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THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

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

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

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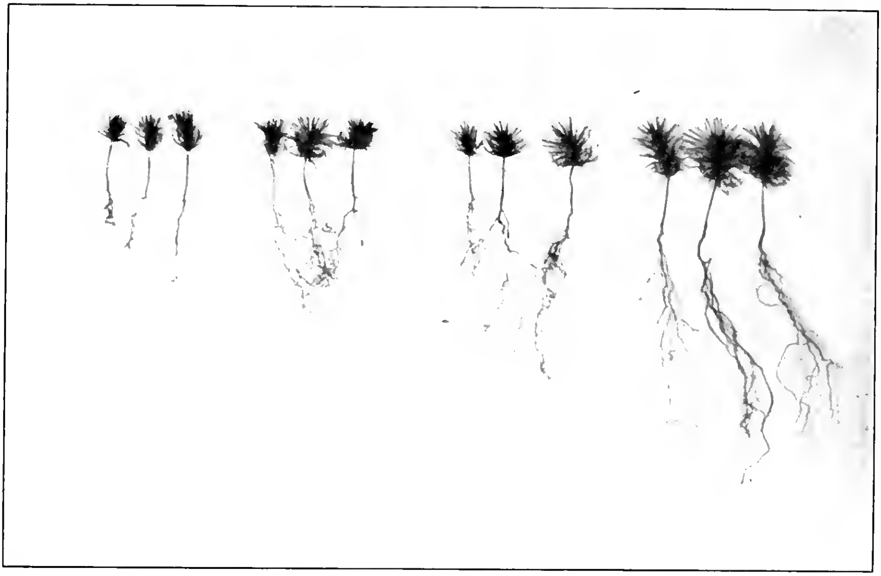

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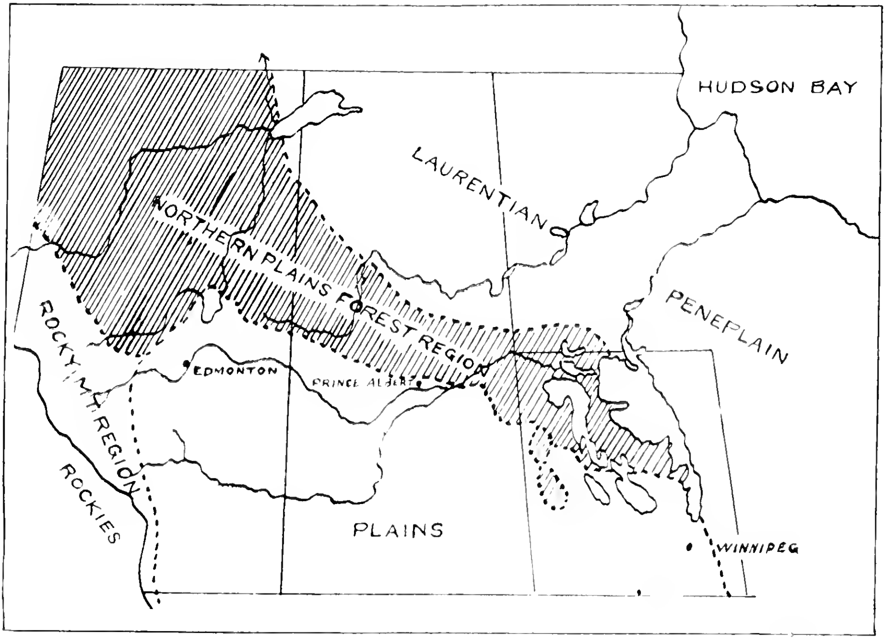

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FORESTRY QUARTERLY

VOL. XIII MARCH, 1915 No. 1

THE POINT OF VIEW[1]

Almost up to the present time the great work that has confronted those engaged in putting forestry into practice in the United States has been the development of an adequate system for the administration of the enormous acreage that in the space of two decades has been made into National and State forests. The administrator and organizer has stood head and shoulder above all those engaged in forestry. The thorough student, the philosopher, the knower of the forest in a scientific sense has been lost sight of among the builders of fences, trails and cabins. Far be it from me to criticize this situation. It is the natural order of development. I simply want to emphasize the brightness of the halo that it has placed upon the administrator and the shadow that it has cast for the time being upon the knower of the woods After our system of administration has been developed, our boundary lines run, our cabins built, and our land classification made, the halo of the administration will fall away in luster and the sun will shine on the technician, because it is only through his efforts that our wild and scarred woodlands can in an orderly manner proceed toward a normal forest.

Although it has been but one or two years since Gifford Pinchot remarked that forestry was advancing everywhere in the United States except in the woods, it is my firm belief that the past few years has experienced a notable advance in the woods. We are making progress toward a normal forest. This advance is noticeable all along the line but mostly in national forestry, less in State forestry, and least of all in private forestry.

[1]Portions of an address by Professor Toumey, Director of the Yale Forest School, at the fourth annual dinner of the Foresters' Club at the University of Toronto held January 22, 1915, entitled "Observations on Forestry in the United States at the Present Day," which dealt with the development of forestry during the past two decades and its effect upon the profession.

Up to the present time the demand for technically trained foresters has been almost entirely confined to governmental positions in National and State Forestry and for teachers in the constantly increasing number of schools. In all governmental positions the administrators have been far more important than the technicians. The schools could not at first supply the men needed, and scores of men without training and without a forester's point of view became the managers of the rapidly increasing acreage of public forests. As the trained men from the schools became available, they were often placed under and were dominated by the non-technical men then in charge. In many instances the older men, entirely without a technical training and often without a college training as well, saw little or nothing in technical forestry and looked upon their work as purely administrative in character. The school men were inclined at first to over-emphasize the need for silvicultural operations and other technical work on the wild lands that they found themselves called upon to help administer and develop.

What was the result? Almost up to the present time the non-technical man has held his own with the school man, provided he is naturally endowed with as strong personality and is equally effective as an administrative officer. The reason for this is that heretofore our forestry has been made largely of an administrative character.

More than one thousand men have received degrees in forestry and presumably a technical training during the past decade in the United States. These men without experience, but with their heads filled with normal stand, sustained yield, and silvicultural systems and the like, have rolled up their sleeves hoping to transform the wilderness into orderly arranged woodland. Instead of improvement thinnings, the development of working plans and other operations requiring the application of their technical knowledge, they have been chiefly engaged in fighting fire, building trails and cabins, and in doing an infinite variety of administrative work which the average non-technical man, because of greater experience, is better able to perform satisfactorily. The school men have often been told by the men without a technical training, with whom and under whom they often work, to forget their training because there is no place for it in American forestry. I have personally talked with a number of technically trained men, after five or more years' work on the public forests, who contend that their technical training was useful in getting them by the civil service examinations, but they see little further use for it. These men have lost their point of view and have been won over by those who see nothing but administration in the care and development of our public forests. Let me tell you, these men are out of the race. I am glad to say that most men trained in forestry have not lost their point of view. The infinite variety of administrative duties—building trails, stringing telephone wires, and fighting fires—has not obstructed the clear light ahead. They see the normal forest ahead—it may be one hundred or two hundred years. With this ideal to work toward, however, they are in the race and must inevitably become the constructive force in the upbuilding of forestry on this continent.

I was told the other day by one who should know that, taking American foresters as a whole, their greatest defect is the lack of the scientific spirit, their imperfect knowledge of the forest—its natural history, its growth and development and the lack of appreciation that this knowledge lies at the very foundations of forestry.

Let me tell you this. From now onward the technically trained man with unwarped vision will have more and more opportunity to apply his technical knowledge. The day of the non-technical man as a directive and operative force in American forestry is going to disappear, and it will be for the great good of forestry when it does. I beg of you to remember that forestry is a profession—a profession that has for its foundation scientific facts and laws, a profession that has for its guiding star a normal forest. We may never attain it. We cannot be foresters in the true sense unless we accept this ideal and work toward it.

The great car which is now moving across the country carrying the forestry of today into the forestry of the future is equipped with both drive wheels and dummy wheels. The former make the car go, the latter the car makes go. I cannot help but believe that the drive wheels of this car must be welded from sound judgment, gleaned from the broad field of thorough technical knowledge, and tempered by practical experience. All the tempering in the world will not make the drive wheel unless the metal has been properly wrought to begin with.

A TOWN FOREST IN AMERICA

BY PAGE S. BUNKER[1]

Emphasis has rightly been placed upon the fact that in order to prove forestry an economic success, the forest land must be maintained continuously in its use as such for long periods of time. While by no means impossible, it has been decidedly difficult to establish this permanency of use in the case of private holdings in America. In notable and important instances, striking progress has been made, but, in general, the time element has been a deterrent factor in the practice of forestry by private owners.

Public institutions, on the other hand, are customarily regarded in larger terms, and provided the purpose to which they are devoted is the highest within their capacity, their continuity ordinarily is not subjected to interruption. The aims and progress of the great national forests of the United States and of Canada are well known to foresters and in a general way to the better informed portion of the public. From their location alone, however, it is evident that these large forest areas can be of but small service as object lessons to the people at large, of whom probably more than ninety-nine per cent. have no direct knowledge of their significance. Provincial and State forests come much nearer to the public, and under fairly favorable circumstances their beneficial effect upon the interests of the country at large can be more readily demonstrated than is possible in the case of national reserves.

It is possible, however, to bring the demonstration of forestry methods still closer to those who pay for the administration of National and State forests, and upon whose ultimate approval depends the entire future of public and private forestry. To bring about general recognition of the practical possibilities of forestry there must be something more concrete than mere propaganda. Examples of practical forestry must be inaugurated where they may be exhibited and explained. The economic status of forest conservation must be as clearly demonstrated as is that of scientific agriculture of any other form of economic

[1]Mr. Bunker is apparently the first "city forester" with a real forest to manage.

production. To the great mass of the population, the town or city forest can be the only means of demonstrating the aims, methods and results of conservative and scientific handling of timber lands.

