angeles, Pasadena, Berkeley.

11. E. eugenioides.

WHITE STRINGY BARK.

IDENTIFICATION: *Leaves*—Opposite and notched in seedlings. Later twigs smooth and leaves regular. Foliage quite dense. *Flowers and Fruit*—Flowers medium size in compact clusters. Seed vessels cup-shaped. *Bark*—Tenacious. Resembles American cedar. Color gray to tan.

GROWTH: Attains heights of 150 to 200 feet. Pleasing in appearance. Seedlings covered with soft hair.

WOOD: Pale colored. Splits readily, not liable to warp. Strong and durable. *Uses*—Useful for timber, fence rails, and posts. Bark used for roofing, mats, and strings. Leaves rich in oil.

REQUIREMENTS: *Climate*—Best adapted to a moderately humid region. Does not do well in too hot climates. Does best near coast. *Soil*—Is found on sandy and poor soil.

PLACES GROWN IN THE WEST: Pasadena, Santa Monica.

12. E. globulus.

BLUE GUM.

IDENTIFICATION: *Leaves*—Early leaves blue and opposite. Older leaves smooth, elongated, and alternate. Small twigs on young trees square, on old trees rounded. *Flowers and Fruit*—Warty protuberances on flower buds. Seeds larger than in most species of eucalypts. *Bark*—Usually peeling but sometimes persistent.

GROWTH: Grows to a height of 200 to 300 feet in Autralia. In California has attained a height of 150 feet in 30 years, and 50 to 75 feet, in 5 years. The fastest growing tree in the world.

WOOD: Pale in color, hard, heavy, and strong. Compares with hickory in hardness. Very liable to check badly unless carefully seasoned. *Durability*—Not very lasting under ground, but lasts well for piling in salt water. *Uses*—Used for fuel; used in manufacture of implements, tool handles, etc. Leaves a valuable source of oil.

REQUIREMENTS: *Climate*—Thrives well in moist warm climates, and quite well in warm dry regions. Endures temperatures between 27° F. and 105° F. Rather sensitive above and below these extremes. *Soil*—Wide range. Prefers river banks and alluvial valleys in Australia.

PLACES GROWN IN THE WEST: Found in most parts of California. Does not thrive at Chico, Cal. (Does not do well in Arizona).

FACTS OF SPECIAL INTEREST: The most widely grown and best known of all the eucalypts. Surpassed in height only by E. amygdalina and E. diversicolor.

13. E. goniocalyx.

Identification: *Leaves*—On young trees and on sprouts from trunk opposite, heart-shaped, and broadly oval. Leaves of adult, long and quite slender; both sides similarly colored. *Flowers and Fruit*—Flowers nearly stemless, in small clusters borne on flattened stalks. Seed cases nearly cup-shaped and usually more or less angled. *Bark*—Commonly persistent, but sometimes flakes off. The character of its surface varies.

Growth: Reaches a height of 300 feet and a diameter of 6 to 10 feet in Australia. At Coopers Ranch has reached a diameter of 8 to 18 inches in 20 years.

Wood: Hard and tough. Wood varies, pale yellowish to brownish color. Does not warp. Interwoven fibres make it almost as difficult to split as E. rostrata. *Durability*—Lasts well under ground. Said to be very durable. *Uses*—Used by wheelwrights, boat builders, and for general building purposes. Suitable for fence posts, ties, etc. Excellent fuel.

Requirements: *Climate*—Grows well in the coast regions of California. Ascends to 4,000 feet in Australia, hence a promising species for mountains of California.

Facts of Special Interest: Has not been tested in dry hot valleys.

14. E. gomphocephala.

TOOART.

Identification: *Leaves*—Thick, shining, rather leathery; upper surface darker than the lower. *Flowers and Fruit*—Flowers large and stemless in clusters on a flattened stalk. Seed cases top-shaped, bell-shaped, etc. One-half to three-fourths inch broad. *Bark*—Gray, rough and persistent, flakes off from branches. Twigs reddish yellow.

Growth: Rather stalky and symmetrical. Has reached 80 feet in 24 years at Santa Barbara.

Wood: Heavy, tough, and strong. Hard to split. One of the strongest timbers in the world. *Durability*—Very durable in all kinds of weather and in many different situations. *Uses*—Used for ship-building and bridges.

Requirements: *Climate*—Thrives along the coast and seems to do fairly well in dry interior valleys.

Places Grown in the West: Santa Barbara.

Facts of Special Interest: Has not been grown enough yet to determine its range.

15. E. gunnii.

CIDER EUCALYPT.

Identification: *Leaves*—Foliage dense and darker than most eucalypts. Frequently confined to ends of branches. Individual leaves said to be wavy or kinked suggesting flutina. *Flowers and Fruit*—Flowers medium size. Seed cases nearly top-shaped. *Bark*—Usually rough and brownish, continually flaking off.

Growth: Not usually tall, may reach 250 feet in Autsralia; 60 feet so far in America. Shrubby in alpine regions, trees sometimes crooked and irregular.

Wood: Too crooked in growth to make good timber. *Durability*—No good for underground work. *Uses*—Promises to be a good forest cover. Makes fair fuel. Excellent for charcoal.

Requirements: Climate—Said to be very hardy. Endures summer heat fairly well. Thrifty at 20° F.

Places Grown in the West: Santa Monica.

Facts of Special Interest: Grows at altitudes of 4,000 and 5,000 in Australia.

16. E. haemastoma.

WHITE GUM.

Identification: *Leaves*—Thick, usually lance-shaped, occasionally verging into oval forms. *Flowers and Fruit*—Flowers of medium size. Covering of flower buds rounded with an abrupt point. Fruits cup-shaped or goblet-shaped with brown or reddish rims. *Bark*—Commonly smooth, but sometimes rough and persistent.

Growth: Medium size. Usually erect and symmetrical.

Wood: Gray or reddish in color. *Durability*—Decays readily and not durable if exposed. *Uses*—Wood used some for fuel. Reported as of no particular value.

Requirements: *Climate*—Thrives near the coast. Not suited to the dry interior valleys. *Soil*—Claimed to do well in dry sandy situations, by Kinney.

PLACES GROWN IN THE WEST: Santa Monica.

17. E. hemiphloia.

GRAY BOX.

IDENTIFICATION: *Leaves*—Thick varying from oval to lance-shaped. Foliage dense enough to make a good shade tree. *Flowers and Fruit*—Flower cup sharply pointed. Fruit commonly goblet-shaped. *Bark*—Persistent and rough but never deep furrowed. Bark on branches stript.

GROWTH: In Australia reaches from 75 to 100 feet in height and 1 to 4 feet in diameter. At Coopers Ranch 80 feet in height and 18 inches in diameter in 20 years.

WOOD: Yellowish white in color; very heavy. Timber strong, hard, and not easily split. *Durability*—Post said to be sound after 16 years. Claimed (by Maiden) to be subject to dry rot. *Uses*—Used for mawls, wheelwrights' work, posts, piles, and ties. Makes good fuel.

REQUIREMENTS; *Climate*—Range of temperatures, 15° to 20° F. and 110° to 115° F. This tree appears to be adapted to a very wide climatic range. *Soil*—Said to be well adapted to dry sandy situations. (Kinney)

PLACES GROWN IN THE WEST: Pasadena, California; Phoenix, Arizona; Santa Monica.

FACTS OF SPECIAL INTEREST: Tree tends to become hollow at an early age.

18. E. leucoxylon.

SOUTH AUSTRALIAN BLUE GUM (McCLATCHIE), OR VICTORIAN IRON BARK, OR WHITE GUM (MUELLER).

IDENTIFICATION: *Leaves*—Foliage of a pleasing bluish cast Leaves scattered. *Flowers and Fruit*—Flowers grow in threes. Seed cases egg-shaped or globular. Flowers while young. May flower while leaves are in opposite stage. *Bark*—Smooth and light in color.

GROWTH: Rapid. Trunk has a tendency to be crooked and out of perpendicular. Seedling weak, disposed to recline on ground. May reach 100 feet in height.

WOOD: White, may vary to shades of light reddish brown. Always heavier than water. Very hard and strong. *Durability*—Durable. Lasts well both in water and under ground. *Uses*—Useful for forest cover, timber, and fuel. Attractive to bees. Highly prized by millwrights.

REQUIREMENTS: Climate—Wide range of climate; from coast to interior desert valleys. Grows on coast, plains, and foothills. Endures 15° to 20° F.

PLACES GROWN IN THE WEST: Especially thrifty at Santa Monica and at Phoenix, Arizona.

FACTS OF SPECIAL INTEREST: Has not been known to freeze. Claimed to be well suited to a limestone country. (K.)

19. E. longifolia.

WOOLLY-BUTT.

IDENTIFICATION: *Leaves*—Long, sickle-shaped. *Flowers and Fruit*—Bloom abundant during several months of the year. Seed cases bell-shaped, angular, growing in threes about one-half inch in length. *Bark*—Grayish tan-colored, rough and persistent, flakes off from branches. Twigs red or yellowish.

GROWTH: Tree of moderate size, but may reach 200 feet in height. Trunk straight.

WOOD: Timber not very strong; on account of gum veins not good for timber. *Durability*—Timber durable, but not very strong. *Uses*—Used for posts, ties, and paving; for fuel. Useful for bees.

REQUIREMENTS: *Climate*—Thrives near coast but not in hot interior dry valleys.

PLACES GROWN IN THE WEST: Claremont, Pasadena, Santa Monica.

20. E. macrorhyncha.

VICTORIA STRINGY-BARK.

IDENTIFICATION: *Leaves*—Of young seedlings, broad and oppositely placed. Young growth covered with short thick hair. Leaves of older trees thick and leathery. *Flowers and Fruit*—Flowers medium size in clusters, 4 to 10. Covers of flower buds distinctly conical or long pointed. Matured seed cases nearly spherical. *Bark*—Of trunk and branches, thick, fibrous, persistent, and usually of dark gray color.

GROWTH: Said to attain a fair height in Australia, but specimens in California have shown up well. Not symmetrical.

WOOD: Hard, durable, easily split. Some samples have indicated a good furniture wood. *Uses*—Wood used for fencing, lumber, shingles, and fuel. Promising as a forest cover. Bark used for strings.

REQUIREMENTS: *Climate*—Not suited to dry hot plains, but thrives on coast. A mountain species.

21. E. marginata.

JARRAH.

IDENTIFICATION: *Leaves*—From ovate to lance-shaped. Somewhat curved, thin to leathery. *Flowers and Fruit*—Flowers quite large, 3 to 12 on conspicuous stalks. Flower cap long and tapering. Seed cases globular or egg-shaped. Three-quarter inches long. *Bark*—Commonly persistent. Somewhat fibrous.

GROWTH: May grow to large size. Few American specimens over 30 feet. In Australia up to 100 feet high and 10 to 15 feet in diameter.

WOOD: Red in color, takes good polish. May be used for furniture. Is rather too brittle for architectural work. *Durability*—Very durable under ground. Exceptionally resistant to teredo and in water. *Uses*—Much prized in India and Australia for piles and ties.

REQUIREMENTS: *Climate*—So far has not been found to thrive well anywhere in America, either on coast or inland.

PLACES GROWN IN THE WEST: Cahueuga.

FACTS OF SPECIAL INTEREST: Not relished by borers and white ants. Has made poor growth at Santa Monica and Pasadena.

22. E. melliodora.

YELLOW BOX.

IDENTIFICATION: *Leaves*—Of young trees oval or oblong, of older trees lance and sickle-shaped; both sides dull green. *Flowers and Fruit*—Flowers of medium size growing in compact clusters on short stems. Seed cases nearly egg-shaped with small end cut away. *Bark*—Outer bark brownish gray and commonly persistent. Inner bark yellow. Branches usually smooth.

GROWTH: Trees usually of medium height. Said to attain 250 feet, and diameter of 6 to 8 feet. Trunks commonly crooked and gnarled.

WOOD: Timber very hard, tough, and durable; not easy to split. Wood of yellowish color. *Durability*—Durable both above and under ground. *Uses*—Used for spokes, naves, cogs, and heavy frame work. Used for telegraph poles, posts, etc. An excellent fuel. A good source of honey.

REQUIREMENTS: *Climate*—Wide range of climate. Will grow near coast on plains and foothills, and in warm, dry interior valleys. *Soil*—Prefers a fairly fertile soil in order to do well.

PLACES GROWN IN THE WEST: Santa Monica.

23. E. microtheca.

COOLIBAH.

IDENTIFICATION: *Leaves*—Foliage dense and inclined to droop. Leaves long and somewhat curved, dull green. *Flowers and Fruit*—Flowers very small, 3 to 8 in cluster, which usually grow in groups. Seed cases very small, broadly top-shaped, valves protruding. *Bark*—Of trunk rough, generally furrowed, commonly persistent, brownish gray color.

GROWTH: Tree of medium size, generally crooked, attains heights of 50 to 80 feet and diameter of 2 to 4 feet. The few growing in America have erect trunks and promise to become fairly large.

WOOD: Dark red or brown, excessively hard and interlocked. *Uses*—Promises well for a forest cover. Furnishes excellent all around timber. Useful for bridges, ties, posts, buildings, and for cabinet work.

REQUIREMENTS: *Climate*—Indigenous to dry, hot deserts. Will stand 127° F. in shade, and even 156° F. Endures heavy frosts. This tree promising under desert conditions. *Soil*—Does best in gravelly, well drained soil.

PLACES GROWN IN THE WEST: Has grown well wherever tried in California.

FACTS OF SPECIAL INTEREST: Roots at times a source of water in dry interior of Australia.

24. E. obliqua.

MESSMATE.

IDENTIFICATION: *Leaves*—Of young tree broad, narrow on older trees, thick, stiff, and unequally sided toward the base. *Flowers and Fruit*—Flowers medium sized, very short stem, stalks slender, slightly compressed. Shape of mature seed cases that of an egg with small end cut away. *Bark*—Grayish, fibrous, and persistent on trunk and branches.

GROWTH: Tree straight stemmed. May attain a height of 300 feet with diameter of 10 feet. According to Maiden a rapid grower.

WOOD: Straight, easily split. *Durability*—Said not to be durable under ground. *Uses*—Wood used for fence, palings, and shingles. The bark has been used for paper making.

REQUIREMENTS: *Climate*—Grows well near coast, does better a little inland. Does not endure drouth, or the dry inland valleys. *Soil*—Will thrive in light, barren soil.

PLACES GROWN IN THE WEST: Los Angeles, Santa Monica.

25. E. occidentalis.

FLAT-TOPPED YATE.

IDENTIFICATION: *Leaves*—Of medium size, quite thick and shiny. *Flowers and Fruit*—Flowers large and conspicuous, stalks of clusters flattened, and flower stems angled. Seed cases bell-shaped or pear-shaped. *Bark*—May be persistent, or cast off in flakes. Branches smooth and white. Small twigs reddish brown.

GROWTH: Individual trees vary. Frequently shrubby, 10 to 30 feet in height. In Australia, tree-like, under favorable conditions attaining 100 feet. Tree flat-topped in appearance.

WOOD: Timber hard and strong. *Durability*—Said to be durable.

REQUIREMENTS: *Climate*—Thrives near coast where temperature does not get below 25° F. Also thrives inland, but will not even endure 25° F. then.

PLACES GROWN IN THE WEST: Santa Monica, Santa Barbara.

FACTS OF SPECIAL INTEREST: A valuable tree. Well suited to California. (Kinney)

26. E. paniculata.

WHITE IRON BARK, OR RED IRON BARK.

IDENTIFICATION: *Leaves*—Of medium size, commonly lance-shaped, or somewhat curved. *Flowers and Fruit*—Flowers abundant, below medium size, 3 to 8 on rather slender angled stalks. Seed cases from low cup-shaped to goblet-shaped. *Bark*—Of trunk grayish brown and usually hard and rough, flakes off in some cases.

GROWTH: Tree usually below medium size. May reach 100 feet in height, usually 25 to 30 feet. Not promising in United States.

WOOD: Dirty dark brown in color. Timber hard, durable, and considered very valuable. *Uses*—Much used for posts, bridges, sleepers, and carriage work.

REQUIREMENTS: *Climate*—Does not endure heat and drought well. Grows fairly well near the coast and in mountains.

FACTS OF SPECIAL INTEREST: Barely survived the drought at Santa Monica. 1899-1900.

27. E. pilularis.

BLACKBUTT.

IDENTIFICATION: *Leaves*—Scattered, nearly lance-shaped. *Flowers and Fruit*—Flowers of medium size, 4 to 16 in clusters, bud coverings conical. Seed cases nearly spherical, or the shape of the broad part of an egg. *Bark*—Of lower part of trunk dark gray, rough, and partially persistent, but from most of the trunk it flakes off.

GROWTH: A well shaped tree that may attain 300 feet in height and a diameter of 15 feet. Usually about 100 to 150 feet and 3 to 5 feet in diameter. Grows fairly well in California. Inclined to be tall and slender.

WOOD: Of a yellowish color. Considered one of the best all around trees for timber. *Durability*—Fence posts reported to have lasted 20 years. *Uses*—In demand for telegraph poles and ties. Very good for honey.

REQUIREMENTS: *Climate*—Does not thrive in the dry, hot interior valleys. Endures neither very high nor very low temperatures.

Places Grown in the West: In America grows quite thriftily at and near the coast. Santa Monica.

Facts of Special Interest: Wood has a tendency to warp when exposed to the sun, hence rather difficult to season.

28. E. piperita.

WHITE STRINGY-BARK.

Identification: *Leaves*—Of adult, variable from broadly lance-shaped and very unequally sided to a narrow lance-shaped and quite straight leaf. *Flowers and Fruit*—Flowers of medium size, 6 to 12 in compact clusters. Seed cases nearly spherical or like broad part of an egg. *Bark*—Grayish bark of trunk fibrous and persistent.

Growth: Tree erect, shapely, and attains considerable height. Young seedlings clothed with distinct hairs.

Wood: Color of wood red. Timber splits readily, checks badly in drying. Is difficult to work. *Durability*—Is reported to have kept sound in damp ground for 40 years. *Uses*—Used for fencing and general building purposes.

Requirements: *Climate*—Does not endure dry hot climates, and will not stand heavy frosts.

Places Grown in the West: Makes a rapid growth near the coast and in cool inland situations.

29. E. polyanthema.

RED BOX.

Identification: *Leaves*—Trees of a spreading habit, characteristic foliage. Leaves roundish, broadly egg-shapped. *Flowers and Fruit*—Bloom profuse and dainty, flowers considerably below average size and arranged in branching clusters. Seed cases somewhat top-shaped and with their stems are quite distinctly goblet-shaped. *Bark*—Of trunk and branches persistent. Somewhat furrowed, grayish in color.

Growth: Tree of medium size, may reach 250 feet. Not a rapid grower. Few American specimens over one foot in diameter.

Wood: Timber very hard, strong and durable. *Durability*—Claimed to be durable, though stems become hollow with age. *Uses*—Used for ties, cogs, wheels, etc., used for fuel. Valuable as honey pasture. A pleasing shade tree. Wood so hard that it is difficult to work.

REQUIREMENTS: *Climate*—Thrives throughout a wide range. Has shown itself drought-resistant at Santa Monica. Endures 15° to 20° F. and 110° to 118° F.

PLACES GROWN IN THE WEST: Santa Monica, Berkeley, Pasadena.

FACTS OF SPECIAL INTEREST: This tree has many points in its favor, besides its attractive appearance.

30. E. populifolia.

POPLAR-LEAVED BOX.

IDENTIFICATION: *Leaves*—Scattered, on rather long stalks, roundish, rather egg-shaped, shiny and deep green on both sides. *Flowers and Fruit*—Flowers very small, 3 to 12 in cluster, on short stems. Lid of flower hemispherical. Seed cases small and nearly top-shaped. *Bark*—Wrinkled, rather furrowed and persistent.

GROWTH: Of medium size and somewhat resembling E. polyanthema.

WOOD: Gray or light brown in color. Tough, strong, and hard to work. Over 50 per cent. of the wood unsound. Takes a good polish. *Uses*—Reported to make good posts. Others claim it to be inferior even for burning. Not well known.

REQUIREMENTS: *Climate*—Thrives in dry situations in California. Said to promise well for the dry interior.

31. E. punctata.

LEATHER JACKET.

IDENTIFICATION: *Leaves*—Lance-shaped or sickle-shaped, and thin. The under surface somewhat paler than the upper shiny one. *Flowers and Fruit*—Flowers above medium size, in clusters of 3 to 10 on rather stiff flattened stalks. Seed cases shaped nearly like the broad part of an egg. *Bark*—Dark in color, rough and with a tendency to flake off.

GROWTH: Tree of medium size. May reach 100 feet in Australia. Of spreading habit.

WOOD: Pale reddish brown, tough, hard, close-grained, difficult to split. *Durability*—Wood durable both above and under ground. *Uses*—Used for fence posts, railway ties, parts of wheels, etc. Makes excellent fuel.

REQUIREMENTS: *Climate*—Thrives at and near the coast; does not do well in the interior.

32. E. resinifera.

RED MAHOGANY.

IDENTIFICATION: *Leaves*—Slender, somewhat curved, paler beneath than above; leathery in structure. *Flowers and Fruit*—Flowers of medium size, 4 to 10 in cluster; buds distinctly cream colored, lids conical with tapering points. Seed cases cup-shaped or bell-shaped. *Bark*—Of trunk dark, reddish, fibrous, and persistent resembling that of the stringy barks.

GROWTH: Of fair size, erect and symmetrical. May reach 100 feet in height.

WOOD: Said by some to be of a rich, red color. The term mahogany considered a misfit by good authorities. *Durability*—Reported to last well under ground. *Uses*—Used in Australia for piles, posts, paving, shingles, and general building purposes. Considered by some as good furniture wood. Used for forest cover and shade.

REQUIREMENTS: *Climate*—Grows well in coast region of California, but does not thrive in interior valleys. It is reported as neither resisting frosts nor very high temperatures.

FACTS OF SPECIAL INTEREST: Best adapted to moist, semi-tropical climates.

33. E. robusta.

SWAMP MAHOGANY.

IDENTIFICATION: *Leaves*—Large, leathery, sometimes 6 inches long by 2 inches wide, upper side dark green, lower side paler green. *Flowers and Fruit*—Flowers cream colored, abundant, 3 to 10 in clusters on stout usually flattened stalks. Seed cases goblet-shaped, or sometimes urn-shaped. *Bark*—Rusty gray, usually wrinkled, furrowed, and persistent, flakes off frequently on branches, leaving branches smooth.

GROWTH: Tree of medium size. In Australia reaches 100 feet in height and 4 feet in diameter. In California 50 feet high and 1 foot in diameter. Of spreading habit.

WOOD: Of reddish color, hard to split, not in favor with artisans. *Durability*—Durable under ground. *Uses*—Used for posts, ties, etc.

Requirements: *Climate*—Thrives near the coast. In Australia found in swampy regions. Will grow in a variety of situations if kept supplied with plenty of moisture. Not adapted to dry interior valleys.

Places Grown in the West: Santa Monica, Alhambra, Los Angeles.

Facts of Special Interest: Will not endure heavy frosts.

34. E. rostrata.

RED GUM.

Identification: *Leaves*—Of medium size, lance or sickle-shaped, and have the same color on both sides. Foliage may vary from livid green to yellowish or brownish. *Flowers and Fruit*—Flowers small on slender stems, 3 to 12 in clusters borne on slender stalks; deciduous covering distinctly beaked. Seed cases cup-shaped with conspicuous protruding valves. *Bark*—Of young tree smooth, reddish or ashy gray. On older ones more rough and furrowed, usually persistent, but may flake off in patches. Twigs and seedlings red.

Growth: Commonly 100 feet high in Australia, may reach 6 to 12 feet in diameter. Makes fairly rapid growth. Tree varies in habits and appearance.

Wood: Rich red when freshly cut; darkens on exposure to air, hard, strong, close-grained and difficult to split. *Durability*—Very durable both underground and in water. Resistant to teredo and white ants, etc. *Uses*—Used for ship building, piles, posts, paving, house blocks, street curbing, etc.

Requirements: *Climate*—Prefers moisture but will endure much heat and drought. Thrives in moist, foggy sections. Wide range. In dry valleys endures 15° to 20° F. and 110° to 115° F. *Soil*—Tolerant of considerable alkali.

Places Grown in the West: Santa Barbara, Berkeley, etc.

Facts of Special Interest: One of the most useful and widely grown of all the eucalypts.

35. E. rudis.

FLOODED GUM TREE OR SWAMP GUM TREE, ETC.

Identification: *Leaves*—Rather thin in structure. Occasionally sickle-shaped. *Flowers and Fruit*—Flowers of medium size, bud covers conical. Seed cases cup-shaped, with prominent protruding valves. *Bark*—Grayish, usually persistent, but sometimes peels off, rough.

GROWTH: Reaches 50 to 75 feet in height. At Fresno, California, a 15 year old grove contains trees 70 to 80 feet tall and 18 to 24 inches in diameter. At Phoenix, Arizona, 30 feet high, diameter, 6 inches in 3 years.

WOOD: *Uses*—Promises to be useful for a forest cover, fuel, and as a source of honey.

REQUIREMENTS: *Climate*—Thrives naturally along streams in Australia. Seems adapted to a wide range if moisture enough is available. Endures 15° to 18° F. and 110° to 118° F. at Phoenix, Arizona. *Soil*—Claimed to be resistant to moderate amount of alkali.

PLACES GROWN IN THE WEST: Fresno, California; Phoenix, Arizona.

36. E. saligna.

GREY GUM OR SILKY GUM, ETC.

IDENTIFICATION: *Leaves*—Lance-shaped, somewhat curved, long pointed, lower side paler than upper. *Flowers and Fruit*—Flowers nearly stemless, medium size, 4 to 8 in clusters; much flattened stalk. Bud cover nearly cone-shaped. Seed cases bell-shaped, valves protruding. *Bark*—Of trunk grayish in color, rendered nearly smooth by the outer layer flaking off.

GROWTH: Lofty, straight stemmed, from 100 to 200 feet high, diameter 3 to 6 feet.

WOOD: Pale reddish in color. Timber of great strength, straight-grained, easily worked, durable. *Uses*—Used for piles, beams, ties. In Australia, of importance for lumber. The wood a favorite with carpenters.

REQUIREMENTS: *Climate*—Has not been thoroughly tried in America, hence climatic requirements little understood. Did not survive well the seasons of 1897 and 1900 in California.

FACTS OF SPECIAL INTEREST: In America, it has not given promise of attaining to great size.

37. E. siderophloia.

BROAD-LEAFED IRONBARK.

IDENTIFICATION: *Leaves*—Large, broad, usually thick, often much curved. *Flowers and Fruit*—Flowers of about medium size, 2 to 8 in clusters on more or less angled stalks. The long covering of flower bud conical and sharp pointed. Seed cases with stems goblet-shaped. *Bark*—Persistent and rough, with quite deep fissures, rusty color, somewhat flaky.

GROWTH: Becomes over 100 feet high in Australia, and 3 to 4 feet in diameter. Promises well in California.

WOOD: Extremely hard, difficult to work, strong and durable. *Uses*—Used for bridges, posts, sleepers, railway ties; makes a fair fuel but burns slowly.

REQUIREMENTS: *Climate*—Fairly wide range of climate. Does not thrive in dry, hot interior valleys. Resist the following temperatures, 18° to 20° F., and 110° to 112° F.

PLACES GROWN IN THE WEST: Los Angeles.

FACTS OF SPECIAL INTEREST: This may be found to be a very valuable tree.

38. E sideroxylon

RED IRONBARK (THE TYPICAL IRONBARK).

IDENTIFICATION: *Leaves*—Narrow lance-shaped, often curved, usually having a more or less silvery surface. Leaves of seedling somewhat like the older trees. *Flowers and Fruit*—Flowers in clusters of 3 to 8; light pink to scarlet; covering of flower bud cone-shaped, sharp pointed, seed cases nearly cup-shaped. *Bark*—Th darkest of the ironbarks, being dark red or brown, furrowed and crooked, studded with beads of kino.

GROWTH: Tree of medium to large size, erect, large side branches; never grows to a great height.

WOOD: Of a dark red color, hard, heavy, strong, and durable. *Durability*—Durable under ground. *Uses*—Used for ties, girders, spokes, and shafts. Makes a desirable shade tree or wind-break. Good for honey.

REQUIREMENTS: *Climate*—In California, thrives in dry soil near the coast, and on the plains and hillsides of some interior valleys. Not suited to hot interior valleys, or to Arizona. Endures 16° to 20° F. and 110° to 112° F.

FACTS OF SPECIAL INTEREST: Considered a very useful tree.

39. E. stuartiana.

APPLE-SCENTED EUCALYPT.

IDENTIFICATION: *Leaves*—Of seedlings, opposite on stems, roundish or lance-shaped with a distinct bloom; when crushed gives forth a pleasant odor resembling apples. *Flowers and Fruit*—Flowers of medium size in compact clusters of 3 to 8; deciduous covering of flower bud cone-chaped. Seed cases rather small and usually almost top-shaped. *Bark*—Of trunk and main branches rough and more or less fibrous, grayish brown outside and salmon colored next the wood.

GROWTH: Trees never attain great size, but grow very rapidly the first ten years. May reach 30 to 40 feet in height and one foot in diameter in 10 years. Grows erect with a stocky appearance.

WOOD: Hard but not straight-grained, light, warm, wavy red color. Takes a polish, hence used for rough furniture. *Uses*—Used for a forest cover, for wind-breaks, for shade, etc. Used some for fence posts and sleepers.

REQUIREMENTS: *Climate*—Thrives near the coast, endures 10° F. to 18° F. Hence adapted to considerable variation in altitude. Not suited to the hot interior.

PLACES GROWN IN THE WEST: Santa Monica, Pasadena.

40. E. tereticornis.

FOREST RED GUM.

IDENTIFICATION: *Leaves*—Of seedlings, broad with short stalks. As they grow older, stalks become longer and leaves more pointed. *Flowers and Fruit*—Flowers above medium size, in open clusters of 4 to 8 on slender stalks. Covering of full-grown flower bud long, round, usually abruptly pointed pod sharp. Seed cases usually below medium size, goblet shape, with prominent and protruding valves. *Bark*—Smooth, grayish, and usually flaking off in thin layers.

GROWTH: Tree may reach 100 feet in height and 6 feet in diameter. Rate of growth about two-thirds of that of Blue Gum. (Cooper)

WOOD: Red, heavy, hard, close-grained, and durable. *Durability*—Maiden reports a post sound after 45 years. *Uses*—Has practically the same uses as E. rostrata, but considered superior by some authorities.

REQUIREMENTS: *Climate*—Grows best near coast but endures drought and the hot valleys well. Range of temperature: 15° to 20° F. and 110° to 112° F.

PLACES GROWN IN THE WEST: Pasadena, Santa Monica.

Facts of Special Interest: Resembles E. rostrata in many respects, but not as valuable a tree.

41. E. viminalis.

MANNA GUM.

Identification: *Leaves*—Of young plant and suckers, stemless, slender, pointed, with broad bases and placed opposite on the stem. Narrower on older trees. *Flowers and Fruit*—Flowers of medium size on slender stalks, variable in number. Covering of flower buds approximately cone-shaped, usually a low, broad cone. Seed case top-shaped or nearly globular, valves protruding. *Bark*—Surface of bark varies. The persistent bark brownish in color, furrowed and rough. Bark on branches usually flakes off.

Growth: Tree may reach 300 feet in height and a diameter of 15 to 30 feet. Exceeded only by E. globulus in rapidity of growth. At Pasadena, in 24 years, 100 feet high, diameter 5 feet. Small branches usually droop.

Wood: From light to dull brick in color. Timber less valuable than that of most eucalypts. *Durability*—Authorities differ about its durability under ground. *Uses*—Useful for forest cover, windbreak, shade, and fuel, though not the best fuel.

Requirements: *Climate*—Does not seem to resist drought well. Temperatures endured, 15° to 20° F. and 110° to 115° F. *Soil*—Shows moderate toleration for alkali.

Places Grown in the West: Pasadena, San Francisco, Santa Barbara, Los Angeles, Cal.; Yuma, Phoenix, Arizona.

Facts of Special Interest: Will grow on portions of the "gooselands" of Glenn and Colusa Counties.

42. E. ficifolia.

Identification: *Leaves*—Scattered, or some almost opposite, dark green above, paler beneath. Somewhat leathery. *Flowers and Fruit*—Flowers, conspicuous 4 to 6 in terminal umbels; stalks conspicuous. Fruits large urn-shaped, valves deeply enclosed, filaments beautifully red. Fruit 1 to 1½ inches long.

Growth: Tree dwarfish in growth. Said to attain 50 feet in Australia. Blooms at a very early age.

Wood: *Uses*—The showy flowers makes it a favorite ornamental tree.

Requirements: *Climate*—Considered rather sensitive to cold.

Places Grown in the West: Berkeley, South Pasadena, Santa Monica.

Facts of Special Interest: The color of the flower said to vary.

CURRENT LITERATURE.

The Timber Supply of the United States. By R. S. Kellogg. U. S. Department of Agriculture, Forest Service, Circular 166. Pp. 24.

This is a brief, yet comprehensive, statement of the knowledge —or, we should rather say, an approximation of the knowledge —we have regarding the extent and rate of decimation of our timber resources. The author himself acknowledges the slimness of his basis for these estimates. Most of the "guesses" as regards extent of original and present forest area agree closely enough with those which the reviewer had ventured some ten years ago as representing a general picture of our status. The data are here worked out in greater detail, and as there are now more and better sources of information at hand, the slight differences may perhaps bring us nearer the truth than the earlier figures.

The total area of productive forest is now stated as 544,250,000 acres; the stumpage as 2,500 billion feet; the cut (in 1907) as 40,256 million feet, 77% softwood and 23% hardwood; the total value of forest products as $1,280,000,000, representing over twenty billion cubic feet of forest-grown material. All these figures practically substantiate the picture painted by the reviewer previously.

The author also attempts to prognosticate future supplies. It would have been interesting to know how he came to the assumption that the annual growth "does not exceed 12 cubic feet per acre, a total of less than 7 billion cubic feet." He properly makes the assumption that three conditions exist; namely, mature forest; partially cut and burned forest; and severely culled forest "on which there is not sufficient young growth to produce another crop of much value." He estimates these conditions—of course, also mere guesses—to be represented by 200, 250 and 100 million acres, respectively. But, instead of using these figures in a calculation, he jumps to the above conclusion as to new growth. Of course, to arrive at such, or any conclusion in this regard, some more assumptions are necessary. The matter is of such a speculative character, that, unless the full basis for it is stated, it becomes worse than useless, and, used as an argument as if it were true, dangerous. We believe it untrue. We might, for instance, assume that on the uncut areas there is no growth until they are cut, which is approximately correct theory, but that, as soon as cut, growth begins, and that, under the enlightened teachings of the Forest Service, this growth is at least not being interfered with by fire or otherwise; we may assume that on these areas the growth will be only half as good as the average experienced, say, in France, namely 20 cubic feet per acre—less than in Germany, where the slow producing selection forest is nearly abandoned and hence an average better by 50 per cent. prevails. We must then still assume that, say, one-third of the standing timber is to be found on the second class, the culled areas. This would give 9 M. per acre to the untouched, and 3 M. to the culled, areas, and, since these latter areas are assumed to be partly burned and otherwise badly treated, we will assume that they show only one-half the increment of the first class, or say 10 cubic feet, and that further cutting does not influence this increment, although, of course, it should do so favorably. To furnish the 40 billion feet of annual consumption, there will have to be cut 3 million acres of 9 M. feet and 4 million acres of 3 M. feet stands annually. With all these not very unreasonable assumptions, we will then find that the total increment during the sixty years, during which the stands are supposed to be cut, has averaged 9 cubic feet on the first class, to which the 10 feet on the second class must be added. And, if in that time the third class of 100 million acres has not begun to contribute its quota, it should not have been mentioned as productive forest area, or is this to be offset by the acreage to be turned into farms? We would like to see something more tangible substituted for these mere assumptions. B. E. F.

Conservation of Natural Resources. Meeting of Engineers, March 24, 1909. 56 pp.

This pamphlet contains five addresses, delivered at a joint meeting of the National Societies of Civil, Mining, Mechanical and Electrical Engineers at New York. Each of the addresses discusses some phase of the subject which through President Roosevelt's insistence has assumed a more than national importance. These utterances are timely, and important mainly in that they are made by entirely sane, and competent, unbiased and disinterested men in an attitude neither of controversy nor of wild popular enthusiasm or unbalanced sentiment, which has characterized discussion elsewhere, but in a cautionary attitude such as an engineer, who deals with precise data would naturally take; as one of them says:

"Let us have less rhetoric and more precise engineering investigation in estimating the extent and value of these great resources."

In reviewing this pamphlet we cannot do better than bodily quote the passages which have more particularly to do with our and cognate subjects, forests and waters, and we quote *in extenso,* because the utterances are not entirely orthodox and of the tenor in which we have been accustomed to hear the subject discussed.

In his introductory address, Dr. James Douglas shows himself in the somewhat ignorant or hazy condition of mind in which a large majority of our citizens is found who have not yet learned that forestry applied to culled areas means expenditure which returns profits only in the long run. He says:

"I have not very clear ideas with regard to forestry, nor do I think that most of the people who preach upon the subject could carry their precepts into practice if called upon to do so. Considering that our forests have all been largely stripped of their best trees, we have not seen any feasible scheme proposed by which scientific forestry on a large and profitable scale can be applied to the recovery of what remains uncut."

Mr. John R. Freeman devotes his time to a discussion

"On certain misapplications of forest influence on stream flow and one or two other features of the conservation movement that have been urged with more attention to making an impression than to scientific truth."

We quote his remarks approvingly at length:

"It has been broadly stated that the cutting off of the forests in our Eastern mountains has increased the floods, intensified the droughts and greatly injured the water power of our rivers. I challenge those who so loudly make these statements to produce proof!

"The broad truth that forest cover in the mountains is beneficial for conserving and regulating stream flow and preventing soil erosion, is too firmly established to be shaken, and the work of reforesting and fire guarding should be pushed with tenfold the present vigor, but nevertheless, let us as engineers caution some of our good friends to be more careful in their applications of this doctrine.

"To be more specific, the statements that lessened summer flow, greater floods, or the shoaling of channels, because of deforestation, have come to the water powers of the Merrimack or to the navigation of the Hudson, rest on fancy and not on fact.

"It is my belief, based on many years' observation, that the lumbering and the clearing for agriculture that have been going on in these Eastern mountain regions for the past hundred years have not measurably affected the flow in flood or drought of any important rivers of the White Mountains or of the Adirondack region, and probably not of those of the Southern Appalachians.

"I was born almost within the edge of the White Mountain forests, was for ten years engineer with a water-power company on the Merrimack, and have had occasion to study stream-flow conditions carefully in certain parts of the Adirondacks and in the heart of the North Carolina mountains.

"The daily flow of the Merrimack probably has been observed with precision for a longer period than any other large American river, and these precise measurements reveal no progressive increase in intensity of flood or drought and no decrease of average flow.

"Why should they? Traverse the highways and climb the hills and estimate the percentage of cleared land. You will find it surprisingly small. Note the abandoned fields and pastures that have grown up to woods. It takes 40 years to grow a good pine, and from 100 to 200 years to grow a good stock of spruce timber, but go where the lumberman has been but five or ten years ago in these Eastern mountains and see how soon the scars that he left are healed. There are some small regions of special sterility where the fire has followed him and made a deeper scar, but the percentage of area in these is small. The sprout land is nearly as efficient as timberland for stream flow. The cutting out of scattered merchantable spruce, hemlock, balsam or pine, from among the large hardwood growth, as I have observed it in the heart of the Adirondacks, can make no very material change in the melting of the snow or in the rapidity with which the rainfall reaches the river.

"In these particular regions, Nature frowns on agriculture and there can never be the broad denudation and change into bald prairie that we find, for example, in the Genessee Valley, and the more of thrifty hardy farmers in the mountains, the less chance that forest fires will run riot, and destroy the sponge-like humus which it may have taken hundreds of years to accumulate and which promotes the forest growth. I beg you not to misunderstand me. There is no more ardent lover of the woods than I, etc.

"After a while, by comparing districts of similar rainfall and topography, and substrata, wooded and unwooded, or before and after close cutting, we could get some precise information on forest influences.

"One frequent error has come from a failure to differentiate between different conditions of climate and porous soil, and to make too specific an application of what may be true on the average. The statements regarding the Merrimack and the Hudson which I have criticised as without foundation in fact may very likely be true of some drainage areas in a more arid region."

The speaker then refers to the "Sinful encouragement of fires," by the methods of lumbering, and cites figures on the burning of brush, 25 to 50 and 75 cents per M feet, and asks:

"Does not the benefit to posterity warrant this tax?" We ought not to be too hasty in answering, but one who has tramped over a recent burn will be inclined to say, "Yes," and that the action of the lumbermen which leads time and again to this result, should be made a crime with penalties that would deeply touch the sensitive pocket nerve.

Speaking of the conditions surrounding the development of water powers, he says:

"I mention these examples (of failures) because I have noted in some of the recent conservation talk an idea that the flow of almost any river or stream of rapid descent could be easily transmuted into a never-ending flow of gold.

"The same glowing accounts fail to discover what use could be made of such vast amounts of power in these remote localities, and they utterly ignore questions of market in reckoning value.

"Ridicule and distrust are the proper reward for those who put forth these unqualified statements."

Note, however, how even the sane, matter-of-fact engineer falls a victim to his esthetic feelings:

"While the scenic value of water has received too scant attention in the work of the engineer, it is at the hands of the lumbermen and the early mill builders that it has suffered most. The dismal swamps, and the ghostly ruins of trees that were killed by dam building in the Adirondacks and in Northern Maine, have made such raw spots in the memories of those of us who love the forest and its lakes that we sympathize with the purpose of the constitutional restrictions which this State of New York has interposed against the flooding of its forest lands by storage reservoirs."

As if it were necessary to make the surroundings unsightly when constructing such reservoirs!

Another speaker, C. W. Baker, M. E., discusses the waste of our natural resources by fire, pointing out that the loss in buildings and their contents was $215,000,000 in 1907, or $2.50 per capita, as against 12 to 49 cents in European countries. He naturally rails against forest fires and concludes as we have always concluded:

"What I most want to make clear to you is that unless and until you create in every forest State of the Union effective laws and effective organization to prevent forest fires—unless and until you do that thing—all our talk of conserving the forests is vain. We cannot get away from economic laws. We cannot expect a man to preserve valuable woodlands uncut when at any time a forest fire may wipe out the property entirely. And the higher the price of lumber goes, the greater the inducement to cut off the trees.

"Thus the more our forests dwindle and the nearer the inevitable timber famine approaches, the more certain we make it that all the forests shall disappear. If a man could hold his timber lands like other property for a higher price without risk of total loss, many would prefer to do this, and many would be found to undertake timber culture; but, so long as timber properties are subject to grave risk of total loss, they cannot be attractive to capital.

"I may be criticised for saying very little so far about conservation. But surely little need be said to prove that the fire loss is a waste and a vast drain upon our natural resources. Every one appreciates it, of course, where forest fires are concerned; but it is just as much of a drain on the forests to burn up the boards and the timber in a house which must be rebuilt as to burn up the trees before they are cut down and sawed. And not only timber but iron, tin, lead, zinc—all the materials used in building construction—and a vast amount of merchandise contained in buildings are devoured annually by the flames. Surely, then, the prevention of this waste—the work of the structural engineer and the fire-protection engineer—is a task whose accomplishment means much for the public benefit, means much for the conservation of the world's resources."

A cautionary attitude in regard to the development of water powers and inland waterways and to the broad propositions of the Inland Water Ways Commission was also taken by L. B. Stillwell, E. E., but, while with all the other speakers this attitude came in only incidentally, Dr. R. W. Raymond made it the principal theme in discussing the futility of attempts to conserve natural resources by legislation; holding that economic adjustments and education—knowledge of conditions—will alone suffice to bring about conservative use of resources. While we do not quite agree with this old Spencerian belief, we admit its force as against unwise legislation, and quote the speaker's pithy language *in extenso:*

"The recent general awakening of public interest in the conservation of national resources is an event for which, as engineers, we may well be grateful. Even if we admit, as I suppose we must, that a part of it is artificial and another part erroneous or premature, and that some of the immediate purposes for which many have proposed to utilize it are questionable in character, the fact remains that a subject, to some aspects of which engineers have been for a generation calling attention in vain, is now suddenly brought forward in such a way that the sluggish sit up and listen, and the tremendous energy of public opinion is liberated by a swift reaction. How this energy shall be wisely directed is another question. The fundamental fact is, that without it nothing at all could be done; and it is better to have the will and the power, even to make mistakes, than to remain in sleep, knowing nothing, or in paralysis, knowing much, but impotent to act.

"The official movement for the conservation of national resources did not, at first, contemplate the aid of the engineers of the country. If I remember correctly, it was to be a convention of Governors and members of Congress. But, by a happy afterthought, the four national engineering societies were invited to take part in this convention, and, consequently, representatives from all of them were present. Their presence had little effect upon the conference, and, indeed, the conference itself had little effect, except through the creation of a more permanent commission; the practical, though informal commitment of the Governors of the States to the general movement contemplated; and the impression of a grand, unanimous advance in a new reform thereby produced upon the public mind. These results, however, were of incalculable importance, and may well be regarded as satisfactory to the friends of the general cause thus inaugurated.

"Concerning the attempt to utilize the results of this conference in support of certain measures in Congress, nothing need be said here. Such arguments were fair enough, to the extent of their real bearing, but they could not be conclusive as to questions involving grave considerations of constitutional power or political wisdom. It is not enough, under our institutions, to prove that a thing is a good thing and ought to be done, in order to establish the proposition that it should be done in a hurry, or in a certain way, or by doubtful means. * * *

"Much of recent eloquence concerning the conservation of resources is merely the revival of what engineers have been saying for a generation, and their experience qualifies them to measure actual conditions and point out actual perils with special authority. * * *

"Another illustration is furnished by timber conservation. Until within a few years the practice of forestry in our Eastern States by owners of small tracts and limited capital was impossible, because timber-land which was not within, say, five years of being ready for the axe would not command a greater price than cleared land. * * Legislation would not have altered the situation; but something else has altered it—namely, the gradual increase in the market-value of the timber, and the corresponding perception of its value when only half-grown. Before long a tree-planted area in this country will advance year by year in cash value, in proportion to the money that has been spent upon it, and the condition of its growing crop. This will make forestry possible, and we shall have no more cause to fear the exhaustion of lumber than of corn. Meanwhile, with regard to our forest resources, even more than as to our mineral resources, it is waste rather than use that needs to be prevented; and the simple, adequate remedies are the pressure of economic conditions and the diffusion of knowledge. * * *

"In my judgment, the progressive education of the people and the steady pressure of economic conditions will effect this result, as a general rule, better than any legislation can do it."

In pointing out the dangers of legislative conservation the speaker does so under six heads, namely, Hasty Legislation; Destruction of Individual Responsibility and Initiative; Tendency of Governmental Agencies to Seek Additional Power; Expense of Governmental Agencies and Regulations; Interference of Governmental Agencies with Private Occupations; Half-way Adoption of European Methods. The results of hasty legislation are most fully exemplified. Although the story is quite familiar to our readers, we may yet repeat it in the words of Dr. Raymond—the story of misguided forestry legislation in the State of New York.

"The first peril to be named is that of hasty and ill-considered action, taken under the influence of an ignorant though well-meaning public sentiment, roused or guided, in too many instances, by selfish interests.

"The history of forestry in the State of New York furnishes a striking case in point. Sentimentalists who had gone no further in the knowledge of the subject than 'Woodman, spare that tree!' and conceived of no more effective reform than a universal observation by the public schools of 'Arbor-Day,' were persuaded in the name of 'Conservation' to carry into our new Constitution, with a rush and whoop of victorious virtue, a provision absolutely prohibiting all cutting of timber—that is, any exercise of forestry whatever—upon the Forest Reserve of the State. At the same time, large sums were spent in the purchase of wild lands, to be added to the Forest Reserve—that is, to increase the area of State lands thus doomed to useless and mischievous decay. The constitutional prohibition was adopted by the Constitutional Convention against the urgent protest of the American Forestry Association, and was carried at the polls, with the rest of the Constitution, by the votes of those who assumed it to be all right, because it sounded so wise and patriotic. Moreover, there were amateur foresters in plenty, who learnedly expounded an 'American' system pursued by Nature, who would take care of her own forests, if we only let her alone. The necessity of such a jungle in the Adirondacks to protect the water-supply of the Erie canal, to conserve water-powers, and to furnish fresh air to invalids, was eloquently set forth. Above all, the wickedness of corporations engaged in actually using the whole forest-crop from one area after another—turning even the little branches and twigs into paper-pulp, and such-like odious products—was rhetorically set forth to a sympathetic and credulous public. Much of this lamentable performance was doubtless sincere; but behind the ignorant sincerity there was an influence which finally made itself recognized as well as felt—the influence of individual owners of small pieces of land, and summer residences thereon, who were determined that the State should preserve at public expense an unbroken old-fashioned wilderness around them—a wilderness in which they could camp or fish or shoot one another by mistake, without being disturbed by the sound of the axe or the saw. To this party, the thing to be conserved was a great open-air sanitarium and game-preserve, with incidental attractions of 'scenery,' unmarred by any unesthetic, because useful, touch of man. The whole history of the matter has never been clearly and connectedly told; indeed, it is not yet ended. But among its unhappy results have been already the arbitrary destruction, through the veto of an ill-advised Executive, and at the dictation of interested parties who knew more, of the foremost forestry school of the United States the abandonment, upon false pretenses, of a forestry experiment, outside of the State Forest Reserve, which, if suffered to continue, would have furnished an object-lesson of incalculable value to private land-owners as well as official bureaus everywhere; and the surrender by the State of New York of its proud position at the head of the great work of the conservation of forest-resources for an ignominious place at the tail of that procession of progress. I say 'at the tail,' but perhaps it would be more accurate to say that New York is out of the procession altogether; for I do not think that any other State, however backward in popular intelligence, has ever gone quite so far as to forbid forestry upon its public land.

"Meanwhile a State Commission has gone on adding by purchase or otherwise to the Forest Reserve. But since the Constitution forbids the subsequent cutting and sale of timber from any tracts thus purchased, after the title has passed to the State, the Commission cannot afford to buy timber-lands at prices including any value assigned to the timber. Consequently, it bargains for such lands, to be delivered to the State after the timber has been cut off, within a limited period, by the present owners, And the present owners, unless they happen to be within market-distance of a wicked pulp-mill, cut the salable timber as fast as they can, and turn over to the State the land with the unsalable underbrush, tops, branches and twigs of the forest—an ideal nursery for forest-conflagrations.

"The final result of all these attempts at conservation by legislation was exhibited last year, when the City of New York was darkened for many days by the smoke from the burning of hundreds of square miles of that Adirondack wilderness which had been prepared by ignorant legislation to nourish just such a bonfire. The destruction of property thus occasioned was so great that one is tempted to wish our Constitution-makers, Legislatures and Governors had let the whole business alone!

"Yet the tragedy has its comic after-piece. For our State authorities are now resuming on the Forest Reserve the once-ridiculed policy of tree-planting, instead of leaving the matter to Nature; and we hear complacent statements of the hundreds of thousands of new trees which have been set out. Yet everybody knows, or ought to know, that these plantations that cannot be properly managed hereafter without the use of 'the forester's weapon,' the axe, and that when, at great expense, they shall have been brought to the condition of ripe, marketable forest-crops, nothing can be done with them, under our Constitution, but let them decay, or sell them as burnt and fallen timber after 'accidental' fires, and go on planting new ones! The alternative is to amend the Constitution—a slow and doubtful process—or else 'construe' it so as to make it mean what it does not say—an easy and fashionable but most demoralizing expedient."

The writer should have stated that this tree-planting is entirely unconstitutional according to the clause in the Constitution which requires these lands to be left in the "wild state."

Other amusing miscarriage of well intentioned legislation is recited. The speaker finally concluded:

"And, as to the general problem of 'conservation,' I think it is the business of all engineers to pour cold water on hot heads, and prevent, so far as they may, the reckless operations of a sincere, but ignorant, enthusiasm."

This is somewhat severe on our enthusiastic conservers, but it is perhaps useful to dampen the ardor of the over-enthusiastic.

B. E. F.

Die Waldungen des Königreichs Sachsen. By Franz Mammen. Leipzig, 1905. 331 pp. 4°. Price, Mk. 16.

A belated reference to this monumental statistical work, discussing in the greatest detail the forest conditions in 1902 of the one of the German States, which until lately has been leading all others in financial results, Saxony, may be justified in order to bring out the fact that these financial results have in part resulted from a reduction in the length of the rotation and the cutting of the older age-classes. The present distribution of age-classes is as follows:

Over 100	81-100	61-80	41-60	21-40	1-20 years
3.6	6.6	16.4	23.8	22.2	24.5 per cent.

This for State forest. For private forest the relation is still less favorable, the series being

2.4	5.1	14.1	24.1	24.9	25.3

As is well known the Saxon forest management is based on a strict financial rotation figured on the soil rent principles. This exhibit makes it doubtful whether the financial results are not secured from the savings of former generations. At any rate, even so, Saxony in financial results is declining, if rising wood prices are taken into consideration, and is now left behind by Würtemberg, and pressed closely by Baden, two States which have not yielded to the persuasions of the soil rent theory. For Saxony netted in 1900, $5.25; in 1902, $4.37, and in 1907, $6.02 per acre, while Wurtemberg stood in 1903 with $5.00 and in 1907 with $7.66 in front of all the State forest administrations, while Baden in 1906 boasted $6.07, in 1907, $5.53 per acre. And these results are secured in spite of the fact that in industrial Saxony the spruce is the prevailing timber and smaller sizes can evidently be turned into workwood, the workwood per cent. here being now 83, in Wurtemburg 63, in Baden only 48; but the total cut per acre was in 1907, 90 cubic feet in Wurtemberg as against 78 in Saxony.

As to ownership, State and private forests appear in almost equal proportion, namely 45.2 and 46 per cent., the rest being commercial or institute forest. Timber forest occupies 99 per cent. of the total area (selection forest .4). Conifers, 58 per cent. spruce, 30 per cent. pine, is prevalent.

The data for this volume are secured under coöperation of federal and State authority, gathered by 186 men, of whom 108 were foresters, and furnish as complete a statement as could well be brought together. B. E. F.

Forest Fires in Canada during 1908. By H. R. MacMillan. Forestry Branch, Bulletin No. 7, Ottawa, 1909.

This is an attempt to get some idea of the extent of damage which Canada suffers through forest fires. Admittedly the attempt is a failure, if anything like the area actually burned over and the damage to young growth and soil is desired to be known. The vast country, especially of the Northland, sparsely settled, experiences extensive fires annually without being noticed, and, even in the more settled and organized communities, only extensive fires destroying merchantable timber are taken note of. Even in the Province of Ontario, which spent over $200,000 on its protective service, and whose towns were filled with smoke in that year, no statistics of the extent of fires were collected, nor does the realization that they did damage, even though no merchantable timber was destroyed, seem to have come to the authorities.

The partial information shows 835 fires reported, occasioning a damage of over $25,000,000, besides the loss of 22 lives, which occured at the great fire in Fernie, B. C. An expenditure of $374,000 in fighting fires was occasioned, Ontario spending most, with $210,000, the Dominion and New Brunswick each with $50,000 being second, Quebec spending $24,000, and Nova Scotia, which seems now the best protected, $6,089. It is a mistake to charge this last amount to public expense, for most of this money is collected from the timberland owners holding more than 500 acres, while any deficiencies in payment for the cost of the service is collected from the municipalities, the Provincial government itself incurring no expense.

It is gratifying to note that the United States can be referred to as one of the countries coping successfully with the fire evil, reference being made to the decrease of fires in the National Forests during the years from 1904 to 1907, when the burned over area was gradually reduced from 0.66 to 0.07 per cent.

B. E. F.

Trees: a handbook of forest botany for the woodlands and the laboratory. Vol. IV: Fruits. By H. M. Ward. New York, 1908. Price, $1.50.

The interest to us in this posthumous volume, as well as in the preceding ones of the series, lies in the method of treatment of the subject, since the descriptions refer only to trees of Great Britain. The method is to describe separately leaves and twigs, flowers and inflorescence, fruits and wood, preceding the specific descriptions by general discussions of the morphology of each, and giving keys based on characters of each of these features.

Illustriertes Handbuch der Laubholzkunde. By C. K. Schneider. 8 Lieferung, pp. 241-366. Jena, 1909.

This is a monumental work, most thorough and practical, on the deciduous tree flora indigenous and introduced into middle

Europe, fully illustrated. The reviewer in the Botanical Gazette refers to it with these words: "Who of our foresters will give us something as good, but perhaps a little less condensed?"

Statistische Mitteilungen über die Ertraege deutscher Waldungen im Wirtschafts jahre, 1907. By Dr. Schwappach. Mitteilungen des Deutschen Forstvereins. No. 2. 1909. 70 pp.

This is the annual budget of statistics of the results of German forest management including not only the State forests but also some of the private and the commercial forests and now comprising 53.4 per cent of the total forest area of Germany .

OTHER CURRENT LITERATURE.

Forest Fires in Massachusetts. By F. W. Rane, State Forester. Boston, 1909. Pp. 43. This bulletin is published "that the people may realize more fully the exact condition, and in the hope that some good will result therefrom." Contains tables of damage, causes, extent and month-frequency, as well as information on methods of organization and protection.

Forest Products of Canada. By A. H. D. Ross. Bulletin No. 4, Forestry Branch, Department of the Interior, Ottawa, Canada, 1909. Pp. 33. Official statistics brought together for the first time.

The Distribution of Woody Plants in the Pike's Peak Region. By E. C. Schneider. Colorado College Pub., No. 6, 1909.

An act for the Protection of Woodlands. New Jersey State, April, 1909. Provides for the construction of fire lines by railroad companies.

Forest Club Annual, University of Nebraska, 1909. Pp. 70. Contains the following articles: Seed Sowing on National Forests, by G. B. McDonald; Notes on Osage Orange, by T. E. Miller; The Advantages of Clear Cutting Lodgepole, by H. S. Stevenson; Experiments in Forest Tree Seed Germination, by

L. L. Bishop; Summer Forest Botany in Colorado, by R. J. Pool; Lumbering Cottonwood, by W. E. S. Hallett; Distillation of Hardwoods, by C. R. Tillotson; Lumbering in Colorado, by H. H. Greenamyre; A Paper Pulp Operation in Wisconsin, by J. C. Ketridge; Logging in Wisconsin, by A. C. Hamel.

A List of the Trees of the State of Florida. By John Gifford. Cocoa Nut Grove, 1909. 24 pp. Enumerates 281 species of native and introduced tree species. Although it is printed for popular consumption, namely, for the "Forestry Department of the Florida Federation of Women's Clubs," and, therefore, does not pretend to scientific accuracy or method, it offends the eye and propriety to see the latin species name printed in capitals and the authors' names left out.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forestry in France.

Dr. Martin continuing his account of forestry conditions in France, discusses the coppice, which plays such a large rôle in French forests, occupying probably over 7.5 million acres. The most important species is the oak in several species, also blue beech, ash, elm, birch, willow and poplar are frequent. Chestnut and Black Locust are found especially in Southern France. Since most of the coppice forest is in private hands the statistics are very incomplete. In the State forests a rotation of 20 to 30 years is applied to 56% of its coppice, 10 to 20 years to 32% and over 30 years to 10%. The majority of the communal forest is also managed in 20 to 30 years rotation.

Regarding production the coppice stands lowest with 11.5 cubic feet per acre in the State forest and 18.5 cubic feet in the communal forests, as against 41 and 24 for timber forest of these two classes of proprietors. On this basis Tassy calculates that this coppice management costs society a loss of 60 million dollars, more than half the direct taxes of the country.

Two primitive forms of coppice are still in vogue, *le taillis sarte* in which the debris is spread out and burnt, and then a grain or hoed crop is grown, and *le taillis fúreté,* in which the sprouts are cut as it were in selection, four to five fellings being made during the rotation, always taking the stoutest sprouts; this to secure better fuelwood. The result is, as with other unevenaged forms, a deterioriation of the stand, the sprouts become poorer and the repletion of stocks difficult.

Tanbark coppice is very general in hands of private owners, some 350 million pounds being the annual product which is sold at about $14.00 per ton. While the maximum product might be attained in 12 to 15 year rotation, these woods are usually managed in 18 to 25 year turns in order to secure a better wood product. Growth conditions are excellent, and replenishing of stocks does not seem much required; where poor growths in oak coppice need improvement, this is often done by sowing pine, which shows a beneficial influence on the growth of the oak.

"Looking at forest conditions of France in general and the statistical data of yields, no doubt can exist that coppice in France just as in Germany and other countries is a form of management not any more timely or compatible with national interests." This verdict will impress itself more strongly as the price of its products sinks in comparison with those of the timber forest, which latter are bound to rise. Coppice is rapine and with increase of civilization more intensive use of the soil becomes necessary.

One of the most essential characteristics of French management lies in the mode of wood sales which differs widely from German practice.

For State forests auctions are the rule; exceptions are admitted only on insignificant items for naval and military use and to those, holding rights of user. In communal forests open sale is the rule, and here mostly of stumpage for the year's cut.

There are three methods in vogue: sale of stumpage (*vente sur pied*); sale according to size and assortments (*vente à l'unité de produits*); sale of cut wood (*vente après façonnage*). The latter method which is the one usual in Germany, is very rarely practised in France, and the second for less than 20 per cent. of the cut in State forests. Buyers in the State forests are mostly wholesale wood merchants hence wholesale sales are the rule. Dates for the sales in series are advertised for each inspection district a long time ahead. Smaller cuts are sold as a whole, larger ones in several lots which are in the forest subdivided by ditches. One lot is not to exceed the amount of $2,000.

When stumpage in block is sold, trees to be cut or to be left are marked with hammer, and the trees to be cut calipered and their contents very carefully ascertained and in detail placed in a protocol, divided by assortments. Then the value of each class of trees is estimated, (*estimation brute*). From the sum total the costs to the buyer are deducted. Among these appear the buyer's profit (*le benefice de l'adjudicataire*) which is figured at 10%; cost of felling and sawing, etc., including eventual pruning of trees left; certain services in connection with delivering wood to officers, assistance in roadbuilding, etc. (*travaux mis en charge*); any other costs. These deductions leave the *"reste net,"* upon which the bids are based.

The sale by assortments is usually applied in selling the result of thinnings, where an estimate of totals is impracticable. The classification is simple and uniformity in three classes; workwood (*bois d' oeuvre*) of at least 32 inch circumference, in two or three subclasses; fuelwood (*bois de feu*), less than 32 inch circumference, several classes; *bois de corde,* split cordwood, and *fagot,* round billets; lastly brushwood (*bourrées*) below 10 inch circumference, which is gathered into fagots of about 3 feet circumference in lengths of 4 to 6 feet.

Sometimes the log timber, *bois de service* is by a kerf marked off from the part of the stem that is to be allotted to *bois de feu,* this latter being reduced by 1.8 to *steres,* cubic meter space.

In the sale *sur pied* the bid is made for the total cut, in the bid *à l' unité* it is made by assortments. At the auction the bidding is downward (*au rabais*); a bid proposed by the auctioneer (*crieur*) equal to double the estimated value, going down by a certain percent. until somebody calls: *je prends,* "I take it."

The conditions imposed upon the buyer are also characteristic, and are recited in great detail on the sale protocol.

In timber forest, trees are as a rule to be dug out *(exploités par extraction des souches),* taking care not to injure roots of the reserved trees. The holes must be filled up again. In the coppice the character of the cut is carefully prescribed and the presence of a grindstone required. In regeneration fellings, beech advance growth must be removed, also soil cover which impedes regeneration. Spots used by the buyer for working up wood, charcoal pits, etc., must be planted, broken branches of standing trees trimmed and tarred; in thinning, trees to be felled may have to be first trimmed. The selection of wood choppers is also supervised. Winter felling is the rule, but for coniferous woods spring felling "in the sap" is recommended, which is said not only to make the wood lighter and barking to avoid insect trouble easier, but also to preserve better appearance.

All smaller dimensions and fuel wood must as soon as possible be moved to roads and to the edges of the felling area. Larger logs may be trimmed and hewn in place, but are then to be moved to landing places, and in regeneration cuttings the chips and debris are to be removed. All damages are paid for according to a predetermined scale.

The furnishing of fuelwood to the forest officers, and assistance in road building, planting, etc., are also often imposed conditions. an inspection (*récolement*) takes place at the end of the felling.

French foresters consider this system of sale, especially for final harvest fellings, satisfactory. It reduces the labor of the officers and insures more adequate utilization of the cut by the better informed merchant according to needs of the market. This may also result in better prices to the forest owner.

Objections are that no consumer can secure materials without the middleman; the volumes and especially defects cannot be as surely determined as on the felled timber—the German method—which is, therefore, fairer. Valuable statistical knowledge, which is needed for an intense management, is lost to the forest manager. The objection that from this mode of sale on the stump damage to young growths is to be experiencel, is overcome by close supervision and inspection, yet, according to Boppé, much damage had resulted, and he ascribes the loss of thrifty oak-stands in West and Middle France to this cause, poor pine plantations taking their place.

Mitteilungen über die forstlichen Verhältnisse in Frankreich. Forstwissenschaftliches Centralblatt. April, 1909, pp. 203-218.

FOREST BOTANY AND ZOOLOGY.

Leaf Fall and Frost.

Dr. Jaccard records a peculiar phenomenon of the leaves of various species persisting through fall frosts which usually bring about their fall. In spite of the frosts of October 20 to 23, 1908, in Switzerland, sycamores, elms and basswood remained quite green, apple and pear trees, oak and horsechestnuts exhibited frosted but persistent foliage, the foliage of the last two remaining green but crumpled, the former brown but with spread-out blades. Horse Chestnut remained green and foliaged until November 10, and then it required considerable force (by wind or hand) to break the leaves off at the insertion of the petioles. Here wound periderm was found, but not the usual layer of separation at the base of the petiole which facilitates the leaf fall, the fibrovascular bundles remaining open, and only a swelling containing gum surrounding the spirals of the ruptured vessels. The absence of the separation layer accounts for the late leaf fall.

According to Wiesner the disorganization of the middle lamella in the separation layer is due to reduced transpiration; this leads to oxidation of the chlorophyll, the formation of acids, especially oxalic acid, and to a ferment which destroys the cells. Jaccard found many oxalate of lime crystals in the mesophyll of the frozen leaves, as well as in the parenchyma of petiole and ribs, but no free oxalic acid.

If the separation layer is formed before the frost, an ice layer is formed in the layer and on thawing the leaves fall, even green ones. The changes which prepare this leaf fall are usually gradual, under the influence of gradual reduction in light and decreasing transpiration; differently colored substances, anthocyan, tannin, tannoidin and humus formations causing the discoloration, while the starch is decomposed and wanders into the twigs; water is lost, certain parenchyma cells at the base of the petiole elongate transversely and form the separation layer.

In the year of observation warm weather prevailed until October 20, vegetative activity continuing, and frost found the foliage unprepared for the fall. While the mesophyll cells were considerably dried out, those of the petiole were turgid with water. This would argue that the formation of the separation layer depends on the chemical changes in the chlorophyll rather than on the cessation of transpiration and assimilation. Starch was found in the petioles two days after the frost, but after a fortnight had it vanished, while the blades still showed undiminished quantities, and it was still present by November 20 in the leaves that were hanging on. It looked as if only the protoplasm in petiole and midrib had been changed, and the ferments of the cellsap which dissolve the starch and conduct it into the twigs had remained active. The cell tissues of the petiole were still able to perform osmotic processes but were unable to form the separation layer.

The influence of frost on the protoplasm was peculiar. While the color remained green much xantophyll was shown by the spectroscope; but a solution in alcohol treated with benzin did not split into cyanophyll and xantophyll; the chlorophyll had become resistant to changes. This experience may account for the finding of green moss and leaves in peat bogs and under thick layers of mud. The green chlorophyll, to be sure, persisted only on the upper side, where the crumpling of the leaves prevented direct light influence; the under side turning brown.

Referring to the biological value of leaf fall, the writer refers to Wiesner's classification according to causes into summer leaf fall, heat leaf fall, shoot leaf fall, autumn leaf fall and frost leaf fall; the first caused by insufficient light reaching the interior of crowns, the second by drouth, the third caused by the sprouting of dormant buds at the base of leaves, the last two by reduction of transpiration and respiration. In all cases except frost leaf fall, it is a natural reaction to exterior conditions and of advantage to the life of the plant.

The loss of foliage in the autumn reduces damage from wind and snow. The fallen litter enriches the soil with minerals, especially carbon from the air, as well as nitrogen contained in organic substance. By humification the physical condition of the soil is improved and the leaf-litter protects the soil against radiation and frost. In early spring the sun can reach all the buds in the leafless crown and expedite their awakening, the summergreen trees having in this respect an advantage over the wintergreen, whose buds are confined to the periphery of the crown.

Wirkung des Frostes auf den Laubabfall. Schweizerische Zeitschrift für Forstwesen, April, 1909, pp. 105-112.

Germination and Dormancy.

The old doctrine that germination of seeds is promoted by the absence of light has been dispelled by the investigations of Kinzel, who has demonstrated with a number of plants that the very opposite is true. Delayed germination or dormancy, the same investigator finds not necessarily to be due to the character of the seed coat, but possibly to the character of the embryo.

Lichtkeimung. Berichte, Deutsche Botanische Gesellschaft, 1908, pp. 631-645.

SOIL, WATER AND CLIMATE.

Forests and Water Flow.

A belated consideration of the proceedings of the Navigation Congress at Milan, in 1905, calls forth a discussion by Buffault of the evidence reported at the Congress and elsewhere of forests on waterflow in answer to the position taken by Rabot, Secretary of the French Geographic Society, to the effect that such evidence is deficient or inconclusive.

Wolfschütz of Brünn adduced instances to show that the efficacy of the forest in retaining the waters fails in long continued and extraordinary rainfall periods. According to Honsell, the best wooded basins of the Black Forest, Harz, Spessart, etc., contributed most to the floods of the Rhine in 1882.

Similar experiences were reported from the watersheds of the Elbe in 1897, of the rivers Enns, Traun and Ybbs in 1899, and from the densely forested Riesenwald in Silesia in 1888, 1897 and 1903. Yet Wolfschütz recognizes at least a limited and local influence in certain regions in reducing disastrous floods.

Lauda, the director of the Austrian Hydrographic Bureau, admits the difficulty of solving the problem and reports very careful and precise observations made in 1903 and 1904 in the basins of two rivers in Moravia, the Bistrizka with 48% forest cover, and the Seniza with only 27%, otherwise the two being geologically and topographically alike, and nearly of the same area. He comes to the interesting conclusion that the preceding weather conditions have a bearing on forest influences. While, generally speaking, the retentive capacity of the forest cover is undoubted, it becomes relatively less in extreme flood times, so that after a certain degree of saturation the run off from the forest is greater than from the unforested area. (Did more rain fall on the forested slopes?) After periods of drouth the retentive capacity of the forest is superior, so that a rainfall after three months' drouth in the better forested basin became noticeable in the river two days later than in the less forested.

Conclusiveness of these observations is doubtful.

A correspondence between Lauda and Tessier, published in a later issue of the same journal, which brings further detail and diagrams of conditions and observations in the two river basins.

Lauda concludes, that, if, as Tessier demands, it is necessary to *prove* identical distribution of rainfall in two basins to be compared, it will never be possible to demonstrate experimentally the forest influence on floods.

Ponti, an Italian engineer, asserts experiences of increased floods due to deforestation in Sardinia, Sicily and Campobasso, and of the watersheds of the Adda and Matero, and on the other hand favorable influence of forest planting in the provinces of Grosetto (Tuscany), Avellino (Campania), Sondrio (Lombardy).

The Russian Lokhtine cites a long series of general experience from various parts of Europe and especially from Russia, which would indicate the bad effect of deforestation. Among others, he cites the statements of Schreiner and Copeland regarding conditions in Monroe County, Wisconsin, where in 70 years the forest area was reduced from 83% to 6%, and the effect has been noticeable in 1887 in a striking manner by low river beds and abandonment of mills.

The results of a special commission to investigate water conditions on the Dnieper and its tributaries show the deforested basins as retaining from 3 to 20 per cent. less water than the forested basins, in proportion to the deforestation. The gradual decrease of average water level in the Soura has been observed from 1888 to 1900 in proportion to the progressive deforestation.

Similarly on the upper Bielaja at Oufa, where deforestation has progressed from 1887-1900, the average water level has decreased, while on the lower Bielaja at Grouzdecka, where the forest cover has remained undisturbed, the water level has practically remained even. Similar experience is cited from the Volga basin.

These citations are followed by a general discussion of the problem. It starts with a reference to the undoubted effect of forest cover on erosion, and rehearses the observations and experiments of Ebermayer, Calas, Henry and others.

The most striking experience cited is that from the department of Aude in 1893, when the main river after a downpour rose 15 feet. In two branches draining almost totally deforested basins great damage was done, in another branch coming through a well forested basin with the same storm, no perceptible rise and no damage was noted. A long list of such observations is recited with references to the sources of information which make the article useful.

La capacité rétentionelle de la forêt. Revue des eaux et forêts. January, 1909, pp. 1-18, 33-34, April, 1909, pp. 229-234.

Nitrogen Fixation in Soil.

The much mooted problem of how nitrogen is made available to plants is, step by step, being solved. It is now certain that an aerobic bacterium, *Azotobacter chroococcum,* is responsible for it. A Russian, Krzeminiewski, contributes further knowledge of the activity of this bacterium. Humus does not serve either as a source of nitrogen or carbon, but it acts as an important stimulant: the addition of nitrogen-free media multiplies the amount of nitrogen fixed by the bacteria many times. Humus from different soils yields different results. On the other hand, the addition of nitrogenous compounds had an inhibitory influence.

The importance of humus is further accentuated by these findings.

Untersuchungen über Azotobacter chroococcum. Botanical Gazette, June, 1909, p. 475.

Peat Bog Investigations.

Mr. G. P. Burns continues an account of his investigations of the Huron River Valley, and the present paper deals with the description of some of its greatest peat bogs, which were investigated in detail by use of a borer, to establish their relation to original post-glacial lake contours. The author concludes that the chief factor determining the position of the greatest amount of peat deposit and the width of the zones of plants—lily, bog sedge, bog shrub, tamarack, maple-poplar, in definite orderly succession—is the depth of the water in the different parts of the original post-glacial lakes. The position of open water is determined by depth: given time enough, the open water will disappear from all bog lakes. Where water is shallow, the bog flora cannot establish itself because of the wave action induced by the winds, and on account of the shore-ward push of the ice.

Botanical Survey of the Huron River Valley. VII. Botanical Gazette, June, 1909, pp. 445-453.

Bog Toxins.

A further contribution towards establishing the theory of "toxicity" of soils as explaining unproductiveness, is furnished by Alfred Dachnowski, based on experiments with wheat plants in water cultures, conducted in the Botanical Laboratory of Ohio State University. The importance of these investigations into the cause of infertility, especially of bogs and swamps, lies in the fact that these swamp and muck lands are naturally rich in constituents needed for plant food, and yet have seldom given satisfaction, even after drainage and addition of fertilizers. In another series of experiments on the cause of xerophily in bogs, the author had come to the conclusion that the inhibiting factors of a bog are, in part, the presence in the soil water of injurious toxic substances, that this toxicity can be corrected by various methods, and that plants grown in solutions thus treated show not only accelerated growth and an increase in transpiration, but also an increase in the green and dry weight of organic matter.

Other tests seem to indicate that the toxins are not merely specific excretions from the roots and rhizomes of bog plants, but probably are certain unstable bodies of the nature of organic compounds excreted from the roots in the absence of oxygen, and in heavy clay soils not adequately aerated.

Following is the summary resulting from the present investigation, as stated by the author:

"1. Many swamp and muck soils exhibit a sterility which cannot be remedied by drainage or by the addition of fertilizers.

"2. The sterility appears to be most marked where investigations on the physiological properties of bog water and bog soils indicate a greater amount and activity of bog toxins.

"3. The production of bog toxins is due to a number of physical and chemical factors. One can only conclude that the chemical constitution of bog water and bog soils at a given moment conditions toxicity and that the excretion from roots and rhizomes of plants is one of the variables of the conditioning factors.

"4. In untreated bog water there are found deposited upon the roots of wheat plants numerous colored bodies as the result of the oxidizing action of roots. The general decay of the root-tips indicates that the oxidizing activity is insufficient to decrease the harmful effect of the bog toxins.

"5. It is possible that ecesis, association and succession of plants depends primarily upon respiration, and that in respiration bog plants differ from other plants.

"6. Treating bog water with an insoluble absorbing agent is invariably beneficial.

"7. Different physiological phases result from the progressive addition of an absorbing substance. With coarser-grained materials, the low optimum rate of transpiration is soon succeeded by a minimum, which is due to the action of toxic substances still present.

"8. Finer-grained insoluble bodies are more beneficial. The response to toxic bodies when present in small amounts leads to acceleration of growth. The period of growth is more prolonged, and the optimum and maximum rate of transpiration lie near together.

"9. The adsorptive action of carborundum and humus is about four times greater than that of quartz; the capacity of soils for retaining toxins is therefore higher the greater the content of humus.

"10. The decrease of the poisonous effect of bog water is probably a function of the surface of the particles; it is relatively proportionate to the quantity of the solid body used.

"11. In agricultural soils used as adsorbents, the presence of the adsorbed unknown toxins replaces normal growth by an abnormal retardation. Fertility is restored through aeration, that is, after time enough has elapsed for the oxidation of the injurious bodies.

"12. The contaminated condition of agricultural soils and the consequent decreased physiological activity of the plants grown in them still further indicates that xerophily cannot be due to acidity; that is, the factors heretofore cited are only in part the cause of xerophily."

Bog Toxins and their Effect upon Soils. Botanical Gazette, May, 1909, pp. 387-405.

SILVICULTURE, PROTECTION AND EXTENSION.

Germination Per Cent. and Seed Storage.

In 1905 and 1906 Oberforster Haak, an expert in this line, published investigations (see QUARTERLY, Vol. V, p. 205) into the relations of the germination per cent. of pine seed to the number of plants actually resulting, which showed that the use value of seed increases and decreases with increasing or decreasing germination per cent. in much more rapid progression than the final number of germinated seeds in a test would indicate. To secure the same number of plants, very much less seed of a high germination per cent. is required than proportionately of seed of a lower per cent., i. e., *lower grade seed is much less valuable than its germination per cent. indicates.*

To secure more precise data on this relationship, to determine what the author calls the "plant per cent." corresponding to a certain germination per cent., some 129 sowings in seedbed and in the open were made with 400 to 800 grains to the sowing, and the number of resulting plants counted. To take account of the difference of seedbed, practically experienced, three different conditions, favorable, unfavorable and half-favorable, were created. From the curves representing the results the following relationships were deduced:

Germination per cents.:	50	55	60	65	70	75	80	85	90	95
Plant per cents.:										
I Under favorable conditions	11	15	20	25	30	35	41	47	54	61
II Under unfavorable conditions			2	4	7	9	12	16	20	27
III Under half-favorable conditions	2	7	11	17	22	28	34	41	48	56
VI Average of I and II	5	7	11	14	18	22	26	31	37	44

While under favorable conditions seed of 60 per cent. germination will furnish one-third the number of plants indicated by its germination per cent., a 90 per cent. seed will furnish 54, more than one-half the theoretical figure. Since there are so many influences at work to make conditions favorable or unfavorable, the author proposes the use of the figures which result from averaging the figures under I and II, and which he finds to agree very well with the best practice.

To explain the strikingly lawful progress of the decrease of plant per cent. with decreasing germination per cent., it is stated as a result of many years of observation that originally, excluding blind seeds, there is 90 per cent. of good seed found in the cones. Various causes bring about deterioration; the same cause which destroys the viability of some of the seeds also decreases the vitality of the others, but not all in the same proportion; at any time some have lost their germinative power altogether, some can still push forth a germ, without forming normal roots, still others are sound but germinate only slowly, and only a portion have remained undamaged, undiscovered individual differences rendering these more resistant to baneful influences.

As regards the question whether the use of mixed seed, i. e., seed with high and low germination to secure an average, is justified, finds answer in the upward turn of the plant per cent. curve: the plant per cent. of mixed seed is never lower than that of unmixed seed of same germination per cent. The equation to secure a mixture of *c* per cent. germination from seed of *a* and *b* per cent. is

$$x\frac{a}{100}+y\frac{b}{100}=100\frac{c}{100}, \text{ or } x=\frac{c-b}{a-b}\,100, \text{ and } y = 100-x.$$

To secure, therefore, 85 per cent. seed from a mixture of 65 and 95 per cent. seed there are needed 33.3 parts of the first and 66.6 parts of the second; or, if 95 per cent. seed is to be mixed with 0 per cent. seed, 89.5 parts of the first and 10.5 of the latter are needed. Now while unmixed 85 per cent. seed shows an average plant per cent of 31, the two mixtures yield 34 and 39 per cent respectively. The impropriety of relying merely on the germination per cent. as regulator of price is apparent. If a seed dealer had two parcels of seed, one of 65 per cent., the other of 95 per cent. germination, the buyers would object to the first as too low, but would not be willing to pay its true value, or more than for an 80 per cent. seed, the average quality The seed dealer is, therefore, justified in mixing, and even to add *o* per cent. seed to a *95* per cent. seed, whereby he even improves the corresponding plant per cent.

If the plant per cent. were used in price making, the following differences would appear. Taking an 85 per cent. seed as of normal quality at the cost of 1, then the value under (I) favorable, (II) unfavorable and (III) average conditions is:

Germination per cent.:	55	65	75	85	95
I	.32	.53	.74	1.	1.29
II	—	.25	.56	1.	1.69
III	.22	.45	.71	1.	1.42

If, therefore, 85 per cent. seed is worth $1.00, one could afford to pay 30 to 70 cents more for 95 per cent. seed.

To secure the same number of plants one would have to sow, under average conditions, to secure a sowing of same density:

Germination per cent.:	65	75	85	95
	4.8	3.8	2.2	1.5 lbs.

The policy of using the very best seed material, especially on poor sites, is strongly argued.

Besides germination per cent., germinative energy needs to be considered, *i. e.*, the rapidity of germination within a limited time, *e. g.* for pine ten days. The author's tests exhibit a striking similarity of the progress of germinative energy with that of the plant per cent., leading to the conclusion that only the rapidly germinating grains furnish the plants in open sowings, and that the germinative energy rather than the germination per cent. is the important factor; a seed test of ten to fourteen days should settle the judgment on seed quality. Proper conditions for testing are, to be sure, essential. The author, having made over 3,000 tests, finds it best, if the seed, lying on filter paper or flannel, secures its moisture by capillary action from water located under the paper 3*cm*, under the flannel 1½*cm*. No special apparatus is needed, a deep plate suffices, and if paper is used a glass cover. A very simple apparatus may be made of a tin tray, 3 inches deep, with ledges on two side walls, across which movable bridges punctured with holes can be placed on which the flannel or paper is placed, and a window glass over all. Contrary to former beliefs darkness is not required, indeed undesirable, but uniform temperature essential.

The author, who has been in charge of a seed-extracting establishment of more than $20,000 capacity, then discusses the propriety and method of securing best seeds. The gathering of only ripe cones, and the regulating of the heat in getting the seeds out are first requirements. The author recommends domestic seed as superior to imported, whose origin is not known. Next comes the keeping of the seed, which when refusing to use imported seed, needs to be done for a number of years between seed years.

The conditions most favorable for keeping seed germinative were investigated in a long series of experiments, detailed in tables and germination curves. The present practice of storing seed in cool, open boxes and shoveling them over, apparently to prevent heating, is condemned. Just as Cieslar has shown in similar experiments, storing in airtight receptacles is most favorable to maintaining germination per cent. and germinative energy. After two or three years, seed stored in such manner produced 1.6 to 3.3 times the number of plants as the same seed stored in open air under most favorable conditions. After three years such seed had lost from 16 to 68 per cent. of germination, while seed kept airtight still showed nearly 90 per cent. The loss in the former was especially noticeable when originally poor seed was involved. Hence, airtight storage is not only desirable for first-class seed, but especially for seed which is difficult to keep. Such storage should, however, not be made in rooms in which the temperature can rise much, if even only temporarily, especially if the seed is not first fully, yet not too thoroughly, dried. The degree of dryness attained by being placed for a few days in the sun or in a well warmed room until the weight of the seed is decreased 1 to 2 per cent. may be the most favorable.

A sample of the tabulation will give an insight into the changes in germination per cent and germinative energy that take place under different conditions, the germination period being 10 to 28 days, the drying having been done in chlor-potash exsiccator for seven days.

EARLY HARVEST OF 1905-6.

	Exposed to Air in		*In Air-tight Bottles*					*In Cellar*	
			In Warmed Room		*In Unwarmed Room*				
Age of Seed	*Garden House*	*Unwarmed Room*	*Not Dried*	*Dried*	*Not Dried*	*Dried*	*Coveerd With Sand*	*Dried*	*Warmed*
	Germination Per Cents.								
0	90-96	90-96	90-96	90-96	90-96	90-96	90-96	90-96	90-96
1	49-83	62-90	— —	— —	83-96	81-95	73-94	80-96	77-96
2	32-44	46-71	61-90	60-89	64-91	67-90	68-92	68-94	68-91
3	18-21	32-46	66-83	61-81	71-91	69-93	66-93	69-93	76-91
3	(The last year kept on ice)							78-85	84-92

Keeping seed on ice in airtight bottles proved under all conditions an improvement over other methods, especially as regards germinative energy. This, as some experiments showed, may be due to the fact that the cold inhibits the carbonic acid formation and consequent loss of substance due to respiration of the seed. Such respiration must also be a cause of deterioration when the respiration is active under admission of air. Yet storage in carbonic acid did not appear to produce advantageous results.

The importance and financial value of these findings as to proper storage may be understood when it is stated that the price of 70 to 75 per cent. seed was in 1906 4 marks; in 1907, 7 mk.; in 1908, 11 mk.; in 1909, 9.5 mk, and that from two to three times as many plants result from seed kept airtight for 3 years, as from the seed kept in open air.

The best place to keep seed is an ice-cellar (cold storage); next, a deep, cool cellar, the seed dried to a loss of 1 to 2 per cent. of its weight, being enclosed in dried-out, corked and sealed bottles, or in zinked receptacles, possibly with a little unslaked lime enclosed.

Der Kiefernsame. Zeitschrift für Forst-u. Jagdwesen. June, 1909, pp. 353-381.

Mixed or Pure Forest?

That mixed forest is superior to pure forest is a dogma accepted without exact investigation. The difficulty of such investigation has postponed its being undertaken, but now, since 1905, Dr. Schwappach has instituted some twenty sample plots for the purpose, and, while so far mainly the methods may be discussed, there are already results noted which throw light on the question.

The object of the investigations are to be: (a) determining the rate of growth of mixed as compared with pure stands; (b) determining the influence of mixed stands on soil conditions; (c) experiments into the most suitable methods of establishing and managing mixed forest. The sample plots, located in East Prussia and Silesia, comprise three general types, namely, (1) mixtures of pine and spruce; (2) mixtures of larch with pine and spruce; (3) spruce and fir with pine, and with beech.