The city of Fitchburg, Massachusetts, has recently established a municipal forest. Within the Commonwealth of Massachusetts there are about one million acres of idle land. The greater part of this land is more valuable for the growing of timber than for any other purpose. The steady decline of those industries directly dependent upon the productivity of the soil has become a matter of grave concern to the more far-sighted of the men prominent in civic and industrial life. The Fitchburg movement means, among other things, that an established but progressive community of straight-thinking people has decided that practical forestry is worth trying at first hand, as an effort to rehabilitate the economic importance of absolute forest land now lying idle. The order establishing the forest was passed by the city government without a dissenting vote.

The legislative act under which the Fitchburg City Forest was established constitutes the land in such cases as public domain to be devoted to the culture of forest trees. The management is placed in the hands of the city forester, or if no such officer is employed by the city, the State Forestry Department may be given the control and jurisdiction. A number of States have passed acts under which muncipal forests may be established, but, as far as is known, no other city or town in America has as yet taken advantage of such laws. Many communities have watershed areas and woodland parks which are to some extent managed on forestry principles, but in such cases the prime objects of the reservation are for the purposes stated, and not specifically for the economic practice of forestry.

It is inevitable that other cities will follow the lead of Fitchburg and such a movement will have a considerable bearing upon the professional scope of municipal forestry. Heretofore, city foresters, generally speaking, have been little more than arboriculturists. With the establishment of town forests, the municipal forester's work at once approximates its proper scope. The town and city system of Massachusetts is peculiarly adaptable to a comprehensive local forestry policy. Each municipality includes not only business and residential sections but also, in most cases, rural and woodland districts. Under the usual combinations of functions in the office of the city forester, the latter may have charge of the suppression of destructive forest insects, protection against forest fires, planting and care of park and street trees, and various related matters. With the management of the municipal forest added to the former lines of work, it is evident that the field will be greatly broadened.

In addition to the town forest, the city of Fitchburg already possesses extensive watershed areas and a large woodland park, together with a number of smaller parks and playgrounds. Freed from the burden of numerous collateral considerations, therefore, the town forest may be managed primarily as such. A working plan for the areas already acquired is in course of preparation, and steps are being taken toward the inclusion of additional land. Compared with the possibilties, the beginning is necessarily small. Apart from its intrinsic moment, however, the Fitchburg movement is significant as the beginning of a new development in American forestry.

In leading the town forest movement, the city of Fitchburg was especially fortunate in possessing title to a number of tracts of land acquired in the past through various means and for a variety of municipal purposes. Among these areas were four separate tracts of eight, sixteen, thirty-one, and fifty acres, respectively, which for decades had been lying idle and unused for any purpose whatever. Of the aggregate area, about twenty-five acres are covered with White pine aged 30-60 years. Thirty acres are in small hardwoods and sprouts, and the balance is brush and worn-out pasture. The question of the disposal of these unused lands narrowed down to the alternative of selling them for what they would bring, or of permanently and legally segregating them as public domain for the practice of forestry; and the forestry plan prevailed. The transfer to the municipal forest of a larger tract of about 200 acres is in contemplation. Certain legal questions affecting the ultimate disposal of this particular tract, however, have not yet been definitely settled, but it is expected that an early solution will be determined.

The formal establishment of the town forest occurred so late in the year that as yet there has been little opportunity for development work, and the expenditures to date, therefore, have been practically nothing. The plan under way provides for the planting of the non-timbered areas to White pine and for the extension of the pine planting to the suitable portions of those parts now in small hardwoods and sprouts, it being desirable to restore as much of the forest as possible to its original type of a pure stand of White pine. A close study is being made of the local markets for forest products and it is hoped that the returns from the improvement cuttings of the timbered portions of the forest will to a considerable extent offset the cost of the proposed planting. Even at this time of small beginnings, hope is entertained that with the inevitable addition of other areas, the municipal forest of Fitchburg will eventually bear the same relation to the city that is borne to their respective communities by the town forests of Europe.

A PRACTICAL SYSTEM OF LOGGING COST-ACCOUNTING

By S. B. Detwiler

The importance of an accounting system that will show the comparative costs of the various logging operations is easily understood. The primary requisite is that the system be simple, so that it may be kept by the camp clerk without imposing an excessive burden on him. The logging cost-accounting system[1] explained in this article was devised and used by the writer with very satisfactory results. It is also well adapted to nursery work and other lines of forestry.

The first step in starting a cost-keeping system is to determine the amount of detail which is necessary or desirable. This is best done by outlining the camp activities. The following division of the work of the camp into accounts or projects is convenient, but any arrangement may be used that will form the necessary basis for comparison.

General Accounts.

1. Superintendence (foreman, clerk).
2. Store.
3. Kitchen (supplies, cooking, labor, fuel, garden, etc.).
4. Stable (labor, feed, medicine, repairs to harness, making hay, etc.).
5. Camp (bull cook and miscellaneous labor, toting, miscellaneous repairs, and miscellaneous supplies).
6. Shop (blacksmithing, filing, carpentering, supplies for shop work).
7. Tools and implements (shop tools, camp tools, logging tools, kitchen utensils).
8. Equipment (permanent buildings, machinery, barges, etc.).

Logging Accounts.

9. Road work (construction, icing, rutting, snowing).
10. Felling (under-cutting, sawing down, bucking).
11. Skidding (swamping, skidding, decking).

[1] On account of limited space the various forms mentioned cannot be reproduced, but may be seen by consulting page 54 of the *American Lumberman* for May 20, 1911.

12. Banking (loading, hauling, landing).
13. Rafting (or loading on cars).

Forestry Accounts.

14. Burning brush (piling and burning).
15. Protection (patrol, fighting fire).
16. Planting (nursery, planting).
17. Thinning.
18. Estimating.

The Moore system of loose-leaf sheets and binders was used for keeping all accounts. The sheets (5 inches by 8 inches) are of convenient size and may be arranged in any order that is found desirable. The binders are quickly and easily operated and a sheet may be removed or inserted without disturbing the others. For a small camp, one binder is sufficient for all accounts. For a camp of 125 to 150 men three binders are required, one for time sheets, one for general accounts and one for logging and forestry accounts, with transfer binders when necessary.

The details of operating the system are as follows:

1. *Time Sheet*—Time is kept in the actual number of hours worked, by two daily visits of the timekeeper to each crew. Each man and each team has a separate monthly time sheet, on which the time is entered by projects. It is advisable to tally time for the actual occupations in which the men are engaged, and enter the number of the project to which the work belongs in an adjoining column. In transferring the figures to other sheets only the totals for the main projects to which such occupations belong need be used. The advantage of detailed time-keeping lies in the readiness with which the cost of special phases of the work may be obtained at any time. Because of the small size of the sheet, two lines are devoted to each project, the upper line for the first half, and the lower line for the last half of the month. Six separate accounts may be tallied on one sheet; if a man works on more than six kinds of work in a month, a second sheet is used. The last three columns on the right side of the sheet provide for the total number of hours of work, the rate, and the amount due on each project for which time was tallied. At the bottom of the sheet space is provided for total earnings, deductions and balance due for the month, balance previously due, and total balance to date. The back of the time sheet is used as a journal to itemize store account, laundry, hospital fees, transportation, and payments made during the month.

2. *Monthly Pay Roll*—This is a large sheet, to which the totals on the time sheets are transferred and summarized by projects. The total wages, deductions and number of the pay check for each man are also included, in ordinary pay roll form.

3. *Time Summary*—A sheet similar to the pay roll is used to summarize the number of hours of work on each project, including horse labor. The number of hours worked on each project is then reduced to days, using ten hours as the unit.

4. *Boarding Account*—An inventory of kitchen supplies and horse feed is taken at the end of each month. The cost of the supplies consumed is added to the cost of kitchen and stable labor, as shown on the pay roll under those projects. The daily cost of board of men and teams is then computed, using the total number of work days as shown in the time summary (less the number of days of kitchen and stable labor) to obtain the unit cost per man or team. Order sheets, in which the names of the various supplies are printed alphabetically with adjoining columns for amount, price, and value, are useful in taking these monthly inventories. The work is further simplified by keeping a price sheet posted in the office on which all articles purchased are listed. This sheet has a number of columns after each article listed, in which the clerk enters the latest prices from the bills as they come in.

5. *Monthly Report*—This is a monthly summary by projects (except kitchen and stable accounts) of the number of days of labor, wages, and the pro rata cost of board for men and teams. A column provides for the cost of tools, equipment and supplies purchased (other than those already cared for in the kitchen and stable accounts). Additional columns are provided for the total cost of each project, the material handled on each project, and the cost per unit of material handled. The condition of the work and the amount of material handled may be learned approximately, in those projects where no scaling is done, by having each crew report daily the number of logs handled. This also encourages competition among the crews.

6. *Project Reports*—A form similar to the monthly report is devoted to each project. On this sheet the figures given in the monthly reports are entered by months, in regular order. The project reports constitute the camp record, the monthly report being sent to headquarters.

7. *Annual Report*—The annual report is a summary of the figures given in the project reports, using a form and arrangement identical with the monthly report. An inventory of tools and equipment belonging to all of the general accounts is made at the end of the year or season and the annual cost ascertained. The expenses of the general accounts, exclusive of kitchen and stable accounts (superintendence, camp, shop, tools and equip-

ment), may be distributed among the logging accounts, making the basis of division either the total days' labor, or the total wages expended on each project.

8. *Journal-Ledger Forms*—All expenditures other than labor (stores, tools and equipment) are posted directly from the bills to journal-ledger forms under the proper project headings. The bills are then O.K.'d and sent to the main office for payment. The items are entered singly, with the name of the firm from which the purchases are made. These are totaled monthly, for use in the monthly report. At the end of the year the journal-ledger sheets for shop, tools and equipment accounts are added to the inventory sheets of these accounts which were made at the beginning of the year, making a complete list to use as a basis for the new inventory. The same journal-ledger forms are used for outside accounts in cases where bills are paid from the camp instead of from the main office.