The following samples from the published tabulations will illustrate the manner of record:

TABLE I.—Mixed Stand.

Number.	District.	Permanent Stand. Species.	Age.	Stem Number.	Mean Height. *m*	Max. Height. *m*	Cross Section. *q m*	Timberwood. *fm*	Volume of Aver. Tree. *fm*	Thinnings. Cross Section. *q m*	Timberwood. *fm*	Site Class.	Pure Stand according to Yield Table. Cross Section. *q m*	Timber-wood. *fm*
							I.—Pine-Spruce.							
2	19	Pi. Sp.	58 61	469 358	23.9 21.3	24.8 25.	22.6 9 8	243 107	.52 .30	2.4 .7	23 6	I II	32.8 38.7	319 416
				827	. . .	. . .	32 4	350	. . .	3.1	29			
							II.—Larch-Pine-Spruce.							
15	128	La. Pi. Sp.	106 99 106	225 108 169	32.4 28.9 22.9	33. 29.4 24.7	22.4 12.1 9.	326 143 95	1.45 1.32 .56	.1 2.3 . . .	2 27 . . .	I IV	33.8 33.	427 369
				502	. . .	. . .	43.5	564	. . .	2.4	29			

TABLE II.—Participation of Species in Composition.

Number.	District.	Species.	Stem Number Per Cent.	Cross Section. Per Cent.	Timberwood. Per Cent.
			I.—Pine-Spruce.		
2	19	Pi. Sp.	34.5 65.5	60.3 39.7	61.2 38.8
			II.—Larch-Pine-Spruce.		
15	128	La. Pi. Sp.	45. 21.5 33.5	51.6 28. 20.4	57.9 25.3 16.8

TABLE III.—Progress of Height Growth

District	Species	Age	1905	1900	1890	1880	1870	1860	1850
132	La. Pi. Sp.	109 104 110	34.5 29.6 33.	34 29.2 31.3	32.9 28.3 28.4	31.6 27.2 26.7	30.1 25.3 25.	28.2 22.8 23.2	25.7 20.3 20.9
	La.—Pi. La.—Sp. Pi.—Sp.		4.9 1.5 —3.4	4.8 2.7 —2.1	4.6 4.5 — .1	4.4 4.9 .5	4.8 5.1 .3	5.4 5. — .4	5.4 4.8 — .6

Table IV.—Volume Increment Per Cent. of Model Trees

District	Species	Age	1896–1905	1886-95	1876-85	1866-75	1856-65
136	Pi.	129	.58	.94	1.14	1.26	1.62
		129	1.39	1.32	1.42	1.62	1.90
		Average	.99	1.13	1.28	1.44	1.76
	Sp.	128	1.80	1.60	2.22	2.26	2.28
		102	1.86	2.12	2.56	2.94	2.58
		Average	1.83	1.96	2.39	2.60	2.43

In the mixed forest of pine and spruce, three types are recognized, namely: 1. Uniform pine—spruce mixture; 2. Pine with interspersed spruce; 3. Pine with spruce undergrowth. These types with many transitions depend on soil quality, especially humidity. The fresher and stronger the soil the more prominent is the spruce and the more it emulates the pine in heightgrowth, while on poorer, drier sites, the spruce becomes a mere intermediate or underwood. The delicacy of the reaction in this respect is noticeable, and makes it difficult to secure really uniform sample areas. In the same stand in the rolling country at short distances and with altitude differences of only 1 to 2*m,* stands show these variations. The differences are best brought out by reference to the heights of trees. In type I, the two species have about the same height. In type 2, the pine in 3 to 4 *m* higher than the spruce; in type 3, the difference is 5 to 7*m* in maximum and 8 to 10*m* in average height.

The sample plots had been chosen according to the type of the stands without reference to site quality, but when afterwards ranged according to average heights it was found that 15 out of the 17 plots of pine-spruce forest belonged to site class I, indicating that only on such sites is an even-aged mixture of these two species likely to persist.

On the poorer sites, in small volumes of the average tree of the more fastidious species show how little they contribute to value production, and that any undergrowth which is only 30 to 50 years old, becomes entirely insignificant in volume production.

The comparison of the volumes of mixed stands with the yield tables of pure stands suffers by the fact that the latter are based on stands produced under regular thinning practice. In the mixed stands of type 1, the volumes lie between those for pure stands of the two species; in type 2 the admixture of spruce adds 15 to 20% to the volume of pure pine in most cases. In type 3, no influence of the spruce admixture or volume is noticeable.

The three plots of larch-pine-spruce, originating from sowings made over 100 years ago, correspond as regards volume and height growth to the ideals which are usually ascribed to mixed stands, their volumes being in excess of yield tables for pure pine or spruce (by 15 to 50%). But the larch, for which yield tables are lacking, is, to be sure, the ideal tree for a mixture, since under its light shade the other species can still thrive. Stands like these are a rarity in Germany. Failure to produce similar stands on the same sites in later plantations in which only few larches have maintained themselves and from which a nearly pure pine stand with spruce underwood resulted, are ascribed to improper amounts of seed used, and perhaps to game damage.

The investigations into relative heightgrowth give valuable hints for the establishment of mixed stands. Even-aged mixtures seem to be appropriate only on the sites of type 1; on the other types the introduction of the spruce is indicated only as underwood when the pines have reached an age of 40 years.

As regards the volume per cent., the interesting fact is brought out, that while in earlier ages the pine shows mostly a higher per cent. than the spruce, the per cent. for the latter after the 100 year is approximately double that of the pine. While the data of tree analyses are insufficient to make deductions for the whole stand it may be concluded that in the mixed stand the current increment shows a higher rate in old age than that of pure pine stands, and that in such stands of pine and spruce mixed the index per cent. sinks more slowly than in pure stands.

The data so far gathered permit preliminary conclusions which, however, may need further verification or correction.

1. Mixed stands, in which the more fastidious species participate in considerable degree, say over 20% of the total volume of the mature (over 100 year) stand are possible only on the better sites which are favorable to that species; otherwise this species can only be underwood or soil cover.

2. Site class I for pine corresponds to site class II to III for spruce (and beech), site class II for pine to site class III to IV for spruce (and beech).

3. An increase in volume production of pine stands by mixing in spruce is attainable only on the best pine sites, and in type 1 especially needful because here site conditions are more favorable to spruce.

4. Apparently the beech-spruce mixture does not produce more volume than the pure spruce forest, while value production is greatly depressed by beech admixture.

5. To determine the best method of growing and managing mixed forest, careful studies on the basis of stem analyses are valuable.

6. The artificial establishment of even-aged mixed stands of pine and spruce are admissible only on the best sites; on the poorer sites, the spruce is best introduced in the polewood stage by underplanting, in order to correct the branchiness of the pine growing up in the open stand.

7. Both technical and financial considerations make higher rotations advisable for pine-spruce mixture than for pure pine stands.

Untersuchungen in Mischbeständen. Zeitschrift für Forst-u. Jagdwesen. May, 1909, pp. 313-332.

Silvicultural Problems.

Although referring to a particular locality and species, the discussion and report of experiments by Forstrat Abele on the natural regeneration of fir in the Bavarian mountains is most suggestive to all who wish to understand silvicultural problems.

The discussion refers to the region of the Bavarian mountains, a range of 100,000 acres, with an altitude of 1,800 to 4,500 feet, mainly gneiss and granite. Up to 3,800 feet the forest consists of a mixture of spruce, fir and beech, some 12,000 acres being in selection forest, 170 to 200 years old and more, culled and open, weedy, with about 60 to 70 % of normal stock.

The aim of the management has been to grow by natural regeneration the three species in mixture of 50% spruce, 20% fir and 30% beech, but, in spite of the preponderance of the fir in the old stand and apparently proper management, no success has been had in propagating the fir. While in the old stands over 100 years the fir forms 68.6%, in those below 100 years not more than 4.2 to 8.5% appear.

The greatest diversity of opinions as to the reason for this failure has for years been advanced by practitioners and theorists, some assigning it to soil conditions, especially the formation of raw humus under the change of light conditions, others to the interference of beech litter or other causes for unsuitable seed bed, snow accumulations, weed growth, others again to the interference by game, by fungus, by insects.

Finally, in 1904, somewhat extensive trials throughout the region were inaugurated to determine the cause of the failing regeneration; 25 groups on 15 trial plots were similarly located, each group of 600 square feet. These were made in 3 series of 5 plots each, the first series was left unprotected to test the influence of game, the second series in full light, the third in subdued light which was secured either by the neighboring stand or by lath screens.

The first set was sown on the natural soil cover, the second set after removal of the loose litter on the unworked humus, the third with the humus layer worked in with the mineral soil, the fourth with both litter and humus cover removed, the fifth with the mineral soil worked after removal of litter and humus.

The seed was gathered from the 200-year old firs on the ground, and was sown as Nature does it, without cover, at the rate or 1 grain to the square meter (90 lbs. per acre). After four years, during which the plats were under observation, the trials were considered concluded. In all cases the loss of plants during the four years was considerable, averaging 79% of the original stand. In the first series only 11% survived; in the second series 31% in the average and 37% on the best, the last set; while the third series (in subdued light) showed 19% survivors, varying from 12 to 21 on the various plots.

Taking series 2, the most advantageous, by itself, and noting the losses from year to year, it is noticeable, that the percentage of loss from year to year decreased rapidly, the loss per cent. averaging 42, 29, 18, 8 from the first to the fourth year, but, with the exception of the plots left in natural condition the proportion of loss from plot to plot showed little difference, the last two series being only slightly favored.

On the plots left natural, at the end of the period there were still over 5,000 seedlings per acre, which would be quite satisfactory, but 8% of all the plots had no plants, 21% at best not over 1,000, 8% at best not over 2,000 seedlings, so that altogether

37% of the area in the first set must from the standpoint of management be considered in unsatisfactory condition. And, if it is considered that an unusually large amount of first class seed had been used, supplemented by nature, it would be proved that natural regeneration without human assistance seems excluded.

Considering the various influences that may cause the difficulty, it is stated, that, qualitatively, the seed from the old firs was altogether without flaw, as tests and comparison with results from other seed had shown, but quantitatively it appeared quite insufficient, since hardly 20 trees, seeding sparsely were to be found per acre, as against 120 normally in stock of 100-year old stands.

The damaging influence of game seemed to be conclusively proven as a concomitant cause of failure. The favorable influence of full enjoyment of light was patent (although fir is a very shade enduring species), supporting the claim of Dr. Martin: "Direct sunlight is always favorable to young firs. From the very day of their germination it would thrive best and grow fastest in full sunlight. Here, too, only the indirect consequences which light brings with it are damaging, namely, in the increased growth of weeds which are still more favored by the light."

As regards the influence of soil cover and humus forms, it is stated that raw humus, of more than 1 to 2-inch depth does not occur in the region. The plots show that the removal of the surface litter does not have any appreciable influence. While the removal of the humus layer seemed numerically to be favorable, the poorer development of the seedling in the soil deprived of the humus leads to the conclusion that the result is in no proportion to the cost of this work of soil culture.

Altogether, while the removal of the loose surface cover was effective, the treatment of the soil in the various ways in order to secure a seedbed did not improve matters. On plats covered with light moss and loose huckleberry growth, seedlings endured better than where soil cover had been removed or soil cultivated, so that with such cover its removal seems disadvantageous. Martin and other authors are quoted as having before assigned to a light moss cover beneficial influence on fir reproduction, especilly in dry years, both for germination and water supply.

As regards foliage litter the conclusion is reached that the removal of old foliage of several years is an indispensable requirement for a satisfactory seeding and development of fir, although a newly fallen leaf layer is not objectionable.

While the influence of weeds could not very conclusively be shown on the experimental plats, except the first set, where the germination was in the first place interfered with, observations on the felling areas show the presence of grass especially inimical to the young regeneration. Especially in the first year the fir is, according to Dr. Martin, very sensitive, to the withdrawal of moisture by the grass, especially where a certain degree of light favors the weed growth; its shade endurance is the sole weapon of defence, so that even under dense beech regeneration it can maintain itself and develop.

Occasionally several species of snout beetles and fungi were observed as damaging the young growth. The conclusion is that the main cause of the failing regeneration may lie in insufficiency of seed supply, and in the grass and weedgrowth impeding germination and further development of seedlings. In the combat with grasses and weeds endowed with an extensive root system, the seedling with its scanty organs of nutrition must succumb.

The unfavorable conditions have come about gradually, so that in the last 50 to 60 years neither fir nor spruce have reproduced, and the conditions for natural regeneration are lost. Here, Martin's and Schwappach's positions in general are justified, the first considering an insistence upon natural regeneration a "rapine in the worst sense of the word," the latter finding the excessive prejudice for natural regeneration when it is to be forced without proper conditions being present, a principal fault of many a management. Hence change to artificial reproduction by planting with 3-year old transplants is the only solution of the problem.

On the other hand the 25,000 acres of stands, 100 to 170 years old, show still favorable conditions for natural regeneration. This is to be practiced, with such variation as is indicated by these trials, preventing especially weedgrowth by keeping fellings dark.

Die Naturver jüngung der Tanne in den Staatswaldungen des Bayerischen Waldes. Forstwissenschaftliches Centralblatt. April, May, 1909, pp. 187-198, 251-266.

Silvicultural Implements.

Just as the moleplow is revolutionizing farm culture, so seemingly is a similar "forest grubber" *(Wühlgrubber)* finding more and more friends. The principle of these plows is not to lay the furrow over but to stir the soil without dislocating it. Several such grubbers are in the market (see notice of Webber's grubber on p. 109 of this volume). The praises of Kähler's grubber are sung by Geist, who accentuates that the superior soil preparation is cheaper than older methods which entail repair-planting and loss of increment.

The cost of plowing furrows with this instrument is $3.60, and at most $4 per acre (10,000 yards, 20 inches wide and deep), to which from 60 cents to $1.50 must be added for harrowing by harrow or hand. But the result in the stand of the sowings is phenomenal, especially in dry humus.

Two furrow sowings, the one made by the old-fashioned plows, the other by the grubber, succumbed to unusual drouth; in the first case $10 had to be spent to secure planting plots; in the latter case no expense for soil preparation was needed. The cost of the implement is about $300.

Zur Kiefernnachzucht, etc., Tiefe Wühllockerung. Zeitschrift für Forst- u. Jagdwesen. May, 1900, pp. 333-337.

MENSURATION, FINANCE, MANAGEMENT.

Value Increment. It has been asserted by various writers that the unit value of workwood—hardwoods in all practical sizes, conifers within certain limits—rises in proportion to diameter—(that is, wherever price is an expression of value, as inGermany. Rev.),—so that e. g. for beech, the following arithmetic progression may be found:

Diameters:	30	40	50	60	70	80 cm.
Price:	9	12	15	18	21	24 Mk.

Schubert has investigated this law of the parallelism of price and diameter, expressed by the equation $y = ax$, *i. e.*, progress in straight lines, for various species on the basis of data from several limited localities. He finds that as a matter of fact, price increase in oak and beech from 8 to 24 inches diameter moves practically in a straight line, with only one exception. With beech, the lines ascend at the ratio of $a = \frac{1}{2}$, with oak the appreciation is more rapid, namely at the ratio of $a = 1$, or even $= 1\frac{1}{2}$, *i. e.*, increase of diameter increases value disproportionately.

Quite different is the relation in spruce and fir. While here too, price increments progress in straight lines, they are not anywhere near parallel to the diameter increase. For the smaller sizes this parallelism holds good, but, after 10 inches is reached, the line curves, *i. e.*, proportionality of price and size vanishes, and beyond the diameter of 14 inches, the price per cubic foot does not change any more. It is interesting to note that the price lines of the two years 1904 and 1907, two years of entirely different market conditions, while absolutely different in value, run entirely parallel.

The author then goes into a discussion of how to shape the official sale rates for logs, which has no direct interest for us. The author calls attention to the fact that such relations as the foregoing can only be local and temporary.

Ueber Wertzuwachs. Allgemeine Forst-u. Jagdzeitung, May, 1909. pp. 153-158.

Loans on Forest Properties.

While on this continent, and especially in Canada it is customary for banks to make loans on forest properties on the basis of the estimated actual timber or "wrecking" value, in Prussia the county credit banks—coöperative banks of the estate holders or farmers (Landschaftsbank)—determine the credit value of forests on the basis of the yield under sustained yield management and of a controllable working plan. In consequence of this principle, a forest which does not admit a felling budget for the first period of the rotation is not loanable. In these provincial or county credit banks the value of all the farms in the county or province have been assessed, so that every member knows to what extent he can loan on it.

The forest assessment is variously made by different banks, but always by experts if at least 250 acres are involved. The rotations for coppice vary from 10 to 20 years; for timber forest usually 60 years, and in some parts up to 120 years. The principles of the working plan are definitely laid down, varying from province to province. The stocktaking is usually confined to the stands allotted to the first period. It is significant to note that selection forest practice makes the forest unloanable. The net yield is determined upon the average price for the last six years in the forest itself or in neighboring properties, diminished by 10% in conifers, 5% in broadleaf forest, to discount calamities, by 20 to 60 cents per acre for cost of management, by $2 to $10 per acre for planting in timber forest (in some parts less), $1 to $4 (or $8) in coppice and composite forest, by cost of logging according to six year average, by the value of any servitudes on the forest, and by the needs of the farm or estate itself according to judgment of the assessor.

In some banks these figures vary, and sometimes an additional allowance of 10% is made against market fluctuations.

The net yield so determined, multiplied by 20 (5 per cent.), represents the yield value upon which loans may be issued. In some provinces a longer rotation than 70 years reduces the rate to 4 and 3 per cent.

It is, of course, understood that the forest is to be managed for sustained yield, and a strict control is exercised, annual budgets and planting plans must be submitted, and every 3 years an inspection and possibly revision takes place.

Lately, in Silesia, it has been found that such improvement in the values of forest properties has taken place that an increase in their loan value, determined on these data, of 15 to 20%, has shown itself admissible. Especially the premium against calamities, experience has shown, may be diminished by one-third. Again, the value of thinnings has increased so that they may be taken into account to the extent of 20 cubic feet per acre and year of timberwood, and up to 15% of the total yield for brushwood.

It is interesting to note how far advantage is taken of this loaning method.

In one of the counties of Silesia 91 private forests, totaling 252,000 acres had their value assessed at around $6,000,000, or $24 per acre. The four largest, however, representing 120,000 acres, figure out only $18.75 per acre, the smaller ones from $30 to $62 per acre and the three best from $83 to $108 per acre. Here, no differentiation of soil and stand value is made. This is done in some of the other provinces. In East Prussia the tax value of the stand was calculated (since 1901) at 45% of the total yield value calculated at $50 per acre. In Pomerania (since 1903) with a yield value of $28 per acre the stand value was calculated to represent 44%; in Posen (since 1907) with a total yield value of $16 per acre, 68% was allotted to soil value.

In the average then, on a total assessed area of around 42,000 acres the yield value being $42, the tax value of the soil was calculated at $18, that of the stand at $24.

Propositions to improve the opportunities for securing credit of forest properties with a view of assisting in lifting farmers out of the burden of debt are made by v. d. Borne. It appears that in the Eastern Provinces these debts represent from 28 to 53 per cent. of their total gross property values, in the western provinces from 10 to 30 per cent.

Die Frage der Waldbeleihungen durch die preussischen Landschaften. Zeitschrift f. Forst-u. Jagdwesen, March, 1909, pp. 141-156.

Municipal Forests in France.

The city of Pontarlier has just added to its forest property about 400 acres, so that the city forest comprises now over 2,000 acres. The price for this new property was around $16,000, one-third of it consisting of severely culled woods, the balance run down pastures and waste lands, which are to be reforested. The 1600 acres of its original forest property, which until 1877 brought annually $5,000, now yields $12,000, and promises to increase its yield to $16,000 shortly, or $10 per acre. This experience stimulated the city to the new purchase.

Bulletin de la Société Française des Amies des Arbes. 1908.

French Forest Administration.

In March, 1909, a reorganization of the French Forest Service was inaugurated, including readjustment of salaries. These are now for the Director General and the Directors from $2,400 to $3,000; Chiefs of Service, $1,400 to $2,200, rising by $200 increases; Sub-director, $1,800 to $2,600; Administrators, $2,200 to $2,600; Conservators, the district officers, $1,600 to $2,400.

Administration centrale des eaux et forêts. Revue des eaux et forêts, April, 1909, pp. 216-220.

UTILIZATION, MARKET, TECHNOLOGY.

Cheap Wood Preservatives.

Professor Henry, of Nancy, discusses the value of different preservatives and methods from the standpoint of efficiency and especially cheapness. Main attention was paid to Carbolineum Avenarius, which, although more expensive than other tar oils, was supposed to be superior.

After a few experiments, some 7,000 ties were treated. The antiseptic was applied in open bath, heated to 60 to 80° C. in a tank holding 15 ties, immersed for half an hour, the arrangement being capable of treating 450 ties per day at a cost of about 6 cents per tie, the absorption being $1\frac{1}{4}$ pound of antiseptic at 4 cents per tie, oak and beech being used. According to experiments the same absorption takes place in ten minutes as in half an hour, and by so much the process may be cheapened.

As these ties were laid down in 1907, there has not been time for an endurance test, but after immersion cross sections were made which showed the sapwood fully penetrated and the heartwood at least at the ends, where, the author claims, the fungus is most likely to get in. Sixteen months later, sections were cut, and at first sight, showed no trace of the impregnation, but exposed to the light for a day, a browning took place throughout the sapwood and part of heartwood, which, the author argues, shows that there was no displacement of the oil, but a chemical reaction, the nature of which remains unexplained.

Another antiseptic to be tried is Green Oil (*Huile verte*), also a derivative of creosote, which sells at about 2 cents per pound, and can be applied cold with brush. With this oil too, when the wood is sectioned the impregnation is not visible, but on exposure the wood turns green, then brown, showing the effect of treatment. This would reduce the cost per tie to about 3 cents.

Another antiseptic made in Belgium is Cresoyle, a hydrocarbon oil, by-product from the distillation of tar, of the density 1.05, and same cost as Carbolineum.

Phenol is also said to be cheaper than creosote and more efficacious.

While these are all products of tar distillation, a new source of antiseptics is found in a derivative of fluor—salts of hydrofluoric and fluorsilicic acid called *Hylinite,* developed in Austria. It is inodorous, colorless and inoffensive, thereby becoming useful in house protection, especially as it also reduces inflammability and combustibility. It easily penetrates wood, and can be applied by brush and is very cheap. It costs less than 2 cents to cover a square yard with two coats. Different woods take up different quantities, but 8 to 10 pounds per cubic foot may be an average. Most satisfactory experiences with this antiseptic are reported.

The possibility of making use of various woods of the French colonies, subject to fungus attack is also discussed.

Essai en grand du Carbolineum Avenarius. Revue des eaux et forêts. April, 1909, pp. 204-215.

STATISTICS AND HISTORY.

Prussia's Forest Management.

A retrospect on the forest management of Prussia during the year 1907 by Semper gives insight into conditions and changes based on official data.

Industrially, Germany was passing through a year of depression, like the United States, due to overspeculation, scarcity of funds, political fears, strikes, etc., but, as in the United States, the crisis was not severe, owing to good farm crops.

Until 1900 the State forests of Prussia in the old provinces were mortgaged for the debts resulting from the wars of liberation, and whenever any of them were sold, the cash had to be devoted to discharging these debts. Since then, both State farms and State forests, especially near large cities have been sold to the amount of over $40,000,000, of which $7,000,000 was for forest properties.

These funds together with an appropriation of $25,000,000 made in 1902, are at the disposal of the government for purchase of waste lands and mismanaged forests, especially in the eastern provinces of Posen and West Prussia.

By 1900 the total area of land under the management of the forest administration comprised 2,809,645 hectar, an increase since 1870 of 175,000 hectar; then the purchases increased at the average rate of 18,418 hectar annually, so that the total area under the forest administration in 1909, was 2,975,407 hectar (7,349,255 acres). Of the waste lands acquired, 237,000 acres had been planted by 1908, and in later years this planting is annually done on about 10,000 to 12,000 acres, which represents about 20 to 25 per cent. of all the planting. It is remarkable to note that about 80% of the plantings required repair during the years 1900 to 1903, which in the following years was cut down to about 60%, as a result of more careful initial planting. It is expected to improve further on this score.

The total budget for planting which in 1907 was $1,300,000, experienced increases of $357,000 and $238,000 in 1908 and 1909 respectively. Since the planting area in 1907 was 63,000 acres, the average cost per acre appears to be near $20.

Great activity is noted in the provincial bureaus in the direction of assisting private owners with advice, working plans, etc.

In 1906 the pine moth (*Bombyx pini*)became obnoxious in the eastern provinces occasioning an expenditure of $52,000, and, in 1907, extending its destruction over near 100,000 acres, $135,000 were spent in combating it, although the need of "liming" was doubted. Now disease has overcome the pest. The spruce moth (*Liparis monacha*) also occasioned damage. Here, mixture of the pine, which is also attacked, with broadleaf trees proved an efficacious means of resistance.

In regard to forest fires, we learn that the year 1907 had only 19 fires destroying 600 acres as against the 15-year average of 24 fires with 1550 acres destroyed.

Forest fire insurance is becoming more general. The original insurance company in this field (Gladbach) had in 1903, 33,000 acres insured, but refused to give later information on account of competitors coming into the field, one competing company reporting 82,000 acres, and another 4,000 acres insured. These latter insure the sale value of the stands, or else the cost value, while the Gladbach company insures the sale value only on stands which are designed to be cut within the decade, otherwise the expectancy value or, in the beginning till the first thinning, the cost value is made the basis of insurance.

The change in the cut, which in 1907 was 398,000,000 cubic feet, and in the resulting income, and in wood prices is exhibited in the following table.

	Cut Per Acre			*Money Yield Per Acre*		*Price Cents Per Cub. Ft.*		
Year	*Total*	*Timber*	*Woodwork Per Cent.*	*Gross*	*Net*	*Workwood*	*Fuel*	*Total*
1890	55	42	47	2.72	1.36	8.3	2.9	4.8
1895	52	42	51	2.49	1.05	7.1	2.8	4.5
1900	54	44	60	3.60	1.97	10.	3.4	6.6
1901	58	47	59	3.62	1.87	9.2	3.0	6.2
1902	61	49	55	3.36	1.60	8.4	3.0	5.4
1903	70	59	63	4.09	2.15	8.7	3.1	6.1
1904	65	55	64	4.29	2.44	9.2	3.3	6.4
1905	61	51	64	4.26	2.42	9.9	3.5	6.8
1906	60	50	62	4.27	2.28	10.3	3.8	7.1
1907	61	52	63	4.55	2.52	10.6		7.5

Prices for wood have risen at the rate of $2\frac{1}{2}$ to $3\frac{1}{2}\%$ per annum for the last 12 years. Mine timbers especially rose in price, owing to the increase in coal prices which invited the miners to develop deeper pockets with more extended use of timber. Mine props in 1906 brought, delivered, 14 cents, in 1907 17 cents per cubic foot.

Imports, mostly from Russia, have nearly doubled in the last six years, imports over exports rising gradually from 3,703,000 tons in 1902 to 7,201,000 tons in 1907. This latter figure, the highest so far attained, can be translated into 500 million cubic feet of forest grown logs, or 25 per cent. more than the home cut.

This enormous activity in the wood market found a check in extensive strikes in the building trades so that prices sank in many cases by 15% below those of the previous year.

Although a new tariff had reduced the duties on both logs and timber considerably, an influence of this feature on imports is discredited, the industrial conditions alone being responsible for the increase. It is interesting to note that nearly 50 per cent. of the import is by water, in the eastern rivers by means of rafts, on the Rhine and Donau by vessel.

To check the loss of forest labor by emigration to town, the State is building houses for laborers, is introducing scales of wages which increase with length of service and is encouraging immigration from Russia, and giving financial assistance in various ways.

In Eberswalde, workmen receive 83 cents, after three years an increase of 8 cents and, after 6 years, an additional 16 cents per day. Wood choppers who have worked one winter for six weeks receive in the following winters premiums for every week they work, from 25 to 75 cents per week; railroad fares are paid them, and other means to keep labor in the woods are resorted to.

Educational changes consist in lengthening the term at the forest academies to three years.

An association of private forest officials was founded in 1904, which in 1908 had 2,553 members. In 1906 it instituted a school for forest rangers which is succeeful. Short courses are given in various districts. The association also holds examinations outside this school to which 202 persons were admitted in 1909. Since there are about 16 million acres of private forest in Germany these efforts to secure properly prepared foresters outside of the government schools is a healthy sign of the development of private forestry, which is also being aided by the State.

Forstwissenschaftliche Rückblicke auf das Jahr 1907. Zeitschrift für Forst-u. Jagdwesen. April, 1909, pp. 232-253.

Japanese Forest History.

The nestor and founder of modern Japanese forestry, Matsumo, died last year in Tokio. Some 30 years ago he abandoned his medical studies in order to study forestry at Eberswalde, and cognate subjects in Berlin for five years. On his return to his country, although he received a position in the government, he found that his ministers constantly changing, harrassed by the many innovations that were demanded, could not be moved to warm to his propositions of reform.

Just as on this continent, it was necessary first to form public opinion and so he began to give public addresses, first to small audiences. Then he organized a society of friends of forest culture, the presidency of which was taken by one of the princes, whose name drew others and the attention of higher circles. The result was the foundation by the Ministry of a forest school in connection with the University, at which Matsuno was first the only instructor, later to be joined by Dr. Nakamura.

Later a forest ranger school was instituted, which, however, had to be abandoned after the Russian war for lack of funds. A forest experiment station of 35 acres was also one of Matsuno's works. On the literary side an elegant volume on the forest trees of Japan, finely illustrated, stands to his credit.

German influence was naturally strong in guiding in the establishment of the forest administration, but particularly on Matsuno, who had married a German wife, a woman of parts, who herself was active in reform work in educational lines.

Allgemeine Forst-u. Jagdzeitung. May, 1909, pp. 187-8.

POLITICS AND LEGISLATION.

Reforestation in Spain.

A new reboisement law is under discussion before the Cortes. Under the law of 1863, considerable areas of mountain brushwood have been sold for pasture purposes, with disastrous consequences, only 10 per cent. of Spain remaining in forest. The same law and subsequent ones provided for reboisement under expropriation and by assistance with money and plant material; the law of 1891 having special reference to restauration of mountain slopes in torrential basins. The results, according to Miguel del Campo, professor of silviculture at the Escurial forest school, are practically nil owing to the failure of private owners and municipalities to act.

The new project contemplates restrictive measures on private properties, and the formation of planting associations with financial assistance by the State, premiums, etc., or else the State may take over and plant the property, paying 4 per cent. of the value of the soil annually, until the proprietor chooses to take it back! According to Campo this is an impracticable proposition. He proposes, therefore, first, differentiation of forest zones, which *must* be kept in forest; if municipal property, it is to be placed entirely under State administration; if private, under limited surveillance, restricting number of cattle, clearings, use of fire, etc. Territory requiring reboisement to be acquired by the State. A 20-year credit to be voted for this work and to be used in 20 equal instalments under a specially organized corps of foresters and subalterns. Creation of special schools for their education, distribution of plant material, exemption from taxes for plantations, low freight rates for forest products, propaganda bureau, arbor days, and the whole rigmarole of methods which have been used elsewhere form part of the plan.

L'o euvre de la restauration forestière en Espagne. Revue des eaux et forêts. March, 1909, pp. 166-171.

Argentine National Parks.

Partly under French influence the Argentine Republic has set aside two national parks, that of Iguazu on the river of the same name, of 50-60,000 acres, and that on Lake Nahuel Huapi in the watershed of Rio Negro in Patagonia, lately ceded by Chili. Picturesqueness has been the reason for these reservations. A movement is also on foot to create a forest reserve in the Terra del Fuego, which has been largely devastated by axe and fire.

La Nature.

French Forest Laws. Increased activity is noticeable in France to further strengthen State influence on forest management. In March, 1909, a new law modifying existing relations was passed. It provides that, besides State and communal forests of whatever description, also forests of areas to be reforested, belonging to associations formed for purposes of public utility and of mutual aid, and certain other private properties are to be placed under State control.

The forest administration may undertake at the request of private owners for a consideration to manage altogether or in part private properties. In such properties contracts and sales previously concluded must be submitted for sanction to the government, or can be annulled.

Other details are enacted.

There is also proposed a bill to prevent clearing land without State permit, which requires that notice of intended clearing be given four months in advance. Permits are to be withheld if the conservation of forest is found necessary. The necessity is, of course, in the first place due to protective influences, but it also includes "the maintenance of existing economic conditions." A fine of $100 to $300 per hectar for disobedience is proposed.

Proposition de loi etc. Revue des eaux et forêts. April, 1909, pp. 234-239.

OTHER PERIODICAL LITERATURE.

The Indian Forester, 1909,—

The Hyderabad Floods and their Moral. Pp. 195-207.

Points out once more the economic importance of the preservation of forests on catchment areas of great rivers.

Notes on the Forests of Northern India and Burma. Pp. 213-219; 257-262.

These notes deal mainly with the coniferous forests of the Himalayas, the sal, the grazing problem, and the Indian Forest Department.

The Forests of the Philippine Islands. Pp. 235-237. Statistics regarding the same.

Influence of Forests on the Rainfall in India. Pp. 262-273. Suggests lines of inquiry.

Report of Woods and Forests Department in the Sudan for 1907.

Bulletin of American Geographical Society, 1909,—

Plateau of the San Francisco Peaks in its Effect on Tree-Life. Pp. 257-270; 365-382.

Ohio Naturalist, 1909,—

The Catalpa Leaf Spot. Pp. 509-512.

The Journal of the Board of Agriculture, 1909,—

Area of Land Available for Afforestation. Pp. 44-47. Statistics regarding waste lands in Great Britain.

Bulletin of the American Institute of Mining Engineers, 1909,—

Conservation of Natural Resources. Pp. 439-451.
Conservation of Water. Appendix, pp. 1-19.
Conservation of Natural Resources by Legislation. App. pp. 20-36.

Waste of Natural Resources by Fire. App. pp. 37-42.
These last three are papers read at a joint meeting of engineers in New York, in March. Also printed as a separate. See review on p. 305.

The Pennsylvania State Farmer, 1909,—

The Future in the Forestry Profession. Pp. 75-77.

NEWS AND NOTES.

We regret to have to record the death of one of the early pioneers of the forestry movement in this country, Colonel W. F. Fox, well known to all foresters as Superintendent of Forests under the Forest, Fish and Game Commission of New York State, which position he held for nearly a quarter century. He died at Albany on June 16, in his 70th year, having ailed for several years with heart trouble.

Colonel Fox, who earned his title during the Civil War, came into his position and into prominence in the forestry world in 1885, when the State Forest Commission was created. He was neither a forester by profession or study, nor had he been one of those who had exercised himself to advance the establishment of forest policies; it was a purely political appointment. He was a graduate of Union College and previous to his appointment had been civil engineer with the Blossburg Coal Company. But Colonel Fox was an intelligent man, with executive ability, and especially with geniality and tact, which helped him to keep his place through Republican as well as Democratic administrations, although he was an openly professed Democrat, and a thoroughly honest man, who steered through the mazes of political corruption without even a suspicion of improper use of his position for personal gain. Later on in his career, his intimate knowledge of property conditions and personnel in the Adirondacks made his services invaluable, and in this direction especially his loss will be most severely felt. Although himself an amateur, he had a proper appreciation of the possibilities of professional forestry, and, as far as the limited opportunities of his activity permitted—circumscribed as it was by the well-known puerile clause of the State Constitution—he tried to make room for it. It was through his suggestion that the fated State College of Forestry at Cornell came into being, and the waste land planting operations of the Forest Commission—a clear violation of the same clause in the Constitution—were encouraged by him.

He was a facile writer, and, besides the annual reports of the Commission, which made up in elegant form what they lacked in professional value, he was the author of "A History of Lumbering in the State of New York." He was also noted as a writer on Civil War history, his chief writings being "Life of General Green," "Slocum and his Men," "History of the Twelfth and Twentieth Corps," "Regimental Losses," "The Battle of Gettysburg.' He leaves behind him the sincere esteem of all who knew him intimately.

One of the saddest losses, which calls forth our gloomiest philosophies, is that of a young, devoted life, suddenly cut off in full vigor and with all the promise of a long usefulness unfulfilled. Such a loss the profession has just sustained in the death of W. W. Clark, one of the strongest, healthiest, and most promising of the small group which claimed Cornell College of Forestry as their alma mater. He died after two days' illness, at Logan, Utah, on July 20, from acute pneumonia, contracted by taking a cold bath while in an overheated condition. Sunshine himself, and, spreading sunshine around him, loved by everybody who knew him, and in love with everybody and with his profession, just starting a happy family life, he had everything to live for. In him the profession loses one of its most valuable and faithful members.

He began his professional work, after graduation, in 1902 in the Philippines, returned after three years to the United States Forest Service, and advanced finally to the position of Supervisor, being in charge of the Cache National Forest.

Mr. Austin F. Cary, Assistant Professor of Forestry at Harvard University, has been appointed Superintendent of State Forests of New York to succeed Mr. William F. Fox, whose death is noted above. Mr. Cary, a graduate from Orono, Me., has been closely identified with forestry work in this country since 1893, having first been associated with the United States Forest Division, then with the Forest Commission of Maine for many years and later with the United States Forest Service. His experience not only covers a wide range of conditions in this country, but he has also travelled extensively abroad, and in educational work has served as Instructor of Forestry at Yale, and later as Assistant Professor of Forestry at Harvard University.

One of the early and successful campaigns of the old Division of Forestry was in persuading the railroad companies that the chestnut oak timber which was cut for bark in the Appalachian region was entirely suitable for ties, and since the railroads have been convinced of this fact they have accepted chestnut oak on a par with white oak. As the supply of white oak ties has diminished, the railroads have been urged to use inferior woods of several kinds and to make them serviceable by preservative treatment, and it is interesting to note that the efforts along this line are at last bearing fruit. The Pennsylvania Railroad, for example, is using treated black gum ties in the New York Tunnels, and is carrying on experiments with loblolly pine, beech, maple, and other hitherto unused or rarely used woods on the main line. The softer woods and even the gum ties in the tunnels are being protected by large flat tie plates and screw spikes. Other roads are evidently working along the same line, as evidenced by the statistics in the recently published circular of the United States Bureau of Census and the United States Forest Service, which show that the purchases of gum ties in the United States during 1908 exceeded 260,000, while but 15,000 were reported in the previous year. The purchases of beech ties in 1908 amounted to nearly 193,000, against 51,000 in 1907. European roads are able to get 20 to 30 years' service from creosoted beech cross-ties by giving them preservative treatment and proper protection, and while the traffic and wheel loads are heavier in the United States, it should be possible to get considerable longer service from treated beech and similar woods than from the untreated oak which has been previously used.

Cross-ties under the present schedule are admitted from the United States into France under the minimum tariff, and the French custom duty on untreated ties imported direct from an American to a French port is 19.3 cents per long ton for ties that exceed 3.1496 inches in diameter. Treated ties pay the above rate plus 20%. Since the duty is not prohibitive, the United States Consular Office sent a communication to French railroad companies and to leading contractors inquiring whether they would be disposed to purchase American ties. The replies are rather interesting as indicating the willingness on the part of the French railroads to purchase American ties under certain conditions, one of these being that they be delivered free on cars, duty paid, at some terminal port or at some distributing point on their respective lines. The French State railways have, as a rule, used ties of domestic origin, but recently purchases have been made of "Baltic redwood" and Black Sea beech ties. In accepting foreign ties, it is usually specified that the place of origin of the species shall be given; that the wood shall be cut only after the growing season; that the approximate age of the trees, the method of cutting the ties—whether two or four per log section—and the proportion and distribution of sapwood and heartwood be given; that ties in which sapwood predominates are preferred, for the reason that they can be given preservative treatment more readily; and in the case of beech, the individual trees which have red heartwood or cannot be easily injected will be refused. There are several reasons why it is not likely that American dealers will attempt to export ties to France. One of the first is that it would be quite out of the question for an American lumberman to approximate the age of the trees, or even in many cases to assure an approximate percentage of sapwood. In the matter of prices, there seems to be a discrepancy between the statement by the Paris-Lyon Mediterranean Company that it will not consider quotations exceeding $1.18 per tie, and an article in the "Timber Trades Journal" to the effect that the above railroad purchased its tie supply for the year 1908 on the basis of 86.8 cents each for oak ties and 67.5 cents each for beech ties. If ties can be procured in France at the above cost, there would certainly be no incentive for American dealers to export timber to that country, as the prices at home would be more than they could hope to receive for ties delivered at French ports. Beech ties cut in eastern Pennsylvania, for instance, are quoted at 82 cents, whereas white oak ties from the South cannot be delivered at Pittsburgh or Philadelphia for less than 85 or 90 cents. It becomes apparent, therefore, that the crisis which American railroads are facing in regard to tie supply is already at hand, and that the use of untreated ties without tie plates is no longer justified on account of low initial cost. Yet in Canada, notably Quebec, the price for cross ties this year is 10 cents lower than last year, 30 cents buying first class cedar ties.

The Board of Water Supply of the City of New York are preparing plans for the establishment of forest nurseries in connection with the maintenance and betterment of the catchment basins in the Catskill on which they depend for water supply. The work is under the general direction of Mr. Alfred D. Flinn, Department Engineer, while the operations on the ground are looked after by Mr. A. Underhill, Landscape Gardener. It is understood that the first reforestation work will be the planting of a strip several hundred feet wide around the large storage reservoirs, the total area aggregating between 8,000 and 10,000 acres. This is a further advance in the adoption of policies of forest planting on city watersheds in the East, in cities of Newark, N. J., Bridgeport, Conn., and several others having taken up the work in the past few years.

The conservation movement in the United States seems to have attained a firm foothold in the minds of the people, and it is encouraging that commercial interests are also giving the movement substantial backing. Conservation meetings are being held in many parts of the United States, and consideration is being given to ways and means of preserving the natural resources, which are rapidly being destroyed through extravagant use. Five years ago such meetings were almost unheard of, and would have created hardly passing interest. Among the recent meetings* is that of the Counties Committee of the California Promotion Committee, which was held at Del Monte, Cal., on May 8. Among the prominent speakers were Dr. Geo. C. Pardee, exGovernor of California; Dr. W. J. McGee, of the United States Inland Waterways Commission; O. H. Miller, Secretary of the Sacramento Valley Development Association; F. F. Olmstead, of the United States Forest Service; G. B. Lull, State Forester of California; W. W. Mackie, United States Bureau of Soils; and John E. Fox, Special Director National Rivers and Harbors Congress. The West has been noted for its interest in the conservation of waters and forests, but it is noticeable that the movement has now passed from a propaganda on a sentimental basis to one which actively discusses ways and means for attaining the desired ends. The realization that the prosperity of a region is absolutely dependent on unfailing timber supply comes home with particular force to

* See account of Engineers' meeting, on p. 305 of this volume.

the people of the West, since they realize that retrogression must follow and decrease in the supply of available water, and the water supply, they have found, is more or less dependent on the forests. The resolutions adopted at the conservation meeting in California, briefly summarized, are as follows:

Resolved; That the plan proposed by the National Rivers and Harbors Congress for the issuance of Government bonds in the sum of $500,000,000 for the improvement of the navigable rivers of the country be endorsed;

That hearty endorsement be given to the work of the United States Weather Bureau in California;

That cordial approval be given the general policy of conserving the forest and mineral resources and the fertility of the soil throughout the country;

That the Forest Service be asked to institute more comprehensive tests and experiments, in order that official data relating to Eucalyptus growing may be placed at the service of the State, and that these tests and data be broadly commercial in their bearing rather than technical.

In this connection a rather daring but by no means insane proposition which looks ahead to the still stupendous possibilities of development on this continent, has been launched by Arthur Hooker, secretary of the board of control of the National Irrigation Congress, who presented a resolution for approval by that organization at its seventeenth sessions in Spokane, August 9 to 14, memorializing Congress to issue 3 per cent. gold bonds, running 100 years, to the amount of $5,000,000,000, or as much thereof as may be necessary, for the following specific purposes:

One billion dollars for drainage of overflowed and swamp lands, thus reclaiming an area equal to 100,000 square miles.

One billion dollars for the reclamation by irrigation of 40,000,000 acres of arid and semi-arid lands, now partly or wholly waste.

One billion dollars to construct and improve deep waterways, to develop thousands of miles of territory now without adequate transportation facilities.

One billion dollars for good roads and national highways, for the lack of which the loss to the farm area of the United States is approximately $500,000,000 annually.

One billion dollars for forest protection, reforestation and conservation of the forest resources, thus assuring timber and lumber supplies for centuries to come.

"Five billions of dollars is an enormous sum, but it is no more than is actually required to carry out the gigantic scheme in developing millions of acres of lands in various parts of the United States now absolutely worthless," said Mr. Hooker in explaining the plan. "Congress will not be asked to appropriate a penny. The returns from the improvements would pay off the bonds. The government would simply act as a banker, as it does now for the various irrigation projects. The bond issue would provide ample funds as required to carry out the work in the several divisions, at the same time giving the best possible collateral to those investing in these securities.

"Government figures bear out the statement that there is enough good land overflowed in Minnesota, Wisconsin, Kansas, Nebraska, Louisiana, Kentucky, Tennessee and Mississippi to make an area as large as the state of Missouri, or more than 44,000,000 acres, while in the eastern, central, and western states there is more than as much more, or about 100,000,000 acres in all. At a conservative estimate of $25 an acre, the sale of this reclaimed land would justify the expenditure of $2,500,000,000, or 150 per cent. more than is required to drain it. This land would support from 2,000,000 to 3,000,000 population.

"Approximately 40,000 acres of lands in western and southwestern states are adapted to irrigation, which, if reclaimed at an average cost of $25 an acre, would be worth not less than $200 an acre or a total of $8,000,000,000, and provide homes for more than 8,000,000 persons. The economic value of irrigation cannot be measured in dollars and cents, but crops of from $500 to $1,000 an acre are not rare in the irrigated districts. There are already 14,000,000 acres under irrigation and the Reclamation Service estimates it will have reclaimed 2,000,000 acres, at a cost not exceeding $70,000,000, before the close of 1911.

"The construction and improvement of the deep waterways required to provide better and cheaper transportation facilities is, I believe, a 100 per cent. investment, from the fact that two-thirds of the bulky freight could be shipped by water routes, at a cost to the shipper of not more than one-sixth of the present rail rates. The importance of this becomes apparent when it is remembered that the food question is becoming a world problem.

"The state of New York is expending $101,000,000 to enlarge the Erie canal, and $100,000,000 is the amount required to improve the Missouri river from a point about 40 miles west of Yellowstone Park to where it meets the Mississippi river, 2,547 miles. Then there is the projected waterway from Lake Michigan to the Gulf of Mexico and scores of others necessary to cheap and better transportation facilities. Millions of dollars will be saved annually to the people of the United States by the completion of these works.

"The maintenance of the greatest water way in the world, composed of the Great Lakes, on which the government of the United States has expended more than $90,000,000 for harbors and connecting channels, presents an argument in favor of the scheme to develop thousands of miles of territory in the Missouri and other valleys. The other projects outlined in the foregoing are of equal if not greater importance, and with proper backing they can be carried out successfully.

"No one questions the statement that good roads have a high money value to the farmers of the nation, and it may be said that this alone is sufficient to justify the cost of their construction as rapidly as practicable under an efficient, economical and equitable system of highway improvement. The big points in favor of this expenditure is the economy of time and force in transportation between farm and market, enabling the growers to take advantage of fluctuations in buying and selling, as well as enhancing the value of real estate.

"It is estimated that the average annual loss from poor roads is 76 cents an acre, while the estimated average increase resulting from improving all the public roads is $9. The losses in five years would aggregate $2,432 for every section of land, or more than enough to improve two miles of public highway. The necessity of good roads is obvious, as it would enhance the value of each section of land about $5.760, or more than double the estimated cost of two miles of improved highway, which constitutes the quota for 640 acres of land.

"The value of our forests was never better appreciated than to-day. Within the arid and semi-arid portions of the western states nearly 124,000,000 acres are covered with woodland, of value for fuel, fence posts and other purposes essential to the success of the farmers. There also 97,000,000 acres covered with heavy forests having commercial value for timber and logs for saw mills, also hundreds of thousands of acres of timber lands in other ports of the United States. Reforestation and conservation of the vast resources are necessary to provide future generations with timber and lumber supplies. The government is expending large amounts of money every year to protect its forests from fires, yet expert lumbermen say that more standing timber is destroyed by flames annually than is converted into merchantable lumber by the saw mills."

No need of adding that the Congress refused to commit itself to this daring program.

A preliminary report by the Census Bureau on the distillation of wood in the United States during the calendar year ending December 31, 1908, shows a falling off of thirty per cent. over the figures of 1907.

Hardwood Distillation:	1908	1907
Number of plants,	101	100
Material:		
Beech, birch, maple, etc., cords,	878,632	1,219,771
Cost,	$2,710,745	$3,824,669
Products:		
Charcoal, bushels,	37,286,520	50,772,234
Value,	$2,644,923	$3,838,392
Crude alcohol, gallons,	6,285,678	7,741,645
Value,	$1,084,223	$1,153,307
Gray acetate, pounds,	108,098,846	133,374,941
Value,	$1,636,825	$2,565,938
Brown acetate, pounds,	1,586,441	8,152,848
Value,	$13,457	$94,446
Iron acetate, gallons,	262,989	
Value,	$25,024	
Oils, gallons,	57,829	382,959
Value,	$3,813	$9,296

Softwood Distillation:		
Number of plants,	30	31
Material:		
Longleaf pine, cords,	90,991	61,149
Cost,	$201,696	$210,604
Douglas fir, cords,	974	
Cost,	$4,581	
Mill waste, cords,	7,247	1,200
Cost,	$925	$240

Products:		
Turpentine, gallons,	505,800	654,711
Value,	$166,343	$304,860
Charcoal, bushels,	1,995,728	1,158,364
Value,	$186,616	$102,411
Oil, gallons,	304,979	391,916
Value,	$56,043	$69,399
Tar, gallons,	966,675	760,836
Value,	$81,349	$58,132
Pyroligneous acid, gallons,	8,100	
Value,	$810	

While the figures indicate a marked falling off in activity during 1908 in the industry of hardwood distillation, the showing for softwoods compares favorably with that of the preceding year. Developments of interest in softwood distillation are noted in the relatively large increase in the quantity of mill waste utilized as material, and in the fact that Douglas fir for the first time was reported in considerable quantity.

A preliminary report by the Bureau of Census on the purchase of poles in the United States during the calendar year ending December 31, 1908, shows the same falling off in production:

Kinds of Wood	*1908*		*1907*	
	Number	*Cost*	*Number*	*Cost*
Total,	3,249,154	$5,928,824	3,283,268	$8,081,768
Cedar,	2,200,139	3,780,973	2,109,477	5,202,617
Chestnut,	516,049	1,227,273	630,282	1,619,785
Oak,	160,702	95,032	76,450	60,285
Pine,	116,749	382,710	155,960	459,545
Cypress,	90,579	148,070	100,368	307,974
Juniper,	42,367	83,401	38,925	109,226
Tamarack,	24,123	32,212	13,884	10,247
All other	98,446	179,153	157,922	312,089

Marked decreases were noted in the returns from the groups of purchasers comprising electric railways, light and power companies, and steam railroad companies, the total for the former group in 1898 equalling only 79 per cent. and that of the latter 53 per cent. of their reported totals in 1907. These were largely offset, however, by the purchases of telephone and telegraph companies, which exceeded those of 1907 by a considerable margin though the returns of some of the largest buyers in this group carried materially smaller figures for 1908. The percentages contributed to the total purchases in 1908 and 1907 were, by groups, as follows: telephone and telegraph companies, 79 per cent. and 70 per cent.; electric railroads and electric light and power companies, 16 per cent. and 21 per cent.; and steam railroads, 5 per cent. and 9 per cent., respectively.

A preliminary report by the Census Bureau on the production of lumber, lath and shingles in the United States during the calendar year ending December 31, 1908, compared with that of 1907 is worth reprinting to accentuate the fluctuations in lumber production with general trade depression, independent of what stumpage prices may do.

State	*No. of Mills Reporting* 1908	1907	*Lumber Production, M. feet, B. M.* 1908	1907
United States,	31,231	28,850	33,289,369	40,256,154
Washington,	929	1,036	2,915,928	3,777,606
Louisiana,	516	531	2,722,421	2,972,119
Texas,	605	673	1,524,008	2,229,590
Mississippi,	905	823	1,861,016	2,094,485
Wisconsin,	899	778	1,613,315	2,003,279
Arkansas,	1,155	1,146	1,656,991	1,988,504
Michigan,	989	906	1,478,252	1,827,685
Pennsylvania,	2,224	2,131	1,203,041	1,734,729
Minnesota,	500	429	1,286,122	1,660,716
Oregon,	595	644	1,468,158	1,635,563
North Carolina,	1,740	1,668	1,136,796	1,622,387
Virginia,	1,937	1,652	1,198,725	1,412,477
West Virginia,	1,044	1,044	1,097,015	1,395,979
California,	288	321	996,115	1,345,943
Alabama,	981	892	1,152,079	1,224,967
Maine,	902	927	929,350	1,103,808
Kentucky,	1,530	1,451	658,539	912,908
Tennessee,	1,490	1,104	790,642	894,968
Georgia,	1,049	788	904,668	853,697
New York,	2,291	2,185	781,391	848,894
Florida,	279	302	730,906	839,058
New Hampshire,	604	544	606,760	754,023
South Carolina,	423	365	560,888	649,058
Missouri,	1,108	916	458,938	548,774
Ohio,	1,094	987	459,259	529,087
Idaho,	255	247	518,625	513,788
Indiana,	1,089	999	411,868	504,790
Vermont,	596	612	304,017	373,660
Massachusetts,	610	518	384,526	364,231
Montana,	173	130	311,533	343,814
Maryland,	384	307	168,534	213,786
Iowa	113	100	97,242	144,271
Illinois,	546	499	123,319	141,317
Oklahoma,	214	129	158,756	140,015
Connecticut,	293	236	137,855	140,011
Colorado,	254	230	182,036	134,239
New Mexico,	61	52	79,439	113,204
Arizona,	11	12	43,287	72,134
Delaware,	112	106	41,184	50,892
New Jersey,	181	166	34,930	39,942
South Dakota,	47	64	25,859	34,841
Rhode Island,	45	41	30,528	32,855

Wyoming,	70	73	18,822	17,479
Utah,	95	80	15,059	14,690
All other states,	5	6	10,627	5,891

	1908	*1907*
Lath	2,986,684,000	3,663,602,000
Shingles,	12,106,483,000	11,824,475,000

The International Association of Experiment Stations has decided to publish a general bibliography of forestal literature, which is to gather all the publications in the various journals—presumably something like what the FORESTRY QUARTERLY attempts to do in a modest way. The Swiss Station has been made the editor. There is to be first a collective volume for the past, comprising the time from 1750 to the present, and then yearly additions. It is calculated that the volume will contain 60,000 references, the cost will be $6,000, and it will require five years to make the collection. The German Forstwirtschaftsrat has decided to assist the undertaking with $250 annually.

In March the Providence of Ontario added one million acres to its forest reserves by the formation of the "Quetico Forest Reserve" in the Rainy River District. This will be part of an international reserve, Minnesota having set aside a contiguous reserve on their side of the border.

Mélard editor of the Revue des eaux et forêts, best known by his article on the threatening timber famine of the world, died in March, 1909.

Willard Springer, Jr., Yale Forest School, '09, has been added to the force of foresters employed by the Pennsylvania Railroad Company. He will assist in the management of the company's timberlands.

It will be learned with regret that Dr. Schenck has, this summer severed his connection with Mr. Vanderbilt at Biltmore, the latter apparently having tired of his experiment.

Dr. Schenck will, however, continue his school on a novel plan, namely as a peripatetic one, with three locations, one near Biltmore, another in the Lake States, and the third in Germany—a somewhat daring undertaking, characteristic of its author.

COMMENT.

It is a pity that our national carelessness prevents us from securing all the good things from abroad without allowing the bad things to slip in also. The first two articles at the beginning of this number accentuate the need of developing greater care in importing material as well as ideas and policies, without closer investigation.

More than a decade ago the need of fumigating imported plant material was fully established, and to-day there is as yet no efficient protection against the importation of fungus diseases; and also while in general the propriety of adopting European methods in handling forest resources has been descried, methods which experience in Europe has proved undesirable and inefficient are nevertheless imported.

The "free use" permit, against which Mr. White's article brings cogent argument, suggests the cancer of which German forest management has suffered for centuries and from which it has only lately been cured—the rights of user or forest servitudes.

It has taken a century, and millions of dollars to get rid of this incubus, which, starting by *permits* grew into *rights* to free use. Just to give an idea of what such rights may eventually amount to in value we may recall a note from the last number of the Quarterly to the effect that the city of Eberswalde, where the Prussian Forest Academy is located, had just succeeded in freeing its forest property from such incumbrance by paying $125,000 to the 316 house owners for the right to secure their fuel from the city forest; and it is calculated that this investment will return six and one-half per cent. by the improved utilization.

While it may have been wisdom to grant these free permits in the National Forests as a sop to the good will of the population adjoining, it will also be wisdom to withdraw these grants as soon as practicable.

The appearance of a fungus enemy to the white pine from a country, in which that pine is not indigenous opens up a rather interesting biological problem. In the larch saw fly and the gypsy moth we have had experience of an imported pest thriving better and doing more damage in its new home than in the old one, due to the absence of its enemies, but that a rust requiring two hosts for its complete cycle should be absent in the country in which the one necessary or preferable host is indigenous appears an enigma. We expect that on closer examination this rust will be found after all indigenous, but for some reason rare, while wholesale cultivation of the host under artificial conditions may have favored its prolific propagation in the new habitat.

The last Legislature of the State of New York enacted two laws of interest to foresters, one amending the general organization of the forest, fish and game laws, the other creating a forest reservation in the Highlands of the Hudson River. Both of them contain curious examples of undigested legislative food. The latter act reminds us somewhat of the ancient inforestation of lands by William the Conqueror. It describes a tract of land of about 75 square miles, and declares all lands within these limits, fit only for timber growing, but excepting lands fit for other specified purposes, a forest reservation "to be managed and controlled after *the method of modern forestry,* and the Forest, Fish and Game Commission are authorized to acquire, maintain and preserve *according to the methods of modern forestry,* the lands and property within the said forest reservation." The land is to be acquired by gift, contribution or bequest, or to be taken by purchase, and the commission may also receive moneys for the purchase and the improvement of the lands. But the commission is to superintend and control the cutting of timber upon the lands included within the boundaries, not only on public, but *private* lands! This is introducing European methods with a vengeance, and that in a state which, by its constitution, has prevented itself from treating its own lands according to forestry principles. Five thousand dollars is appropriated to carry out this "Unding" (absurdity).

The phrase "after the method of modern forestry" is delightful, especially when placed in juxtaposition to the phrase used in the act amending the Forest, Fish and Game Law, in which it is provided—"The commissioner shall appoint all foresters necessary for tree, garden and forestry work."

In this act, too, the cutting of timber by private owners is regulated. Evidently and properly for the purpose of diminishing fire danger, it prescribes that within the forest reserve counties, all felled coniferous trees shall have their branches lopped, under penalty of $2 for every tree not so trimmed, besides fine and imprisonment.

The important portions of the law are in the direction of improving the protection against forest fires, increasing the machinery by the appointment of fire inspectors to inspect engines and railroads, and providing that the railroads operating in the forest preserve counties shall maintain fire patrols. In these counties four fire districts are established, with appointed superintendents of fire at the head, who are to organize the fire patrols, fire stations, fire signals, etc.

There is one important provision, which will probably not be enforced, because in its present form it is unmanageable, but which shows that the restrictive European police measures which it was once declared could never be enforced in this free country are at least being recognized as probably after all necessary to reduce the danger from forest fires. This section reads:

"Whenever, by reason of drouth or other cause, it shall be dangerous to the forests of the state, or for other reasons contrary to the public interest, for any person or persons to enter any portion of the lands within the forest preserve counties of the state for the purpose of camping out or taking fish, fowl, birds or quadrupeds therein, or for any person or persons being already within the forest preserve counties of the state to take fish, fowl or birds or quadrupeds therein, the Governor shall have authority to determine, and shall determnie and declare that it is dangerous to the forests of the State or contrary to the public interest for any person or persons to enter any portion of the lands within the forest preserve counties of the state for the purpose of camping out or of taking fish, fowl, birds, or quadrupeds therein, or for any person or persons being already within the forest preserve counties of the state to take fish, fowl, birds, or quadrupeds therein, and upon such determination and declaration, the Governor shall have authority to forbid, and shall forbid by proclamation, any person or persons from entering the said lands for such purposes, and any person or persons being already therein from taking fish, fowl, birds, or quadrupeds therein. But the Governor must state in such proclamation the reason or reasons why he has so determined that such acts would be dangerous to the forests or contrary to the public interest, and he must in such proclamation limit the time during which such entry and such acts shall be prohibited."

What language!

After all, the efficiency of fire control lies in the men in charge rather than in the law, and in the morals of the community more than in the patrol.

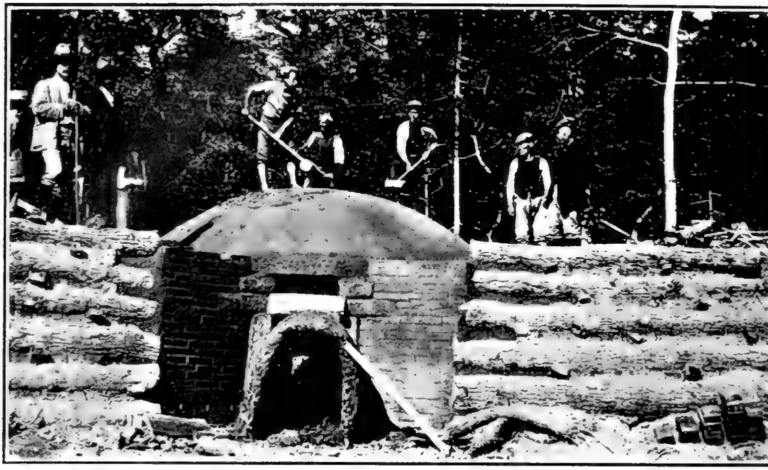
It is interesting to note the revival of ideas and directions of work in the Forest Service which were originally devised in the old Division of Forestry. The "timber physics" work, to which the old Division had given much prominence as providing the most direct means of reducing waste in the use of resources, was abandoned as "not germane to forestry," but has been revived with appropriations five to six times as large as the old Division could secure, and forms an important part of the investigatory work of the Service. Now, the "phenological observations," which for some time were carried on by the old Division, have again come upon the program of the Service. This was the first line of work which the reconstructed Division instituted in 1886, more for the purpose of getting into relation with, and interesting a larger number of people more definitely in tree growth—that is, for educational purposes, "to promote an interest in forestry which may lead to a better appreciation of its aims and methods"—than for any practical results that might be expected from it.

It is well known that the original idea of contemporaneous observations of the phases of plant development—the phenology of plants—first proposed by Hofmeister long ago, had in view to bring out climatic conditions. It was supposed that the phenomena of budding, leafing, blossoming, leaf fall, fruiting and ripening, etc., gave a better index of climatic difference than statements of the single factors of temperature and humidity. While, theoretically, this supposition is true, practically, difficulties arise in selecting objects of observation, continuing observations on the same objects for sufficient time, and then interpreting the results.

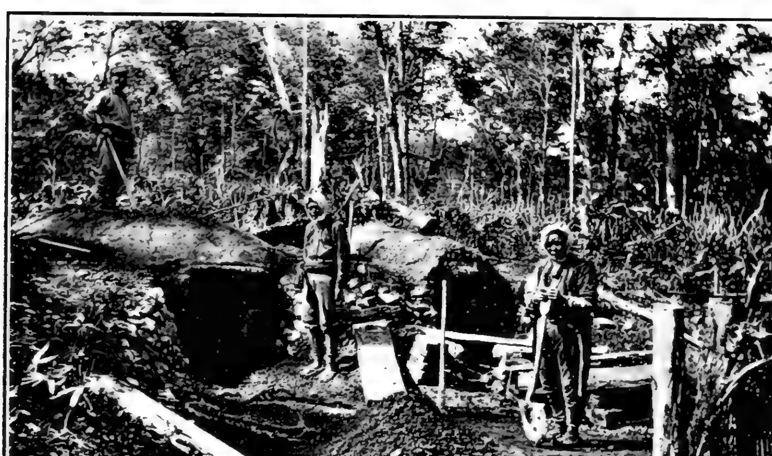
The Smithsonian Institute had attempted this line of work before, and published a volume of observations compiled by Dr. Hough, some 30 or 40 years ago, but did not continue it.

The enterprise launched by the old Division collapsed for lack of clerical assistance to compile the data, and the impossibility of keeping the same observers on the same objects from year to year, an essential condition for satisfactory results. Both these troubles are probably not going to beset the revived enterprise. There is all the cash needed for compiling, and there is much more lively interest in the subject than there was twenty-four years ago, and, perhaps, at least a special class of observers can be continued.

Altogether, many things that a quarter century and even a decade ago were thought impossible, and, indeed, were impossible, are easy now—so changed is the temper and attitude of the people.



Charcoal Kiln made at the Experiment Station at Noporo, Japan.
Ready for kindling.



Kilns made by farmers at Kanayama, Japan.
One just burnt out, other ready for kindling.

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WHY AMERICAN FORESTERS ARE POORLY TRAINED.

BY A PROFESSOR.

Every new calling which aspires to the dignity of a profession must pass through a stage of militant propaganda to obtain a footing among the old established professions. Some prove their worth and take their proper place; others fail and remain in the class of trades. Law, medicine and the ministry were formerly looked upon as the professions. It was only after a bitter struggle that the engineer and chemist obtained recognition. The forester is now knocking at the door for admission. Is he to be a professional man or a tradesman?

The situation in the case of the forester is unique in our history. It is not the struggle of a new profession for recognition in the world of science, but the struggle of a profession already old in Europe for a recognized footing in the United States and Canada. The question is are we doing our best to obtain that footing?

If a calling is to take rank as a profession it must require some training other than skilled labor, and peculiar to itself. So long as men of another vocation can enter the field of forestry without any special training and do successfully the work which is demanded of them there is no distinct profession of forestry and the forester's proper standing has not been attained.

According to these premises the forester in this country is undoubtedly without footing as a professional man. Men of all professions and many trades dabble in the planting of parks, the planting of windbreaks, or the patching up of decayed trees and pass current as foresters. The thoroughly trained forester, the botanist who has studied the life history of a single tree, the lawyer who has studied up the forest laws, the engineer who has tested the strength of a few beams, the stock man with a little experience in grazing sheep in the woods, the manufacturer of packing boxes who is utilizing his waste, the collector of census figures, the maker of maps, the writer of reports; all these are accepted as foresters on the same footing and no distinction made between them.

Three causes seem to be contributing to this chaotic state of affairs: The ignorance of the general public; the policy of the U. S. Forest Service; and the consequent fragmentary nature of the training in the "Forest Schools."

The training of public opinion can come only with time. The forester must insist on doing his own proper work and insist on the proper recognition. The employment of a forester by a lumber company for the better cruising of its timber is an insult to the profession and a disgrace to the man who continues to hold such a position and contents himself with such work. The bad example of the employment of the trained man in the National Forests for just such work is largely responsible for this point of view. The forester should refuse such work and the makeshift forester be discredited by the profession.

The U. S. Forest Service is the great aggressive force which is leading and directing forestry development in the United States. To them every one looks for an example and demonstration of what forestry in this country is and what the work of the forester should be. Are they setting the best example of what this development ought to be?

In this article we are more particularly interested in the work of the forest schools. Let us look at the conditions of this work and try to trace the causes of these conditions.

This condition is little short of chaos. There are three classes of schools: Graduate schools and undergraduate schools which are attempting to cover the whole field, and undergraduate courses which are more or less fragmentary in nature. All are giving arbitrary degrees without meaning—for there is no standard by which to judge them.

The so-called graduate schools are giving graduate degrees for undergraduate work. They are turning out men of anything but a uniform grade, because there is no uniformity in the entrance requirements. A degree, no matter what kind, is all that is necessary. If that degree happens to be for science work the student is well prepared; the man who obtains his first degree for literature, history, economics and philosophy has no preparation and the class can go no faster than these poorest prepared men are able to go. In either case the work is strictly undergraduate and necessarily of a low order to meet the necessities of the poorly prepared.

The four year undergraduate school gives a uniform and more thorough course. The work is more consecutive, and the longer time gives more chance for the practical application of the principles learned to existing conditions, more time for the significance of the theories taught to sink in. The graduate from such a course is a better trained man, but is lacking in general education, which the forester of all men should have. A course on top of this degree would be real graduate work and would give splendid results, but such a thing is out of the question till some opportunity offers a proper reward for such training.

The fragmentary courses given at so many schools in the country serve a good purpose. They are centers of education for the enlightening of the laymen. They instill a leaven which will lighten the whole loaf of public opinion wonderfully, but they should not be considered as professional schools. Some men are being graduated from these schools who have never seen a forest. The education obtained in all of them is necessarily one-sided.

The complete undergraduate school gives a bachelor's degree for a four years' course, the graduate school gives a master's degree for a two year course of the same work; the fragmentary course often yields a degree which sounds as well as either. Who shall say what the standard shall be?

The civil service examinations are largely responsible for this state of affairs. Nine-tenths of the men graduated from the forest schools go into the forest service, and there is nothing for the schools to do but live up to the standard of those examinations. A man with two or three years experience as a lumber jack stands quite as much show of passing these examinations as the well trained technical forester and a great deal more show of rapid advancement when he is in.

Many of the high places in the Forest Service to-day are held by men of little or no technical training. What show has the technical man under such conditions? It is the same old question of the grammar school man belittling the college graduate, and in the end the result will probably be the same, but in the meanwhile it is rather hard on the trained man, and the school which is trying to turn out trained men.

What is the incentive to good work in the schools? How can a school hold on to a man long enough to give him a thorough training when he knows that a year's work in a lumber camp on top of a little superficial work in school will give him a better standing in the government service than the best technical training he could possibly get in the schools. Many of the best men leave school in their sophomore and junior years to take a position on a ranch or in a lumber camp because they feel that the man so trained stands a better show than the man with the better technical training.

Can the schools be blamed for this? They are obliged to turn out such men as the public demands. The public in this instance is largely represented by the Government Forest Service, the largest consumer of forest school products. The following is the inevitable conclusion: When the Forest Service reserves its forester's positions for thoroughly trained foresters and ceases to dub every unclassified man they pick up with the title which belongs properly to the trained forester alone, then, and only then, will the schools be able to, or be justified in, turning out well trained, well rounded men worthy of the title of "Forester."

AVERAGE WOOD PRODUCTION IN THE UNITED STATES.

On pages 304-5 of the Forestry Quarterly for August, the reviewer of Forest Service Circular 166, "The Timber Supply of the United States," after quoting some of the statistics given in the Circular, continues:

> "The author also attempts to prognosticate future supplies. It would have been interesting to know how he came to the assumption that the annual growth 'does not exceed twelve cubic feet per acre, a total of less that seven billion cubic feet.' He properly makes the assumption that three conditions exist; namely, mature forest; partially cut and burned forest; and severely culled forest, 'on which there is not sufficient young growth to produce another crop of much value.' He estimates these conditions—of course, also mere guesses—to be represented by 200, 250 and 100 million acres, respectively. But, instead of using these figures in a calculation, he jumps to the above conclusion as to new growth. Of course, to arrive at such or any conclusion in this regard, some more assumptions are necessary. The matter is of such a speculative character, that, unless the full basis for it is stated, it becomes worse than useless, and, used as an argument as if it were true, dangerous. We believe it untrue."

Then follows a discussion leading apparently to the conclusion that the average increment per year for all our forest area during the next 60 years might be about 8 or 9 cubic feet per acre, an estimate which tallies closely with that given on page 51 of "Economics of Forestry," and which upon the assumptions given, is very reasonable, although the author says, it is probably far too high. I wish, however, to call the reviewer's attention to the fact that the conclusion reached in the circular—that the annual growth for all our forest area does not exceed 12 cubic feet per acre—is not a mere jump as he implies, but is the result of a carefully worked out calculation in which the different classes of forest land in each region were considered. Circular 166 is but a brief popular statement of the best facts and estimates which our present knowledge enables us to give concerning our forest resources. It states only conclusions. Space, and its non-technical character, forbade filling the circular with the details of forest calculations. The data upon the growth and yield given in the Circular are based upon the very excellent paper entitled "Rate of Forest Growth," prepared by Mr. E. A. Ziegler for the National Conservation Commission, and published in Vol. II of the report of the Commission. Since the number of copies of this report published is so limited as to prevent its distribution among forest students, I hope very much that the following discussion by Mr. Ziegler upon present growth can be given publicity in the Quarterly.

I am sure any further discussion of this paper as well as of others issued from the Service will be welcomed by the readers of the Quarterly.* It is only in this way that the truth can be finally established, and the absence in so many cases of sufficient data upon forest growth, conditions and stand gives room for wide divergence of opinion.

R. S. KELLOG.

After giving all the available data upon the growth of individual species in various localities Mr. Ziegler continues his article as follows:

PRESENT AVERAGE PRODUCTION PER ACRE AND TOTAL PRODUCTION.

From the foregoing notes on the growth of the different species and the yield per acre in the infrequent fully stocked stands of second growth forest, little information can be got on the actual wood production throughout our forests, since growth conditions are often very unfavorable. In the very old mature forests growth is offset by decay, and our millions of acres of this type of forest may for all practical purposes be regarded as nonproducing capital. Were all our forests of this class, the production per acre would be zero. Were all mature trees removed and the land all densely stocked with thrifty growth, the yield would approximate from 30 to 110 cubic feet per acre per year according to the species and locality. The actual forest represents all degrees of production between these two extremes. There are large bodies of overmature timber that are not increasing. There are small areas of pure second growth producing the maximum amount. There are culled-over areas containing mature defective trees or undesirable species mixed with second growth, areas denuded by ax

* The reviewer is glad to have provoked the above most interesting article, which really was the object of his criticisms. Ingenious as the method of arriving at data upon which to make a statement of the acre production, the result does not fill the reviewer with any more confidence in its truth than his own mere guesses.

and fire with no appreciable growth, and, the largest class of all, cut over and burned over lands with some growing trees, but usually not nearly as dense as the virgin forest.

To arrive at any approximation, then, of the total wood production of the country some rough classification of the entire forest area is necessary. Hence the following is offered:

TABLE XIII.—CLASSIFICATION OF FOREST LAND.

REGION.	Total forest and woodland area.	Probably mature timber and woods.		Probably not restocking.		Probably growing forest and woodland.	
	Acres.	*Per cent.*	*Acres.*	*Per cent.*	*Acres.*	*Per cent.*	*Acres.*
Lake States, ...	47,000,000	4	2,000,000	38	18,000,000	58	27,000,000
Northeastern States, .	48,000,000	4	2,000,000	18	8,000,000	78	38,000,000
Central States, ...	71,000,000	9	6,000,000	15	11,000,000	76	54,000,000
Southern States:							
Pine land (60 per cent.), ...	124,000,000	33	41,000,000	27	33,000,000	40	50,000,000
Hard wood land (40 per cent.), ...	82,000,000	43	35,000,000	7	6,000,000	50	41,000,000
Rocky Mountain States	97,000,000	70	68,000,000	12	12,000,000	18	17,000,000
Pacific Coast States. .	76,000,000	80	61,000,000	3	2,000,000	17	13,000,000
Total, ...	545,000,000	. . .	215,000,000	. . .	90,000,000	. . .	240,000,000

The total forest area, including woodland, is seen to amount to approximately 545,000,000 acres, of which about 50,000,000 acres are scrubby woodland, producing only cord wood. This is confined largely to the Southwest, such as the scrub oak, piñon, and juniper lands of California, New Mexico, Arizona, Texas, and other Rocky Mountain States. This estimate of total forest area is based on almost complete returns from county clerks, usually supporting estimates previously made by the United States Geological Survey for Washington and Oregon, the Forest Service forest maps of California and New Hampshire, and the more general State estimates of Doctor Fernow.

The classification into mature timber and cut and burned land probably not restocking are estimates based on reports of Professor Roth for Michigan and Wisconsin and General Andrews for Minnesota, the Geological Survey revised township estimate for Washington and Oregon by Henry Gannett, together with special reports of state foresters, and more general regional reports, such as the "Report of the Secretary of Agriculture on the White Mountains and Southern Appalachian Watersheds, 1908;" "Southern Appalachian Forests," Ayers and Ashe, Geological Survey; "Timber Pines of the Southern United States," Forestry Division Bulletin 13, by Mohr, etc. That some difference of opinion may be expressed on this classification is not to be doubted, but the totals are good, errors in high and low estimates compensating to some degree.

The mature timber totals over 188,000,000 acres, which might be raised to approximately 215,000,000 if all woodland such as the scrub oak, juniper, and piñon lands of the Southwest are included. It is evident that there is little mature timber in the Lake and Northeastern States. The States included as Central States have a little more mature timber, though culled forests, which consist largely of mature trees, are here included under growing forests, to be conservative. The Southern States are figured as having one-third mature timber on pine lands and a little larger proportion of the hardwoods of the alluvial bottoms and southern Appalachians. The Rocky Mountain and Pacific coast forests are largely mature forests. Since there has been a great lumber output on the coast it might be supposed that the Rocky Mountain region should have a larger percentage of mature forest, but the thinner forest of the Rockies and much greater damage from fire have tended to lessen the mature forest percentage and greatly increase the "not restocking" percentage. This large area of mature forest can not be considered as increasing materially by growth above the loss by decay, windfalls, insects, etc. The burned areas restocking are included under growing forest.

Under the head of "Probably not restocking" the Lake States lead with 38 per cent. This is due perhaps to the more complete reports and forest and logging conditions which invited the many great conflagrations credited to this region. The larger amount of hardwood, different topography, denser population, larger percentage in small wood lots, and other factors decrease the percentage of forest not restocking for the Northeastern States. These same factors—notably the composition of the forest as of hard woods almost entirely with sprout reproduction—lessen it still more for the Central States. In the Southern States on the pine lands it rises sharply and would be still higher were not the effects of fires less destructive in the more open mature forests still existing. Southern hardwoods suffer much less. This is due to their location in the lowlands and mountains, to the less inflammability of nonresinous wood, and to sprout reproduction. In proportion to the cut-over land the Rocky Mountains show a large percentage of land not restocking, while on the Pacific coast climatic conditions make reseeding better and safer. The areas of land not restocking are believed to be very conservative even though the total seems startling when placed at about 82,000,000 acres of forest land or 90,000,000 acres of forest and woodland. To the observant forester several trips through the Lake State pineries and southern pineries (where one-half of this land is to be found) are sufficiently convincing. This is the second large item which must be withdrawn from the total so-called forest area. The question may be raised whether this has not already been excluded in the classification of total forest and woodland. It is not, because it is inseparably mingled with the mature and growing timber areas, and it is still potential forest land but unable to restock on account of recurring fires and lack of seed trees. For example, Minnesota is given 15,000,000 acres of forest land, only 7,500,000 of which is restocking to a degree indicative of a second crop. The other 7,500,000, while not entirely devoid of tree growth, will require many decades of efficient fire protection and a large amount of artificial regeneration to bring it into the producing forest class.

The growing forest area is got by deducting the mature forest and the area not restocking from the total forest area. This is approximately 225,000,000 acres of forest land, or 240,000,000 acres of forest and woodland. These figures give a total forest area of about 495,000,000 acres, which is raised to 545,000,000 to include woodlands (lands incapable of producing saw timber forest).

Having thus analyzed the total forest area and secured an approximation for the area of growing or producing forest, there remains a discussion of the actual increment on this area. Since (as has been stated before) the growing forest is made up of all conditions of growth from the lightly culled mature forests producing little increment to the pure dense stands of young growth with an increment approaching the maximum, the arriving at an average production is very difficult. The most important single factor is the amount of growing stock present or the density. The second is the age of the growing stock.

In the first column of the table below, the annual production per acre of fully stocked forest is taken as the basis for calculation (being the average for the life of the trees to maturity for all qualities of forest). This is expressed in cubic feet of stem volume (not all of which is merchantable) got from the few American yield tables (see Appendix, pp. 45-61) supplemented by German yield tables, and weighted roughly according to the species in the growing forests of each region.

TABLE XIV.—ESTIMATED GROWTH PER ACRE.

REGION.	Average estimated production in fully stocked forest per acre per year.	Average "best virgin forest" density in per cent. of fully stocked.	Estimated density of immature forest compared with best virgin.	Probable growth per acre in growing forest.
	Cubic feet.	*Per cent.*	*Per cent.*	*Cubic feet.*
Lake States, ...	90	60	70	38
Northeastern States, . . .	80	60	70	33
Central States, ...	60	70	60	25
Southern States:				
Pine land, ...	70	46	65	21
Hard-wood land, . . .	70	70	60	29
Rocky Mountain States, .	30	53	60	9
Pacific Coast States, . . .	110	73	70	56

In order to see how the density of our virgin forests compares with the fully stocked forest of the yield tables recourse is taken to a comparison of basal areas (area of tree cross sections). The total basal area (see Appendix, pp. 62-63) for northern virgin forests containing a large percentage of conifers ranges from 75 to 200 square feet, averaging about 120; the central hardwood forests from 90 to 150, averaging about 117 square feet; the southern pine forests 30 to 120, averaging 70 square feet; the Rocky Mountain forests 30 to 130, averaging 80 square feet; and the Pacific coast forests 190 to 240, averaging 220 square feet. These basal areas, when compared with Quality II 80-year white pine in New England (see Appendix, p. 64, for normal yield table, basal areas and increments), with 242 square feet per acre; paper birch, Quality I, 60 years, in New England, with 120 square feet; loblolly pine in Texas, at 40 years, with 126 square feet; second-growth hardwoods in the Southern Appalachians, with 140 square feet. Norway spruce 120 years old, in Germany, with 288 square feet; beech with 192 square feet; and Scotch pine with 212 square feet, show that our virgin forests, even of the best grades as selected and of much greater age than the normal forests compared, are not nearly normally stocked—the redwoods of California being exceptional. This deficiency of stocking in the best virgin forest is expressed by a percentage in column 2 of the above table. Column 3 gives the estimated relation between the immature or growing forest and the best virgin tracts. Here the percentage for the central and southern hardwoods is placed at 60, in order to allow for the large number of mature trees still in these culled forests. The density, including these mature non-producing trees, would of course be much higher than 60 per cent. of the virgin forest density.

By multiplying the production in the fully stocked forest (Table 14) by the percentages of effective stocking in virgin and growing forests successively, the last column of that table is secured, indicating a production of from 21 to 56 cubic feet per acre per year in the immature forest in all regions except the Rocky Mountain region, where the large area of juniper, piñon, and scrub oak woodland included in the total wooded area reduces an already low average growth to approximately 9 cubic feet. These figures are believed to be, if anything, higher than the truth.

Applying this estimated average growth to the area of growing forest—

TABLE XV.

REGION.	Probable area of growing forest and woodland.	Estimated growth per acre.	Estimated total production.
	Acres.	*Cubic feet.*	*Cubic feet.*
Lake States,	27,000,000	38	1,026,000,000
Northeastern States,	38,000,000	33	1,254,000,000
Central States,	54,000,000	25	1,350,000,000
Southern States:			
Pine land,	50,000,000	21	1,050,000,000
Hard-wood land,	41,000,000	29	1,189,000,000
Rocky Mountain States,	17,000,000	9	153,000,000
Pacific Coast States,	13,000,000	56	728,000,000
Total,	240,000,000	*a*28	6,750,000,000

a Average.

an estimated total production of about 6,700,000,000 cubic feet is indicated. This is an average of about 28 cubic feet per acre for the estimated 240,000,000 acres of growing forest and woodland, or about 12 cubic feet for the entire forest and woodland area of 545,000,000 acres, including mature and devastated forests.

Of this probable total of 6,700,000,000 cubic feet the part suitable for saw timber would represent an actual mill output of probably much less than 20,000,000,000 board feet, the rest being cord wood and mill waste.

AN EXPERIMENT IN LOGGING LONGLEAF PINE.*

By Herman H. Chapman.

At the suggestion of John L. Kaul, of Alabama, the conservation committee of the Yellow Pine Lumber Manufacturers' Association, at its session held in May in Tyler county, Texas, decided to recommend the cutting of yellow pine in two operations separated by a period of years, instead of removing the entire stand in the first cut as at present.

The chief argument presented in support of this change was that small timber that is now unprofitable to log, would, if left twenty years, have grown to valuable sizes, and, with the increased price of stumpage, would pay a fair interest on the investment, and make it possible to prolong the operation over a second period nearly equal to the first.

This suggestion, coming from lumbermen, is of great value, for it agrees perfectly with the method of cutting which seems to be demanded by longleaf pine to secure reproduction and perpetuate the forest. Timber land owners can undertake only such measures as promise a reasonable interest on the investment. For this reason lumbermen can not be expected to develop longleaf pine lands at a financial loss for the sole purpose of getting a crop of seedlings started which will mature in eighty to one hundred years. But if a new crop of seedlings can be secured as a side issue with very little extra expense, the future value of the land so stocked would be very much increased and the final disposition of the land by its present owners probably will be much simplified if it is seen to be in good productive condition.

At present the probable value of the second cutting is the important factor. This will depend, first, on the amount left standing from the first cut; second, upon the growth secured and, third, upon the increase in stumpage values.

Longleaf pine, growing as it does upon the driest and sandiest soils, matures more slowly and produces less timber in a given time than either shortleaf or loblolly pine. Growth figures

*This article appeared first in the American Lumberman, July 10, 1909, and is reprinted at the request of the author.

for longleaf have therefore a special value as indicating the smallest returns that can be expected from growth on stands left for a second cut.

In deciding on the amount and kind of timber to leave standing, the owner may have in mind only the second crop. In this case he will remove all his old timber and large sizes, leaving only the smaller diameters, and might attempt the operation on the basis of a diameter limit high enough to secure a reserve of the size desired. But there are decided objections to this method, even from the standpoint of the second crop. A diameter limit ignores the two main factors which will give value to the second crop—soundness and ability to grow. It also ignores the matter of distribution or spacing of the trees left, upon which growth in the next period largely depends, and it tends to leave large blank areas which will not seed up, so that the seedling crop is not fully secured. The results of cutting to a diameter limit must therefore be very disappointing, and the value secured at the end of twenty years must fall far below the results which might be secured on the same area, leaving the same amount of timber standing, provided an intelligent system of selection is used in the first cutting.

It is not generally realized that in many longleaf forests at least one-fourth of the area is covered with thrifty, young timber below 14 inches on the stump, ranging in size down to seedlings. Measurements of sixteen 40-acre plots taken in stands which averaged 9,500 feet showed 25 per cent., or ten acres for every plot, fully stocked with young pines. How many timber owners have any accurate knowledge of the area of virgin forests already restocked with young growth, or any conception of its possible future value? For lack of this knowledge it happens that most of this young growth is frequently wiped out during logging, when much of it might be saved if it was looked upon as having a value.