This system is simple and except for a day required at the end of the month to make out the pay roll, time summary, boarding account and monthly report, it makes no greater demand on the clerk than the old style journal and ledger system. It is flexible, compact and cumulative—that is, the cost of the work from month to month is shown, and it is an easy matter to learn the exact expenditure at any time. A close analysis of comparative costs is made possible. And this is not only interesting, but very useful in leading to better methods of conducting the work.

TABLES FOR DETERMINING PROFITS IN FORESTRY

By W. D. Sterrett and W. B. Barrows

In considering the advisability of forestry for any particular area or species, the important thing is to determine what interest rate on the capital invested can be realized from such an enterprise. Probably the most practical method is to consider the capital as including only the initial investment in the land and cost of forming the forest crop.[1] In this case the annually recurring expenses for taxes and administration, after allowing a liberal compound interest rate (6 per cent.) on them, are deducted from the gross profit when the crop reaches maturity and is sold. The net profit is considered as the gross profit (total stumpage value of the crop at end of rotation) less the cost of formation and less the annually recurring expenses for the whole rotation compounded at 6 per cent. The land is considered of the same value at the end as at the beginning of the rotation and, therefore, its cost is not deducted. The advisability of forestry can be readily determined by figuring what compound interest rate this net profit represents, for the entire rotation, on the initially invested capital. The following formula is used for this calculation[2]:

$$p=100\left(\sqrt[n]{\frac{S+L-A}{L+F}}-1\right),$$ where p = compound interest rate, n = number of years of rotation, S = stumpage value per acre at n years, L = cost of land, F = cost of formation, and A = cost of administration and taxes in n years at 6 per cent. compound interest. The net profit will equal S − F − A. In the tables the column headed "Expenses" gives the values of A.

It will be seen from the above that, in order to predict the profit in and advisability of forestry in any particular case, it is necessary to predict what the yield and its stumpage value will be in a certain number of years, and also the annully recur-

[1] "Forest Management of Loblolly Pine," Bulletin 11 of the Department of Agriculture, by W. D. Sterrett, and article by W. B. Barrows, Proceedings of American Foresters, Vol. VIII, No. 3.

[2] This method is conservative in that it does not allow for possible returns from thinnings, which in Europe often equal 25 and up to 40 per cent. of the final returns.

Rates of Interest Received on Different Initial Investments in Timber Growing Calculated for Various Yields, Stumpage Values, Ages, and Costs of Land and Establishment

Yield per Acre—Board Feet; and Stumpage Values per M Feet

Initial Investment					5 *M*				10 *M*				20 *M*				30 *M*				40 *M*				50 *M*			
					$5	$10	$15	$20	$5	$10	$15	$20	$5	$10	$15	$20	$5	$10	$15	$20	$5	$10	$15	$20	$5	$10	$15	$20
Age, Years	*Land*	*Establishment*	*Total*	*Expenses*[1]	*Profit, Per Cent.*[2]				*Profit, Per Cent.*				*Profit, Per Cent.*				*Profit, Per Cent.*				*Profit, Per Cent.*				*Profit, Per Cent.*			
30	5	0	5	7.90	5.1	7.8	9.3	10.4	7.8	10.4	11.9	13.0	10.4	13.0	14.6	15.7	11.9	14.6	16.2	17.3	....	....	....	....	....	....	....	....
	5	5	10	7.90	....	5.3	6.8	7.9	5.3	7.9	9.4	10.4	7.9	10.4	12.0	13.1	9.4	12.0	13.5	14.6	....	....	....	....	....	....	....	....
	10	5	15	11.86	....	4.0	5.4	6.5	4.0	6.5	7.9	9.0	6.5	9.0	10.5	11.5	7.9	10.5	12.0	13.1	....	....	....	....	....	....	....	....
	10	10	20	11.86	....	....	4.4	5.4	....	5.4	6.9	7.9	5.4	7.9	9.4	10.5	6.9	9.4	10.9	12.0	....	....	....	....	....	....	....	....
	15	10	25	15.81	....	....	3.7	4.7	....	4.7	6.1	7.2	4.7	7.2	8.6	9.7	6.1	8.6	10.1	11.2	....	....	....	....	....	....	....	....
	15	15	30	15.81	....	....	3.1	4.1	....	4.1	5.5	6.5	4.1	6.5	8.0	9.0	5.5	8.0	9.4	10.5	....	....	....	....	....	....	....	....
40	5	0	5	15.48	....	5.3	6.6	7.5	5.3	7.5	8.7	9.5	7.5	9.5	10.7	11.5	8.7	10.7	11.8	12.7	9.5	11.5	12.7	13.5	....	....	....	....
	5	5	10	15.48	....	3.5	4.8	5.6	3.5	5.6	6.8	7.6	5.6	7.6	8.8	9.6	6.8	8.8	9.9	10.7	7.6	9.6	10.7	11.5	....	....	....	....
	10	5	15	23.22	....	....	3.6	4.5	....	4.5	5.7	6.5	4.5	6.5	7.7	8.5	5.7	7.7	8.8	9.6	6.5	8.5	9.6	10.4	....	....	....	....
	10	10	20	23.22	....	....	....	3.7	....	3.7	4.9	5.7	3.7	5.7	6.9	7.7	4.9	6.9	8.0	8.8	5.7	7.7	8.8	9.6	....	....	....	....
	15	10	25	30.95	....	....	....	3.1	....	3.1	4.3	5.1	3.1	5.1	6.3	7.1	4.3	6.3	7.4	8.2	5.1	7.1	8.2	9.0	....	....	....	....
	15	15	30	30.95	....	....	....	....	....	....	3.8	4.6	....	4.6	5.8	6.6	3.8	5.8	6.9	7.7	4.6	6.6	7.7	8.5	....	....	....	....
50	5	0	5	29.04	....	3.3	4.8	5.6	3.3	5.6	6.6	7.4	5.6	7.4	8.4	9.0	6.6	8.4	9.3	10.0	7.4	9.0	10.0	10.6	7.9	9.5	10.5	11.1
	5	5	10	29.04	....	....	3.3	4.1	....	4.1	5.2	5.9	4.1	5.9	6.9	7.5	5.2	6.9	7.8	8.4	5.9	7.5	8.4	9.1	6.4	8.0	8.9	9.6
	10	5	15	43.55	....	....	....	3.0	....	3.0	4.2	4.9	3.0	4.9	5.9	6.6	4.2	5.9	6.9	7.5	4.9	6.6	7.5	8.2	5.5	7.1	8.0	8.7
	10	10	20	43.55	....	....	....	....	....	....	3.6	4.3	....	4.3	5.3	6.0	3.6	5.3	6.3	6.9	4.3	6.0	6.9	7.6	4.9	6.5	7.4	8.1
	15	10	25	58.07	....	....	....	....	....	....	....	3.7	....	3.7	4.8	5.5	....	4.8	5.7	6.4	3.7	5.5	6.4	7.1	4.3	6.0	6.9	7.6
	15	15	30	58.07	....	....	....	....	....	....	....	3.4	....	3.4	4.4	5.1	....	4.4	5.4	6.0	3.4	5.1	6.0	6.7	3.9	5.6	6.5	7.2
60	5	0	5	53.32	....	....	....	4.0	....	4.0	5.1	5.9	4.0	5.9	6.7	7.3	5.1	6.7	7.6	8.2	5.9	7.3	8.2	8.7	6.4	7.8	8.6	9.1
	5	5	10	53.32	....	....	....	....	....	....	3.9	4.6	....	4.6	5.5	6.1	3.9	5.5	6.3	6.9	4.6	6.1	6.9	7.5	5.1	6.6	7.3	7.9
	10	5	15	79.97	....	....	....	....	....	....	....	3.7	....	3.7	4.7	5.3	....	4.7	5.5	6.1	3.7	5.3	6.1	6.7	4.2	5.8	6.6	7.1
	10	10	20	79.97	....	....	....	....	....	....	....	3.2	....	3.2	4.2	4.8	....	4.2	5.0	5.6	3.2	4.8	5.6	6.2	3.7	5.2	6.1	6.6
	15	10	25	106.63	....	....	....	....	....	....	....	....	....	....	3.6	4.3	....	3.6	4.5	5.1	....	4.3	5.1	5.7	3.1	4.8	5.6	6.2
	15	15	30	106.63	....	....	....	....	....	....	....	....	....	....	3.3	4.0	....	3.3	4.2	4.8	....	4.0	4.8	5.4	....	4.4	5.3	5.8
70	5	0	5	96.80	....	....	....	....	....	....	3.6	4.5	....	4.5	5.5	6.1	3.6	5.5	6.3	6.8	4.5	6.1	6.8	7.3	5.1	6.5	7.2	7.7
	5	5	10	96.80	....	....	....	....	....	....	....	3.5	....	3.5	4.4	5.0	....	4.4	5.2	5.8	3.5	5.0	5.8	6.3	4.0	5.4	6.2	6.7
	10	5	15	145.20	....	....	....	....	....	....	....	....	....	....	3.5	4.2	....	3.5	4.4	5.0	....	4.2	5.0	5.6	....	4.7	5.4	6.0
	10	10	20	145.20	....	....	....	....	....	....	....	....	....	....	3.1	3.8	....	3.1	4.0	4.6	....	3.8	4.6	5.1	....	4.2	5.0	5.5
	15	10	25	193.59	....	....	....	....	....	....	....	....	....	....	....	3.2	....	....	3.5	4.1	....	3.2	4.1	4.7	....	3.7	4.6	5.1
	15	15	30	193.59	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3.2	3.8	....	....	3.8	4.4	....	3.4	4.3	4.8

[1] Five cents per acre annually for administration (including fire protection) and one cent on the dollar (full valuation) annually for taxes, with compound interest at 6 per cent.

[2] Calculated by the formula $p=100\left(\sqrt[n]{\frac{S+L-A}{L+F}}-1\right)$ where p= compound interest rate, n=number of years or rotation, S=stumpage value at n years, L=cost of land, F=cost of formation, and A=cost of administration and taxes in n years at 6 per cent compound interest.

ring expenses. The following tables aim to show for quite a wide range of yields and stumpage prices what will be the net profit and corresponding compound interest rate on a number of different initial investments. The annually recurring expenses are difficult to figure satisfactorily, but it is thought are liberally provided for by allowing for administration and taxes 1 per cent. annually on the value of the land plus 5 cents per acre annually, both compounded at 6 per cent.