The mature timber, above 14 inches on the stump, is seldom if ever even-aged. On the area of a forty usually are found groups of overmature trees, or single trees, 25 to 40 inches in diameter, in many cases decaying rapidly and bound to disappear before long. Below these in size come a much larger number of smaller and younger trees which make up the main stand, ranging from 12 to 25 inches. The heights are equally variable, ranging from two 16-foot logs up to five or six logs on the same area. The trees are distributed very unevenly, growing sometimes in dense clumps, then scattered or singly with wide blanks.

It is evident that under natural conditions, even in the presence of repeated fires, the longleaf pine forest renews itself, young trees coming in on areas left blank by the death of old timber. Seed is constantly supplied from the surrounding trees and seedlings finally survive the fires and form groups of saplings and poles.

But along with this restocking are at work the processes of decay and destruction. Red rot, which attacks trees that have dead stubs of branches to give the spores a chance to enter the wood, is constantly weakening old trees and will attack smaller timber, especially the stunted weakened trees. In time such timber dies or blows over. Fire, if it once succeeds in burning through the bark at the base, will continue to eat into a tree in successive years until it brings it down. These two factors reduce the number of trees to the acre and others, in competition with stronger trees close by, cease to grow and finally die.

All trees in a stand do not grow equally fast, nor continue to grow at the same rate. In longleaf pine this is especially noticeable. Only the largest trees, with the biggest crowns, continue to grow at a rapid rate after a stand has reached merchantable size. The older a tree becomes, the slower it grows, as a rule.

The falling off of growth in old or crowded stands is one of the main reasons for advocating a selection of trees in the first cut, rather than a diameter limit. After a longleaf pine stand reaches the age of about 120 years the loss from rot, fire and suppressed growth increases so fast that the net gain in growth on the stand would not pay the taxes. The following figures are taken with some care and may be accepted as representing the yield on average longleaf soils for old stands.

These are actual yields from average stands, with the area occupied by timber below 14 inches excluded. It was found that the number of trees to the acre diminished constantly as the stands grew older, till at 300 years ten trees per acre was a full stand, while at 100 years sixty trees per acre was the average. This slow destruction of timber which, as the table shows, offsets growth, is due chiefly to the inability of the soil to support so many trees of large size. Rot and fire are merely the agencies for removal, since they attack trees weakened in the struggle, or old trees whose vitality is ebbing.

TABLE I.—YIELD OF LONGLEAF PINE IN PURE, EVEN-AGED STANDS.

Doyle Rule.

Tyler County, Texas.

Age, Years.	*Yield per Acre, Board Feet.*
100,	8,600
110,	9,500
120,	10,300
130,	11,000
140,	11,600
150,	12,200
160,	12,800
170,	13,500
180,	14,000
190,	14,400
200,	14,800
210,	15,100
220,	15,400
230,	15,600
240,	15,800
250,	16,000
260,	15,900
270,	15,700
280,	15,400
290,	15,000
300,	14,350
310,	13,000
320,	12,400

TREATMENT IN CUTTING.

If a cutting is made with the intention of leaving a thrifty growing stand, this process of waste and overcrowding will be checked provided each acre is treated separately. Trees are dependent on their immediate surroundings, and the thinning made on one acre will not benefit the trees on an adjoining acre. But properly made, a heavy cutting will put the whole forest into shape so that for the next twenty years the largest possible growth will be obtained, with practically no loss.

This means the removal of:

1. All trees affected by red rot or otherwise injured.
2. Trees with burns or cat faces at the base.
3. Stunted or suppressed trees, no matter what size.

These trees are either not increasing at all in value or are liable to complete destruction before the second cut, and their presence prevents other trees from making rapid growth.

In addition to these classes, large trees, say above 20 inches, and slim, long-boled, small-crowned trees should come out. It is especially important to remove stunted or slow growing trees. Anyone familiar with the appearance of crowns of trees can learn in a day or two to detect the difference between a thrifty tree and a stunted one. The former will have a large, often pyramidal, crown, with long dark green needles, while the crown of the stunted tree is small, misshapen, with short needles.

The presence of these stunted trees means that growth of the stand has been checked, and loss will follow if they are not cut and used. It is usually a better plan to *cut out* the stunted trees in a group and leave the thrifty ones even if the latter are larger, since the thrifty trees already have a large root system and will make splendid growth if left. The stunted trees will require several years' time to recover and will probably get into good shape to grow just about the time the second cutting comes around.

These principles apply to all owners. But there will be a difference in marking, depending on whether the owner is willing to try to obtain a crop of seedlings. Longleaf pine seed is heavy and can not be counted on to blow much farther than the height of the trees. If a crop of seedlings is desired, it may be necessary to leave a few trees of larger diameter than would otherwise be left, and, in some cases, defective trees if no others are available, so that no blanks are left larger than about half an acre. Two large trees to the acre, or four or five smaller ones, will produce plenty of seed. Where young timber already is in the sapling stage, no seed trees are needed and in many cases, where dense thickets of blackjack would prevent reproduction, it would be foolish to leave them.

The best way to secure the proper cutting and reservation of the right trees is to blaze every tree that is to come out. An experienced man can mark carefully about thirty acres a day in stands running 6,000 to 10,000 feet per acre, which, even at $5 a day, would make the cost of marking about 2½ cents a thousand feet.

Method of Marking.

In order to demonstrate the possibilities of this method of marking, about 400 acres were marked for cutting, in plots ten acres square, each of which was tallied by diameters and estimated. The object was to leave all the young thrifty timber, take out all overmature, stunted and defective stuff, and leave seed trees.

The actual results are shown in tabular form, according to the density of the original stand.

TABLE II.

PROPORTION OF MERCHANTABLE STAND PER ACRE OF LONGLEAF PINE REMOVED BY A SELECTION CUTTING.

CLASS Bd. ft. per acre.	*Average stand.*	*Amount cut.*	*Amount left.*	*Pct. cut.*	*Pct. left.*
FEET PER ACRE—	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*		
Under 5,000 ...	4,257	3,053	1,204	72	28
5,000-7,500	6,704	5,198	1,506	77	23
7,500-10,000	8,679	6,311	2,368	73	27
Over 10,000	12,029	9,712	2,317	81	19

Table III shows strikingly the contrast between an intelligent selection of trees and an arbitrary rule of cutting. Even in the 12-inch class, corresponding with 14 inches on the stump, 34 per cent. is removed because it is unfit to remain. On the other hand, some timber is left standing that is over 20 inches. This is in all cases left as seed trees, but is sound and windfirm and will stand safely till the second cut and make considerable growth. In the 14 to 20 inch classes a diminishing number of trees are left, those taken being the trees that will not make good growth. In these classes the trees which grow the best are also the best seed trees, have well developed crowns and are not too tall.

The amount of growth to be expected on such stands is influenced by three factors:

1. Number and size of merchantable trees left standing.
2. Number of trees which will become merchantable before the second cut.
3. Increased growth due to opening up of the stand.

The growth was studied on eight typical plots of ten acres each or eighty acres, and the results show what can safely be depended on for similar stands.

A period of twenty years was taken as the time elapsing before the second cut. First, the actual diameter growth of several hundred trees was measured for the last twenty years on stumps,

TABLE III.

NUMBER OF TREES OF EACH DIAMETER REMOVED AND LEFT FOR SECOND CUT, BY SELECTION SYSTEM OF CUTTING, ON 100 ACRES.

Diameter at 4½ feet. Inches.	*Stands under 5,000 feet.*		*Stands 5,000-7,500 feet.*		*Stands 7,500-10,000 feet.*		*Stands over 10,000 feet.*		*Av. per cent. of all stands.*	
	Cut. Trees.	*Left. Trees.*	*Cut. Trees.*	*Left. Trees.*	*Cut. Trees.*	*Left. Trees.*	*Cut. Trees.*	*Left. Trees.*	*Cut. Pct.*	*Left. Pct.*
12, ...	76	224	116	176	120	200	109	242	34	66
13, ...	62	104	104	153	108	162	59	117	39	61
14, ...	88	85	86	87	84	81	70	103	48	52
15, ...	73	41	97	70	65	97	90	106	50	50
16, ...	69	51	93	70	112	86	141	112	57	43
17, ...	77	44	134	62	138	97	169	82	65	35
18, ...	100	37	173	60	144	94	195	105	68	32
19, ...	66	24	147	39	105	57	162	43	75	25
20, ...	59	27	85	34	127	35	157	50	75	25
21, ...	32	11	63	21	109	12	95	23	82	18
22, ...	44	10	52	13	110	10	138	22	87	13
23, ...	21	10	32	5	84	14	111	11	86	14
24, ...	33	3	39	4	64	11	92	13	88	12
25, ...	17	4	39	4	40	4	83	10	90	10
Over 25, ...	91	6	145	7	147	9	307	29	94	6

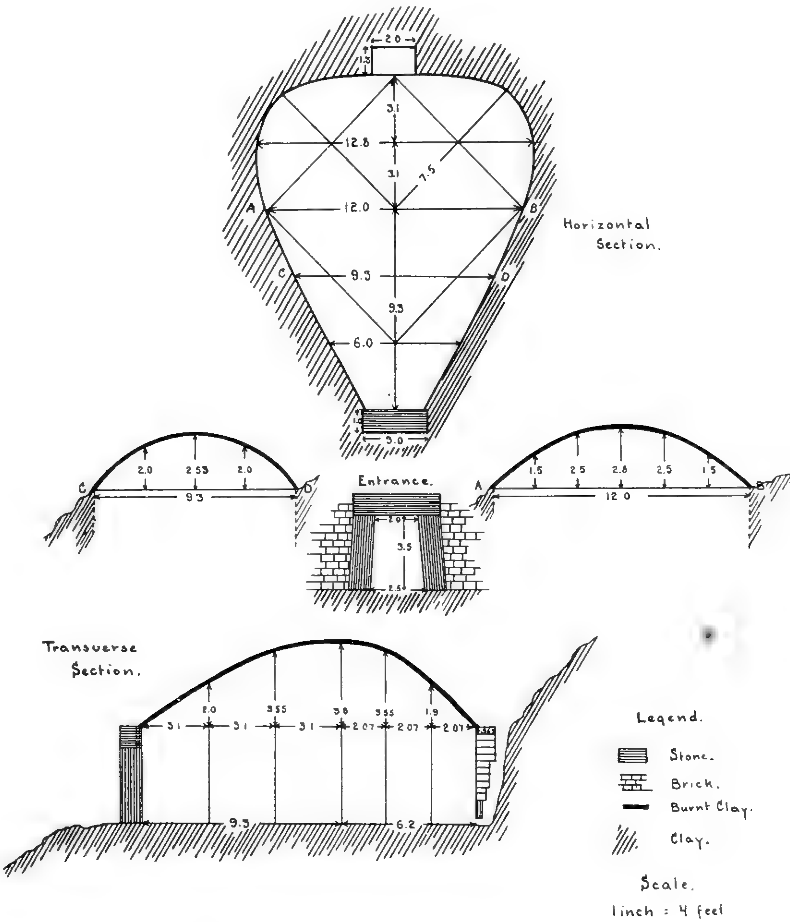
and a table prepared showing the average rate of growth in diameter, omitting the badly suppressed trees, since these will not be left.

TABLE IV.

GROWTH IN DIAMETER OF LONGLEAF PINE FOR TWENTY YEARS.
TYLER COUNTY, TEXAS.

Present diameter at 4½ feet, inches.	*Growth in twenty years, inches.*	*Diameter in twenty years, inches.*
9	2.3	11.3
10	2.3	12.3
11	2.3	13.3
12	2.25	14.25
13	2.2	15.2
14	2.15	16.15
15	2.1	17.1
16	2.1	18.1
17	2.05	19.05
18	2.0	20.0
19	1.95	20.95
20	1.9	21.9
21	1.85	22.85
22	1.8	23.8
23	1.7	24.7
24	1.6	25.6
25	1.55	26.55
26	1.5	27.5
27	1.45	28.45
28	1.45	29.45
29	1.4	30.4

This rate of growth is not nearly as rapid as that of shortleaf or loblolly on old fields or even in the forest, but it is all that can be expected of longleaf, grown in the forest. No allowance is made for possible increase as a result of thinning, so the actual growth will from this cause probably be greater than shown.



Japanese Charcoal Kiln
By Nils B. Eckbo, M.F.
1909.

JAPANESE CHARCOAL KILN.

By Nils B. Eckbo.

There is a great deal more charcoal used in Japan than in any other country, and it is a necessity in every Japanese household. According to statistics of the year 1906, the quantity of charcoal amounted to 956,422 tons which represents a value of about six and a quarter million dollars.

The burning of charcoal has been known for centuries; while the methods naturally have had their course of development. The method described here is the one used most commonly throughout Japan, and the construction of the kilns in their most complete form is shown in the accompanying illustrations. As the woodsman and farmers make it, it is somewhat simplified, which can be seen clearly in the photographic reproductions.

The kiln is most easily made in a clay hillside where it can be dug out with four to five feet high walls. These may also be made of stone, which is a little more expensive, but makes a whiter charcoal, which is more valuable than the black. The entrance is made of three stones and one hundred bricks, the bottom of the chimney is also constructed of stone with about one hundred bricks composing the funnel. Wood of broadleafed trees is used exclusively and is cut as long as the wall is high, then piled vertically from back towards the entrance. On the tops are laid shorter pieces so as to make a properly curved roof, which is covered with straw mats.

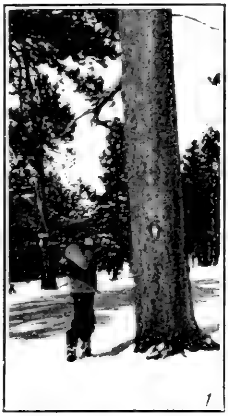
The roof of the kiln is made of burnt clay and water, the clay being pounded into a layer of three to five inches in thickness and with a perfectly smooth surface. This is practically airtight, and when burned becomes hard as brick and cracks with difficulty. In the entrance are put two rows of round wood, about one foot in diameter, to prevent too much draft, and the kindling is started under a small canopy made of clay in front of the entrance.

As the fire spreads, during the first seven to twenty-four hours, one-half of the entrance is closed gradually with rocks. At the end of seven days, pale smoke usually emanates from the chimney, teristic group of reproduction in the foreground. This area also is near a wagon road and the timber was left untouched because of its landscape value. In such a case it would be unnecessary to leave seed trees since the young growth is ample and already constitutes the basis for an early second cut.

While marking in winter is advisable because of its being done economically at that time and not interfering with other forest work, such as fire patrol, improvements, etc., still the season presents unexpected difficulties, especially after a heavy snowfall when the unfortunate marker has to walk through deep drifts, as illustrated in Cut 5.

A final word as to the relative value of marking implements may not be amiss. The marking hatchet has the advantage of being easily carried, especially on a saddle, but the old fashioned heavy marking ax is far easier if much marking is to be done, since its very weight carries it through the heavy bark of the western Yellow Pine and of the Douglas Fir. If a man is going to do much marking it is best for him to pick out a helve suitable to his individual tastes.

So much has been said about marking being the most important work on a Forest that a repetition seems superfluous. However, marking is forestry in the truest sense, and the results are for all time to come. I believe there is no satisfaction greater than going over a sale area which one has marked himself and feeling that the work has been well done. Equally poignant is the regret for mistakes forever past remedying; for there is no work where one can more clearly realize mistakes. Errors stand out with uncompromising distinctness. It is because of its supreme importance that the men in charge of the District offices are more and more getting out and marking timber along with the supervisors and rangers. "Paper work" will be abandoned, the mimeographed marking rules will be vitalized by actual marking examples by the men who formulated the marking rules. Just in proportion as this is done will the standardizing of all timber sales work be consummated.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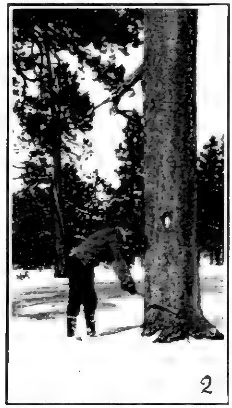
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then be done very rapidly. Where the country is sectionized, the marking is usually by land lines. Where the area is unsurveyed the topography governs, as it may also govern in very rough country even though it is surveyed. Marking is best done up and down the slope. When a strip is finished the group of men should "wheel" so that the inside man becomes the outside one on the return trip. It is also well to mark "en echelon," that is the inside man being a little ahead of his partner and so on.

The advantage of this is that the inside man can watch the previous marking and is sure to omit no trees, and each man can watch the marking of the man in front. Care should, of course, be taken not to go too fast and to have each man observe his own strip. It is very necessary to have a sense of direction. Each man's strip should usually not exceed 150 feet in width, although this must vary greatly with the density of the timber. Where the strip adjacent to a section line is being marked the inside man may find it well to do no marking at all but to follow the line by the aid of a compass.

Perhaps the most important thing in marking is to do it slowly and carefully and to study every tree before it is marked. It is very poor policy to walk up to the base of a tree and then decide whether you want to mark it or not. It is far preferable to watch the trees in advance and to pick them out as you approach them (This is well illustrated in Photograph No. 3, where the illustration shows the Forest officer carefully looking over the timber before marking any.) If a man is inexperienced in marking it is well for him to tally the trees which he cuts and those which he leaves, making a rough estimate of their contents in board feet. In this way he gets a check on the amount and percentage of the total stand left and can be assured that he has not exceeded the two-thirds of the total stand allowed to be cut under the general marking rules. Cuts 3 and 4 illustrate two different conditions of stands, frequently met in the yellow pine forests of the Southwest. Cut 3 shows an overmature stand with practically no "black jacks." In this case, all the spike top trees in the foreground were marked for cutting and the large tree next to the Forest officer and also the one in the right hand margin of the picture were left not only as seed trees, but also on account of their scenic value, being close to the wagon road. In cut No. 4, the conditions are entirely opposite. The timber is all young and there is a characas that the marking should be done slowly and carefully and not too far in advance of the cutting. Even the Use Book has little to say on this important subject other than that "all trees which are to be cut shall be marked or otherwise unmistakably identified for cutting * * * the Forest officer may instead of marking * * * every tree, blaze and mark the boundaries of the cutting area * * * standing timber must be marked 'U. S.' near the ground so that every stump will show the mark. Where snow may conceal the marking from the cutters each tree must also be marked at a point several feet from the ground."

As a rule, the marking in connection with small sales and in free use timber is done by a ranger without any assistance. Any one who has done much marking will agree that it is the most arduous physical work of any on a National Forest except fighting fire. It requires all the force of a woodchopper, besides a considerable amount of skill. If it is carefully done a man can with one blow take off the bark at breasthigh and reversing his marking ax stamp it "U. S." By picking out a projecting root with one downward and one sidewise "swipe" and stamping the "U. S." he marks the base of the tree. It is always well to mark in strips, unless the sale area is very limited or only a small amount of free use timber is being marked. Where marking is done in strips it is well to blaze the trees at breasthigh on a uniform side, i. e., on the side towards which the marking proceeds. In other words, if the marking is done from north to south, the trees should be blazed on the south side and the marker can then always tell at a glance without going up to a tree whether or not it has been marked. It is especially convenient to mark when there is snow on the ground for the footprints indicate clearly whether or not the tree has been included in the marked strip. In order to be perfectly sure that every tree has been passed upon, it is a good practice when snow is on the ground to actually walk around the seed trees which are left, in order that on the return trip the footprints may show that it had been left on purpose. Where the sale is of large size, the marking should preferably be done by a crew. It is not advisable to have more than six men in one crew. Of these at least two should be men experienced in marking timber, each of these keeping an eye on the work of the green man on either side of him. The work can

MARKING IN PRACTICE.

By A. B. Recknagel.

So much has been written on the theory of marking timber in sales on the National Forests that a brief review of the field practice in common use may not be amiss. Even under the Land Office, it was the practice to mark timber for cutting, and when, in 1905, the reserves were transferred to the Department of Agriculture, this practice continued.

At that time, there were no instructions for marking other than those contained in the Use Book. It soon became evident that further instructions were necessary, so that the practice developed of issuing marking rules with every timber sale of any importance. This worked well until the sales increased in number and importance so rapidly that it became impossible to draw up careful marking rules in each individual case. Then general marking rules for each Forest were formulated so far as possible, but the lack of data made them unsatisfactory. During the fall of 1907, all the supervisors and all the technical men stationed on National Forests were requested to submit general marking rules for their Forests. The replies showed a remarkable unanimity of opinion as to the general principles and made possible the compilation of standard marking rules for the various silvicultural regions in the West. These were (1) the Lodgepole Pine region; (2) the Douglas Fir region of the Northwest; (3) the Yellow Pine region, with (a) the northern division comprising eastern Oregon and Washington, (b) the eastern division comprising eastern Montana, Wyoming, and eastern North and South Dakota, and (c) the southern division comprising Arizona and New Mexico; (4) the Engelmann Spruce region of Utah and Colorado; (5) the Sugar Pine region of California; and (6) the woodland region of Nevada and Southwestern Arizona.

These rules, mimeographed and in the hands of all the rangers, helped to standardize the silvicultural side of marking. But the general marking rules made no mention of how the actual field work should be done except to emphasize a few points, such maintain their present output by cutting a slightly larger area each year, are, with each acre cut, changing the overmature forest into a thrifty growing form, comparatively safe from loss by fire, rot or insects. In fact, so great is the difference between the powers of resistance of thrifty trees and of old, rotten or suppressed trees, that such a cutting might be regarded as the best form of insurance which is available for standing timber.

The experimental markings and studies of growth the results of which were given here were made by the seniors of the Yale Forest School on the holdings of the Thompson Lumber Company in Tyler county, Texas. The company does not own the land and the marking was made for purposes of instruction only. The timber will be cut clear. Therefore these figures do not represent the results of an actual operation, but are intended to give a definite statement of methods and results which can be obtained by their adoption.

which 56 per cent. is growth on merchantable trees and 44 per cent trees maturing in the interval.

As was well shown on the area marked, a stand of from 1,500 to 2,500 feet per acre will usually be about all the timber that ought to be left, and in addition will furnish enough seed trees to secure the new crop. These seed trees would in most instances be the best trees to leave, even if no effort were made for the third crop, and it is only an occasional large or defective tree that could be cut instead of left if the third crop were ignored. The provision for the third crop thus entails a very small additional sacrifice.

Once the probable yields are agreed upon, it is not a difficult matter to compute the expense and profit of leaving a second cutting. The method applies only to regions where transportation and railway construction are reasonably cheap, but this is fortunately the case over most of the longleaf pine areas.

The leaving 1,500 to 2,500 feet per acre will not so reduce the present cut as to make profitable logging impossible—in fact, much of the young timber now cut is probably handled at a loss. The growth upon a reserve larger than 2,500 feet would not be as great in proportion to the capital invested as upon this small stand.

It is probable that an increase in twenty years from 1,700 to 3,400 feet per acre would not of itself be sufficient to pay 5 per cent. interest compounded annually. But there is no reasonable doubt that stumpage will double in value in that time. This makes a fourfold increase in the value of the standing timber, independent of the improvement in quality and grade with increased age and size.

This method of cutting can not be considered as an impractical scheme. It is absolutely sound in principle, which is to reduce waste and secure at once the largest rate of increase in value on property which it is the intention of the owner to hold for at least twenty years. The plan should appeal to owners who expect to continue cutting for fifteen to twenty years and can control the amount of their output. Instead of cutting clean and destroying all future increase in value on the cutover areas on the one hand, and allowing the virgin forest to lie in its present state of stagnation on the other, such owners, while they can

TABLE V.

GROWTH IN BOARD FOOT CONTENTS, DOYLE RULE, IN TWENTY YEARS—LONGLEAF PINE IN TYLER COUNTY, TEXAS.

Present diameter.	*Present volume, board feet.*	*Growth in years, board feet.*	*Growth, per cent., twenty years.*
12	75	65	87
13	95	80	84
14	130	95	73
15	167	108	65
16	220	117	54
17	280	125	45
18	325	132	40
19	375	138	37
20	465	143	31
21	530	146	28
22	600	148	25
23	670	150	22
24	760	151	20
25	845	153	18
26	940	154	16
27	1,040	155	15
28	1,150	154	13
29	1,260	152	12

The volumes in board feet, Doyle rule, of trees of all sizes were prepared by measuring about 400 felled trees. By using the average merchantable heights, assuming that a tree of one diameter will grow to the height of the average tree in the upper diameter class, the growth per tree as taken from the volume table was as recorded in Table V.

On the eighty acres upon which the growth was measured it was found that 690 trees now below the limit of 12 inches would become merchantable in twenty years. Their volume added to the growth on the present stand gives the total second crop.

TABLE VI.

GROWTH PER ACRE OF LONGLEAF PINE IN TWENTY YEARS AFTER REMOVING FIRST CUT—TYLER COUNTY, TEXAS.

Original stand, board feet,	7,690
First cut, board feet,	5,990
Stand left, board feet,	1,700
Growth in twenty years, board feet,	957
Trees maturing, per acre,	86
Volumes of same in twenty years, board feet,	743
Total growth, board feet,	1,700
Final volume, board feet,	3,400

This gives an increase of 100 per cent. for twenty years, of which is a sign that all the openings can be closed entirely and the kiln left to cool off in two or three days.

No water must be applied on the roof during the burning, which is also often protected by a wooden shed. One man is sufficient to watch the kiln and cut wood at the same time.

When the wood is completely carbonized, the charcoal is taken out through the entrance of the kiln and the roof remains intact and is ready for a second burning. A kiln like this can be used steadily from three to five years, when kept in proper condition.

It can be said, to the advantage of this kiln, that it is not expensive to construct, is maintained very cheaply, and is a decided improvement on the customary dirt kiln. The gases can be collected. As a drawback, however, must be considered the long time required for carbonization, which can not be avoided with a kiln made on that principle.

METHODS OF DETERMINING THE TIME OF THE YEAR AT WHICH TIMBER WAS CUT.

By Raphael Zon.

It is generally admitted that the time of the year at which timber is cut has an influence upon the durability of the wood, and that timber cut in winter gives longer service than timber cut in summer. This opinion is based not merely on theoretical considerations but also on actual experiences, especially with railroad ties. Ties made from trees which were known to be cut in summer rotted sooner in the ground than ties made of the same species but cut in winter. The reason for this is found in the scantiness of easily decomposed chemical substances in the tissues of trees after the close of the vegetative period. The sap in the tree during winter consists almost entirely of water, and therefore does not offer a favorable medium for the development of micro-organisms. In summer, on the contrary, the sap contains albuminous and other chemically unstable substances which under the influence of the high temperature of summer readily ferment and favor the development of decay-producing micro-organisms.

The few who oppose this view claim that by proper handling of the timber after cutting, wood cut in summer may prove as durable as that cut in winter. Since the presence of moisture in the wood more than the chemical composition of the sap favors the starting of decay, they argue that the smaller amount of water in the tree and quicker drying of the wood in summer prevent decay. This might be true if the wood could always be dried immediately after cutting, but there is no doubt that unless timber cut in summer is at once dried artificially or in the air, it is invariably less durable than timber cut in winter. That the advantages of winter cutting are fully recognized by the users of wood may be readily inferred from the fact that practically all of the government railroads abroad and some of the railroads in this country, specify in their contracts for ties that the latter shall be of winter cutting. Since however, there is no accurate method for determining with certainty the time of cutting, the inspectors of ties have often been compelled either to make merely a pretense that they can tell whether or not ties were cut in winter, or to allow this specification to remain altogether a dead letter. Sometimes, as in the case of the railroads in Russia, agents have been sent to the places where the ties were supposed to be cut in order to ascertain on the ground the time of cutting. The lack of any accurate method of determining with certainty the time of cutting has also prevented many users from enforcing the specification that wood used for construction purposes should be cut exclusively in winter.

The ability to tell readily and accurately if not the month, at least the season at which a given piece of wood used in construction was cut would evidently be of both scientific and practical value. Scientifically, it would be of advantage because it would enable us to determine with accuracy the exact role which the time of cutting plays in causing decay. Practically, it would be useful in helping us to study conditions under which wood of summer as well as winter cutting may be used to the best advantage. It would undoubtedly lead to a demand by users of wood to have the timber employed in construction cut in winter, and in this way would lead to greater enconomy.

It is easy to figure out the saving which could be made on railroad ties alone by the use of ties of winter cut only. There are now about 300,000 miles of railroad track in the United States. Since each mile of railroad requires on an average about 2,700 ties, there are in the neighborhood of 810,000,000 ties on the main lines alone. Let us assume that ties cut in winter will give only one year more service than ties cut in summer, or, in other words, remain in the ground eight years instead of seven. If the ties were to be changed every seven years there would be required annually 810,000,000 divided by 7, or about 115,700,000 ties. If the ties gave an eight-year service, then the number which it would be necessary to replace every year would be 810,000,000 divided by 8, or about 101,250,000 ties. Thus, by using ties of winter cutting there would be required annually about 14,450,000 less, which at an average price of 50 cents per tie would make a saving of $7,225,000, not counting the cost of replacing the additional 14,450,000 ties. Since a large number of ties now used by the railroads are cut in winter, this example does not pretend to represent the actual saving, but merely to illustrate the possibilities of using ties of winter instead of summer cutting.

Such a method may also prove useful in case of litigation when it is necessary to determine the exact time of a trespass cutting.

Is there any way of determining with accuracy the time of cutting?

From what is known of the chemical changes which take place in the tissues of trees at different seasons of the year, and from the structural development of the annual ring, one naturally turns to chemical and microscopical methods for finding characteristic differences in the wood cut at different seasons of the year.

Chemical Methods.

During the vegetative period the tissues, especially the living, active tissues, contain albuminous or proteinous substances which enter into the composition of the living cells, but very little starch. In the fall, just after the tree enters into its dormant stage, it contains considerable reserve material in the form of sugar, dextrin, and especially starch, deposited in the medullary rays and the pith. One would expect, therefore, that a piece of wood cut in winter when treated with an alcoholic or watery solution of iodine would assume a yellow color, while the pith and the medullary rays containing starch would assume a dark blue color. If the piece were cut in summer all the tissues would become of a uniform yellow color. This method, theoretically at least, should enable us to determine broadly whether a given piece of wood was cut in winter or summer. In practice, however, it gives dubious results; first, because the differences in the chemical substances found in the wood of trees in summer and winter are not so much qualitative as quantitative, and second, because trees of the same species, like all living beings, are subject to variations depending upon climatic and soil conditions.

Another chemical method which suggests itself is the determination of the amount and the composition of the ash contents of the wood cut in summer and winter. The amount of mineral substances in the wood as represented by the ashes obtained after burning the wood is supposed to vary with the season of the year. At least this has been proven with certainty in regard to the foliage. It is generally assumed that the wood in summer contains a larger amount of mineral substances (and consequently yields a larger amount of ashes), of which a larger per cent. is insoluble in water, than is usually found in wood during winter.

The amount of mineral substances, however, is still more subject to variation than organic substances. The mineral composition of the soil has a decided influence upon the amount of mineral substances contained in a tree. Fliche and Grandeau have demonstrated that a difference in the amount of ashes in the wood of different trees of the same species may amount to one per cent., while the difference in the amount of the individual components of the ashes may often be as high as 16 per cent.

In the following table are brought together results obtained by a chemical analysis of the amount of ashes and the per cent. of their soluble and insoluble components for ten samples of pine wood cut at different seasons of the year. The time of cutting of each sample was accurately determined beforehand:*

No. of Sample.	*Total per cent. of ashes.*	*Per cent. of insoluble and soluble portions. Insoluble.*	*Soluble.*	*Time of cutting as indicated by chemical analysis.*	*Actual time of cutting.*
1	0.410	74.4	25.6	Summer	Summer
2	0.230	65.2	34.8	Winter	"
3	0.365	68.5	31.5	Summer	Winter
4	0.570	89.5	10.5	"	"
5	0.275	65.5	34.5	Winter	"
6	0.220	63.6	36.4	"	"
7	0.217	67.7	32.3	"	Summer
8	0.275	70.9	29.1	"	"
9	0.183	43.7	56.3	"	Winter
10	0.208	61.0	39.0	"	"

If sample No. 1, which contains the largest amount of ashes and the largest per cent. of mineral substances insoluble in water, be accepted as typical for wood cut in summer, then samples 3 and 4 must also be put in the same group, although as a matter of fact they were cut in winter. If sample No. 6, which contains a comparatively small amount of ashes and a comparatively large amount of soluble mineral substances, be taken as typical for wood cut in winter, then samples 2 and 7 must also be placed in the same category, which, however, is contrary to the facts. These results, therefore, clearly show that no dependence can be placed upon these chemical methods of determining the time of the year when a tree is cut.

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* P. I. Rashevsky, An Accurate Method of Determining the Time of Cutting of Felled Trees (in Russian). Warsaw, 1897.

Microscopic Method.

The wood of all trees native to the temperate zone is clearly marked on transverse section by circular bands which are known as annual layers or rings. These annual rings are due to the fact that the cells composing them are not of the same structure throughout the whole ring. In spring and early summer the cells are large, thin-walled, and in the case of broadleaf trees, traversed by many water-conducting vessels. Toward the end of the vegetative season, the cells become small, thick-walled and compact, and in the broadleaf trees the number and size of fibro-vascular bundles decrease. At the beginning of the following vegetative season, the new layers begin abruptly again with large cells, and this sudden transition from one kind of cell to another makes the wood appear in the form of clearly defined rings. The exact cause of this structural difference in the "summer" and "winter" wood is not fully known, but it is present in all trees of the temperate zones or climates with periodic changes of season.

It is evident therefore that the stage of development of the last ring furnishes a means of determining the time at which the tree was cut. If the last layer of pine wood for instance, examined under the microscope or magnifying glass, shows only large, hexagonal, translucent cells, one may infer with certainty that the tree was cut during the early part of the vegetative season; if the last layer in addition to large hexagonal cells contains also a fringe of small, compact, elliptical, whitish-yellow cells, it is a sure indication that the tree was cut in the latter part of the vegetative season, or, if the layer of winter wood elements is large, that it was cut after the termination of the vegetative period.

This periodicity of the seasons marked on the wood by annual rings with their characteristic "summer" and "winter" wood, served as a basis for a Russian civil engineer, P. E. Rashevsky, to develop a practical and accurate way of determining the time at which timber was cut. During the 20 years of his service as civil engineer on one of the Government railroads in western Russia, he became convinced that ties cut in summer did not give the same service as ties cut in winter; yet he was powerless to make the contractors live up to the stipulation that all ties delivered to the railroads should be only of winter cut, since there was no accurate way of telling this at the time of inspection at the points of delivery where large numbers of ties were accumulated. This led him to investigate the problem, and although the results of his study do not contain anything which was not known to students of wood before, yet their practical application makes them of considerable interest to both foresters and users of wood.

His method presupposes as a *conditio sine qua non* that there should be present in the wood a portion, no matter how small, of wood containing a part of the last ring, a condition which can be readily met in all hewn ties, piling, and similar material. He extended his study of the differences in the structural appearance of the last layer over a whole year, during which he cut a tree on the first day of each month. From each tree thus cut he took two disks about one inch thick from the butt and the crown, in order to study the formation of the cells at different heights in the tree. Since he was chiefly interested in the species which were used for railroad ties, his studies were confined exclusively to pine and oak. The method which he followed in preparing the sections for examination was this: From each disk he cut with a penknife small sections parallel to the long axis of the tree, including in every case the last layer of wood near the bark and placed these in water so that they should become soft and more easily cut. He then obtained by means of a microtome, thin, transparent cross sections of these pieces not more than the thickness of thin writing paper, for examination under the compound microscope. The last layer of wood was examined under the microscope, and its structural appearance in each month of the year studied. As a result of these investigations Rashevsky came to the conclusion that it is possible to tell from the appearance of the cells of the last layer of wood not only whether the tree was cut in summer or winter, but whether it was cut in the spring, summer, fall, or winter. This he determined by comparing the width of the last layer of wood elements with the width of a similar layer of the previous year. If, for example, the winter layer directly adjoining the bark appeared under the microscope to have a width of half an inch, and the winter layer of the previous year a width of one inch, he inferred that the tree was cut in the middle of winter. If, however, the winter layer of the last wood appeared to have a width of about an inch, he would take it for granted that the tree was cut at the close of the winter. The same rule he applied to the summer layers. If the summer layer bordering upon the bark appeared under the microscope as having a width of half an inch, while the summer layer of the previous annual ring had a width of one inch, he took it for certain that the tree was cut in the middle of the summer period; if, however, there were only a narrow layer of summer cells under the bark, it would indicate to him that the tree was cut in the early spring. Since, however, the width of summer layers as well as winter layers varies not only in different trees, but even in the same tree from year to year, it is not enough to compare the width of the last wood with the width of the corresponding layer of the previous year only. In order to obtain accurate results, it is necessary to compare the width of the last wood with the average width of a layer of the same character for a number of preceding years.

In determining the time of cutting of old trees, and especially of trees that have been lying for a long time on the ground, it often happens that it is difficult to make out the cells under the microscope, and therefore to determine the time of cutting. In such case it is well to dip the section of wood into a solution of iodine which colors the walls of the cells a dark orange and enables them to be more readily distinguished.

The results of these investigations are fully illustrated by a number of photographs of the structure of the last wood as it appeared under the microscope.

Since the exact date of cutting of the tree from which each section has been taken is definitely known, these photographs obtained by means of a microscopic camera afford a most interesting insight into the development of the layer of wood during the entire year.

These investigations convinced Rashevsky of the entire accuracy and practicability of such a method of determining the time of cutting to such an extent that it was made compulsory by the railroad for which he worked for all the inspectors to make microscopic examinations of not less than four samples from each consignment of ties. If among these samples even one proved of summer cut, the whole consignment was rejected and had to be removed from the railroad grounds and substituted by another consignment of ties of winter cut.

In order to make these examinations, it is not necessary of course, to go to the same length as did Rashevsky in his pains-

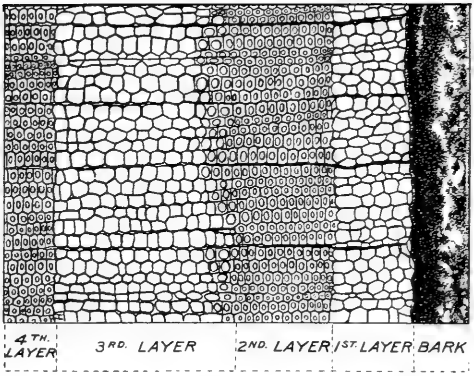


FIG. 1.

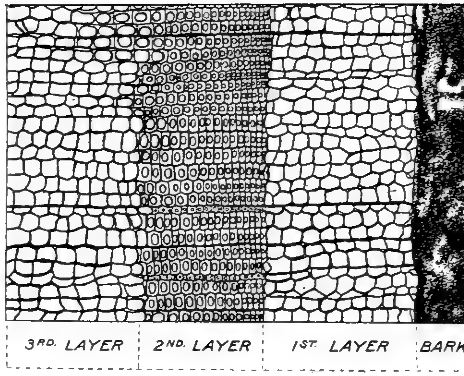


FIG. 2.

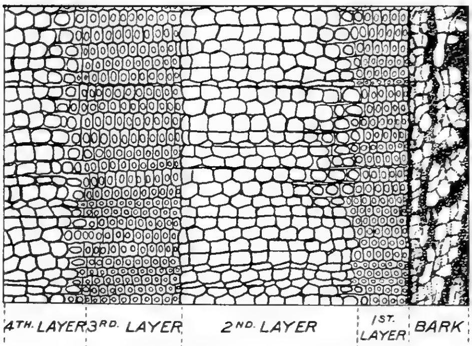


FIG. 3.

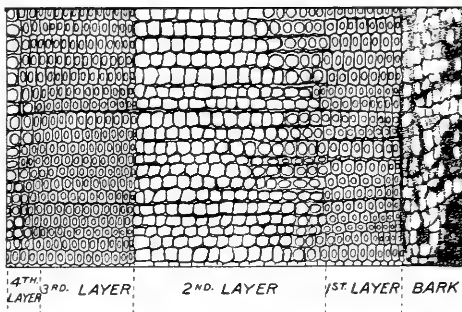


FIG. 4.

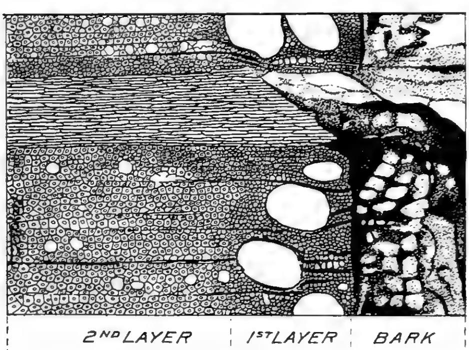


FIG. 5

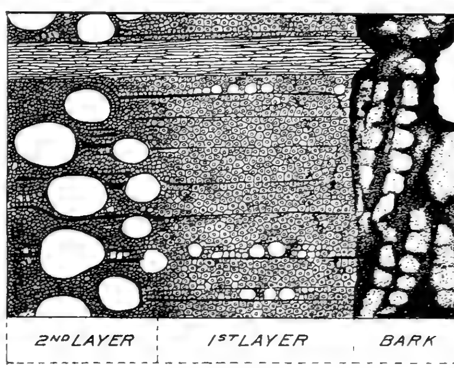


FIG. 6.

Figure 1 section of pine cut May 1
" 2 " " " " July 1
" 3 " " " " October 1
" 4 " " " " February 1
" 5 " " oak " July 1
" 6 " " " " February 1

taking work by means of costly instruments. Such instruments are, of course, necessary for careful scientific investigations, but for ordinary determinations of the time of cutting, a cheap microscope with a magnifying power of 140, which can be bought for $25 or $30, a sharp penknife and a small piece of wood containing a portion of the last layer of wood are about all that is needed for such examinations.

Rashevsky's examinations, supported by microscopic photographs of the actual structure of the wood obtained from trees cut each month of the year, open also a new field of investigation into the structural changes which take place in the annual layer after the close of the vegetative period.

Rashevsky's studies do not leave any doubt as to the possibility of determining from the appearance of the last wood layer whether the tree was cut in the spring, summer, or during the dormant period of the tree. This for the practical end which is sought by such a method is all that is required. His claim, however, to be able to tell from the appearance of the last layer whether the tree was cut in the late fall or middle winter, must be taken with considerable reservation. It is evident that there can be no increase in the width of the last layer after the growing season is over. The actual division of the cambium cells and the formation of wood elements take place within a comparatively short time, in the temperate climate between May and July. While the new layer of wood is in the process of growth its width may serve as a measure of time; but after its growth is completed it is hard to see how the width of its winter wood can determine whether the tree was cut in the beginning or the middle of winter, *unless some subsequent changes take place in the wood elements,* which change the proportion of summer and winter wood in the annual layer. This would open new vistas into a field which so far has been but little investigated.

[The Editor can not allow this contribution to pass without accentuating and enforcing Mr. Zon's doubts as to the likelihood of structural changes in the wood during winter.

It is well established, we think, that different species in the northern climate exhibit growth periods of different lengths (some extending it into September, see QUARTERLY, Vol. V, p. 259), but also, that all cease growing in winter. The Russian Civil Engineer evidently knew little of the physiology of tree growth, and his scheme sounds fanciful. All he could possibly determine is whether the wood was cut before or after the summer wood of the year had been formed.—ED.]

ARGENTINA AND ITS CHACO*

By Herman Kluge.

The term Chaco means all the lands formerly controlled by the once powerful Guaranie Indians before the Spanish conquest. The name first used was Yacu, which is the name for the wild turkey; for in former times they were abundant. Gradually the name changed to Chacu, then to Chaco. Thus Paraguay, Uraguay and Bolivia have their Chacos. The Chaco in Argentina extends through the northern, northeastern and northwestern parts. Chaco does not necessarily mean timber land, but the timber land is in the Chaco. The belts of timber cannot be distinctly defined, but they lie more or less in the river districts of the Parana, Paraguay, Pilcomayo and Bermejo. This makes it easy to subdivide the Chaco into districts. Of these, the part called "Rio Bermejo Chaco" is best known by the writer. This tract lies east of Chile and South of Bolivia at an elevation of from 500 feet to 4,000 feet above the sea level.