These tables should be helpful in rough determinations, in particular cases, of the advisability of forestry and the financial rotation—the one which will yield the highest rate of interest. They indicate at once under what conditions forestry is advisable and are, of course, incomplete, but it is hoped to elaborate them to a considerable extent in the future. They also indicate the relative advisability of a policy of spending considerable money on cost of formation with expectation of getting large yields, as opposed to being content with small yields from stands established at slight cost.

The calculations are given only for yields and values which will pay 3 per cent. or more, compound interest. The initial investments given may be considered as roughly applicable to a large number of combinations of cost of land and cost of formation, which, when added together, will give the same totals as any of those represented in the tables. For instance, it has been found that, for a given yield at any age and for equal stumpage prices, the compound interest rate on the original investment will be about the same whether it consisted in $10 for land plus $5 for formation, or $5 for land plus $10 for formation. Thus with a yield of 5,000 board feet per acre and a stumpage value of $10 per thousand at the age of 25 years, the interest rate is 5.1 per cent. in the first case and 4.9 per cent. in the second.

Interest rates for values not shown in the tables can be obtained by interpolation or curving. Thus, other factors being equal, the rate for a stand in which the initial investment is $12 would be between the rates for $10 and $15 investments. By plotting the values for $5, $10, $15 and $20 investments, using the quantities of capital invested as abscissas and the rates of interest as ordinates, a curve can be drawn which when read at the $12 value will indicate the corresponding rate of interest.

REFORESTATION OF BRUSH FIELDS IN NORTHERN CALIFORNIA

By Richard H. Boerker

One of the greatest silvicultural problems which confronts the Forest Service in California is the reforestation of the vast brush fields in the central and northern parts of the State. Rough estimates place the total area so occupied at 2,000,000 acres. This area instead of producing timber worth from $30 to $50 per acre, is occupied by brush of little value even as browse. Moreover, with such an enormous area of potential forest land lying unproductive, the State has a problem not only of great importance to itself, but one of great economic importance to the nation.

Unlike the chaparral regions of southern California, this brush is only a temporary type and is, in most cases, the result of fire having destroyed the forest cover. In the days before the Forest Service system of protection was maintained, fire, originating in various ways, swept through the timber unmolested. Not a small part of our brush areas may be attributed to "light burning"[1] which was practised for many years by Indians and more recently by stockmen. In most cases, in from 5 to 10 years after the fire has consumed the timber, the brush takes possession of the land; the length of time depending upon the severity of the fire, the presence of brush plants in or near the fire area, and other conditions. After the brush has established itself, if seed trees are nearby, seedlings will get started and fight their way through the brush. It takes from 15 to 30 years for a seedling to get large enough to overtop the brush, this depending upon the height of the brush, the tree species, and other factors. This is usually an intense struggle and, even if a sapling has succeeded in winning out, it is of small size as compared to forest-grown trees of the same age. In course of time, if the stand of saplings becomes dense enough, the brush underneath will be killed for lack of sunlight and a forest cover will begin to form. This is nature's

[1]The methods and results of light burning are described in detail in an article, "Light Burning versus Forest Management," F. Q., Vol. X, No. 2, pp. 184 ff.

very slow process of reestablishing a forest cover. If there are no seed trees near the burned area, it is only a matter for conjecture how long it will take a forest to reestablish itself.

One of the important lines of investigation which the Forest Service has undertaken is to assist nature in reclaiming these useless areas. Planting has been resorted to in favorable localities where the absence of seed trees makes the process of natural regeneration an extremely slow one. It is the purpose of this paper to describe an apparently successful operation in reforesting a brush area of this kind.

The Lassen National Forest has about 150,000 acres of this brush land and some of it can be seen from the top of any mountain one may choose to climb. The individual areas vary in size from small patches to areas covering as much as half a township. The species are mostly evergreen xerophytes and many of them, or at least close relatives, may be found in the well-known chaparral regions of southern California. A list of the more important species in the order of their abundance follows:

1. *Arctostaphylos glauca*—great berried manzanita.
2. *Arctostaphylos manzanita*—common manzanita.
3. *Ceanothus velutinus*—snowbrush.
4. *Ceanothus cordulatus*—whitethorn.
5. *Amelanchier alnifolia*—serviceberry.
6. *Ceanothus integerrimus*—bruebrush.
7. *Castanopsis chrysophylla minor*—chinquapin.
8. *Prunus demissa*—chokecherry.
9. *Prunus emarginata*—bittercherry.
10. *Cercocarpus ledifolius*—curlleaf mahogany.
11. *Cercocarpus parvifolius*—birchleaf mahogany.
12. *Ceanothus prostratus*—squaw carpet.
13. *Uva-ursi paulta*—dwarf manzanita.

With the exception of the large sagebrush areas, these species constitute approximately 95 per cent. of the brush areas referred to in this article. The three most important species, which make up most of the large areas, and the per cent. which they represent in these areas are: Manzanita species, 60 per cent.; snowbrush, 20 per cent.; whitethorn, 5 per cent.; all others, 15 per cent. Besides the species enumerated above, there are from 40 to 50 others which, however, are of minor importance in reforestation.

Next to the matter of abundance, the most important consideration is tolerance. With the idea of tolerance are coupled the ideas of density of foliage, ability for man to penetrate it, amount of direct and diffused light admitted to the seedlings underneath, and the possibility of allowing young trees to start under it and penetrate through it. Such species as manzanita, snowbrush and cherry are less tolerant than whitethorn, chinquapin, and serviceberry, and hence are more favorable in every respect for planting purposes.

VALUE OF THE CHAPARRAL TYPE

In addition to being only a temporary type, the chaparral is a transitional type between timberland that has been swept bare by fire and timberland that is actually producing timber. This type seems to be an intermediate stage through which most of our timberlands which have been swept bare by fire must pass before they can again revert to timberland. There are many reasons why the forest will not take direct possession. When fire has finished its work there is usually nothing left but the bare mineral soil; even this has suffered severely from the heat. The soil has lost its humus condition and its fertility. The valuable nitrogen has gone off in the smoke and has left the less valuable mineral elements. In addition to this, the light, shallow, volcanic soils are left to the mercy of their worst enemies, drought and erosion. Our long dry season deprives these soils of every vestige of moisture, and if it were not for the brush, our heavy rains and snows and high winds would soon transport most of these soils, leaving nothing but the bare rocks. To wait for the forest to slowly take hold of these burned-over areas would be to expose our soils to all these conditions for many years before there would be a stand dense enough to protect the site.

The so-called brush species are the only plants that can endure these adverse conditions, so that, in establishing themselves on these burned areas, they perform a most valuable silvicultural function. They not only prevent the soil from being transported, but they also put the soil into a condition so that it can again produce timber. Brush, besides enriching the soil with decaying leaves, forms temporary forest conditions for the young seedling.

The humus, which is formed from the yearly fall of leaves from the brush, due to its hygroscopic character, increases the water-holding capacity of the soil. Humus also acts like a cultivator in that it keeps the soil loose and flocculated, and for this reason, too, the soil will hold more water. The litter and leaves from the brush, and the brush itself, forms a cover for the soil which prevents evaporation. In consequence, not only does the soil gain more water but it loses less. This is very important on account of the long dry season. Brush affords the young seedling a certain amount of shade, which, while of minor importance to the moisture element, may be likened to the shade of the mother trees in the forest which prevents excessive transpiration through the leaves.

SITE CONSIDERATIONS IN PLANTING

Before going into the details of the work, a brief discussion of the site conditions under which this planting must be done may be in order. Especially is the discussion of climate important to show why fall planting is necessary. The most characteristic elements of the climate of this region are: (1) a long dry season; (2) regular fall rains; (3) frosts during the growing season, and (4) a heavy snowfall. Of these the first two are of the greatest consequence. Only 2 per cent. of the total annual rainfall occurs from June 1 to September 30, hence this period constitutes the dry season. The regular fall rains come in the latter part of October and November. Spring planting would subject the young plants to the long period of drought just at the critical period of their growth. Hence fall planting, just preceding the rains, is more desirable, and was in this case resorted to. Frosts may occur at almost any time of the year above an elevation of 5,000 feet. At the higher elevations huge snowbanks keep the soil well supplied with moisture until late into the summer.

The two factors which are apt to cause failure both at the time of planting and subsequently are lack of soil moisture and extreme temperatures. Of the two, the former is the more important.

Of the two general slopes of the Sierras, the east and the west, the latter is from every standpoint the more favorable. On the east slope there is much danger from drought, due principally to the small amount of precipitation, high summer temperatures, and a high degree of insolation. The west slope, being in the path of the humid winds from the ocean, has a more equable climate; that is to say, neither the daily nor the seasonal extremes of temperatures are as great as on the east slope. The statistics of the United States Weather Bureau show that for the same elevation and same latitude on both slopes there is from 10 to 25 inches more rainfall on the west slope; the mean monthly temperature for January is from 3° to 5° higher and the mean monthly temperature for July is from 1° to 4° lower than on the east slope. The average date of the latest killing frost is from 10 to 12 weeks earlier in the spring on the west slope and the average date of the earliest killing frost is from two to five weeks later in the fall. This makes the average growing season about 200 days on the west slope, as against only 135 on the east slope.