The entire Chaco seems to contain the more important woods distributed over the whole, such as cedro, quebracho, urendel or unrendey and lapacho. Yet of the less common woods each part of the Chaco shows its peculiar distinctive trees. Pine is said to be found along the Andes from the Strait of Magellan to Bogota, Columbia, in more or less quantities, but there is no reliable information. In Brazil, on the head waters of the Uraguay river, a good kind of pine exists which in small quantities reaches the mills at Buenos Ayres. South America is still in such an unexplored condition that the best one can say is: there is timber here and timber there, without being able to give an idea of the extent of the tracts. Argentina, taken as a whole, has not a great amount of timber, but what there is is of the finest kinds, very little strictly ornamental wood but the best of hard woods. There are immense tracts of land that are untrodden by white men and the government is making no effort to have it surveyed. In the Bermejo region the timber runs from 2,000 feet to 15,000 feet

* This article was published in the American Lumberman of November 13, after having been submitted for publication in the Quarterly.

per acre. A curious fact is that within these tracts of timber are found large grassy flats or pampas. The many varieties (as many as 30 merchantable woods) occur in spots or bunches called islands, which are rarely very large. According to their nature some seek the highlands, like urendey, and others the low lands; mora, lapacho and cedro like damp lands near water, but this law of distribution often fails. All the trees grow to large sizes. Trees measuring six feet in diameter and thirty to forty feet to limbs clear are common, in fact almost the rule. Quebracho, urendel, cedro, quina, cevil, mora and others are sound while growing, having few if any defects, on the other hand palo amarillo and palo blanco are rotten when large or overgrown. Some forests do not contain an old tree of any kind. Wind falls are always the best lumber when of quebracho, urendel, mora, guayacan and lapacho, for they never seem to rot. One never hears of forest fires, for the woods are always green. In this region it is the custom to fell the timber from two to four years before hauling in order to season it somewhat, but even then in many the crown remains still green, while roble will even sprout again. The fact that only cedro floats, makes the numerous streams useless for logging purposes; therefore, all logging propositions are for railroad. A German firm, the Arthur Koppel Co., of Berlin, with a branch office in Buenos Ayres furnish practically all the rails and locomotives, and make a good steel logging car. In connection with the railroad the most primeval methods of logging are in existence. In many places they still load the cars by hand, a few by oxen. The main logging is by oxen and a cart on two wheels, especially a structure of this section. This method is slow and expensive but not knowing that there was any other method loggers were contented until the Lidgerwood Mfg. Co. of New York entered the field, and now the advantages of steam logging are being seen.

The woods are full of very heavy underbrush and, as is usual in all semi-tropical countries, vines of great size and number are very abundant. These vines so hold trees together that 8 or 10 have to be cut before any fall and when they do fall there is a mess. The oxen are of a good breed and there are plenty of them, but mules are small, not much larger than burros. The laborers are of Spanish and Indian descent. In most parts they are what their employers make them, but a very strong, firm hand is required to handle them. Their homes are but of a few sheets of tin, and hardly any of them own or care to own land. Those that do, never work in the mills, while the others live a hand to mouth existence and seem contented, working for very low wages.

The market for most of the timber is local. All the railroads are calling for ties and timber, but certain classes are shipped to Buenos Ayres. At present the freight rates are heavy but a new outlet is being built by way of the Parana-Paraguay River which will do wonders for the section. There is no market wanting and all mills could dispose of double their output.

About the only wood exported in any amount is quebracho colorado, and the official report for 1908 is as follows:

Of 254,571 tons of quebracho colorado (round logs) exported to foreign countries 203,065 tons were sent to Great Britain, which also took 48,000 tons of tannin (quebracho extract). This represents about 65 million board feet of quebracho. The latest figure on quebracho colorado ties is $2.25 gold each, for 2.7 meters or wide gauge. $35 paper or $15 gold a ton for tannin quebracho logs is the rule, no difference being made between green or dry. Of the saw milling it must be said that American saw mill machinery is and has been an absolute failure here. The saw mill machinery must be made to suit the peculiar conditions of the country before it is shipped, not after it is here and by the buyer. The labor and the wood must be thoroughly studied as the French, German and English have done, resulting in their manufacturers controlling the market by such companies as the Ransome & Company Ltd. of England, Panhart & Gavassor of France, and Kirchner of Germany. None of the American machinery seems adapted to cutting the very hard wood. Such things as live rollers, edgers, conveyors are almost unknown. In a mill of fifteen band saws I made inquiries as to American band saws and was surprised to find one in use, but, on close questioning, I found that the saw could not be filed by them as in the United States, so they recut the teeth after the usual style, and now the saw is giving good results. The mills are all ground mills, with shafting buried where only snakes can easily go. There is much to learn in saw milling here, but the Americans will have to learn much themselves before they will be able to teach much. The following kinds of timber are the most in use:

Cedro.—A reddish, soft wood, floats readily and is very fine for interior construction of all kinds. Weight dry is about 25 pounds per cubic foot.

Mora.—A yellowish wood and very hard. Does not float, weighs about 75 pounds per cubic foot. As this wood has a very close interwoven fibre it is especially used for cross strains and compression. It is used for heavy doors, construction of cars and special bridge ties.

Quebracho colorado.—A reddish wood, the color depending on exposure, when much exposed it secretes the natural preservatives or else they come to the surface and it changes to a blood red and deep ruby. Is also hard and very rich in natural preservatives. In this section the quebracho is not used for the extraction of tannin nor for export trade, but rather for ties and wooden bridge construction. Weighs from 75 to 85 pounds per cubic foot.

Urendel.—Good for the same uses as quebracho, it being a sister wood and only an expert can detect the difference.

Lapacho.—A deep yellow green, hard wood, taking a fine polish. It is noted for its tensile strength and lasting qualities. I have never seen a better heavy construction wood. It is used in all better classes of construction. Weighs about 70 pounds per cubic foot.

Quina.—This is a hard wood of reddish color and rather brittle. It is used in second class construction, ranking way below lapacho. Weight 70 pounds per cubic foot.

Cevil.—A very hard heavy wood of reddish white color, but color not running true. The bark is very rich in tannin. Burns with an intense heat and scarcely any smoke. It needs very careful handling and drying, for it warps badly. Used on dry construction, but will last about 25 years in the ground, while the better class lasts 50 years easily. Weighs about 85 pounds per cubic foot.

Palo blanco.—A semi-soft, white wood. It makes a good flooring and ceiling, being like the best spruce but heavier.

Palo amarillo.—A hard, yellow wood, better than palo blanco for construction. This does not grow to very great sizes nor over two feet in diameter.

Roble.—A wood resembling North American oak in weight and color. It is not a true oak but still has the name. Entirely used in furniture.

The less common are: Horco moyo, Afata, Matr, Palo Lanzo, Guayabil, Tipa and others.

The people have been lumbering here for about 60 years, but they will have to lumber a long time before they reach such conditions as prevail in the United States. They cannot understand why American pine and spruce can be sold at Buenos Ayres at the price it is. Still they make no effort to solve the problem. The country is asleep to the fact that it has some resources in lumber. Many good propositions have not even been discovered for the country is as yet unexplored. Argentina does not know what Argentina has.

CURRENT LITERATURE.

Report of the National Conservation Commission. Sen. Doc. No. 676, 60th Congr. 2d Sess. Edited by Henry Gannett. Febr., 1909. 3 vols. 276, 771, 793 pp.

We have succeeded only just before going to print in securing a copy of this voluminous (1840 pp.) and most valuable report, which brings out the most complete statements regarding the natural resources of the United States. It is a pity and a shortsighted policy to have limited the edition to such an extent as to leave no copies for a liberal distribution by the Commission itself. The limit is set so low as to suggest an attempt at suppressing the information, but we hope and have no doubt that the essential points will not fail to be propagated gradually among the public, as we have begun in the present issue.

We have now space and time only to refer to the structure of the document. It consists not only of three volumes but of three parts which do not correspond to the volumes. The first volume containing two parts, namely summaries of different degrees of condensation, and the third part being distributed through the other two volumes, namely, the separate papers by experts on which the summaries presumably are based or supported.

The first volume contains, besides the President's message and the brief summarized report of the Commission, and of the conservation conference, the summary statements by the secretaries of the section of waters, of forests, of lands, and of minerals.

These summaries are the part of the report which should be widely distributed among the people.

That on forests was prepared by Mr. Overton W. Price on 23 pages under the caption, What forests do; what we have; what is produced (see article in this issue); what is used (differentiating by character of use, by States, and by species); what is wasted; where we stand; what should be done; and where we might stand.

It is to be hoped that not all the statements are as inaccurate and misleading as the one on which our eye fell accidentally: "For *ten* years the Department of Agriculture ...... has carried forward a national campaign of education." This statement 'kills by silence' all that has been done previously by the American Forestry Association and the Department of Agriculture!

The following "experts'" articles in Volume II have special interest for foresters:

Underground waters, by W. C. Mendenhall; Floods, by M. O. Leighton; Relation of surface conditions to stream flow, by William L. Hall and Hu Maxwell; Denudation, by R. B. Dole and H. Stabler; Original forests, by R. S. Kellogg; Standing timber in wood lots, by Wesley Bradfield; Stand of timber, by Herbert Knox Smith; Standing timber owned by the States, by J. Girvin Peters; Standing timber in possession of the Federal Government, by G. M. Holmans; Forest products, by R. S. Kellogg; Rate of forest growth, by E. A. Ziegler; Methods of increasing forest productivity, by E. E. Carter; Foreign sources of timber supply, by Raphael Zon; Cost of forestry in different countries, by H. S. Graves; Extent to which foreign methods of administration are suited to conditions in the United States, by S. T. Dana; Forest fires, by Clyde Leavitt; Waste and reduction of timber supplies caused by insects, by A. D. Hopkins; Conservative turpentining, by George B. Sudworth; Conservative logging, by Earle N. Clapp; Waste in milling, by Louis Margolin; Waste in use of timber, by McGarvey Cline; Taxation of timber lands, by Fred Rogers Fairchild; Reduction of timber supply through abandonment or clearing of forest lands, by W. B. Greeley; Utilization of wood waste by chemical and other means, by H. S. Bristol and L. F. Hawley; Wood preservation, by W. F. Sherfesee and H. F. Weiss; Forest planting, by A. S. Peck; Water circulation and its control, by Bailey Willis; Methods which should be adopted by private owners to insure the perpetuation of our timber supply, by C. S. Chapman; What the State should do to perpetuate the forests, by Filibert Roth; Past and present prices of forest products, by H. S. Sackett.

We hope to come back to the details of this Report as occasion is afforded. B. E. F.

Barkbeetles of the Genus Dendroctonus. By A. D. Hopkins. Bulletin No. 283, Part I. Bureau of Entomology. U. S. Department of Agriculture. October, 1909. 169 pp.

This report deals with the results of economic interest of the careful investigations conducted in recent years by Dr. Hopkins and his assistants. Together with Technical Series No. 17, Part 1, in which the species treated of in the present report are characterized in detail, it forms one of the most thorough and complete treatises on a single genus of American forest insects that has come to our notice.

The genus Dendroctonus includes 23 species of which one occurs in middle and northern Europe and in western Siberia while the others are distributed over the whole of North America wherever coniferous trees occur, and among them are the most dangerous enemies of pine and spruce forests.

Their destructiveness is due in large measure to their habit of swarming or concentrating their attacks upon groups of trees in the forest, and their ability to attack and kill living trees wherever their numbers are sufficient to overcome the resistance offered by the trees. Contrary to opinions hitherto held, in the case of certain species especially the Black Hills beetle (*D. ponderosae* Hopk.), an actual preference for living trees has been demonstrated, and the widespread destruction caused by this species is mainly due to this habit.

The relative destructiveness of the different species also depends upon the part of the tree attacked and upon the character of the larval mines. Species attacking the middle and upper parts of the trunk are more destructive than those which affect the lower part, and those species whose larvae excavate transverse winding galleries girdle and kill the tree more rapidly, though not less surely, than those whose galleries are straight and longitudinal. An immense amount of timber is killed in this way, and many large denuded areas in the Rocky Mountains supposed to have been killed by fire were primarily caused by Dendroctonus.

Emphasis is laid upon the necessity of knowing the peculiarities in the life history of each species as a basis for the successful control of their ravages. The time for directing operations towards the control of a particular outbreak, depends e. g. upon the time of hibernation and that of emergence of adults in the spring, the number of broods in the season, and these features not only differ in the different species but vary in any given species in different parts of its geographical range, the variations depending upon climatic conditions, chiefly those of temperature.

Among the influences other than climatic, affecting the multiplication of the beetles, forest fires and commercial cutting of timber may act favorably or unfavorably, depending upon the species involved and in the latter case upon the time and method of cutting. It is important that the principal cutting operations be carried on during the period of hibernation, i. e., in the late fall and winter, since during the following summer the stumps and slash serve to attract the beetles away from the trees, and as the new broods remain in the bark during the following winter they can then be burned before the time of emergence in the spring, When more than one annual generation occurs, as in the southeast and Rocky Mountain region, it may be necessary to burn the winter slash before the first of July.

In fifteen of the species, removal of the bark from the main trunk is all that is required to kill the broods which live in the inner bark, and are killed on exposure to the drying influences of the sun and wind. In the remaining eight species, it is necessary to burn the bark, as in these species the larvae enter the outer bark to transform into pupae. If necessary the barked trees may be allowed to stand for several years without the value of the wood becoming impaired. Various methods are also suggested for the destruction of the broods without removal of the bark, such as converting the logs into lumber and burning the slabs, placing the logs in water, etc.

On the occurrence of an extensive invasion the affected areas should be surveyed and mapped in the fall and the amount of infested timber estimated, and logging operations should, when possible, be concentrated upon the affected areas so that as large a percentage as possible of the infested timber can be cut, barked or otherwise treated before the broods begin to emerge. If this course cannot be adopted, as much as possible of the infested bark should be removed from the standing timber or from those felled for that purpose.

The trap-tree method of control is not recommended in the case of Dendroctonus beetles.

The introduction and protection of natural enemies such as parasitic and predatory insects and insectivorous birds is another important phase of the subject of the control of these insects but has as yet received comparatively little attention.

The general part of the report concludes with an account of some very gratifying results obtained from efforts made in recent years to control various outbreaks of Dendroctonus, especially the extensive depredations of the Black Hills beetle.

This is followed by a detailed account of the various species, extending over 127 pages. Each species is briefly characterized, its work, life history, habits and economic features are described, and special methods of control given.

The report is profusely illustrated with accurate text-figures of the beetles and their work, and photographs showing the appearance of infested trees.

E. M. W.

Diseases of Deciduous Forest Trees. By Herman Von Schrenk and Perley Spaulding. U. S. Department of Agriculture, Bureau of Plant Industry. Bulletin No. 149. Pp. 85.

Not as one would expect from the title, but as one would expect from the authors, the greater part of this Bulletin, (fifty-eight of the sixty-seven pages in the text proper), is devoted to fungus diseases. The diseases of trees are discussed under two groups, those caused by unfavorable environmental conditions and those caused by living organisms. Under the former group, the relation of trees to smoke and sulphur gases, unfavorable soil conditions and extreme cold is briefly discussed. The diseases caused by living organisms are treated under three subheads, namely, those caused by insects; those caused by the parasitic higher plants and those caused by fungi and by bacteria. For the first of the subheads, however, one is referred to previous publications and the latter subhead is chiefly devoted to the various rots of standing trees and structural timbers. Only general descriptions of the various fungi concerned are given, most of the discussion being devoted to the response of the host to the disease. The Bulletin closes with a discussion of the decay and prevention of decay in structural timbers. It is accompanied by eleven figures in the text, ten plates and a bibliography of one hundred and fourteen numbers.

C. D. H.

Report on Fertilizer Experiments on Swamp Soils. By R. Harcourt, in Thirtieth Annual Report of the Ontario Agricultural and Experimental Union. Ontario Department of Agriculture, 1909.

This report embraces the result of information gathered by correspondence regarding the extent and productivity of Ontario swamp soils, the result of soil analyses and of field and pot experiments with fertilizers.

In the writer's opinion swamp lands with clay subsoil are more common in Ontario than those with a sand subsoil. In general the former produce good crops, while the latter and those where decomposition has not progressed sufficiently to form a soil that will hold water after tile-draining, do not.

The forty-four analyses showed that those with sandy subsoils contained a lower percentage of the mineral food constituents, especially potassium and phosphorus, than the others; but that on the whole the non-productiveness of Ontario swamp soils could not be ascribed to lack of mineral food. Fertilizer experiments on deficient soils, with potash, however, did show increased yields, while the addition of lime and phosphoric acid made little change. So far, however, results are meager, owing to the difficulties incident to co-operative work, in this case especially to get the experimenters to drain their plots sufficiently.

The writer suggests that the reason for the non-productiveness is to be found in the nature of the humus, analyses indicating that its decomposition does not take place rapidly enough to keep vegetable growth supplied with food. Pot experiments in innoculation with germs to hasten this decomposition, garden lawn and farmyard manure being used, showed increased growth, indicating the probability of this explanation. Co-operative field experiments in such inoculation have not so far been tried.

J. H. W.

Fourteenth Annual Report of the Forestry Commissioner of Minnesota, for 1908.

This report gives the text of several important additions to the forest laws. Following a season of drought and severe fires, an effort has been made to improve the machinery of the fire law. The reported damage from fire was $2,000,000 of which $1,500,000 was caused by the destruction of the mining town of Chisholm.

Among the measures adapted, the emergency appropriation for payment of fire fighters was raised to $14,000 annually and the compensation of wardens put on a basis of 25 cents per hour, and for helpers 20 cents per hour instead of $2.00 and $1.50 per day. The minimum penalty for violation of the statute against setting fires accidentally or otherwise was made $50.00. Formerly no minimum was stated. Camp fires must by the new law be built only after clearing a space ten feet from the fire, of all combustible material and must be extinguished before leaving. The provisions for prosecution of offenders are strengthened by an increased appropriation of $2,000 annually, by allowing the acceptance of circumstantial evidence of neglect in allowing fire to spread, and by adding a penalty for the neglect or refusal of county attorneys or magistrates to take action against offenders.

The old system of requiring the town supervisors to act as fire wardens is retained, and town clerks and highway commissioners are given similar duties.

But the most important acts are three in number: First, the commissioner is empowered to district the portions of the state exposed to danger from fires, irrespective of local organization and to appoint paid rangers at $5.00 per day to patrol for the prevention of fire. The only limit to the extension and use of this plan is the amount of money available. It marks the definite adoption of the only scheme of fire protection that has ever proven successful.

Second. Railroads are required to employ a patrol for every mile of road in districts where the danger is great. This is in addition to the provision for clearing right of way and providing spark arresters. If enforced, this will insure almost absolute immunity from fires from railroads.

Third. The slashings (tops, branches, and rubbish) must be burned at a seasonable time, and before May 1st, using due precaution to prevent injury to standing timber. Before burning, they must be piled, and burning without piling is prohibited.

While conditions in Minnesota justify the enforcement of such a provision as a measure for the prevention of damage from subsequent fires, it is doubtful if the present organization of the warden force, or the state of public opinion will permit of its rigid enforcement except near towns or on land where there is an active effort being made to secure a second growth of pine. The expense of piling may often be considered unnecessary and the burning be just as effective without the piling if done for the sole purpose of reducing the fire risk. The law will require for its enforcement a far greater development of public interest in the care of wild lands and activity in the actual work of reforestation than exists at the present time. But there is no doubt that active efforts to enforce these provisions will have a great educational effect.

Another provision of some importance is the passage of a law submitting a constitutional amendment to the people which would provide a 1-15 mill State tax to raise funds for reforestation. The usefulness of this amendment, if adopted, will be greatly hampered by the limit of $3.00 per acre incorporated as a part of the amendment.

It is interesting to note that the State has provided for the acceptance of a gift of 2,200 acres near Carlton as a demonstration forest for the University of Minnesota Forest School, and has made a $5,000 appropriation to pay students employed in the practical work of forest protection.

The Chief Fire Warden is now known as the Forestry Commissioner and continues to be the active head of the Fire Warden system, and nominally responsible for forestry propaganda and education, while the Forestry Board has charge of state forest reserves and their administration. H. H. C.

The Forests of Mindoro. By Melvin L. Merritt, Forester, Division of Investigation. Bulletin No. 8, Department of the Interior, Bureau of Forestry, Manila. 1908. Pp. 51, plates 10, maps 1.

The main part of the bulletin is devoted to a general description of Mindoro, one of the more important islands of the Philippine Archipelago and contains an interesting description of the types of vegetation and the utilization of forest products. In an appendix are found 19 tables of yield for different forest types and a list of forest tree species reported to date. This list contains 445 species many of which are not merchantable. The family of Dipterocarpaceae and Leguminosae are the most important from a commercial standpoint. The Dipterocarps reach their best development on the slopes of the foothills and lower mountains. Here they form a distinct forest type. This is characterized by large tall growing trees, chiefly belonging to the family Dipterocarpaceae, and by an undergrowth less dense than is found in other types. The maximum diameter is about 5 feet, and the clear length ranges from 65 to 115 feet. The dipterocarp forests will be the chief source of timber supply of the island.

The solid commercial forest unbroken by clearings is estimated at 818,000 acres with a stand of 5,755,300,000 feet of board measure of merchantable timber (7,000 feet per acre), and the commercial forest broken by clearings is estimated at 262,000 acres with 400,000,000 ft. B. M. (1,500 ft. per acre). The heaviest stands average 20,000 ft. B. M. per acre.

Steam logging with railroad transportation is recommended as the only feasible way of exploiting the larger part of the forest. Few species are adapted for driving because of their specific gravity and hauling is too slow and expensive with the primitive methods now in use. Under the present system the cost of logging and delivery from the forests to the beach, a distance of one or two miles, ranges from $4.35 to $9.00 per 1,000 ft. B. M.

Shipping facilities to the Manila market are inadequate and rates are between 10 cents and 15 cents per cubic foot.

Four small saw mills operate at different points on the island, but they are too light for satisfactory work and most of the lumber used locally is cut by hand with whip saws.

The subject of forest protection is discussed briefly. The chief damage the forest suffers is from clearings made by the mountain tribes who denude and cultivate small areas for one or two seasons and then abandon the plot. In some parts of the island all the merchantable timber has been destroyed in this manner. The solution of this problem is a serious one in many parts of the Philippine Archipelago, as it is a practice that can be regulated with difficulty because of the irresponsible character of the natives with whom the forest officers must deal. Fires follow up these clearings and kill any reproduction that may have started. A patrol for the prevention of fire is considered too expensive under present conditions and no recommendations are made for forest protection except rules which prevent waste in logging and injury to young growth.

The forest map appended to the report shows in colors the location of the different forest types, some topographical data and the boundaries of the proposed forest reserve. The data collected in this bulletin are a valuable addition to our knowledge of the forest resources of the Philippines and other bulletins on this subject will be awaited with interest.

This bulletin can be had for 80 cents U. S. currency, map separately, 50 cents.

R. C. B.

The Status of Forestry in the United States. By Treadwell Cleveland, Jr. Circular No. 167, U. S. Forest Service, Washington, D. C., 1909. Pp. 39.

This circular is an excellent statement of the present status of forestry in this country. It describes what is being done by the Federal Government, by the States, and by private owners. There are many useful tables showing the extent of the work on the National forests, a list of the States which have undertaken organized fire protection, lists of the National forests, State forests, and forest schools.

In reading the circular one is impressed by the immense amount of work being actually done on the National forests and by the relatively meager work done by private owners. The small number of large private proprietors practicing forestry in the United States is very striking. Not only that, but those who have undertaken it have in many cases not gone beyond the initial stage of an attempt to protect their property from fire. The showing would have been better if the author had laid more emphasis on the silvicultural work by small proprietors.

Mr. Cleveland describes very clearly the obstacles to private forestry, thus explaining the reason why progress in that direction has been so slow. I do not think that he has done full justice to the question of forestry as an investment for private owners. There is no question that with the present fire risk and the unfair taxation the planting of trees on a large scale is not attractive. On the other hand, there is an enormous amount of immature timber which it will distinctly pay the private owner to hold and protect for its future increment. Many lumbermen will find it profitable to cut very conservatively and to hold the medium sized and young trees for future growth. In many cases it would be a good investment to purchase second growth timber which can now be secured cheap and to hold it for a later cutting.

H. S. G.

Paper Birch in the North-East. By S. T. Dana. Circular No. 163, U. S. Forest Service, Washington, D. C., 1909. Pp. 37.

Mr. Dana has presented a very satisfactory account of the Paper Birch as it grows in the North-East. The tree is described from the commercial, botanical, silvical, and silvicultural standpoints. There are excellent tables of growth, volume, and yield.

In the chapter dealing with management the author has described three possible methods of silviculture:

1. Cutting to a diameter limit to utilize the young growth to the best advantage.

2. Clean cutting of pure stands to secure sprout reproduction.

3. Complete removal of the birch from mixed or changing types to give way to species which are more valuable or better adapted to the locality.

It is made clear that the present birch types are transitional in character and that a birch stand cannot be replaced by a birch stand indefinitely except by planting or possibly by the use of fire. The systems advocated are essentially methods of handling the stands as they occur to-day.

The first of the systems advocated is applicable to middle-aged pure stands which are more or less even-aged but which show considerable variation in diameters. The plan is to thin out the larger trees and give an opportunity for the smaller ones, which otherwise would be suppressed, to grow to a merchantable size.

The second system is simple coppice applied to thrifty middle-aged stands.

The third system is applicable in mixed stands or where there is already reproduction on the ground. It is designed to replace the birch by other species.

It would have been useful if the author had expanded this chapter on silvicultural treatment of the birch and had illustrated it by diagrams and photographs. At the present time the science of silviculture is in such formative stage that the most specific statement of principles underlying a proposed form of management is required to prevent it from becoming a mere rule of thumb.

It is hoped that the Forest Service will publish other monographs like this circular. Like the monograph on the Douglas Spruce by Mr. Frothingham, the Paper Birch in the North-East constitutes a very valuable contribution to silviculture.

H. S. G.

Farm Forestry. By Alfred Akerman. Published by the Georgia Forestry Association, Athens, Ga., 1909. Pp. 22.

This pamphlet is an outline of a text designed for use in agricultural schools and colleges of Georgia. It is to be followed by a more extended text later on. It is essentially a statement of the principles of farm forestry considered under the headings of, the timber trees, principles of establishing stands by natural reproduction and planting, the protection of forests, and improvement work. The matter is presented in very clear and simple language and the pamphlet should be of distinct use to farmers.

H. S. G.

The Planting and Care of Shade Trees. From the Fourth Annual Report of the Forest Reservation Commission of New Jersey. 1908. Patterson, N. J., 1909. Pp. 142.

In view of the increasing interest in the care of city trees, this publication is very welcome. Many towns and cities are appointing tree wardens and shade tree commissions and need precisely the information presented in this report.

The pamphlet contains three articles: First, The Planting and Care of Shade Trees, by Alfred Gaskill, State Forester; second, Insects Injurious to Shade Trees, by J. B. Smith, State Entomologist; third, Fungi of Native and Shade Trees, by B. D. Halsted, State Botanist.

The report contains also the laws of New Jersey relating to shade trees.

It would have been very useful if there had been included information regarding the proper organization by a town or city of the work of the care of the shade trees. The municipality first looking toward the protection of its trees needs information as to the cost of the actual work of spraying, pruning, and planting, and the cost of administering shade tree departments.

The experience of such cities as New Jersey, Newark and East Orange, and of cities in other states, would have been very useful.

H. S. G.

The Present Status of the White Pine Blight. By Perley Spaulding. Circular No. 35, U. S. Department of Agriculture, Bureau of Plant Industry. Pp. 12.

This circular has been issued to allay fears for the safety of the White Pine which has been subject to a noticeable disease during the past few years. In 1907, the disease was apparently due to a parasitic fungus in the leaves, although the primary cause may have been the extreme climatic conditions of the preceding winters. Relatively few trees were actually killed by this leaf blight. No new trees became affected, and half of the diseased trees recovered in the following season.

In 1908, the diseased pines were suffering chiefly from twig-blight which was due in some cases to winter killing, in others to insect and fungus parasites. Serious damage by the parasites is not anticipated, and winter killing of twigs usually results only in retarding growth for a year or two. C. D. H.

The Present Status of the Chestnut Bark Disease. By Haven Metcalf and J. Franklin Collins. Bulletin No. 141, U. S. Department of Agriculture. Part V. Pp. 45-53.

This bulletin is not so hopeful as the circular from the Bureau of Plant Industry mentioned above. The disease appears practically to exterminate the chestnut trees in any locality which it infests, since, in the past five years it has killed more than half of the trees in New York City and its environs, where it is estimated to have caused a financial loss of several million dollars. From this center it has spread north to Rhode Island and south to Virginia.

The disease is being distributed rapidly by means of nursery stock. Cases have been noted where it has undoubtedly spread to native trees from this source. The bulletin recommends that chestnut nursery stock be placed upon the quarantine list by the state governments. Apparently the only way to fight the disease successfully is to burn the infested parts, still better in most cases, the entire tree.

The disease has not yet extended to the commercial forests of chestnut in the southern mountains, and they may be outside of its probable range, but it is potentially so dangerous that every effort should be made to check its spread. C. D. H.

Directions for Collecting and Preserving Insects. By N. Banks. Smithsonian Institution, U. S. National Museum, Bulletin 67. 1909. Pp. 135, pl. 1, figs. 188.

After a brief statement of the characteristics of the classificatory groups of insects, the writer describes very fully and simply the necessary apparatus for their collection, mounting and storing. Details are given also of the special methods suitable for larvæ and wing mounts. Hints are given for collecting the various groups, and in addition the reader will find a fund of information as to insect cases, arrangement of specimens, dealing with collection pests, breeding and shipping specimens, etc.

The bulletin is a good one, generously illustrated, and made more useful by a list of entomological periodicals and dealers in supplies, and a bibliography. J. H. W.

OTHER CURRENT LITERATURE.

Report of the British Timber Conference. Issued by the Royal English Arboricultural Society. London, 1909. Pp. 48.

Contains the following papers: Railroad Rates for Native as Compared with Imported Foreign Timber, by Chas. Hopton (a protest against discrimination); Extraordinary Traffic and Excessive Weight, by E. Charles; The Rating and Taxation of Woodlands, by Leslie S. Wood (suggests a scheme of remission to woodland owners who attempt to carry out forestry principles); The Best Means of Encouraging the Consumption of Native Timber, by Murray Marshall.

Proceedings of the Society of American Foresters. Vol. IV, No. 1, 1909.

Contains the following articles: The New Reconnaissance—Working Plans that Work, by A. B. Recknagel; Experiment Stations on the National Forests, by S. T. Dana; Forestry for Railroads, by E. A. Sterling; Problems in Nursery Practice, by C. R. Pettis; Plant Formations and Forest Types, by F. E. Clements; Relation Between State and Private Forestry in Pennsylvania, by J. T. Rothrock; Some Notes on the Yellow Pine Forests of Central Alabama, by R. C. Bryant; A Study of the Reproductive Characteristics of Lodgepole Pine, by G. E. Tower; Preliminary Forest Management in the Southwest, by T. S. Woolsey, Jr.; Timber Estimating, by H. H. Chapman.

Yearbook of Forestry. Seventh Annual Report of the Society of Protection of the New Hampshire Forests. 1909. Pp. 78. Illustrated.

Forest Laws of New Hampshire. Bulletin No. 1. Concord, New Hampshire. 1909. Pp. 18.

The Genus Dendroctonus. By A. D. Hopkins. Technical Series No. 17, Part 1, Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C. 1909. Pp. 164. Illustrated.

Bark Beetles of the Genus Dendroctonus. By A. D. Hopkins. Bulletin No. 83, Part 1, Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C. 1909. Pp. 169. Illustrated.

Year Book of the Department of Agriculture, 1908. Washington, D. C. 1909. Pp. 822.
Contains an article on the progress of Forestry in 1908, by Treadwell Cleveland, Jr., and statistical tables of Forest Products, of Forest Associations, Schools of Forestry, and State Forest Officers.

Silvical Leaflets, U. S. Forest Service, Washington, 1909: No. 43, *Red or Norway Pine;* No. 44, *Jack Pine;* No. 46, *Limber*

Pine; No. 47, *Pinon Pine;* No. 48, *Pignut Hickory;* No. 49, *Shagbark Hickory;* No. 50, *Big Shell-Bark Hickory.*

Instructions for the Building and Maintenance of Telephone Lines on the National Forests. U. S. Forest Service, Washington, D. C. 1909. Pp. 23. Illustrated.

Location and Area of the National Forests in the United States, Alaska, and Porto Rico, and Dates When Latest Proclamations Became Effective. U. S. Forest Service, Washington, D. C. 1909.

The list shows a grand total of 150 national forests, aggregating 194,505,325 acres.

Properties and Uses of Southern Pine. By H. S. Betts. Circular No. 164, U. S. Forest Service, Washington, D. C. 1909. Pp. 30.

The Green Striped Maple Worm. By L. O. Howard and F. H. Chittenden. Circular No. 110, Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C. 1909. Pp. 7.

Record of Wholesale Prices of Lumber. U. S. Forest Service.

Heretofore this material has been published monthly by the Forest Service. Hereafter it will be published quarterly.

Pulp Wood Consumption for 1908. Forest Products No. 1, Bureau of the Census. Compiled in co-operation with the Forest Service, U. S. Department of Agriculture, Washington, D. C. Pp. 12.

Tan Bark and Tanning Extracts for 1908. Forest Products No. 4, Bureau of the Census. Compiled in co-operation with the Forest Service, U. S. Department of Agriculture, Washington, D. C. Pp. 10.

Wood Distillation for 1908. Forest Products No. 7, Bureau of the Census. Compiled in co-operation with the Forest Service, U. S. Department of Agriculture, Washington, D. C. Pp. 10.

Cross Ties Purchased for 1908. Forest Products No. 8, Bureau of the Census. Compiled in co-operation with the Forest Service, U. S. Department of Agriculture, Washington, D. C. Pp. 8.

Poles Purchased for 1908. Forest Products No. 9, Bureau of the Census. Compiled in co-operation with the Forest Service, U. S. Department of Agriculture, Washington, D. C. Pp. 8.

Emergency Bulletin on the Blister Rust of Pines and the European Currant Rust. By George G. Atwood. Horticultural Bulletin No. 2, New York State Department of Agriculture, Albany, N. Y. 1909. Pp. 15.

European Currant Rust on the White Pine in America. By P. Spalding. Circular No. 38, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. 1909. Pp. 4.

Co-operative Experiments in Forest Planting. By F. J. Phillips. Circular No. 1, Department of Forestry, University of Nebraska, Lincoln, Nebraska. 1909.

Missouri's Opportunities in Forestry. By S. J. Record. Reprint from New York Report of Missouri State Board of Horticulture. Pp. 7.

First Biennial Report of the State Board of Forestry of Oregon for 1907-8. Salem, Oregon. 1909. Pp. 39.

Fifth Annual Report of the Shade Tree Commission of Newark, New Jersey. 1909. Pp. 54.

Experiment Station Work. Farmers' Bulletin No. 60, U. S. Department of Agriculture, Washington, D. C. 1909.
Contains an article on Street Trees: Their Care and Preservation.

Conservation of Natural Resources. The Annals of the American Academy of Political and Social Science, Vol. XXXIII, No. 3. Philadelphia, Pennsylvania. 1909. Pp. 256.
Contains the following articles:

Forestry on Private Lands, Hon. Gifford Pinchot.

Public Regulation of Private Forests, Professor H. S. Graves.

Can the States Regulate the Private Forests? F. C. Zacharie.

Water as a Resource, W. J. McGee, LL. D.

Water Power in the United States, M. O. Leighton.

The Scope of State and Federal Legislation Concerning the Use of Waters, C. E. Wright.

The Necessity for State or Federal Regulation of Water Power Development, C. W. Baker, C. E.

Federal Control of Water Power in Switzerland, T. Cleveland.

Classification of the Public Lands, G. W. Woodruff.

A Summary of Our Most Important Land Laws, Hon. Knute Nelson.

Indian Lands: Their Administration with Reference to Present and Future Use, Hon. Francis E. Leupp.

The Conservation and Preservation of Soil Fertility, C. G. Hopkins.

Farm Tenure in the United States, Henry Gannett.

What May be Accomplished by Reclamation, Hon. F. H. Newell.

The Legal Problems of Reclamation of Lands by Means of Irrigation, Morris Bien.

Our Mineral Resources, Hon. G. O. Smith.

The Production and Waste of Mineral Resources and Their Bearing on Conservation, J. A. Holmes.

Preservation of the Phosphates and the Conservation of the Soil, C. R. Van Hise.

The Report of the National Conservation Commission and the Chronological History of the Conservation Movement. Bulletin No. 4. Issued by the Joint Committee on Conservation. Washington, D. C. 1909. Pp. 52.

Report on National Vitality; Its Waste and Conservation. By Irving Fisher. Public Bulletin No. 30, of the Committee of One Hundred on National Health. Prepared by the National Conservation Commission. 1909.

Conservation of Resources in California. By Edward Hyatt. From the 23rd Biennial Report of the Superintendent of Public Instruction of California. Sacremento, California. 1909. Pp. 98. Illustrated.

An admirable popular presentation of conservation problems.

The Riding Mountain Forest Reserve. By J. R. Dickson. Bulletin No. 6, Forestry Branch, Department of the Interior, Ottawa, Canada. 1909. Pp. 42.

Indian Woods and Their Uses. By R. S. Troupe. Economic Products Series, Vol. 1, No. 1. Calcutta. 1909. Pp. 273.

Ethyl Alcohol, made from Wood Waste. How it is done and what the process means to the world.

A trade announcement of the Standard Alcohol Company of Chicago, containing a description of the newly discovered process.

Forestry in Nature Study. Special Circular, Office of Experiment Stations, U. S. Department of Agriculture, Washington, D. C. 1909. Pp. 10.

The Rabbits of North America. By E. W. Nelson. North American Fauna No. 29, Bureau of Biological Survey, U. S. Department of Agriculture, Washington, D. C. 1909. Pp. 314, pls. 13.

Exports and Imports of Forest Products, 1908. By A. H. Pierson. Circular 162, U. S. Forest Service, Department of Agriculture, Washington, D. C. 1909. Pp. 29.

The Future of the Forests. By E. T. Allen. Oregon Conservation Association, Portland, Oregon, 1909. Pp. 10.

Forest Trees of Maine and How to Know Them. By Gordon E. Tower. Maine Forestry Department. 1909. Pp. 62. Illustrated.

Co-operative Demonstration Forestry. Bulletin 6, Volume XI, University of Maine, 1909. Pp. 10. Illustrated.

Care of the Farm Woodlot. By Gordon E. Tower. Timely Helps for Farmers Series, No. 8, Volume I. University of Maine, 1909.

Trees: a handbook of forest botany for the woodlands and the laboratory. Vol. V: Form and Habits, with an appendix on Seedlings. By H. M. Ward. Cambridge University Press. 1909. Pp. 308.

This volume, which completes the series, treats the subject after the method of the preceding volumes.

PERIODICAL LITERATURE.

FOREST GEOGRAPHY AND DESCRIPTION.

Forest Conditions in France.

In two further instalments Dr. Martin finishes his critical review of forest management in France, the one referring to reforestation of waste lands, especially of the Landes, the other to forest management in the Pyrenees.

In the light of our movement for the conservation of resources the reforestation of the Landes should attract particular attention. It exhibits a brilliant example of the permanent success of well planned persistent activity through 60 years on a large scale, some 1,675,000 acres being involved.

The character of the Landes in their original condition, a heath on infertile sand with impervious subsoil—hence swampy like the so-called barrens of Nova Scotia and other parts of this continent—has often been described.

The work of reclaiming these wastes was done partly by the State directly, partly by the municipalities under force of legislation. Remarkable to tell, by sale on the part of municipalities the larger portion of these reclaimed lands (80 per cent.) belong now to private owners, 14 per cent. to corporations, and only 6 per cent. to the State.

The legislation of 1857 obliged municipalities to reforest; in case of refusal, the State was to do it and retain the land until recouped. In the end, the municipalities unloaded their obligation in part on private owners by selling their lands, and these have reforested them to their financial advantage, the investment of some ten million dollars having made these areas worth tenfold.

This experience is rather damaging to the theory that such vast undertakings in forestry can only be carried on by the State directly.

Another theory which has proved erroneous here, is that forestry furnishes little opportunity for human labor. Compared with what was the case, a considerable population finds lucrative employment now. The region offers a most varied picture of farm, forest, vineyard and orchard.

Pine (*P. maritima*) is almost exclusively planted on the larger areas; on smaller areas, Black Locust is found. Oak has proved a failure.

With railroads running through these highly inflammable pineries, and with the habit of the former herders of burning over pastures not entirely subdued, damage from fire is not unusual. The measures of prevention are wide rides or fire lines, 10 to 15 yards wide, cut open every 1,000 yards, which in the State forests is done systematically. These serve merely as lines of defense from which to start counter-fires. They are kept free from excessive weed-growth and for one-third of their width absolutely clean of inflammable matter, *a sable blanc*. Roads and rides are kept free from brush along their sides.

Distribution of suitable tools for fire fighting, forbidding all smoking, and a telephone service are also measures practiced.

The condition of these plantations is, to be sure, not by any means, extraordinarily good. Form, density and increment are medium to poor. Ripe stands are 45 to 50 feet in height; numbers per acre, 150 to 200; cross section area, 200 to 220 square feet; diameter of final harvest trees, 12 to 16 inches; volumes, between 4,240 and 5,650 cubic feet; stands corresponding to those of III and IV sites in the North German sandy plain.

Towards the ocean the stands under the influence of seawinds become even shorter, in spite of the excellent dune improvements.

The management of these pineries is simple indeed. The original crop was, of course, planted, but new crop is secured by natural regeneration, the pine seeding every year. Volunteer growth is usually removed. The result is not very complete or regular or full stands. These could be improved by cutting out the broom, which is impeding the young crop. The market for vineyard stakes permits a thinning practice beginning with the 15th year and repeated every 10 years; the final harvest being made at 70 years.

The budget is determined by area. Five annual areas are sold together, the tapping for resin being practiced for 5 years, the final cut taking place in the fifth year.

In the absence of other woods the pine is good enough for all kinds of use, hop poles, vineyard stakes, mine props, even for export, at 5 cents per cubic foot, telegraph poles impregnated, also for paper pulp, wood pavement (in blocks at 16 cents per cubic foot), railroad ties (at 55 cents apiece), poor building material, boxboards, etc.

The value increment, it appears from the prices stated, is considerable between 40 and 70 years with an average price of say 5 cents. The annual yield may be placed at $1.60 to $2.00 per acre. But this low result is improved by the addition of the resin crop which may increase it by 85 cents.

Contrary to the beliefs held in Germany the bleeding of trees is supposed not only not to injure but to improve the quality of the wood in regard to durability (Demontzey) and to quality in general (Violette).

In the stands designated for harvest *gemmage à mort* is practiced for five years before the cut. On opposite sides the bark is removed from the root up for 3 feet and an incision is made, 4 inches wide and about half an inch deep, which is kept open by weekly laceration (30 times a year). A zinc gutter and a glazed pot facilitate the gathering of the resin, which is gathered every 3 to 5 weeks. Only once a year is the scrape gathered. One tree with 3 to 5 incisions furnishes at one harvest about one quart liquid resin.