SELECTING PLANTING AREAS

For the purpose of this experiment in reforestation two distinct plantations were made—one on the east slope and one on the west slope of the Sierras. The seedlings were shipped from the Pilgrim Creek Nursery at McCloud, California. Regarding the site and the shipments, the following is of interest:

	East Slope Area	*West Slope Area*
Elevation	5,600 feet	5,000 feet
Area	18 acres	18 acres
Aspects	Northern and northeastern	Northern Northwestern Western Southwestern Southern
Soil	Fine, deep loam	Sandy loam with gravelly areas
Density of brush	50 per cent medium 50 per cent dense	33⅓ per cent open 33⅓ per cent medium 33⅓ per cent dense
Stock: Yellow pine	13,500 (1-1)	12,500 (1-1)
Yellow pine		1,000 (1-2)
Sugar pine	1,000 (2-1)	1,500 (2-1)
Incense cedar	500 (1-1)	1,000 (1-1)
Method of shipment	Express	Freight
Shipment by rail	131 miles	201 miles
Hauled by team	100 miles	15 miles
Total days en route	7 days	11½ days

THEORY AND METHOD OF PLANTING

The theory upon which the planting work was based was that the young plants needed protection and shade after they had been planted. The soil should be shaded to reduce evaporation to a minimum and the young trees should be shaded to prevent transpiration through the leaves. For these reasons, wherever it was possible the trees were planted on the shady side of the individual brush plant, viz: that side which gets the least direct sunlight. Temperatures in the shade of the brush are cooler in the warm part of the day and warmer in the cold parts of the day than in the open. Evaporation of moisture from the soil is important both winter and summer, hence planting under evergreen brush is much more advantageous. Snow lies longer under the brush and hence feeds the soil with snow water for a longer period of time than is the case in the open places. The moisture of the soil is distributed somewhat differently in the shade of the brush than in the open. A careful investigation of the condition of the soil directly at the stool of the brush plant and then at various distances away from the stool, until one gets out on open ground, reveals the following facts: Directly in the shade of the brush plant, and especially those places that get the minimum of direct sunlight, there is first a layer of leaves and under this a layer of humus from ½ to 1 inch deep. This latter layer together with about an inch of humus soil directly underneath comprises the soil layer of greatest water content. As one digs down, the moisture content gets less, down to a depth of about 15 inches, below which the moisture content remains practically constant. In the open, away from the brush plant, there are no leaves and humus. The top layer of soil is the layer of minimum water content, drier than the driest layer in the other case. From 6 to 12 inches there is not much more moisture and at about 20 inches there is not as much moisture as there is at 12 to 15 inches in the soil under the brush plant. This difference is more marked when contrasting the soil to the south of a brush plant with that to the north than it is when contrasting the south side with either the east or west. Not only does the soil in the shade of the brush absorb more water, but it loses less than the soil in the open. From the standpoint of soil moisture, therefore, it seems reasonable to assume that a young tree would endure our long droughts much better if it were placed in the shade of the individual brush plant.

The trees were planted about 6 feet apart each way, but this arrangement could not be strictly adhered to on account of the distribution of the individual brush plants. Holes were dug with a mattock and behind the digger came the planter with a canvas water bucket containing seedlings. Each pail contained a few inches of water to keep the roots of the seedlings constantly moist. A small area in the shade of the brush was selected which was free from dead branches, rocks, etc., where a man could work with a mattock and where planting could be done without much preliminary work. The two crews averaged from 250 to 275 trees per man per day, but often the work was a good deal slower than this, especially in the dense brush.

WEATHER CONDITIONS AT THE TIME OF PLANTING

Weather conditions at the time of planting, in the opinion of the writer, is one of the most important factors which determines the initial success of a plantation of this kind. On the east slope the days were bright and clear. At noon the temperatures were very high, while every night the temperatures fell below the freezing point and sometimes as low as zero. In peculiar contrast to this the weather on the west slope was mild. The days were mostly cloudy. On one or two days it rained and snowed. The days were usually warm and the nights cool; only on one or two occasions did the thermometer reach freezing point. The Incense cedar, Sugar pine, the Yellow pine (1-2) and about 1,000 of the Yellow pine (1-1) were snowed under for six days prior to planting. Following the snowstorm, the weather became very mild and the snow melted off completely. The planting work was then completed, although without doubt the trees had suffered considerably from the exposure. From this it will be seen that, except for the snowstorm, weather conditions were much more favorable on the west slope than on the east slope. Doubtless this had a considerable bearing on the success of the respective plantations; at least the plantation, which was made under the unfavorable conditions, did not succeed.

COSTS PER ACRE—(36 ACRES)

Species	*Cost of Trees per M*	*Cost per Acre (860)*	*Cost from Nursery to Site*	*Cost of Planting*	*Total*
Yellow pine	$11.78	$10.13	$2.23	$8.89	$21.25
Sugar pine	12.41	10.67	2.23	8.89	21.79
Incense cedar	20.30	17.46	2.23	8.89	28.58
Average apportioned by number of each species					$21.53

According to the latest data available from the nursery, the costs of raising stock have been materially reduced. By planting the accessible brush areas first, thereby reducing transportation charges, and by planting less trees per acre, the cost of establishing a plantation could, if undertaken on a commercial scale, be reduced considerably.

RESULTS

Both areas were examined by the writer in July, 1914, about 21 months after the planting was done. For reasons difficult to determine, the plantation on the east slope was a total failure, less than 5 per cent. surviving. The causes of this failure seem to the writer to be due, first, to the less favorable climatic conditions under which the young trees must struggle, and, second, to the extremes of temperatures encountered at the time of planting.

The plantation on the west slope (except the incense cedar) may be considered a success, about 73 per cent. surviving. The results on the west slope based on an actual count on representative areas of 3,346 plants by rows, are shown in the following table:

COUNT REPRESENTATIVE OF 15,000 TREES PLANTED WEST SLOPE SIERRA NEVADA MOUNTAINS

Species	*Character of Brush*	*Aspect*	*Age*	*Total Counted*	*No. Alive*	*No. Dead*	*Per Cent. Alive*
Sugar pine	Open brush, few mature trees	N.	2-1	248	188	60	76
Yellow pine	Open brush, few trees	N.,N.W.	1-1	861	697	164	81
Yellow pine	Medium brush	N.,N.W.	1-1	415	317	98	76
Yellow pine	Medium brush	N.W.,W	1-1	475	381	94	80
Yellow pine	Dense brush	S.,S.W.	1-1	324	196	128	60
Yellow pine	Dense brush	W.,S.W.	1-1	782	492	290	63
Yellow pine	Open brush, scattered timber	W.,N.W.	1-2	241	170	71	70
Total all pines				3346	2441	905	73

Since each brush density class covered approximately one-third of the area, it is interesting to compare the same species and age of stock in the various parts of the area planted. The data gathered for 1-1 Yellow pine tabulated below shows, irrespective of aspect, the per cent of living trees found in the different densities of brush:

Brush Density—Class	*Total Count*	*Number Alive*	*Number Dead*	*Per Cent Alive*
Open brush	861	697	164	81
Medium brush	890	698	192	78
Dense brush	1106	688	418	62
Total	2857	2083	774	73

The conclusions to be drawn from the examination made and the recommendations for future work of this kind will be discussed under the following heads:

Soil—On a northern aspect the Yellow pines survived, regardless of whether they were on coarse, granitic soil, or on fine humus loam. On the southern and southwestern aspects practically the only trees that survived on the coarse soil were in the shade of the brush. The poorer the soil the more plants were found in the shade of the brush; and, in general, the less plants were to be found on the poor aspects. Soil seems to intensify the favorable or unfavorable effects of other factors. Where other factors are unfavorable, good soil becomes important in direct proportion.

Species—Nothing conclusive was shown in regard to the various species planted. Sugar pine seemed to do about as well as Yellow pine. There seems little room for doubt that the intolerance of the pines was the principal cause for the greater per cent. surviving in the open and medium brush, as against the dense brush. For future work this should be taken into account: openings and open brush should be planted with pines and the dense brush with more tolerant species like firs and cedar.

Age of Stock—Nothing conclusive was shown in regard to age, as between the Yellow pine 1-1 and the 1-2. The data collected show a smaller per cent. of 1-2 surviving than 1-1 under practically the same conditions of aspect, brush, and soil.

Density of Brush—The data collected show that as far as Yellow pine 1-1 stock is concerned the more open the brush the greater are the chances for success. Yellow pine was more successful in the open, scattered brush than in the brush of medium density, although this difference was not marked (only 3 per cent.). A greater difference was manifested between the medium and the dense brush (16 per cent.) In future work, either the very dense brush should be thinned out before planting, or the scattered areas of open and medium brush should be planted to pine and fir with the intention of letting the fir gradually extend naturally into the adjacent dense brush.

Aspect—On a northern and northwestern aspect less trees survived the very dense brush than on the western and southern aspects. On the northern and northwestern aspects more trees survived in the open brush than on the western and southern aspects. In other words, the more unfavorable the aspect the more shade seems necessary to produce success. The primary cause for this is undoubtedly difference in degree of insolation of the different aspects. Dense brush on a north aspect is quite as unfavorable as open brush on a south aspect, other factors being equal. The data show that the aspects for pine on the west slope in the order of their favorableness are: western, northwestern, northern, southwestern, southern.

Brush Species—From observations made it seems that pines are more successful under the intolerant brush species than under the tolerant ones. The tolerant ones should be underplanted with firs and cedars.

Concerning the method of planting little can be added, except that too much emphasis cannot be laid on the finer points of planting nursery stock. There can be no doubt that planting in the shade of the brush generally increases the chances for success. This is especially true on the poorer soil and the less favorable aspects. In these cases the shade of the brush tends to become an ameliorating factor, helping to retain the moisture in the soil by reducing evaporation and transpiration. In the case of the intolerant pines there is, of course, a limit to the amount of shade that is beneficial. Firs and cedars would undoubtedly survive in denser shade than would pines.

While the conclusions derived from this work are by no means indisputable and final, they at least ought to lead to further and more intensive experimentation along these lines, until something definite is obtained. The problem is one that deserves concentrated and intensive effort of the highest quality. In future operations it should be remembered that for experimental purposes five acres of plantation ought to show as much as 40 to 50 acres and cost considerably less. For the same reason, 500 trees per acre would serve the same purpose as 1,000 or more per acre. It is highly desirable to stake all trees at the time of planting, so that a more accurate count can be made later. Successful areas should be protected from live stock and fire.

CHARCOAL AS A MEANS OF SOLVING SOME NURSERY PROBLEMS

By George A. Retan

In an article, "Effective Fertilizers in Nurseries," (Forestry Quarterly, Vol. XII, No. 1), mention was made of an experiment in the use of charcoal in the Mont Alto Nursery at the Pennsylvania State Forest Academy. This work was started by Forester T. O. Bietsch in 1912. At that time the charcoal used was obtained from old pits in the mountains. This charcoal was thought to have a comparatively large percentage of wood ash as one of its constitutents, and this uncertain composition made it doubtful as to whether the action of the charcoal in the bed was purely physical, or partly chemical. The beds where this charcoal was used were so much better than the other beds in the nursery that it seemed worth while to determine just what the effect of pure charcoal might be, and to compare the beds so treated with untreated beds, and with beds treated with pit charcoal.

The soil in the nursery at Mont Alto is a heavy clay, quite unfavorable to the raising of coniferous seedlings. The nursery has never produced as many seedlings as its capacity, judged from area alone, would call for. In very favorable years there has been a good production, and in other years there has been comparative failure. The problem confronting the man in charge of the nursery has been that of conquering this unfavorable soil condition. Many different methods had been tried without success, and the marked benefit of the charcoal at once aroused hopes that a successful method had been found. Pit charcoal was hard to obtain, and rather expensive; but if pure charcoal would answer the same purpose, it could be obtained at very little cost from the remains of the old charcoal pile used by the furnace in the days of the Mont Alto Iron Company.

During the past season there have been carried on a series of experiments for the purpose of answering these questions in connection with the use of charcoal. About 130 beds were treated with pure charcoal from the furnace pile. The beds, which were treated in 1912 and had produced one crop of two-year seedlings, were spaded up and again sown. In addition, some of the beds made were in the sections as yet untreated and were of pure clay. All of these beds were managed in the same manner throughout the season. A few of the clay beds received applications of acid phosphate. On ten of the clay beds different combinations of fertilizers were applied two weeks before the seed was sown, a combination to each bed. In this way it was hoped to get comparisons of charcoal and commercial fertilizer effects in the same section.

The seed used on all these beds was purchased by the Department of Forestry from Otto Katzenstein & Company, Atlanta, Georgia. It was sold as seed gathered from open-grown trees in New York, and stored in cloth bags in a room with a temperature of 90° to 100° Fahrenheit. It was, as a result, very dry. This seed, like all the other seed used in the nursery, was tested by Mr. Barnes, a senior at the Academy, in connection with his thesis and under the direction of the writer. The methods used were adapted from those described in an article in the *Proceedings of the Society of American Foresters* (Vol. VIII, No. 2), "The Technique of Seed Testing." Boxes 7 inches wide, 5 inches deep, and 28 inches long were filled with sterile sand, and the sand pressed down so that exactly ¼ inch of sand could be put over the seeds. In each compartment 500 seeds were carefully distributed over the area. The sand was well wetted before sowing, and each compartment received 125 cubic centimeters of water every other day. The temperature of the germinating room was allowed to fluctuate between 65° and 85° Fahrenheit. The room was heated by steam, lighted from the north, and well ventilated.

The "germinative force" was taken as the percentage of germination attained when the germination in a single day dropped below two seeds, if in the following day the germination did not exceed two. The germinative capacity was taken as the germination attained when no seeds germinated in five successive days. The "real value" was taken as a result of the formula

$$\frac{\text{Germinative Force x per cent. of Purity}}{100} = \text{Real Value per cent.}$$

By "percentage of purity" is meant the ratio of the weight of the seed alone to the weight of the seed and dirt as taken from the bag. This gave a valuable figure for determining the number of ounces which ought to be sown per unit of area. In the White pine seed used in these experiments the germinative force was 51 per cent. (37 days); purity, 83 per cent.; real value, 42.3 per cent.; germinative capacity, 51.7 per cent. (50 days); actual germination on nursery check plot, 40.7 per cent in 70 days; establishment August 1 of 1 ounce seed, 27.7 per cent.

There were 28,000 grains of this seed in a cleaned pound and 24 ounces of the seed were sown on each of the beds used in these experiments. These beds contained either 96 or 100 square feet each, depending on the location. The real value of this amount of seed was 17,766 seeds. It was estimated that the loss during the season would be from 30 to 50 per cent., and that a permanent stand of about 10,000 seedlings to the bed would be left. That this estimate was not far wrong is shown both by the data given below and by the nursery check plot in which the seed showed a germination of 40.7 per cent., and an establishment of 27.7 per cent., or a loss of a little over 30 per cent.

In addition to the beds sown in the spring, on December 13, 1913, nine beds were made up and sown with 2 pounds each of the same seed. As far as known, this is the first fall sowing of White pine ever made in this nursery. The germination in these beds was considerably above the figures given for the tests. Counts of six strips on different beds, each strip 4 inches wide the full width of the bed, showed an establishment of 696 per running foot, 17,000 seedlings to the bed, or 30.3 per cent. Since these beds suffered very severely from birds during the migrating season, the germination must have been, comparatively, very high. This is especially shown in the manner in which they started germination. Instead of the slow, irregular germination of the beds sown in the spring, these beds were characterized by a complete, even germination very early in the season. The sun screens were placed on these beds on May 1. This experiment was so successful that thirty beds have been made up this fall for 1915. If these are equally successful, fall sowing will be adopted for this nursery as far as possible. So far it has been tried only with White pine.

The other beds of the experiment were made up during the period April 22 to 30. Germination in these beds was very slow and irregular. Dry weather in May made it necessary to water the beds before germination. The mulch was not removed until the last week in May, and at that time it was feared the beds would be failures. Careful watering, however, brought the germination up to a satisfactory percentage. On September 21 these beds were estimated on the basis of a count of all the seedlings present on a strip across the bed 1 foot wide, the strip taken at the center of each bed. The thirteen beds with no charcoal content gave an average establishment of 17 per cent. The fifteen beds treated with charcoal in the spring of 1912, which have raised one crop of two-year seedlings, gave an average establishment of 26.8 per cent. A count of fifteen strips on beds of the section containing 97 beds treated in the fall of 1913, gave an average establishment of 28.2 per cent., or 11,850 seedlings to the bed, a better average than the test plots.

It may be fairly objected that the best test in such an experiment is not numbers, but quality of the product. To meet this objection the following table is submitted. One hundred trees were taken from each of four beds; the trees being taken in each case from the northeast corner of the bed, and as they ran. There was no attempt at any selection of best or even average trees. From the standpoint of density, the trees from the untreated beds had the most growing space, and the trees from the fall beds the least. The table shows, however, that the weights do not correspond to the growing space, but to the kind of soil, and to the age of the tree. (See also frontispiece.)

Number of Lot	*When Sown*	*Time of Application of Charcoal*	*Weight of the Bunch in Grams*
1	spring 1914	none present	22.0
2	spring 1914	spring 1912	39.3
3	spring 1914	fall 1913	35.3
4	fall 1913	fall 1913	40.3
5[1]	fall 1913	fall 1913	48.5

The great problem of the nurseryman is the control of the fungi causing the so-called "damping-off." During the past few years there have been several publications issued telling of work along this line. The work of Spaulding, Hartley, and Johnson may be

[1]Same bundle as previous one hundred, but fair sized trees substituted for the culls. Illustration numbers correspond to this table.

mentioned. The preventatives which are given as being effective seem to be too expensive for use in a nursery where the desire is to raise fewer seedlings to the bed, to work for stockiness, in order that the seedling may be fitted for permanent transplanting at the end of two years. It is believed that five to six thousand strong plants taken from 100 square feet ought to be the aim, rather than twelve to fifteen thousand for transplanting. Since the first cost of the bed is the same under the two methods, there must be a saving effected in the care of the less dense bed during the two-year period. There seems to be good basis for a belief that the application of charcoal to the bed is a very great aid in the prevention of "damping-off." Certain phases of the subject are not as yet settled and experimentation will have to continue longer before a definite statement to this effect can be made. There were 350 beds sown in the Mont Alto Nursery this year, White pine leading with 250, Norway spruce being sown on 50, and larch, Scotch pine, and Pitch pine occupying a small number each. Constant observation of these beds seems to indicate that where the proportion of charcoal in the bed is large there is less "damping-off." In the section with 97 charcoal beds, only six showed severe loss. The germination in these beds was so delayed that the loss of 30 per cent. during the season was not surprising. When the loss from weeding and other causes is subtracted, not a very large proportion remains to be assigned to the fungi. In another section in which ten beds were made almost wholly of charcoal, there has been no loss at all from "damping-off" and the beds are far too dense. In the clay beds adjoining these, the loss was very great during the period from the twentieth of June, in which rain fell thirteen out of twenty-six days.

No exact percentage can be given as the proportion of charcoal in the beds. The plot was plowed and disk-harrowed; then about 3 inches of charcoal was spread over the top. The paths were shoveled into the beds, raising the beds about 4 inches above the surface. The spading was not done very deeply, thus keeping the charcoal in the upper portion. Contrary to expectation, these beds did not dry out easily, even in the severe drought of the fall, while they drained out rapidly after heavy rains.

There are so many factors affecting the activity of the "damping-off" fungi that it is almost impossible to say that any one remedy will meet all of them. Since the fungi demand optimum conditions of heat and moisture to develop, it would seem that a control of the moisture conditions would be most effective in regulating the trouble, and this is the usual procedure. It is commonly secured through the manipulation of the screens. Besides using the charcoal, two other means of regulating the moisture conditions have been tried. One is the use of sand as a seed cover. A mixture of sand and compost, half and half, proved most effective in preventing a caking of the surface soil, but a larger percentage of sand seemed to help more in damage prevention. However, it cannot be said that pure sand was an absolute preventative, even though it was sterile. In most cases the sand was an aid, but there were conspicuous exceptions, especially on some beds in heavy clay. Another means tried was a change in the method of watering the beds. It was observed that in dry, hot weather, watering, even with the utmost care as to time and amount, increased the liability of attack. A portion of the nursery was so planned that it was made possible to irrigate the paths. The water seeped in very rapidly from the side and supplied the roots of the seedlings without wetting the surface of the bed farther than by the water drawn up by capillarity. This was a very great aid in maintaining favorable conditions at the surface of the bed. Incidentally, it forced out large numbers of the white grubs which are so destructive.