The remaining younger stands are also bled. The trees destined to be removed in the thinnings are tapped so as to exhaust them (*gemmage à epuisement*). The others are to be tapped with greatest care and without decreasing the increment. A diameter limit of 13 inches is set for this operation, hence the smaller trees are exempt from bleeding.

The yield per acre may run as follows:

1	2	3	4	5	year
160	130	130	100	95	gallons

The total gross value of the harvest is around $90.00, half of which goes to pay for the harvesting.

In the last decade or so, the French forest department has done considerable work on a large scale in the Pyrenees to correct the evils of deforestation on soil and water courses. Here, too, when private property is involved, the owners are forced to perform the required work of safe-guarding, or else the State may expropriate and do the work, when the owners can buy back upon payment of costs and interest. The procedure is based upon a general law of 1882 and special declaration on the public utility of the work in each case by the legislature.

The cause of the devastation by the torrents is largely to be found in the pasturing of steep mountain sides. Also log slides are found to start the evil of soil erosion.

The procedures are the same as those well known in other reboisement work of the French, the barrages of stone, the fascines of wickerwork, followed by sowing grass and planting trees. The establishment of a sod often precedes the tree planting, but sodding alone is not permanently efficacious. In the neighborhood of the brooks, poplar, willow and alder is planted; at a distance, other deciduous trees, especially maple; also Scotch Pine, Austrian Pine, *P. montana* and *cembra*, spruce, fir, and especially larch are used. The planting is done on plats prepared with the hoe, 3.5 to 4.5 feet apart, with 2 to 3 year olds, sometimes in bunches. The plant material is grown in temporary camps; the large nurseries at lower altitudes having been abandoned as not satisfactory. It has been found that deciduous trees are more resistant than conifers, which suffer from snow breakings, insects, fungi, and fire. The sprouting capacity of the former is also in their favor in the protective forest.

Hence, lately, oak, and in milder situations chestnut, and on gravel beds, Black Locust have been widely used. In medium altitudes up to 5,000 feet, the beech which is native here, has proved best. For the Alpine situations up to 6,500 feet, Mountain Ash, Alder, Birch, and various willows, mixed in groups are most important. Transplanted stock is mostly used.

The management of the existing forest areas is determined by the protective function of the forest cover. In the particular locality, however, conditions are such as to harmonize economic requirements with protective functions. The principle of securing changes in stands only gradually, which is the one adapted to protective forest also satisfies here the economic needs. Selection forest with its group-wise reproduction, in fifteen years return, is mostly practiced.

The author closes with the following pertinent remarks: The management of a protective forest never consists in allowing it to grow on in its original form. By passive measures, by avoiding cutting, no protective forest is kept in good condition. It is decidedly needful to cut all that is mature. Overmature stands and members of stands are for protective purposes undesirable, as these forests clearly show. The old firs and beeches are rotten, break down in storms, and make undesirable openings. Reproduction, young growths in good condition, furnish the best protection.

Mitteilungen über forstliche Verhältnisse in Frankreich. Forstwissenschaftliches Centralblatt. July, August, 1909. Pp. 375-386; 421-433.

Timber Famine in France.

The latest statistics (1905) give the following ownership classification of forest land in France: State, 2,881,070 acres; communal and institutional 4,844,310 acres, private, 15,000,000 acres. Eighteen per cent. of the State and 3.6 per cent. of the communal and institutional forest land is considered unproductive, the reason for the former high figure being that the State deliberately buys up denuded land for reforestation.

Thus only some seven and one-half million acres is forest under government control. The State forests are of course under absolute control, but in the communal and institutional forests the supervision is less effective, while in the case of the fifteen million acres of private woodland the restrictions of the law of 1859 have been so poorly enforced that they are seriously exhausted.

Statistics show the financial return per acre to be much higher on the State forests than in those belonging to communes and institutions. This is to be explained not alone on the ground of more able management, but also because the products include a higher percentage of larger sizes—in other words, there is less depletion in the State forests. In the case of privately owned forests this depletion has gone still farther, and it is becoming more and more difficult to obtain high grade lumber. At the present time, France can meet her own needs only in firewood, ties, poles, posts, etc.; the higher grades of lumber and timber must be imported, so that to-day this country ranks third in wood imports among European countries.

In consequence of this condition of affairs the French government is not only busy reforesting, but has in preparation a new law to encourage reforestation, which will also impose more restrictions upon the cutting of timber on communal and private forest lands.

The Inadequacy of Home Grown Timber in France. The Indian Forester. September, 1909. Pp. 543-548.

Alaskan Forest Conditions.

The following description of a portion of the Yukon River basin, where it enters the United States from Canada, is given by Mr. Wilfred H. Osgood.

"The low banks are fairly well wooded, but their most common condition is what may be called semi-tundra—a line of fair-sized trees bordering the river, and inland on more or less level ground, moss and small shrubs, with a few scattered trees and many small ponds. A few islands appear here and there, becoming larger and more numerous as Circle is approached. They are flat and heavily timbered and rarely more than a mile in length.

The region as a whole is not heavily timbered, and deciduous trees greatly outnumber the conifers. The most abundant trees are poplars (*P. tremuloides* and *P. balsamifera*). The White and Black Spruce (*Picea canadensis* and *P. mariana*) occur, but neither attains large size, usually being from six to ten inches in diameter. They grow in small clumps on the central parts of the islands, in protected places on the hillsides, in long fringes on the low banks of the river, and rather scatteringly throughout the more or less level country. The Paper Birch (*Betula alaskana*) is mixed with the poplars, but is neither large nor abundant. The Dwarf Juniper (*Juniperus nana*) is common in dry gulches and occasionally occurs on open hillsides.

Other woody plants worthy of mention are as follows: Alders (*Alnus?*): Very abundant, chiefly in damp situations on level or nearly level ground; sometimes in dense and very extensive thickets growing in swamps to the exclusion of almost all other trees and shrubs. Willows (*Salix?*): Several species occur, mostly about the borders of the islands and wherever the river banks are low and sandy. From the ripe catkins (in July), seeds were blown by every current of air. Dwarf Birch (*Betula glandulosa*): Very abundant in damp situations where semi-tundra conditions prevail. Buffalo Berry (*Lepargyrea cana-*

densis): Found sparingly all along the route. High-bush Cranberry (*Viburnum pauciflorum*): Quite abundant in many localities; in full bloom about July 1. Wild Rose (*Rosa acicularis*): Very common, particularly on comparatively dry ground near the edge of spruce woods; blooming profusely early in July. Arctic Sagebrush (*Artemisia frigida*): Abundant on dry sandy hillsides with southern exposure, where it grows to the exclusion of almost all other plants. Labrador Tea (*Ledum*): Rampant in suitable places, always so in semi-tundra, and very conspicuous on account of its striking starry white flowers. Dwarf Laurel (*Kalmia glauca*): Abundant in swamps. Andromeda (*Andromeda*): Occasionally found in swamps in great abundance. Bear Berry (*Arctostaphylos uvaursi*): Fairly common, but much scattered.

The trees, shrubs, and general plant life are much the same as throughout the Hudsonian and Arctic-Alpine zones elsewhere in the northwest. Among those worthy of mention are the following:

Picea canadensis (White Spruce).—The most abundant conifer; occurs in scattered clumps near timberline and in more or less continuous forest on the lower slopes of the mountain and on comparatively dry ground lower down. The trees along Mission Creek are not very large, being about eight inches in diameter and from thirty to fifty feet high. A few groves of larger ones were seen on Comet Creek, some being eighteen inches or more in diameter and about sixty feet high.

Picea mariana (Black Spruce).—Common in moist places on high exposed ridges and saddles, as well as in swampy flats lower down.

Populus tremuloides (Aspen).—Common on dry knolls and low ridges near Eagle and scattering along Mission and Seward creeks.

Populus balsamifera (Balsam Poplar).—Common, probably more so than *P. tremuloides.* In many places along Mission Creek it stands in large groves, many trees of which are sixty to seventy feet high. It is cut for fuel in considerable quantities wherever easily accessible, being preferrd to the other timber of the region.

Salix (Willow).—Several undetermined species of willow occur along the streams. The following two species grow above timberline: *Salix reticulata* (Net-veined Willow).—Found sparingly in the matted vegetation high above timberline. *Salix phlebophylla*.—One small colony of several plants was observed on a rocky flat near Glacier Mountain. Specimens were preserved, and have been identified by Frederick V. Coville.

Alnus sinuata (Alder).—Much less common than in mountains near Cook Inlet and other points on the Alaska coast. It does not form extensive thickets on the open mountain sides nor even in the draws above timberline, but is confined chiefly to the borders of streams below timberline.

Betula glandulosa (Dwarf Birch).—Excessively abundant; by far the most common shrub on the upper slopes of the mountains, chiefly above timberline, in many places growing in thickets covering five to ten acres. According to situation and possibly soil, these thickets may be of very low almost prostrate shrubs not exceeding eight inches in height, or they may be good-sized bushes two to four feet high.

Betula alaskana (Paper Birch).—Along Mission Creek beautiful groves of birch are frequently seen. In such places there is little underbrush and the ground is covered luxuriantly with grass (*Agrostis*). A few birches are scattered indiscriminately throughout the spruce forest. Along Seward Creek a few small trees occur not far below timberline.

North American Fauna No. 30. Biological Survey, U. S. Department of Agriculture, 1909.

Government Forests of Java.

In the island of Java there are 1,665,000 acres of Government forest—principally teak-wood. They are primeval forests, more or less damaged by dishonest fellings. Three hundred and sixty thousand acres of them consist already of plantations. Nearly all these forests are worked on working plans. In the greater part—1,545,000 acres—the management is not so thorough, as forests are felled there by contractors. In the remaining part—120,000 acres—management is effective, the timber bing cut by the Forest Service. The area under effective management increases yearly, and consequently the felling by contractors will decrease in future. In 1907 the teak forests yielded 175,000 tons of timber, of which 129,000 tons were cut by contractors, 39,000 tons by the Forest Service, and about 7,000 tons by others. The yield of fire-wood and fuel was 27,000,000 cubic feet (stacked).

Government felling was started in 1897. In 1905 these fellings yielded 26,000 tons of teak timber, the next year 36,000 tons, and in 1907 the yield was 39,000 tons. Fellings by contractors yielded in those years 120,000, 116,000 and 129,000 tons respectively. Nearly all forests being worked on working plans, it cannot be expected that the annual output will increase by increased felling of forests.

Contractors arrange for the exploitation of forests with a yearly supply of about 1,400 tons of timber for five to eight years. They pay a certain sum per month or year, or at a rate per ton of timber yielded. The exploitation of these forests is mostly determined by open contract, a great number of such forests being in the hands of a few companies, who sell the timber after its arrival in depots, or export it. The timber supplied by the Forest Service is mostly sold at public auction, the supply of some Government depots being sold by public tender.

At the beginning of this year the Government started an experiment with a donkey engine that was ordered from Seattle. Prior to this time all the timber had been hauled to the roads by buffaloes or by men. The transport from the forest to the nearest railway or great river is done along logging railroads or on buffalo cars. Floatable streams are scarce in Java. Most of this timber is hewn into balks that are made in the forest with the axe. However in the last few years the production of logs has been growing into practice.

The export of teak timber in 1907 was 47,000 tons, distributed as follows: 24,500 tons to Europe, 3,600 tons to Asia, 18,000 tons (mostly sleepers) to Africa, 650 tons to Australia, and 150 tons to America. 128,000 tons were used in Java. The export has increased of late years. In 1903 it was 20,000 tons; in 1904, 22,000 tons; in 1905, 43,000 tons; in 1906, 46,000 tons, and in 1907, 47,000 tons. Besides the teak forests, Java has wild wood forests of considerable extent. All wood that is not teak is called wild wood here. However, the good timbers have disappeared from most forests. They occur still in the mountains, but transportation is difficult there. Besides, many of the mountain forests have been reserved for climatological and hydrological reasons.

In other islands (Sumatra, Borneo, Celebes, etc.) there is no forest management deserving the name. However, the Government is considering the exploitation by contract in the Island of Sumatra of a great forest area. Of course, it would be necessary for capital to interest itself in this enterprise. Steam logging appliances and saw mills and export on a large scale would be necessary conditions for success.

There are still enormous areas covered with forest on these islands. Thus, if the experiment should be tried and prove a success, exploitation could be greatly extended there.

Canada Lumberman and Wood Worker. October 15, 1909. P. 31.

Forestry in Chile.

Although Chile imports from three to five million dollars worth of wood from the United States in addition to wood manufactures from the States and other countries of around half a million, she has in the southern portions a valuable forest resource with excellent woods, among which the most useful are Raulí, a mahogany-like wood; Roble Pellin, a beech; Laurel; Luma; Canelo; Ulmo; Quillay; Coihue; a larch; a pine; a cypress. Absence of means of transportation and the very rainy climate make exploitation difficult and expensive. Yet, in 1907 and 1908, some four lumber companies with a capital of nearly two million dollars were formed.

Fire has been, as everywhere on the American continent, the worst enemy, and of the 75,000 square miles (26.7%) of estimated forest area probably little of it has remained untouched.

In 1872, a forest protection law was passed, but in 1891 again abolished, having probably never been applied. In 1908, a revival of this law was proposed in the legislature, and the government of Magallanes Territory instituted a commission to draw up a forest and field code to stem in part the forest destruction.

Silva. August, 1909. Pp. 570-572.

Forest Resources of South America.

Most of the South American forests are tropical, but in the Andes and at the southern end of the continent may be found forests characteristic of temperate and subarctic zones. The tropical forests have such a mixture of species that logging is always expensive and often unprofitable. Rubber hunters have traversed most of the areas where rubber trees may be found. Otherwise the forests have scarcely been touched except along the coast and principal rivers.

In Paraguay the timbers of lapacho and quebracho used by Jesuit missionaries are well preserved while imported North American woods decay rapidly. In Columbia the eucalyptus grows very successfully. The west coast depends almost entirely on North American woods because of the transportation difficulties caused by the mountains.

Canada Lumberman and Wood Worker. June 15, 1909.

BOTANY AND ZOOLOGY.

Present Problems in Plant Ecology.

The student of Biological Dendrology can find no more suggestive and stimulating reading than that in the series of articles cited below. Dr. Cowles' paper is a protest against the theory of vitalism in Plant Ecology, that is, the philosophy that plants develop structures because such structures are of use to them. To cite one of his many illustrations: "Hard bast and similar mechanical tissues are an undoubted source of strength in plants, yet recent experiments have failed to get any significant response in bast development by exposing growing tissues to considerable tension. Bast primordia, however, are very plastic and respond readily to changes in moisture. Thus, bast fibers do not adapt themselves to a demand for tensile strength, although such a response would be highly advantageous, but they do respond to increased transpiration, although it has never been claimed that bast fibers are of especial value in checking transpiration." The writer points out that such terms as adaptation, adjustment and regulation are misleading because they are vitalistic words which imply that plants can transcend their environment and can contravene the ordinary laws of matter.

Dr. Livingston makes a plea for more accurate quantitative studies of the factors of site and for the development of more accurate recording instruments. For example, there is no reliable and practical instrument for measuring light intensity. The so-called photometer is not a photometer at all but an actinometer and is thus most responsive to the shorter light waves which are not the most important in plant activity. Methods for determining the amount of soil moisture are at present crude and unsatisfactory and in regard to the most important problem of all, the rate of possible supply or the resistance offered by the soil particles to water absorption by the roots, practically nothing is known. This might possibly be determined approximately by a study of the easily ascertained capillary power of the soil with reference to vegetation, yet it is a problem which ecologists have hardly even attempted.

Prof. Shaw's paper in the series has already been reviewed. (Forestry Quarterly, VII, 194.)

Professor Spaulding discusses the recent advance in the knowledge of the ecological relations of desert plants and he makes suggestions for future work. He shows that important results come from the simplest experiments and observations when they are conducted with exactness and with a definite end in view. Such as these are the conditions required for the germination of the seeds of the various species; the determination of the soil moisture; the relative root development and the determination of the strata of soils which the roots of apparently competing species occupy; the pre-emption of the soil by various species.

In discussing the relation of climatic factors to vegetation, Transeau calls attention to the fact that in the past century sixty different proposals of geographic zones and regions have been published for North America alone. This shows the futility of the point of view which disregards all but one or two climatic factors. When one tries to apply the actual distribution of plants to these zones and regions he is still further impressed by their inadequacy. Actual plant distribution through its lack of uniformity, its tendency to concentric dispersal and the coincidence of the optimum areas of many species, seems to demand a larger basis for classification in harmony with the processes, composition, and origin of their components. The point to be recognized and appreciated is that continental zones and their subdivisions are not natural organizations of plants or plant formations.

The writer points out that we have as yet almost no experimental data, from a modern point of view, on geographic variation as related to climate. For such experiments pedigreed plants should be used. The use of seeds from the same plant or branch, or even from the same fruit is not sufficient unless the source of the pollen is known, since among the larger number of plants necessary for such experiments, there may be physiological or ecological races within a species, and such races would respond differently to their environment. The use of homogeneous material (elementary species or varieties) is an indispensable prerequisite.

Another field that is practically virgin to the plant ecologist is exact experimentation in regard to the processes of competition, migration and adjustment in relation to climatic factors.

C. D. H.

The Trend of Ecological Philosophy. H. C. Cowles. The American Naturalist. June, 1909. Pp. 350-368.

The Present Problems of Physiological Plant Ecology. B. E. Livingston. The American Naturalist, June, 1909. Pp. 369-378.

Vegetation and Altitude. Ch. H. Shaw. The American Naturalist. July, 1909. Pp. 425-431.

Problems of Local Distribution on Arid Regions. V. M. Spaulding. The American Naturalist. August, 1909. Pp. 472-486.

The Relation of the Climatic Factors to Vegetation. E. N. Transeau. The American Naturalist. August, 1909. Pp. 487-493.

Pruning and Increment.

The results of an extensive series of investigations into the effects of pruning at different seasons with different species and locations, on the manner of treating the wounds, and increment, made by Zederbauer at the Austrian Experiment Station, is of interest to us only so far as the physiological data are concerned and incidentally as far as foresters on this continent are supposed to be general "tree-sharps" who should know all about trees, ornamental as well as economical. It is, however, possible that in the not very distant future, under some conditions, tree pruning may become a forest practice.

As regards the season for pruning, it would appear that spring is the most satisfactory, the operation at other seasons not only delaying the healing process but giving rise to discolorations at the margin of the wound. That the healing process progresses more readily if the cut is made close to the bole is well known. The rapidity of the process depends also upon the species, rapid growers callusing more rapidly, and in the growth conditions generally.

Among the species investigated Douglas Fir was included. Among other things it was found that just as with deciduous trees, pruning in the fall leads to browning of the wound, and a retardation of the callusing process. While wounds made in the spring 1906 were in 1908 already closed, those made in the fall of 1905 were mostly still open three years later. The influence of pruning on the increment of the cross-section area is of special interest. In these investigations six to twenty trees were treated for each season.

By removing one-half of the crown the average increments were as follows:

	1906.	1907.
Spring, ...	.372 sq. in.	.341 sq. in.
Summer, ...	.108	.387
Autumn, ...	.542	.558
Winter, ...	.806	.682
	1.828	1.968
Per tree, ...	.450	.491

By removing one-third of the crown the increments were:

	1906.	1907.
Spring, ...	.713	.852
Summer, ...	.713	.698
Autumn, ...	.883	1.162
Winter, ...	.729	.760
	3.038	3.472
Per tree, ...	.760	.868

When only dry branches were removed, i. e., when no influence on the rate of growth was of course experienced, the increments were:

	1906.	1907.
Spring, ...	1.426	1.410
Summer, ...	.992	2.092
Autumn, ...	1.937	4.945
Winter, ...	1.535	1.085
	5.890	9.532
Per tree, ...	1.472	2.382

The loss then per tree due to the removal of half of the crown was 1.022 and 1.891 sq. in., or 70 and 80 per cent. respectively in the two years.

The loss when one-third of the crown was removed was .712 and 1.514 sq. in., or 48 and 64 per cent. respectively.

These figures show a very considerable influence of the pruning on the rate of growth. Other species investigated in these directions were beech, oak, and Norway Spruce. Regarding the latter it was found that the influence on the cross-section increment was not as large as in the Douglas Fir. Here, also, the decrease in height growth of twelve-year-old spruces was noted, but, after a few years, the height growth again gradually increased.

When removing one-third of the crown in August, 1905, the progress of the height growth for the different years was

1904	1905	1906	1907	1908	1909
48	17	18	11	23	44 cm.

When removing one-half of the crown the progress was

31	17	24	14	31	54 cm.

When only dry branches were removed,

46	21	19	47	45	60 cm.

Untersuchungen über die Aufastung der Waldbäume. Centralblatt f. d. g. Forstwesen. October, 1909. Pp. 413-427.

Mechanics of Tree Growth.

Dr. Metzger, who some fifteen years ago advanced most interesting theories to explain the laws of mechanics under which the form of tree trunks is built up, publishes similar investigations of the static and mechanical principles involved in the minute anatomy of the wood. The discussion, the author admits, lacks experimental basis, and is therefore fragmentary.

The author discusses the problem of epi- and hyponasty. Why in conifers the underside of branches, in deciduous trees more often the upper side shows increased tissue formation, is one of them. That these tissues are mechanical adaptations to give in one case additional compression strength, in the other additional tension strength, seems clear. The tension strength of the upper side of a birch branch showed nearly double that of the lower side.

The author finds altogether, that deciduous trees are constructed more for tension, coniferous trees more for compression, although some data appear to contradict this finding. In wind breakages, with conifers the broken stem usually preserves connection with the stump on the leeward, i. e., the compression side, while in deciduous trees usually on the windward side; the side of attack, i. e., the tension side exhibits usually a long-fibred break, showing that here it gave way last.

Metzger adduces the straight, cylindrical, vertical shaft form and the uniform, bricklike cell structure of the tracheids in coniferous wood as suggesting its structure for compressive strength, the opposite conditions in deciduous growth.

Interesting references are made to the derivation of climbing and creeping varieties from treelike dicotyls, or else the reverse, the ancestors of the treelike dicotyls winding themselves on the historically older conifers. From that period until to-day the diametrically opposite principle of epinastic and hyponastic structure of one-sidedly loaded members has persisted. Unfortunately, as Dengler points out, this position is not so generally supported as the author seems to imply, for of 92 branches of oak, 27 were found epinastic, 40 hyponastic, in beech 88 and 49, in pine 28 and 123 respectively, and these differences often on the same individual. Roots, which also exhibit epinastic and hyponastic structure vary similarly.

In explaining annual ring structure by statical and mechanical laws, it is pointed out that resistance to the force of winds in the crown tests the bending strength of the stem. At the end of the period of vegetation force and resistance must be in proportion. In the spring when by increase of crown the proportion is disturbed, an interior tension of cambium cells is created which results in the formation of the annual ring of corresponding breadth, or rather strength. The wide-lumened tissues are needed for physiological purposes; the effect on strength is greatest if with the same amount of material the wide-lumened elements are disposed on the inside, the narrow-lumened, thick-walled ones on the outside. This mode of disposition has become an inherited quality. While Metzger then claims for increase of the wood body (diameter growth) direct mechanical causes for the division into spring and summer-wood, he relies upon teleological explanations. He refuses to accept Schwarz's explanation who refers the formation of summer-wood to longitudinal pressure, which stimulus during spring-wood formation is offset by other forces.

To this position Dengler also takes exception with good reasoning, and altogether, acknowledging the ingenious and interesting character of the discussion, and the priority of Metzger in this field points out the hypothetical condition in which the theories are left.

Ueber das Konstructionsprincip des sekundären Holzkörpers. Naturwissenschaftliche Zeitschrift für Forst-u. Landwirtschaft, 1908, as reviewed by Dengler in Zeitschrift f. Forst-u. Jagdwesen. April, 1909. Pp. 272-276.

Identification of Woods.

Another contribution to the knowledge of wood structure comes from the botanical laboratories at Harvard in the form of an anatomical study of the wood of the pine family. The wood of the genus Picea heretofore has been characterized by the entire absence of wood parenchyma. By making slightly oblique tangential sections, Bailey found wood parenchyma upon the outer surface of the summer wood in seventeen species, American and foreign. The occurrence of such cells, however, is extremely sporadic. They were distinguished only with difficulty in the species of northeastern America.

It is stated in Penhallow's North American Gymnosperms that spruce wood lacks spiral thickenings of the tracheids. The writer of the paper found them well developed in the summer wood up to the tenth year in seventeen species. In wood formed later than this, they were very sporadic in occurrence.

The investigator uses the above points, together with others, to show the futility of distinguishing woods by any one character, especially is this true of the genera Picea, Larix and Pseudotsuga. In fact, to distinguish them one must refer to all of the anatomical characters as well as to the gross characters.

The Structure of the Wood of the Pineae. Botanical Gazette. July, 1909. Pp. 47-55.

Microscopic Structure of Wood.

A thorough and accurate knowledge of the microscopic structure of wood is as essential to investigators and users of preservative and seasoning processes, and to the use and identification of woods as a knowledge of anatomy is to the modern physician. Take for example the injection of preservatives and the drying of wood. An accurate understanding of the structure of water conducting elements and the method by which fluids pass through wood is essential to the development of successful and simple processes of attaining the results desired. In pulping woods and in the extraction of by-products much could be done by a well trained chemist with a thorough knowledge of wood structure. Unfortunately the anatomy of woods has never been studied with a practical application of knowledge gained in view, and much of the purely scientific work has been superficially or inaccurately done owing to the fact that only recently have proper methods of technique been developed. The minute size of woody elements and of the water conducting systems makes the use of the highest powers of the microscope and delicate and careful treatment of material essential. Bailey points out some of the difficulties of identifying woody structures and in making keys for the identification of wood by microscopical structure. The Gymnosperms and their structure have received a great deal of attention and have been the basis of much controversy. Yet in this field which has been so largely thrashed over, much yet remains undiscovered or improperly understood.

A Weeping Variety of Picea Canadensis.

A curious weeping spruce probably a variety of *Picea canadensis* has been found about one hundred miles north of Winnipeg. It is a tree about 60 feet high with the lower branches at least 20 feet from the ground; the strikingly pendulous branches are six feet or more long, slender and but little branched themselves. It evidently bears the same relation to White Spruce that the *pendula* variety of the commonly planted Norway Spruce does to *Picea excelsa.*

"A Weeping Spruce." Torreya. July, 1909.

Quebracho.

Quebracho, a contraction of the Spanish *quiebra-hacha* or "ax breaker," is applied to many tough, hard trees in Latin America. In recent years the name has been restricted to a peculiar tree found only in the drainage basin of the Parana river. The genuine quebracho is found in Brazil, Paraguay and the Argentine Republic. There are two varieties. *Quebracho colorado* or *Loxopterygium lorentzii* and *Quebracho blanco* or *Aspidosperma quebracho*. The former yields the best qualities of tannin extract and very durable railroad ties.

In 1907 there were 28,195 tons of extract exported of which 17,733 tons were sent to the United States. The bark, sap and heartwood all yield extract. The bark has 6-8%, the sap 3-4%, and the heart 20-25%. The heart represents two-thirds, often three-fourths of the tree.

For extracting the tannic acid the wood is shaved into fine pieces, then treated in immense kettles by chemical processes to remove the extract; the fluid is then evaporated into a thick jelly-like mass which is poured into sacks and dried into the solid substance sold in commerce. The industry of manufacturing sleepers from this wood has assumed large proportions and large companies with modern machinery are sawing out lumber and ties and making extract. One company owns 4,000,000 acres and another turns out 20,000-30,000 sleepers per week.

The Hardwoods of the Americas. Bulletin of the International Union of the American Republics. September, 1909.

Chicle, The Basis of Chewing Gum.

For the fiscal year ending June 30, 1909, there were imported into the United States 5,450,139 pounds of chicle, valued at $1,987,112, to be used in the manufacture of chewing gum. Chicle is obtained from the sap of the *Achras Sapota* tree of the northern South American countries, Central America, and Mexico. The Sapota tree reaches an average height of 25 to 40 feet and reaches maturity at 40 to 50 years. A tree 25 years old producing 20 to 25 pounds of gum will be about 22 inches in diameter and 25 to 30 feet high.

The wood is of a reddish color, closely resembling mahogany, is quite hard, heavy, compact in texture and fine grained. The wood is very durable and in great demand by cabinetmakers.

The operation of gathering chicle and preparing it for market is similar to that employed in the sugar maple industry in the United States. Under careful management trees have been tapped for 25 years.

As yet the systematic cultivation of the *Achras Sapota* has not been carried on to any extent, but experiments have shown that trees planted at a distance of 10 feet apart will yield from 5 to 6 pounds of chicle gum when from 8 to 10 years old and from 12 to 15 inches in diameter. In its wild state the tree is usually found in groups, frequently growing to a height of from 40 to 50 feet; it is straight, and has a long, clear length, thus making it most desirable for timber. While it grows well in a variety of soils it seems to thrive best in a rich clay loam, with good drainage and an annual rainfall of about 90 inches.

Chicle, the Basis of Chewing Gum. Bulletin of the International Union of the American Republics. October, 1909.

Combatting Insects.

The "Nun" (*Lymantria monacha, L.*), a close relative of the gypsy moth, is one of the most destructive insect pests in Europe. returning periodically. As a result of long extended observations and investigations in library and field Dr. Sedlaczek of the Austrian Experiment Station publishes a very exhaustive article, the conclusions of which are of interest as exhibiting biological habits that may apply more or less generally to the family of spinners.

As regards the origin of an invasion this appears to be autochthonous.

Eggs are deposited at varying heights according to site, weather during the flight and other exterior influences, and in the same stand can in different years be at different heights.

Neither when young, nor in later life, do all caterpillars leave the once chosen location. According to species, site and other indeterminable influences sometimes a larger, sometimes a smaller number descends. Pupation takes place at varying heights. Duration and liveliness of flight depends on weather. The moths, like the caterpillars come down out of the crowns only when exterior influences force them.

To be eaten clean, requires a predisposition of the stand.

Precautionary revision consists in gathering moths by day in not too high and too dense stands. Baiting by means of torches is successful only in dark, warm, calm nights. Egg masses should be determined carefully on felled trees, and not only the number but the position in height should be noted. Providing means of gathering excreta is commendable. Trial baiting with insect lime is uncertain in results and lack of success does not assure the absence of the pest.

For combating the pest the use of insect lime is commendable when egg deposits are low, and in polewoods, especially of pine and spruce mixed, when the two species are of equal height.

In low, easily accessible stands gathering the moths is practicable. Other methods recommended or practiced are only conditionally effective.

The "polyeder" disease of the Nun is discussed by Dr. Wahl in the same publication.

Die Nonne. Centralblatt f. d. g. Forstwesen. April, May, June, 1909. Pp. 145-172; 241-261.

Fighting the Curculio.

A similar piece of work to the above in which, however, more stress is laid on the methods of combating the insect based upon an extended series of trials with various means is published by Dr. Eckstein, namely, on the Pine curculio, *Pissodes notatus,* the warfare against which involves in Prussia an annual outlay of over $10,000. The beetle attacks the young plantations from one to twelve years old; it flies May, June, but also in August; winters hidden on the ground, chooses for ovi-deposition sickly trees injured by fire, "schutte" or otherwise, but not those badly infested with root fungi.

To grow healthy stock is the best prevention, daily collecting from plants and baiting billets, the method of combating.

Die Bekämpfung des Pissodes notatus. Zeitschrift für Forst- u. Jagdwesen. April, 1909. Pp. 209-232.

Baiting Curculios.

A new method of baiting Curculios has been devised by forest guard Kissel. An earthen pot, flaring inward, filled with water to which is added a strong smelling substance (turpentine) is placed in the ground flush with the soil surface and loosely covered. The beetles attracted by the smell, creep through the surface litter to the pot and falling into it, die. The cover is placed over the pot to prevent useful beetles from falling into it; these, it is found are not attracted by the smell and do not approach the pot in the same manner. The pots remain effective for several weeks.

Der Rüsselkäfer-Fangtopf. Allgemeine Forst- u. Jagdzeitung. September, 1909. P. 325.

SOIL, WATER AND CLIMATE.

Utilizing Swamps and Bogs.

In these days of reclamation of waste lands the report of Dr. Kienitz, how the alder swamps in his district are changed into meadows is of interest. For this purpose there is needed, first, the lowering of the water table to 20 inches, sowing of grass species carefully selected according to their adaptability and character, taking care to choose for upper and lower stand, partly permanent, partly rapid growers and nitrogen gatherers. Annual fertilizing and harrowing is necessary.

For regulating the water table, only a partial level survey is needed to see whether altogether the water can be drained off. Only a slight grade is required. The main ditch, located in the direction of the greatest fall is usually made 1 yard deep, the base half a yard, the top 1.5 yards wide. Side ditches are placed at right angles to the main ditch, of varying depth, 20 inches at top and 12 inches at base.

After regulating the water-table the whole area is thoroughly cleared of brush and roots, and, as far as possible, leveled, not, however, removing other vegetation. When the moor has settled so far as to bear horses the ground is harrowed and manured. Mostly only potash, and sometimes magnesia, is deficient, which is best supplied by cheap potash salts, about half a ton of kainit to the acre. Sometimes an addition of phosphates, Thomas slag, to the amount of a quarter ton, is indicated.

The fertilizing must be repeated annually.

Sowing of grass seed is not necessary, since grasses will come in naturally, but it is advisable in order to secure the best result. This is done with well selected material at the rate of 20 to 25 pounds per acre, after harrowing and rolling.

Versammlungen Norddeutscher Forstvereine. Allgemeine Forst- u. Jagdzeitung. September, 1909. P. 318.

SILVICULTURE, PROTECTION AND EXTENSION.

Silvicultural Sins.

The one-sidedness of American foresters in advocacy of natural regeneration, and that in selection form, —a silvicultural doctrine which, owing to Gayer's fervent and brilliant exposition, gave rise to an enthusiastic school of natural regenerators in Germany and elsewhere—receives a severe rebuke in a very judiciously written article by Oberforstmeister Guse.

He refers to Judeich as an associate in opposition to the "fashion of proposing to force everything with natural regeneration and selection forest."

In Saxony extensive trials were made on four different sites, the species being prominently spruce, namely:

1. In most exposed alpine sites of the Erzgebirge, where protection is principal concern, and clearing threatens devastation.

2. In better, yet frosty situations where hitherto small clearings with planting had given good results.

3. On milder, good sites where success of planting on larger openings is successful without doubt.

4. On granite, quartzite and basalt soils of steep, rocky as well as fresh good sites in mild climate.

On the first two sites success was attained only when volunteer growth was already in existence. With long regeneration periods, even under rather open stands the young growth after snowy winters simply vanished; hence, where protection against wind breakage exists, return to small openings with planting became necessary, otherwise selection cutting, but only following up the natural regeneration is practiced.

In some localities, where, besides climatic ills, poor soil is encountered and, hence, the stands are short-boled, natural regeneration is successful.

On the milder, good sites, no favorable experiences were had with natural regeneration, grass had choked out much young growth, snout beetles multiplied, much young growth was destroyed by the after-fellings, windfalls were frequent, loss and expense in logging were deterrent.

The best results were secured in the last named sites. Here the same favorable conditions as in the Black Forest prevails. Here, however, "pre-regeneration," i. e., regeneration before the old stand is removed, is not necessary.

These were the results announced 27 years ago by the Saxon foresters, and now the author adds the results of his observations in the meantime. Success of natural regeneration he finds very variable. He considers the saving of all volunteer growth on clearings desirable, but it is not to be forgotten that in some cases this volunteer growth must be gradually brought into open position, or else it is lost. Beech and fir are naturally regenerated as a matter of course. There are also sites where only what dies is to be taken out, and one must be grateful for whatever nature provides.

Altogether, careful consideration as to species and site must determine where natural regeneration is practicable. For oak, on bottom lands, there can be no question as to natural regeneration: grass and water prevent it; planting is successful, especially after agricultural use of the ground. In other sites where oak is at home, either natural or artificial regeneration with gradual opening is indicated wherever natural volunteer growth is found.

As to spruce, no species can be more surely regenerated artificially; but it must be carefully managed, namely, by making small felling areas to prevent dying out, and utilizing volunteer growth. But, although in some situations natural regeneration is successful, planting is more so.

In spite of the dangers which accompany it if not properly done, for pine, artificial reproduction is the only satisfactory method. According to the author's 60 years of observation in various districts, wherever pine and spruce are mixed there is plenty volunteer growth of spruce to be found, but not of pine. In pure stands, opening up is apt to deteriorate soil conditions. Under cover, "damping off" is more frequent than in open cultures. The use of volunteer growth of pine is questionable.

In conclusion, the author points out that the return wave of enthusiasm for natural regeneration emanates again from South Germany, where the mildness of the climate, the frequency of seed years, the fertile soil, the mixture of species, all conspire to make natural regeneration more readily successful.

Wiederkehrende Strömungen. Forstwissenschaftliches Centralblatt. September-October, 1909. Pp. 453-461.

Principles of Thinning in the Dominant.

An unusually thoughtful discussion by Forstrat Schubert on the applicability of the French method of thinning in deciduous woods develops the principles underlying the practice of thinning so lucidly that we brief it at length.

Hartig's teachings which still pervade most of the practice in thinnings were based on the principle that they were to move only in the subordinate stand. Within the last 20 years ideas opposed to this teaching which does not recognize the dominant stand have asserted themselves, and under various names (*Plenterdurchforstung, Kopfdurchforstung, Durchforstung im Herrschenden, freie Durchforstung*) systems of thinning in the dominant (the French *eclaircie par le haut*) in juxtaposition to thinning in the subordinate (*Niederdurchforstung, eclaircie par le bas*) have been developed.

The object of thinnings in general is the production of the largest and at the same time most valuable wood quantities in shortest possible time.

It has been recognized that the largest volume is dependent on a certain degree of density of stand. What degree, is still unsolved, although we are nearer its solution. Volume is the resultant of the work of crown and root, a combination of the radiating energy of the sun and the chemical energy of the soil. We have learned through Wiesner, that not all, and not the direct light, but certain rays and of the diffused light—only a certain part of the light surrounding the crown is active. It may be asserted that the useful light—the so-called relative light enjoyment (*Lichtgenuss*)—becomes the smaller in amount, the more effective the crown density. But since root activity has also to be considered, a limitation results. Not the densest crown cover represents the optimum, although here the largest amount of foliage and light are interacting, but root energy is reduced especially by retaining precipitation in the foliage and lower temperature. Considering various degrees of density the optimum must have passed when after interruption of crown cover the soil covers itself with a green vegetation, which withdraws part of the total growth energy from wood production.

The working hypothesis, then, may be formulated that the largest increment occurs when a minimum of foliage is pervaded by the largest amount of utilizable light. The optimum will be at hand, theoretically, just before other vegetation appears, practically when the crown cover is slightly opened. Hence a severer opening of the crown cover means decrease of volume production (not of the single stem, but of the stand); except temporarily when through more rapid humification the soil energy is increased. But this is merely anticipating the use of the fertile elements which would be otherwise distributed in time.

All data available confirm this conclusion, that the total volume production cannot be increased beyond a certain amount attainable under proper crown density. From the standpoint of volume production a rational practice of the old method of thinning seems to be unassailable.

The second requirement, namely of value production, however changes the aspect.

After referring to what constitutes value and to the observation that diameter and price more or less parallel each other up to certain limits (see p. 340 of this volume), the author points out that of two stands of the same species, same soil, same age and density, the one with the smaller number of stems has the larger diameters (although usually smaller volume): where a smaller number participates in the crown cover, the individuals have larger diameters, in other words, the diameter is a function of the light enjoying crown.

Since, apparently at least, a given site presents a limited growth energy, if a larger number of individuals must grow on it, each individual secures less than if there were fewer. Hence, the number of stems per acre, stock density, is of importance, and the regulation of numbers, which does not enter into the consideration of the old thinning practice, becomes a second primary concern. Examples are given which accentuate the failure of the old method in this respect.

The third primary requirement which influences value production is to secure best stem forms; not only forms of bole, but of the crown as well, which is in relation to form development.

Finally the author formulates the object of stand improvement; to utilize to the fullest the source of energy on a given site for the existing stand and to distribute its results over stems determined as to kind and number.

This direction is given by opening up around selected individuals in order to increase the lighted part of the crowns. The apportionment of the existing growth energy among the individuals would appear the most important and most productive task of the forester, and this is attained by thinning in the dominant, which will furnish larger intermediate and smaller final harvest yields, the opposite of thinnings in the subordinate stand.

General recipes of procedure to attain these objects cannot be given. General considerations are, that in order to preserve soil cover and to secure the clearing of the dominant, the living intermediate or underwood is left undisturbed. The opening up of the upper crown level must be gradual; rapidity and time of return depends on soil, age, condition of stand; in younger stands not less than in five year periods.

To secure clean boles the opening up should not begin until thirty or forty to fifty feet of clear bole have been secured by dense position which may be in fifty to seventy-five years. Pruning to secure this is a doubtful measure, but pruning in the intermediate to help the development of a superior tree, when its removal would open up too much, is commended.

Form development and correction of composition form the concern in the young period, until the superiority of the select is readily visible and the elite can then be favored. The general rule then is to take out stems which interfere with the crown development of a more valuable neighbor. In a mixture of oak and beech in Bramwald an average distance of twenty-five feet for the elite, say sixty to eighty trees to the acre, providing for losses, appeared a desirable number. These are marked with a white mark on two sides, this mainly to help the eye and train the personnel in this new way of marking for thinning.

Die Hochdurchforstung im Laubwalde. Forstwissenschaftliches Centralblatt. September-October, 1909. Pp. 461-474.

Results of Thinning in the Dominant.

In an article of over 100 pages, Dr. Heck publishes the results of fourteen years' practice with this new method of thinning, called by him Freie Durchforstung (free thinning) to denote that it is independent of any schematic prescriptions or rules. The results are given in a long series of tabulations, in which all growth conditions are given in detail measurements from year to year. Side by side, in the same stand of beech, thinnings after the old and the new method were made and compared in every detail. The article discusses at length every phase of the subject. Of the conclusions the following may be of more general interest. Stem classes, made after Kraft's classification, change soon after they are made; only one-half to two-thirds of the trees remain in the same class for a decade, the rest, with the exception of a few which advance, falls into a lower class. After five years a new classification becomes necessary, while shaft-form classes, as made by Heck (see QUARTERLY, vol. III p. 40) remain more constant.

In all stem classes the cross section area increment varies greatly from year to year according to treatment, season, and peculiarity of species. The East-West diameter is in the average several millimeters larger than the North-South diameter.

The better shaft form produces the larger increment, at least in beech. The thinning after Heck in spite of the smaller cross section area produces a larger and at the same time more valuable increment than a moderate thinning after Kraft. In two experiment areas this difference in ten years was 35% and 10% respectively, in one area 6% less, average 12%. In comparison with the old method, this larger area and value increment is secured on a smaller stock capital, hence a higher interest on the value of the stand is secured, and the latter method continuously improves this relation, approaching the ideal stand, the best stems becoming more and more prononunced and prominent in making up the stand.

Ein Jahrzehnt Durchforstungsversuch, etc. Zeitschrift für Forst- u. Jagdwesen. May-August, Pp. 281-313; 382-408; 436-472; 502-520.

The Silvics of Piñon Pine.

Some interesting notes on the silvics of Piñon Pine are given by Phillips. Of particular interest are those relating to the unfavorable conditions of moisture, altitude, and soil which this tree is capable of resisting. Besides its value as a cover for arid regions the Piñon Pine is of considerable economic importance. The wood is largely used for fuel and possesses high fuel values. The seed is sold in large quantities as a delicacy.

The wood is cut after it has been dead two years as before that time it is unseasoned and if left for a longer period of time will have deterioriated. The wood has been used for posts and ties, but is not durable in contact with the soil and needs preservative treatment for this reason. Extensive tracts have given a yield of ten to twelve cords to the acre.