It is too early to give definite answers to the questions raised in the use of commercial fertilizers. By the end of another summer it is expected there will be a large amount of data at hand by which the seedlings of charcoal and fertilized beds can be compared. In the same soils, "damping-off" has been much worse in the fertilizer beds. This is true whether in clay or charcoal beds. Probably the fertilized seedling will have a little advantage in weight, but even that is not certain. The greatest advantage of the charcoal is that the effect is permanent. The fertilizer must be constantly renewed.

SOME ASPECTS OF THE NORTHERN PLAINS FOREST REGION OF CANADA

By A. B. Connell, B.Sc.F.

The following notes are presented as the results of two seasons' exploration work in the forest region lying north of the prairies. An endeavor is made to sketch in a few words the salient features of the physiography and permanent types of the region.

In new regions such as this, where the first attempts at permanent forest management are just being inaugurated, it is imperative that the natural conditions of the forest should be studied before they are artificially tampered with by excessive fires and cuttings. In this connection descriptive ecology is of prime importance, even though from the standpoint of dynamic ecology it merely scratches the surface. Wide generalized surveys over large areas must form the basis for future work. Thus a conception may be gained of the forest region and of the permanent types and associations within it. These are organic structures and capable of exact study. Upon this foundation detailed studies may be carried out within the various associations. In the results thus obtained will be found the key to the successful management of this northern forest.

The Forest Region—Based on species and physiography, the boundaries of what may be termed the Northern Plains Forest Region can be defined as conforming on the east and north with the contact line of the Laurentian peneplain, on the south with the northern limits of the prairies and on the west with the foothills of the Rocky Mountains. On the northwest its boundaries are indefinite. This region forms an integral organic whole with uniform climatic and soil conditions. It also exhibits a marked uniformity in the forest cover.

The Laurentian peneplain, which lies to the north and east, presents entirely different physical conditions and should be regarded as a separate region. (See frontispiece.)

Physiography—The Northern Plains Region is underlaid on the west and south by cretaceous strata. To the north and east the cretaceous gives place to Devonian limestones, which continue to the contact with the Archean rocks. These undisturbed sediments have produced a generally flat and level type of country, rising gradually towards the west. The region is relieved, however, by occasional low residual elevations originating from pre-glacial circum-denudation. These hills, or mountains as they are sometimes called, generally rise less than 1,000 feet above the surrounding country and are composed of shales and sandstones of upper cretaceous age. The more prominent of these elevations occur along the line of the Manitoba escarpment, which marks the boundary between the first and second prairie levels, and also in northern Alberta. They are all heavily mantled with glacial drift and few outcrops of bed rock can be noted.

The greater portion of the region is covered with drift and as a result a rolling type of country has been produced. Well-defined eskers and kames are frequently noted, but it is the familiar low, rounded ridges of boulder clay which are most characteristic of the region.

A third prominent feature is the large areas of lacustrine stratified clays which have originated from pre-glacial and post-glacial lakes that at one time were very extensive in this country. These areas possess an extremely flat and level appearance and are usually poorly drained. The most important and characteristic of the lascustrine plains is that of Lake Agassiz, which covered several thousand square miles and of which the Winnipeg system of lakes is the residue. Extensions of Lake Athabaska in northern Alberta have also given rise to large areas of this nature.

Occasionally extensive delta deposits of sands are encountered. Of this nature are the sand lands forming the Nisbet and Fort a la Conne Forest Reserves east of Prince Albert, Saskatchewan. They were formed in Lake Agassiz and its western extension, Lake Saskatchewan, by the Saskatchewan River.

The majority of the lakes of the region merely occupy shallow depressions in the drift and clay deposits and bear no relation to the pre-glacial features of the country.

In the western portion of the region the larger rivers have cut rather deep well-defined valleys, but the tributaries are generally sluggish.

Based on soil, moisture and topography, three permanent types can be distinguished. These are as follows: The boulder clay slopes type; the sand ridge type; the swamp muskeg type.

During the season of 1914, a considerable amount of time was spent in the study of these types in the Pelican Mountain country of northern Alberta. An area of some 3,000 square miles was covered and the types were found to be distributed in the following proportions: Boulder clay slopes type, 50 per cent. of land area examined; swamp muskeg type, 32 per cent.; sand ridge type, 18 per cent.

The Boulder Clay Slopes Type—The soil of this type ranges from clays to loams and varies greatly as regards the amount of space occupied by the transported striated boulders. Three associations occur within this type.

1. The Pure Spruce Association, 1.3 per cent. of area of the type, is found in small, widely scattered patches. The composition appears as follows: White spruce, 81 per cent.; Balsam poplar, 7 per cent.; Aspen, 6 per cent; White birch, 6 per cent. Average density, 300 stems per acre.

2. The Mixed Spruce Poplar Association, 20 per cent. of area of the type in which the spruce reaches its greatest individual development in mixture with the poplar and birch. The composition was found to be as below:

	Number per Acre	*Aver. D. B. H. Inches*	*Composition Per Cent*
White spruce	110	12	31
Aspen	132	10	38
Balsam poplar	60	7	17
White birch	53	5	14
	353		

The understory was composed of willow and alder and was rather dense. This association appears to be unstable and in process of transition towards the spruce association.

3. The Pure Poplar Association, 53.3 per cent. of area of the type, is the most widespread association of the Slopes type. It exhibits a variety of conditions but is typically a mixture of aspen and Balsam poplar with occasionally considerable amounts of birch intermixed. While ordinarily regarded as a temporary formation, it should be emphasized that in this northern forest the poplars often form permanent stands, due perhaps to lack of effective competition but nevertheless maintaining themselves indefinitely. The composition appears as follows: Aspen, 66 per cent.; Balsam poplar, 23 per cent.; birch, 8 per cent. Average density, 140 stems per acre.

The birch as referred to above is composed of two species, the Paper birch (*Betula papyrifera*), and the White birch (*Betula alaskana*). Twenty-five per cent of the area of the Slopes type was burned.

The Sand Ridge Type—The only association which occurs upon this type is the pure Jack pine (*Pinus banksiana*). In the western portion of the region the Lodgepole pine appears in mixture with it.

Swamp Muskeg Type—The swamps and muskegs occupy shallow landlocked depressions in the drift and also cover large areas of the poorly drained lacustrine clays. A stunted growth of Black spruce and larch occurs on these in the proportions of 65 and 35 respectively.

THE USE OF BRANDS AND OTHER MARKS ON LIVESTOCK

By Carnot Valiton

Brands and other marks are still widely used to indicate the ownership of range livestock on forests in the western range country, and a general idea of the basis for such marks would be of interest to those who are going to these forests, and a general idea of the subject would aid in several ways. First and not least comes the man's own satisfaction with the knowledge that he is in a position to tell anyone just what kind of a "crazy-letter-number-bar" a certain bunch of cattle on a certain range is carrying around. Secondly, his employer may have a wider field of action for him, if he can make an accurate report on the brands that are found on a certain range. On forests where grazing fees equal timber-sale receipts, this second point may be quite important. Third, the forester is better fitted to mix well with the stock men since he is enabled to understand more of their conversation and interests.

There are five principal methods of marking livestock in use in the western range country. The earmark is made by removing a portion of the ear. The wattle and the dewlap are hanging cylinders of hide, hair out, made by slicing the hide of the young animal. Metal tags are used with registered stock in a few cases; they are fastened on the inside of the ear of the animal. Brands are of two kinds, painted and burned. The painted brand is used on sheep, various colors of paint such as black or blue being used, and are put on the sheared sheep with a wooden brand or a brush. The burned brand is used on cattle and horses and is made by applying a red-hot iron to the hide of the animal till the hide and hair is killed in the desired outline or figure.

The purpose of all brands and other marks on range livestock is to show ownership. The principal use is to show which cattle in a certain region belong to a certain owner, and to make possible the separation of mixed herds at the various round-ups. These marks also serve, in some degree, to prevent the theft of cattle and other livestock. Branded stock is made dangerous to steal since the "rustler" has to alter the brand, dispose of the hides carefully, and take a great many other precautions to avoid detection. In line with this second point, these marks serve to prevent the accidental sale of another's stock, and also the accidental marking of stock not owned by the brander. Sometimes, in a big round-up and branding "bee," the "boys" will fail to notice that a stray cow has a calf, and when the final count is made, the calf may show up with the wrong brand on it. Such accidental brandings should not be classed as "rustling" for at times the corral may contain over 200 cows and calves and to locate the mother of each calf would be impossible. With big herds of cattle, long use of a brand gave rise to a natural extension of its use as a trade mark. At first my father's ranch was called "Peter's Ranch," then our herd took the name of the PV (read "PV bar") outfit, and finally our ranch was known as the "PV Ranch."

The literature on brands, earmarks, and other marks used on livestock in the range country is very much limited. Of this supply, the book that seems to cover the subject best is "Western Grazing Grounds," by W. C. Barnes. In 390 pages Mr. Barnes treats the history of the livestock industry in the west, the range management, the present day livestock industry, diseases of livestock, saddle horses, and range equipment. In chapter IX he treats quite fully of brands and earmarks, as well as of brand-books, and this portion of the book should be of considerable help to the beginner. The official "Brand Books" of the Montana Stock Growers' Association, Western Livestock Association, and similar organizations, and of the bureaus of the western states, contain a varied and almost endless list of brands and earmarks. Such books also often include information as to the owner's headquarters and his range. When the beginner has become acquainted with the contents of a few of these books, he would do well to turn to the old stockman for further information. The Forest Service at present has in employ quite a number of men once in the cattle business, and such men, if properly approached, will teach the green man more than he could ever hope to get from books.