The fruit is gathered in immense quantities, single dealers have been reported as handling 20,000 to 50,000 pounds. During seed years native collectors sell the seed at five to fifteen cents a pound.

Dealers in cities get from forty to sixty cents a pound. The seed is plentiful during seed years (about every five years). Mature trees produce one to eight bushels of cones. Each cone averages ten to twenty seeds and trees have been known to yield 300 pounds of seed per acre, while large areas have produced sixty-five pounds per acre. The seeds have a high per cent. of infertility and lose their germinating power easily unless they are especially stored. There follows a table of five samples of seed collected from various localities, with their germinating per cents.

No. seeds per pound.	*% viable, knife test.*	*% viable, water test.*	*% viable, green house.*	*% viable, open.*	*Where collected.*
2510	87.2	84.0	82.2	75.6	Ft. Bayard, N. M.
2215	87.1	86.6	80.3	69.2	Tres Piedras, N. M.
1810	91.2	86.0	78.1	70.4	Ft. Garland, Col.
1950	92.7	88.5	81.3	71.0	" " "
1520	99.2	97.1	96.4	90.3	Lincoln, N. M.

Owing to infrequent seed years, infertility of the seed, loss of germinating per cent., loss of seed from rodents, birds, grazing, and man, and unfavorable site-conditions it is difficult to secure a reproduction of Piñon Pine. In the future management of this tree a selection system in which the dead and dying trees are removed for fuel seems to be the only practical one.

A Study of Piñon Pine. Botanical Gazette. September, 1909.

Nursery Practice.

The name of the small town of Halstenbek in Holstein is familiar to many American foresters as the seat of the extensive nurseries of Heins' Sons. Evidently the location is favorable for this business for, according to v. Reitzenstein, there is still another monster nursery to be found there, namely, that of H. H. Pein, the oldest in existence, nearly a century old, which covers about 200 acres and controls altogether the growth on nearly 500 acres, most of the transplants being grown under contract with small adjoining growers, who have become experts under the influence of the principal grower. The trade is about 150 million a year.

The location is within the direct influence of a sea climate, on a fine deep, strongly humose loose sand. Hedges of Thuya, Carpinus, and Syringa surround and separate the smaller nurseries besides furnishing windbreaks.

In the main nursery the beds are made 1.2 m wide and 13 m long (say 4 x 42 ft.), forming the normal bed of 168 square feet.

Thorough cultivation of the soil, on which great stress is laid, is secured by a specially constructed machine, consisting of a heavy roller (in three parts) followed by a series of very rapidly rotating knives in spiral position on an axle. These fine the soil to a depth of three inches. For sowing in drills, which is used for coarser seeds, this is all the preparation needed. For smaller seeds full seeding is practiced, and for this the soil is once more fined carefully with narrow rakes.

For transplant beds, which are usually seeded the year before and hence well worked, a mere ploughing to twelve inch depth and planing with a board suffices.

Artificial fertilizer is tabooed, and even green manuring has not been found desirable, but animal manure is largely employed after having been exposed for a whole year and a half in compost heaps. In these a 4-inch layer of horse manure is alternated with a layer of half this depth of raw humus or street sweepings, which is brought by the carload from Hamburg. The weedings are also added, the heat of the manure destroying the germinative power of the seeds. A ditch around the compost heap gathers the leached waters, which are either poured over the compost or placed on the land.

This manure is uniformly distributed over the harvested fields in spring or fall after being plowed, and then again plowed. For deciduous trees the largest amount used is 1,400 cubic feet to the acre, for conifers about one-half; for certain species, Douglas Fir, Sitka Spruce, Black Locust, which are apt with too good treatment not to ripen their wood before the early frosts, no manure is used.

Besides the thorough soil preparation extensive water-works with pumps, water-tower of 150 feet, and four to two-inch piping, prevent any chance of drouth.

Drill sowing is practiced only for a few deciduous species, and mainly to avoid transplanting, when every second row is used in the second or third year.

No fancy tools are used for making drills, a simple rake with hollow tine teeth properly distanced suffices to make the drills in the length direction of the beds, and after sowing by hand, an ordinary wooden rake finishes the work.

As reason for relying mainly on broad-casting, especially of conifers, is stated that the latter permits a more uniform development in all directions. This is a poor reason except as to looks of the plants, and where winter cover is needed drill sowing is preferable.

The sowing is done with greatest care especially as to the amount of cover, so that practically every sprouting seed will make a plant.

A man lifts with a shovel from one-half of the bed a layer of earth of about one-fourth of an inch and throws it on the other half, a girl sows the carefully determined quantity of seed, a second girl covers the seed with a layer of sand about one-eighth of an inch, and the man returns the removed layer of earth. And this process is continued from bed to bed by the well drilled crew at an average cost of twenty-five cents per bed. The intermediate layer of sand has for its purpose to prevent the formation of a crust under the influences of rain, breaking the connection between upper and lower earth layers. To keep the soil in friable condition until the cotyledons appear, great pains is taken, using a simple but effective instrument, called "Igel" (porcupine), a wooden roller of twenty-four inch diameter beset with one inch long wire teeth.

The seed, naturally tested and measured out according to germination per cent., is largely pre-germinated in order to effect uniform germination.

For this purpose, according to hardness or time needed for germination, earlier or later, the seed is placed in walled-up ditches and water poured over it. Seeds in not too thick layers (to avoid heating) liable to lie over are bedded in moist sand.

Transplanting is also done without machinery. Men make rills with a spade across beds, a line being stretched over all the adjoining beds. Women place the plants along a lath on which the distance is marked. The making of the second rill accomplishes the firming of the plants in the preceding rill. Three persons transplant in this way 25,000 plants.

Curiously enough the transplanting begins in July and is finished by the beginning of October, partly in order to employ all the help through the year efficiently, partly because in this way the plants repair the roots the same fall and are ready next spring to start at the earliest.

The transplanting of deciduous trees and pines is done with yearlings, except *P. Strobus.* The latter, as well as spruce, fir, larch, are transplanted in the second year. Only first class seedlings are transplanted.

Altogether the whole procedure is primitive and the great success lies in the skill of the well-trained labor.

To protect the beds against night frost, especially of exotics they are covered with bamboo mats, supported on laths, sixteen inches above ground. These are also used in drouthy periods during summer, after watering to prevent rapid drying. Birds are shot. June bugs are fought by chickens.

Plant diseases occur rarely. *Only a few years ago the White Pine rust had made its appearance. To-day this is an unknown thing in Halstenbek. The infested plantings were burnt, and the White Pine is being transplanted in double spaces, too close stands having been the main cause of the spread of the disease.*

Even the "Schütte," so common, is in pine seedlings unknown and hardly noticeable in two-year-olds.

Weeding in the broad-casted beds is done, of course, by hand; in the transplant beds with the Planet, Jr., or another simpler tool of local construction, which consists of a stirrup-like contrivance on a handle the base being an obliquely set knife, which, pushing forward, cuts the weeds, and pulling backward, lays them over and frees them from soil. They are left on the ground to wither, except in humid weather.

In shipping, the principle is strictly adhered to of never allowing plants to lie in the cellar more than one day before packing. Broad-leaf transplants are dug in the fall and heeled in, conifers in the spring directly for shipping.

The lifting of plants is done by a special plow with a horizontal share at proper distance from the surface which lifts the plants about two inches, when they can be gathered without any injury to roots, being at the same time sorted and counted.

In packing, the waterworks are constantly in use, and the packages after being made ready for shipping, are once more sprayed. Conifers are shipped in baskets, the roots in moss. When the season is advanced dry heather is packed in with the moss to prevent heating.

The author concludes by pointing out that such nurseries can produce cheaper and better material than the small home nurseries.

Die Baumschulen von H. H. Pein in Halstenbek. Forstwissenschaftliches Centralblatt. July, 1909. Pp. 353-364.

New Planting Tool.

Split-planting, the most generally practiced, the cheapest at the start, is recognized as responsible for many failures, especially on compact soils. The premature dying of pine on abandoned farm and heath soils, while sowings persist, is explained by the unnatural position of the roots in this mode of planting.

An example is cited by Splettstösser of a pine sowing made twenty-five years ago, which for six years was repaired by split planting. The pines originating from seed have now a height of about twenty-six feet, a diameter at base of six inches, and taproots of about eight feet in length. The planted pines are in the average nine to ten feet lower, have a diameter of hardly two inches, a taproot of little over one and a half feet and the root development more or less in one plane, the result of the split-planting. The fan-like form of the root system reduces the feeding area, the side roots lying above the taproot robs it and impedes its development, the trees are underfed, sickly, liable to insect attacks, and lose in wind firmness.

To overcome this trouble the author has constructed a new planting tool, which makes the hole not by pressing the soil, but by moving it: a cylindrical hollow borer with a turned-in removable cutting edge (forming a slot with the other half) in two halves with handles, one of iron, one of wood, working like a pair of scissors, processes in the iron handle fitting into recesses in the wooden handle which keep the cylinder closed, when removing the earth. The tool is applied by a boring motion, and is kept closed until the soil is to be emptied out. It is, of course, not useful on gravelly or very stony soil. The diameter of the cylinder is made from four to eight inches; four or five inches being found best for one and two year seedlings.

On slightly grassy sand soil one experienced planter can make 180 holes per hour, which will occupy two women to set with plants; a crew of three under favorable conditions planting 1,400 trees, which, with us, would bring the cost to less than $3 per M. Very satisfactory results, also with oak and beech, are recorded. The tool in three sizes (10, 15 and 20 cm) may be had for $5 to $6 from Bach and Mahlow, Sophienstrasse 32, Berlin.

An additional finesse, useful in connection with this tool, is

Nörings plant holder, which insures the proper depth of setting, and a firming tool. (See Illustration on page 483.)

Der Zangenbohrer von Splettstösser. Centralblatt f. d. g. Forstwesen. June, 1909. Pp. 283-286.

Seed Yield.

A very interesting investigation has been made by Prof. Toboleff reported in the Journal of the Imperial Forest Institute for 1908, to ascertain the seed yield of spruce stands by means of sample plots, each containing 100 trees, which were under observation four years. The amount produced was not ascertained by direct count, but by gathering the cones from about ten per cent. of the tree number in seven to ten tree classes.

The dominant trees, class I, II, III, and the two sub-classes of the last two, produced 98% of the total yield, class IV, although represented with 17% gave the other 2%, class V representing 20% of the number yielded nothing. The contribution of each class per tree was in the proportion of 3, 2, 1, $\frac{1}{8}$, 0, for the five classes from I down. That is to say, a tree of class I would yield three times, of class II, twice that of a tree of class III.

The seed yield of the single tree depends on development of crown, size of cone, number of seeds in cone, size of seed, germination per cent. and age of tree. The largest yield of single trees in each of the four classes were 2.3, .83, .167, .107 pounds of germinative seed.

A calculation showed in good years around one million seeds per acre and 40,000 to the tree.

Ueber den Samenbetrag der Fichtenbestände. Zeitschrift für Forst- u. Jagdwesen. July, 1909. Pp. 477-479.

Silvics of White Pine.

The experiences in Germany with our own species are accumulating, and naturally of interest to us. In the Palatinate, this experience with White Pine in forest conditions is over a century old. Forstrat Neblich reports: The natural reproduction of White Pine offers no difficulties if begun at the proper time. In stands over 110 years old, its regenerative power begins to decline. As regards light requirements in the red sandstone district it is to be classed with the tolerant species and its biologic characteristics place it with Abies rather than Pinus, standing in silvicultural characteristic between Picea and Abies. Its great recuperative power, due to elasticity and rapid rate of growth in the natural regeneration is praised; also its ease of artificial reproduction. Two to three-year-old seedlings are planted on soil free of weeds; three to five-year-old transplants are used in wet or peaty soil and repair planting. Its largest and best production occurs in dense stands, hence the spacing should not be too wide. The speaker claims that the species clears its bole best in pure stand, but also in mixture with others if not outgrowing them too fast. If mixed with a too large preponderance of spruce and fir the cleaning process is the slowest, and then dry pruning has to be resorted to. Contrary to our experience, according to the speaker it does not bear green pruning. While not very fastidious, it does not thrive in dried out sunny sites, but shows still good growth on wet, peaty soil with raw humus. For improving soils it is excellent, crowding out weeds and forming a mild humus. The smooth straight shaft is praised for increasing in full-woodedness with age. The work-wood per cent. is placed at eighty-three.

The 116 year old White Pines show 85% of heartwood as against 45% in Scotch Pine. Altogether the White Pine accomplishes in 100 years what the Scotch Pine in the district under discussion does in 160 years. At 104 years of age the stand showed 1,360 cubic feet timberwood as against 1,324 for spruce on site I, and 910 for Scotch Pine.

Prices paid are now much better than for native pine, 70% in the better grades, and still 10% in the lowest. Its resistance to diseases and dangers is praised and also its wind firmness.

Allgemeine Forst- u. Jagdzeitung. August, 1909. Pp. 290-291.

Frost Hardiness of Pseudotsuga.

In a note by Zederbauer, observations at various places in Austria are recorded which substantiate that generally the blue variety of Douglas Fir (the one from the dry regions of the Rocky Mountains, etc.,—Rev.) is more frost resistant than the green variety. Under cover, and in the open after about twelve feet in height is attained the green variety does not suffer, while in the open all those under twelve feet did.

Centralblatt f. d. g. Forstwesen. August-September, 1909. Pp. 387-388.

Sitka Spruce. A stem analysis of a single Sitka Spruce in the forest garden at Giessen, shows that even in a climate by no means similar to its native habitat this species preserves its rapid rate of development tolerably well.

Age	10	20	30	40	50	58	
Height	4	21	39	56	69	73	feet
Diameter		3.4	7.4	11	13	15	inch
Area		3.5	16	31	50	66	sq. inch
Volume		1	6.6	18	32	46	cu. ft.
Form factor		.61	.48	.47	.44	.44	
Annual rate—							
height	1.7	1.8	1.7	1.3	.4		feet
diameter		.4	.34	.2	.2		inch
area		1.35	1.5	1.9	1.6		sq. inch
volume		.56	1.24	1.4	1.4		cu. ft.
per cent.		14.8	9.2	5.6	4.5		

Allgemeine Forst- u. Jagdzeitung. August, 1909. Pp. 295-6.

MENSURATION, FINANCE, AND MANAGEMENT.

Accurate Log Measure. To secure a measure which in valuable timber will permit more accurate measure than the customary lath or tape, Beuz has constructed a measure consisting of a lath, at one end of which an iron point is inserted at a right angle, at the other, a V scribe the length from the point to the scribe being exactly a meter or any other unit length. A stub handle near the point end, and the usual ring handle of the scribe permit a rapid and accurate measuring of log length.

Das Ablängen des Langnutzholzes bei der Ausformung im Rohen. Allgemeine Forst- u. Jagdzeitung. June, 1909. Pp. 190-195.

Aims of Forest Management. It is interesting to note with what precision the technical aim of a forest management in Saxony may be expressed, as deduced from the results in the log market.

By investigating the sales (about 100 million cubic feet) of logs for 20 years, from 1880 to 1899, Pursche comes to the conclusion, that the aim of Saxon forest management is to be sought in growing normal stands, in which about 35 per cent. of the total log volume is to be found in trees which have a middle diameter of 9 to 12 inches. The growing of logs of a larger diameter appeared during that period at least disadvantageous in Saxony.

In cutting to logs such stands, in which 35 per cent. of the volume is represented by 9 to 12 inch middle diameters, while 45 per cent. will be represented by stems with 6 to 9 inch middle diameters, there will be found 40 per cent. of the volume over 9 inch at the small end.

This discussion recalls a similar investigation by Wagener in his *Waldrente*, in which according to the testimony of various saw millers the most advantageous diameters for German log markets are: 6 to 8 inch, 27%; 8 to 10 inch, 37%; 10 to 12 inch, 23%; over 12 inch, 13%.

Ueber Hiebszugswirtschaft in Sachsen. Allgemeine Forst- u. Jagdzeitung. June, 1909. Pp. 189-90.

Financial Results.

The great variation of financial results of forest management under varying conditions even in Germany, where conditions over the small territory of 200,000 square miles might be supposed not to be extraordinarily different, appears from a comparison of two State administrations with the results of a private forest management in Suabia.

The latter property of about 6,000 acres, 92% spruce, the balance oak and beech, has a good road system and several railroads passing through, insuring high prices. The cut (average for last three years) is 690,000 cubic feet, or 117 cubic feet per acre. Comparing the financial results with those of the large forest area, much on poor soils, of Prussia, and the small but intensely managed State forests of Württemberg, the following interesting figures appear:

	Gross Yield		*Net Yield*		*Expenditures*			
	Per acre.	*Per cu. ft.*	*Per acre.*	*Per cu. ft.*	*Pers.*	*Mge-ment.*	*Cul-ture.*	*Road.*
	Dollars.				*Per acre.*			
Prussia	3.90	.068	2.40	.043	.62	.91	.17	.17
Württemberg*	9.20	.096	6.0	.057	.92	2.27	.23	.40
Private	19.24	.164	17.47	.119	.47	1.32	.16	.08

The logging cost on the private property is relatively high, wages being high, and all wood being moved to roads, namely,

* These figures have lately been improved, see p. 479.

4.5 cents per cubic foot. On the other hand supervision is easy and relatively inexpensive. The total cost of management is just a little more than that of the Prussian State forests, yet the total net result is 8 times as great.

Eine forstliche Winterreise in die schwäbische Hochebene. Allgemeine Forst- u. Jagdzeitung. September, 1909. Pp. 302-3.

Forest Fire Insurance.

In spite of the relative significance of fire losses in Germany, the desire to insure against these small losses is still active, in addition to the effort of preventing or reducing them by severe laws, effective self-help of owners, increased care of visitors, etc. The few insurance companies (see Vol. VI, p. 434) who are in this business insure at high rates, sometimes as high as 10 to 14 cents per acre per year.

To overcome the difficulty Keiper proposes that the government take hold of the insurance, and to make it obligatory. He proposes the method of doing it in Bavaria.

We are interested only in the technical side. Species, kind of management, age and location form the basis for making danger classes. Deciduous forest over 60 years old, belongs to the lowest danger class, then follow the younger deciduous stands with coppice and standard coppice. Coniferous forest, the most endangered is graded by three age classes following the two deciduous danger classes; those over 60 year form the third, those from 30 to 60 years the fourth, and the young growths the fifth or highest danger class; mixed forest to be ranged according to prominence of species. Specially endangered locations near cities, roads, railroads, factories, etc., increase the rate.

The larger the number of insured properties the smaller may be the rate.

The following example is based on the whole Bavarian forest area of all properties over 12.5 acres in extent, which comprise altogether 3,750,000 acres. Making the average rate 4 cents per acre, this would furnish $150,000 insurance premium, of which the State itself would have to pay $90,000. The author thinks this would suffice, and indeed, soon according to the interest created and the resulting decrease of fires, the rate may be decreased, perhaps halved, so that hardly any financial burden would be experienced.

Waldbrandversicherung. Forstwissenschaftliches Centralblatt. October, 1909. Pp. 418-21.

Forest Fires in Bavaria.

In connection with the above the statistics of forest fires in the State forests of Bavaria for the 30 years from 1877 to 1906, just published are of interest.

On the state forests there were altogether 2,728 fires covering 2,958 hectar, only two of which ran over areas of more than 250 acres. The total damage, including cost of extinguishing fires in the 30 years has been \$135,000, hence per annum \$4,500, less than \$18 per acre of damaged area (about 240 acres) less than half a cent per acre of the total forest area (2,300,000 acres).

The necessity for fire insurance for the Bavarian State forests does therefore not exist.

That the spring months are the most dangerous, is supported by these statistics, 64% of the cases occurring during March, April, May. Running fires from over 78%, tree fires, hardly 5%. The overwhelming number of cases was due to foolishness or negligence; yet over 15% was due to malevolence.

Forstwissenschaftliches Centralblatt. October, 1909. Pp. 441-2.

UTILIZATION, MARKET, AND TECHNOLOGY.

Hardness of Wood.

A very careful, learned and extensive discussion of the factors entering into hardness and hardness tests of wood, and of the meaning of hardness, which goes fully into the mathematics involved, comes from the pen of Dr. Lorenz as a contribution from the Austrian Experiment Station. It is of such a character as to make briefing impossible. The contents may be seen from the following headings: 1. The theoretical equation of the hardness test. 2. The theoretical equaitons of the pressure in hardness tests. 3. The determination of the constants of pressure and hardness equations from empiric hardness data. 4. The application of theoretical pressure and hardness equations to empiric hardness data; subjecting various data secured by various methods to analytical examination. 5. Mutual advancement of theory and experience.

Under the last heading the dependence of hardness to specific weight forms a special feature of the discussion, in which the result appears that the hardness of specifically heavier woods increases more rapidly than their specific dry weight, when the pressure is applied with not too acute bodies.

In the resumé the author states that a comparison of hardness in wood on the basis of equal area, or equal indentation depth, or a combination of the two, or on the basis of equal surface of punches, which have different form, is theoretically not admissible; the most suitable basis for comparison is the volume equality of the punches.

He develops the conception of "form pressure" as the most suitable expression of the hardness measure of the compression tests, conceptions which can only be discussed with the use of formulae.

Untersuchung des Begriffs der Holzhärte. Centralblatt f. d. g. Forstwesen. August, September, 1909. Pp. 348-387.

New Wood Preservative.

From the Austrian Experiment Station Dr. Lorenz reports a new wood preservative which overcomes the objections to the salts soluble in water (hence easily leached out), and to the expense when using efficient tar oils, the phenols of which are also leached. This new, effective and cheap preservative is arsenate of copper, which is absolutely insoluble in water. The preparation is made by dissolving 5.5 pounds of copperas with 16.5 pounds of ammonia of 25% NH_3 (sp. gr. .91) and water, to make 50 gallons. To this is added 50 gallons of arsenious acid, 2.2 pounds dissolved in 5.5 pounds of the same ammonia and diluted with water.

After being filtered to get rid of some carbonate of copper and other impurities, the dark blue ammoniacal solution of arsenite of copper ($CuHAsO_3$) is ready for use.

According to the dryness of the wood from 25 to 40 per cent. of the wood volume is taken up. The ammonia evaporates and the blue green color of the impregnated wood changes to gray green which remains constant (the arsenate of copper). A beech tie impregnated with this liquid will contain from one-half to one pound of the dry very poisonous arsenate. The cost is 15 to 25 cents per tie as against 50 to 80 cents for tar oil impregnation.

Centralblatt f. d. g. Forstwesen. August, September, 1909. Pp. 388-90.

Removal of Stumps.

A new safe explosive, called "Ammoncahücit," for use in removing stumps and roots has been most satisfactorily used in the Bavarian Forest Department. With this safely handled explosive three men can get out from 120 to 150 stumps per day.

Ueber die Stockrodung, etc. Silva. August, 1909. Pp. 565-67.

Oak Flooring.

Oak floors laid nearly two hundred years ago in Versailles and Fontainebleau are still in excellent state of preservation. The famous colonial mansion "Adena" at Chillicothe, Ohio, which was built in 1805 still has the original oak floors well preserved. With the advent of the use of White Pine, oak was used to a less extent for flooring except in the finer houses. At this time when kiln drying was almost unknown the more modern methods of heating are said to have been injurious to oak floors.

The first oak flooring was made by hand, and later it was made from boards which were matched by machinery after being ripped to width. Most of such flooring was manufactured at local planing mills and was cut for each separate order. A Wisconsin manufacturer began the practice of cutting hardwood flooring and ceiling into shorter lengths and butting the ends of the pieces by machinery. This was soon followed by end matching of pieces, which was perfected by a Chicago firm and patented. The patent was contested in the courts and at first upheld but later the decision was reversed and the manufacture of flooring became an important industry. The present high demand for oak and other hardwood floorings is largely due to the construction of more sanitary floors.

The Southern Lumberman.

French Method of Turpentining. The French method of turpentining requires more labor and skill and produces less result than any of the methods used in the United States. It has the great advantage, however, of maintaining the flow of resin for a longer period than our methods. The box method reduces the productive life of the longleaf pine to four to six years, the cup and apron system allow 15 to 20 years tapping, while the French system allows bleeding of the maritime pine for 30 years or more without diminishing the flow. Axes with curved blades set at a slight angle to the handle are used for chipping, which is performed about 30 times between March and the middle of October and results in a face of 26 to 30 inches each season. Turpentining is carried on along the Bay of Biscay where the primary purpose of the forest is to hold the light sands.

The Southern Lumberman.

Uses of Palmetto. The palmettoes were once fairly common along the South Atlantic coast, but have been cut in such large numbers that the supply is said to be almost entirely exhausted in North Carolina. This endogenous wood is admirably suited for the construction of wharves, since it is said not to be affected by the teredo or other sea worms. In early days, large quantities were used for wharves at Norfolk, Wilmington, Charleston, Savannah and other places. During the Revolutionary War the palmetto was considered to be the best wood for constructing forts, since the soft, fibrous nature of the timber made its destruction difficult by either small or large shot. The wood is not of value for furniture.

The Southern Lumberman.

STATISTICS AND HISTORY.

World's and Russia's Forests. Prof. Surosch of the forest school at New Alexandria (Poland) has brought together with great industry, in over 500 pages, statistics and description of the world's forest areas, lumber trade, and forest management. The data of Russia occupy naturally the larger portion of the work, and are given in more detail. According to Surosch the forest areas of the world appear to be:

Europe	1200	thousand	sq. miles,	30%	of	the	total	area,	1.7	acre	per	capita
Asia	4280	"	"	27%	"	"	"	"	3	"	"	"
Africa	2040	"	"	18%	"	"	"	"	8	"	"	"
America	5640	"	"	35%	"	"	"	"	22	"	"	"
Australia	490	"	"	15%	"	"	"	"	53	"	"	"
Total	13,650	"	"	28%	"	"	"	"	5.15	"	"	"

The total exports of wood products in 1903 totaled $335 million, the imports $371 million, while in 1890 the figures were $176 and $205 million respectively.

In the exports the following countries participated:

Russia and Finland, ...	$59	million
North America (means U. S.), ..	56	"
Austria-Hungary, ...	52	"
Sweden, ...	43.5	"
Canada, ...	39.7	"
Norway, ...	19.5	"
Holland, ...	16.4	"
France, ...	10.2	"
Germany, ...	5.8	"
Roumania, ...	4.5	"
Others, ...	28.4	"

The imports going to the following countries were valued at:

Great Britain, ...	$114	million
Germany, ...	51	"
France, ...	30.5	"
North America, ...	28	"
Belgium, ...	26	"
Holland, ...	25	"
Italy, ...	12.7	"
South America, ...	11	"

The north temperate zone of the Old World has, with 3,880 thousand square miles the most important forest area, of which Russia in Europe has 800, in Asia 2,200, or altogether 3 million square miles. The author places Canada next with 1,260 square miles, the United States and Mexico next.

While European Russia has 38.8% of forest area (according to others 36) it is stated that 57% of the population are crowded on 22% of the area and suffer from lack of wood. At least 20 million use straw and dung for fuel, withdrawing 15,000 cubic feet of manure each year from the farms.

In southwestern Asia, in the mountains there are still coniferous woods, but the largest part is sandy plain occasionally with chapparal.

In western Siberia the watershed of the Ob (Tomsk and Omsk) is an immense, swampy plain, of 26,500 square miles, one-third without any forest, two-thirds conifer forest with little fit for cultivation. Seven thousand square miles are tundra.

Eastern Siberia shows similar zones, coniferous forest, almost without population, occupying 27,000 square miles. North of the 73° dwarf growth begins. South of the Amur the most significant growth is to be found. Roads, people, capital, are lacking to develop these areas.

The Russian forest department controls altogether 870 million acres, and 1,025 million acres in Asia are not yet placed in its hands. But only 250 million acres are State forests, the rest held either for partition among the peasants, in other branches of the administration (mines) for corporations, or in dispute. An army of nearly 32,000 guards, of whom 20,000 educated underforesters, are employed. The stumpage is usually sold to lumbermen at a stated price per tree or per area, sometimes for a number of years.

In 1897 on the peninsula of Kola for 288,000 pieces sawlogs of 12 inch and over to be taken in 5 years nearly $200,000 were paid; a million trees in Jeniseick were sold in 1900 for 13 years at 20 cents apiece. In 1903 the cut offered at $25 million brought at auction over $30 million. The total receipts in 1902 were $32.3 million, expenditures $5.7, net $2.6.

The law of 1899 which obligates buyers to reforest has mostly remained a dead letter; the lumbermen allow as a rule their guarantees to lapse, so that in 7 years $3,000,000 were to the credit of the planting fund, only half of which had been used. Meanwhile the unplanted area grows. Natural regeneration has proved a total failure.

Beiträge zur forstlichen Statistik. Zeitschrift für Forst- u. Jagdwesen. August, 1909. Pp. 545-550.

Statistics of Württemberg.

Württemberg has the honor of showing the most profitable forest management among all the German States, with a net result of $6.74 per acre, in 1906. Most complete statistics are published by the forest administration. The productive forest area comprises 471,000 acres, from which were harvested in 1907 at the rate of 87 cubic feet timberwood per acre, of which 68 for main harvest, the balance in thinnings, which are only moderate. The workwood per cent. for conifers was 79, for oak 55.6, for other deciduous woods 16.5, excepting beech with only 8.7%.

Wood prices have continuously, though slowly, risen, the price for oakwood being 29 cents, for coniferous logs 14 cents per cubic foot, for beech fuelwood $2.15 per cord, for pine (with 79% taken out for workwood) $1.66 per cord. These prices are for logs and cords in the woods.

The area of annual plantings is 4,722 acres, which corresponds to just about 100 year rotation in the average. Actually, in the timber forest it is higher, but statistics in this direction are lacking. With the exception of about 330 acres, which are sowed, this area is planted with 1,494,880 conifers and 205,840 deciduous trees at a cost of $8.60 per acre, which is considered moderate. Repair planting to the extent of 30% seems rather exorbitant.

Altogether, the cost for cultural work represents 25 cents per acre of forest, an amount which corresponds to that spent by other administrations, but is larger than in former years. Roadwork requires 44 cents per acre. All expenditures represent 32.9% of the receipts, which amount to $4,716,000, the net income, as stated, figuring at $6.74 per acre.

It is interesting to note the changes in all items during the 53 years from 1853 to 1906, which show, of course increases in all cases; the cut by nearly 66 per cent.; the gross income by 375 per cent.; the total expenditure by nearly 200 per cent.; the expense for cultural work by 230 per cent.; for road building by nearly 600 per cent.; the net yield by 620 per cent.; and the *net yield per acre nearly 740 per cent.*

Forststatistische Mitteilungen aus Württemberg für das Jahr, 1906. Forstwissenschaftliches Centralblatt. September-October, 1909. Pp. 524-527.

POLITICS AND LEGISLATION.

Forest Planting in China.

The German government has for some time reforested waste lands in Kiautschou, which is the territory over which Germany exercises a protectorate. The results of this planting have been so satisfactory, even financially, and have aroused such widespread interest among the Chinese that increased activity in this direction is promised.

Silva. August, 1909. P. 567.

MISCELLANEOUS.

Prussian Foresters' Salaries.

Lately, an improvement has been made in the salaries of the field men in the forest service of Prussia. The Oberförster, or managers of districts, begin with $750 and can attain $1,800, besides free lodgings; in addition, they may attain supplementary pay for travel, representation, etc., up to $750, and small additions up to $75, if located in special places. It must not be forgotten, however, that these, as all other government positions, entitle the holder to a pension, variously graded. Aspirants to managerships (Forest assessor) who used to be variously employed at daily rates, are now, for the first two years, employed at monthly rates, namely $45 and $50 respectively, then at yearly rates, $675, $750, $825, and in the sixth year they are appointed Oberförster without a district.

The underforesters (rangers) receive from $350 to $625, besides free house and fuel and some other emoluments which may amount to $200.

Guards are paid on the average $400, with $50 added for house rents, free fuel, and $7.50 towards a uniform. These, too, are entitled to a pension.

Forstwissenschaftliches Centralblatt. July, 1909. Pp. 387-389.

Education of Foresters.

The requirements for a full-fledged higher education in forestry are formulated by Dr. Wagner for German conditions as follows:

1. Better mathematical preparation in the preparatory schools.

2. Fuller theoretical education at a university by increasing the duration of studies from seven semesters to nine, and creation of fellowships for the still further increase of education for selected men.

3. Organization of the practical education into thorough and systematic courses.

4. Regular continuation courses in theory and practice of a few weeks duration for officials.

Dr. Wimmenauer objects to the increase of the study time on the ground that in German Universities where attendance is not enforced many students will only waste more time, and prefers to attain the object by increasing entrance requirements.

Allgemeine Forst- u. Jagdzeitung. September, 1909. P. 323.

OTHER PERIODICAL LITERATURE.

Quarterly Journal of Forestry, 1909,—

Judicious Tree Planting for Shelter. Pp. 114-125.
Shows the economic importance to farmers.

Wood Used at Scotch Collieries. Pp. 125-130.
A short report containing details of the individual use of the various kinds of wood for colliery purposes. A pertinent question is why Great Britain must depend upon foreign countries for her supplies, with so much waste land suited for pine growth.

Pinus cembra. Pp. 130-133.
Silvicultural notes.

Second Report of the Royal Commission. Pp. 138-157.
A review by Dr. W. Schlich.

Experimental Plantations at Cooper's Hill. Pp. 228-232. Gives the present condition of 22 plots planted in 1891-2.

The Botanical Gazette, 1909,—

A Study of Pinon Pine. Pp. 216-223.
A discussion of the silvical characters.

The St. Louis Lumberman, 1909,—

Melted Wood. P. 84.
Gives the method of preparation, and qualities of the finished article.

Canada Lumberman and Woodworker, 1909,—

A Novel Tree Felling Machine. P. 31.

Canadian Forestry Journal, 1909,—

The Regina Meeting. Pp. 105-121.
An account of the proceedings of the Canadian Forestry Association at the special meeting at Regina, Saskatchewan, in September.

Outlook for the World's Timber Supply. Pp. 123-126.
A paper read before the British Association for the Advancement of Science pointing out the inevitableness of a timber famine.

The Forest Trees of Canada. Pp. 130-136.
This is a very complete enumeration of the arborescent flora of Canada giving the distribution by provinces. We note only one serious omission, namely *Quercus acuminata,* which ocurs in south-western Ontario. By admitting a number of the many species of Crataegus, given in Sargent's Silva, and recognizing *Betula fontinalis, alaskana, Alnus sitchensis,* several species of Salix, as well as *Acer saccharum* var. *rugelii, Juniperus scopulorum, Ptelea trifoliata,* and also several others which attain tree form elsewhere, it would be possible to extend the list to over 150 in all.

The Indian Forester, 1909,—

Afforesting Waste Lands and Financial Returns Therefrom. Pp. 247-256; 305-312.

The American Forest Service. Pp. 313-346.
A comprehensive article.

Some Notes of a Tour in Ceylon. Pp. 346-353.
Instructive reading regarding Ceylon forests and their working.

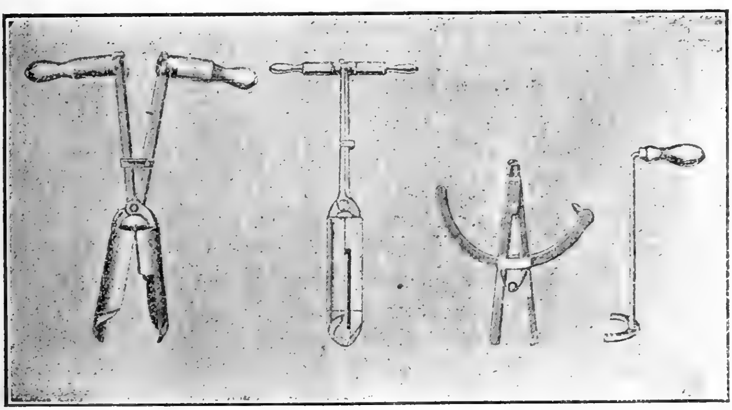
Reproduction of Teak in Burma. Pp. 367-376.

Inheritance in Plants. Pp. 418-419.
Experiments with seeds from trees of the same species growing on different sites.

Bulletin of American Geographical Society, 1909,—

Die Vegetation der Erde. Pp. 523-4.
A review of numbers 7 and 8 of this notable series of monographs on plant geography.

Northern Alaska in Winter. Pp. 601-610.
Contains a few items regarding the forest flora, and the fuel question of that region.



Splettstösser Planting Tools.

NEWS AND NOTES.

The timber owners of the State of California have organized themselves into a Forest Protective Association, with Thomas B. Walker of Minneapolis, the well-known lumberman, as president, he being the largest timberland holder in the State. He is reported in the American Lumberman as expressing his attitude in the following words: "I hold this timber because the laws of the country make it possible for me to acquire it, and because in a sense it was offered to me by my government. It has increased in value because of the work that other men have done in this growing country of ours and under the guardianship of our laws. I feel that it is mine, but mine to use for the public welfare. Therefore I have no right to handle it recklessly, to destroy it, to leave a waste where there is now a forest, beneficent in its influence; but I must use it so as to perpetuate it and to continue the benefits which it confers upon the regions in which it stands. I feel secure not only in title but in reward for administering this property, but, after all, I hold it only as a trustee."

During the season of 1908, the Forestry Department of the Ontario Agricultural College at Guelph, Ontario, sent out to farmers, for waste land planting, 400,000 trees, chiefly White Pine, Scotch Pine, Jack Pine, and Black Locust. In addition, collections of small forest trees were supplied to the public schools as an educative factor.

Statistics of Canada's trade in wood products for the fiscal year ending March 31, 1909, give: Exports of unmanufactured products to Great Britain, $10,024,123; to United States, $26,377,715; exports of manufactured products to Great Britain, $1,481,750; to United States, $3,217,331; imports from United States, $8,306,360.

At the request of the State, the United States Forest Service has undertaken a detailed forest survey of Mississippi with a view to the adoption of legislation providing for protection, conservation, and improvement of taxation methods. In South Carolina a similar survey is in progress.

The new specifications for southern yellow pine bridge and trestle timbers recently issued by the Yellow Pine Manufacturers' Association can be obtained from the secretary, Mr. Geo. K. Smith, Lumbermen's Building, St. Louis, Mo.

Persistent effort is being made by cypress manufacturers toward establishing a much wider market for this species. Good results from this special endeavor have been noted in Minnesota, Maine, Colorado, eastern Canada and the British Isles. The exports to the British Isles and the Continent show an increase of 300% over what they were twelve months previous. The California Wine Growers' Association on March 17, 1908, decided that Cypress was the best substitute for White Oak in tight cooperage suitable for wine barrels. Other woods in competition with the Cypress were Redwood, California Cedar, Washington Cedar, Western Spruce and Idaho Cedar. This will open a large field for cypress lumber.

A movement is on foot to adopt log grading along the Columbia River. Such grading has been practiced for several years on Puget Sound with good results. The advantages of log grading are mutual to loggers and millmen.

A recent decision of the U. S. Circuit Court of Appeals at New Orleans makes it prohibitive for non-residents to cut timber from school lands. This decision affects large lumber concerns to the extent of fully $5,000,000.

A classified list of more than 5,000 consuming concerns is given in the "Southern Lumbermen's Directory of Lumber Consuming Factories of America." The book is to be issued annually with quarterly supplements. The consuming factories embrace those manufacturing furniture, vehicles, implements and tools, boxes and coffins, and toys, as well as planing mills, mill work shops and others. The list is presented alphabetically by states, towns and cities, and gives the nature of the output in each case.

At the meeting of the Hardwood Manufacturers' Association, Mr. Lewis Doster, Secretary, it was stated that in the last year there had been a loss of nearly 40 per cent. in business as a result of the substitution of paper, fiber, and pulp boards in box making.

The annual loss to the State of Maine through failure to utilize properly its wealth of timber is estimated by Fred. A. Gilbert of The Great Northern Paper Co., at over $10,000,000 a year on five of the most common kinds of timber, spruce, pine, fir, hemlock, and cedar. In addition to this the State is slowly losing its principal asset, the standing timber. Only a little more than one-half of what the State is capable of producing is marketed. The rest goes to make up the losses due to waste, decay, fire, and wind.

Mr. Edwin A. Ziegler resigned on October 1st as Chief of Computing in the Forest Service, to become an instructor in the Pennsylvania State Forest Academy at Mont Alto, Pa.

Mr. John M. Nelson, Jr., who had been Assistant Chief of Wood Preservation in the Forest Service, was furloughed on October 1st to accept a position with the Philadelphia & Reading Coal & Iron Company at Pottsville, Pa.

Mr. E. T. Allen, District Forester at Portland, Oregon, has accepted a position with the Weyerhausers. Mr. C. S. Chapman will succeed him.

Mr. S. N. Spring, who has been working as a consulting forester since leaving the Forest Service last February, has accepted the post of State Forester of Connecticut. He will be assisted by Mr. W. O. Filley.

COMMENT.

Catalpa-Brown has succumbed as far as the publication of Arboriculture is concerned, which with the October number comes to an end, in a beautifully illustrated issue in honor of the Catalpa-Tree. Mr. Brown reminded us of the German professor who on his death bed bemoaned his mistake in having devoted his life to the study of the definite article instead of confining himself to the *casus accusativus*. It is questionable whether any one species of tree can show such an amount of literary devotion as Mr. Brown has bestowed on the Catalpa. It is useful to have men with one idea if that idea is not run into the ground. Catalpa is good in its place, but it is not any more a cure-all than Eucalyptus.

We must call special attention to a sentence in the article on nursery practice, briefed on p. 463, which has reference to the occurrence of the White Pine rust in the Halstenbek nurseries. It will perhaps allay the fears of those who saw the end of trade relations with Germany in the line of seedlings to learn that the rust *once was,* but now is *not any more* found in Halstenbek. We can trust the thoroughness with which such things are handled in Germany. Yet it will do no harm to scrutinize carefully all importations.

Dr. Schenck, after an experience of fifteen years with Mr. Vanderbilt, writes: "It is obvious that private individuals, in the long run, will never practice timber forestry, whilst corporations might be induced by proper tariff legislation, proper tax legislation, and proper fire legislation, to indulge in long-time investments of the character required in business forestry."

We are tempted to bowl over even these pillars of private forestry, especially those built of tax releases and tariff reductions or increases, and leave only the one incentive, the pocketbook (which is but little affected by taxes and tariffs) as the only persuasive argument for private forest management. While there are still cheap ready-made forests to be had, while there are still endless opportunities to reap speculative values, in other words, while the new world is still unsettled, only very special conditions can justify private capital in engaging in forestry as a business. The need of the country at large to husband its resources, to protect itself against damage by waste, and against ruination of fertile areas, that need will never be met by private enterprise; it is the function of the State. Nor should it be overlooked that the people will have to pay for this insurance of the future, reaping the benefits in the long run.

We regret to anounce that on November 20th, the well-known editor of the American Lumberman, Mr. J. E. Defebaugh, succumbed to the attacks of a malignant cancer. Mr. Defebaugh was a selfmade man of high ambitions, who exerted himself in later years on behalf of forestry, giving considerable space and personal discussion in his journal to the subject, thereby becoming an important factor in advancing forestry interests among lumbermen. He was also the author of a voluminous History of the Lumbering Industry in United States and in Canada, of which two volumes have appeared.

Born in Williamsburg, Pennsylvania, on March 28th, 1854, he learned the printer's trade. In 1877 came to Chicago and became a correspondent of trade journals. In 1885 he established The Timberman, in competition of the North Western Lumberman, with which in 1899, a consolidation was effected under the name of the American Lumberman. Of this enterprise he became, in 1906, the sole owner. In him the forestry interests lose a staunch and sane friend.