Earmarks—The word earmark is applied, not to some mark put on an ear of an animal, but to a certain shaped section which is removed from the ear, usually when the animal is under a year old. The earmark, used mostly for cattle, is the most useful mark for quick identification of cattle when they are on the range, being "worked over" in large bunches, or when being inspected as they file rapidly through a chute or gate. Otherwise, the earmark is not as sure a mark of ownership as the brand, for two men on a certain range may use the same earmark for their herds, but with calves which are too young to brand when the herd is turned out on the range, the earmark is a very convenient temporary mark of ownership.

The number of earmarks is much smaller than the number of brands since they are limited to a much smaller portion of the animal. A brand may be made quite complicated, but an earmark must be simple because an intricate earmark would require too much time to make; would offer greater chances of harm to the animal; and would destroy its usefulness for rapid recognition. W. C. Barnes in "Western Grazing Grounds," page 185, illustrates a number of the more common marks. In addition to these marks there are several common ones for Montana described below. They are illustrated in the 1903 "Montana Stock Growers' Brand Book."

1. The "slit," as the name implies, is a narrow section cut from the ear, the width varying slightly but usually just enough to prevent the cut from healing. The number of slits in one part of the ear usually does not exceed two, but there may be slits in two different parts of the same ear.

2. The "scallop" is made by removing a half-circle section of the ear. This mark may also be used with either edge of the ear or the end.

3. The "toothpick," called "sharp" by Barnes, is made by removing parts of the edges to make the ear sharp pointed.

4. Combinations of earmarks are also widely used; for example, the "crop and slit," where the cropped end of the ear is also slitted.

To describe an earmark completely, it is necessary to specify: (1) The name of the mark, as, bit, slit, crop, or scallop; (2) whether it is a single mark, double, or combination; (3) on which ear the mark occurs; (4) on what part of the ear it occurs, that is, upper or lower edge, or in the end of the ear.

Sample reports on earmarks are as follows: Earmark—Double-end-slit, and double-lower-slit in the right ear. Earmark—

Swallow-tail in the left ear, cropped right. The swallow-tail is often called the "swallow fork.")

Metal tags are sometimes used in the ears of cattle as marks of identification. These tags are small, usually of brass, and bear some distinctive mark as a number or a letter. They are fastened on the inside of the ear much in the same manner as patent fasteners for papers. The ear tag is in more common use with registered stock at present, but as the ranges decrease and the cattle are kept closer in the bounds of the owner's land, their use may become more general on all stock. One of the present objections to the ear tag is that one cannot readily tell who owns an animal without getting close enough to look in the animal's ear, and this would be very difficult under the ordinary range conditions of today. The animal may also rub the tag out of its ear, though this objection is of less importance than the first since methods of fastening the tag may be improved.

Wattle—The wattle is a cheek or a chin mark as a rule. This mark is made by cutting loose a strip of the hide of the desired length on the jaw or the chin. The strip is rectangular in shape and is fastened at one end only, and when the cut begins to heal, this strip of loose hide curls into a hanging cylinder with the hair on the outside. When completely healed the old wattle appears much as a natural growth. The wattle is merely an additional mark for identification, and may be used with ear-marks or in place of them. There may be one or more on an animal and if several they may be arranged in various ways.

Dewlap—The dewlap is a neck or shoulder mark in general. It is made in the same manner as the wattle and looks the same, that is, like a cylinder of hide with the hair on the outside. It serves the same purpose as the wattle. The several kinds are called the "upper-cut," "lower-cut" and "split dewlap." The upper-cut dewlap is one in which the cut in the hide is made with an up stroke of the knife, resulting in a hanging cylinder; the lower-cut dewlap is made with a down stroke, resulting in a more or less erect cylinder of hide; and the split dewlap is a combination in which there is an upper-cut dewlap with a lower-cut dewlap immediately below. The position of the dewlap, of course, may vary as in the case of the wattle, and there may be any number of dewlaps in a combination, usually not over three in one place; for example, "three dewlaps on shoulder," or "triple dewlap on the right shoulder." Dewlaps and wattles may be used on the same animal, though one of these is usually considered mark enough.

Brands—A brand is the principal mark used to indicate ownership of livestock in the range country. It is usually a letter or a combination of letters, an Arabic or Roman numeral, a geometrical figure or hieroglyphic, or any combination of these which a man's fancy leads him to devise. Both the painted brand on sheep and the burned brand on other livestock may be in any of these forms. The more complex and fancy the brand is, the greater chance the paint has to run into a blotch, and the greater chance the hot branding iron has to kill the hair over the entire area included in the brand, thus causing a blotch instead of alternate bands of bare hide and hair as originally desired.

The finished brand on a two-year-old depends on other things than the figures in the brand. The personal equation enters largely, for, if the "boys" are in a hurry, the irons may be slapped on the animal instead of being carefully handled, or a part of the brand may show up in an inverted position, or the brand may be put on the wrong hip. Towards evening the chances for poor work increase, for the men may become tired and there may be a long ride before them after the work is over. Climatic factors also enter. If it is rainy weather, the wet hair does not brand as well; and if the weather is hot and sultry with lots of fly pests, the new brand stands better chances of turning to a large fester. Under unfavorable conditions the branding iron may not reach the right heat before it is used, and a "cold iron" results in a poorly appearing, blotchy, and often temporary brand.

The western forester especially, will quite often come in contact with the livestock business and the brands used in his locality. A brief review of the Forest Service Grazing Manual will illustrate how often the forest officer is apt to meet with the pleasant job of reading brands. Though there may not be any hard and fast rule of reading, in general a brand will read from the top, then left to right, and ending with the lower part of the brand much as B-X, read "B-bar-X-bar."

Brands may be classified about as follows in the order of use:

1. Straight brands as; P, PV, K, 72, 101, N-N.
2. Combination brands as; D♡, [J] (box-J), and ⌒11 (quarter circle-11).
3. Name brands as; FOX, KT (Katie Barr), D♡ (DeHart).
4. Lazy or odd brands;
   Lazy..... ꝏ (lazy B), ⊣ (lazy T), and ⌐ (lazy 7).
   Crazy.... 8 (crazy B), ✓ (crazy L), and Ɛ (crazy 3).
   Flying...W (flying W), Y (Y), U (U).
   Running..W (W), V (V).
   Walking..M (M), A (A), H (H).

The above brands are illustrations only and do not include all the possible variations, for that would fill a good sized brand book.

Natural changes in brands, due to the growth of the hide, may cause the brand reader a great deal of trouble. In western Montana the usual custom is to brand the calf within the first year of its life. Shortly before the herd is moved to the summer range, a round-up is made of the cows and calves, the calves are separated into a smaller corral, and are earmarked and branded. Our brand used on calves had letters about three inches high, one and one-quarter inches apart, and was applied to the right hip. By the time the animal was one year old this brand no longer had the same dimensions as when applied to the hide, but had grown to letters perhaps five inches high. As long as the hide on that part of the animal grew, the brand enlarged at approximately the same rate. Our brand, PV, grew quite uniformly, due to the favorable shape of the letters and their position, but this is not the general rule with brands. The average brand in going through this growing process will enlarge horizontally at a different rate than the vertical growth and may become so irregular that one not well versed in reading brands would never accuse the brand on a three-year-old of being the same that was put on the calf.

A certain brand on the hip will enlarge in different proportions from the same brand on another part of the animal. The hide of the animal grows at varying rates which is different for the shoulder, hip, side and neck, and the brand may widen faster than it will lengthen, so that one letter may become distorted at a faster rate than another of the same brand. This fact may often make the deciphering of a brand impossible. When the hot iron is applied to a calf in the branding process, it kills the hide directly beneath and a little to the side of the metal. If the letters are close enough together and the brand is complex enough, these burned places may gradually extend as growth takes place and the resulting mark will be a big burned blotch. A sample of this was with the "box-J" brand (a square with a J inside) which looked very neat when the calf was first branded, but within a few months the brand often had turned to a blotch.

To determine old brands, with living animals, about the only accurate method is to shear the hair away from the branded part, and then the brand may be closely enough traced for ordinary purposes. A new brand will peel, that is, the hide will usually "scab-up" to quite an extent, although an old brand may be chafed by the animal and become sore, so that a scab brand is not always a sure sign that it is new. The only sure way that I know to detect an old brand which has been altered or which is in dispute is to kill the animal and skin it. The old brand will be plainly visible on the inside of the hide, though it may be invisible from the outside. The inside of the hide will show a welt that will give the outline of the brand, and this will hold true even though the hide has been tanned. With disputes between owners this method is, of course, not referred to very often, but if one has an idea that beef comes from a "rustler," it is well to try to get the hide before it is buried or burned, since the brand on the inside of the hide is good court evidence.

"Venting" a brand is the use of some known and accepted, and usually recorded method of cancelling a brand. The vent is, as a rule, recorded just as carefully as the brand. The two most common methods of venting brands are to place the same brand above, below, or to one side of the old brand; or to add some new mark. Examples of official venting are: PV becomes $\overline{\underline{\text{PV}}}$ when vented, K becomes $\begin{array}{c}\underline{\text{K}}\\ \overline{\text{K}}\end{array}$ when vented, and CC becomes $\begin{array}{c}\text{CC}\\ \text{CC}\end{array}$ when vented.

As the brand is the only definite means a man has of telling whether an animal belongs to him, it is usually taken for granted by the owner that the best course is to record the brand in some official way. In the State of Montana the Stock Growers' Association has a record book for its members, and the State also keeps a record of the brands in use in that State. Some outfits have but one brand, while others may have a dozen each, acquired through the purchase of other herds of stock. As an example of this condition: When our outfit, PV, in 1911, sold its entire herd to another cattle outfit in the same valley, we sold them the brand also, for we were going out of the business. This did away with the necessity of re-marking all the old cattle with the new brand. However, the new owners do not use the PV on the calves and so in a short time there will be no cattle with that brand. The registration of brands accomplishes the double purpose of establishing a certain mark as indicating ownership by a certain man, and prevents the duplication of brands in any one State.

The red-hot branding iron has served a very useful purpose in the past, in fact was indispensable to the livestock owner for it was the only means of recording his ownership over cattle that he often never saw. Today there are many men who could not take their oath as to the exact number of cattle bearing their brand and so it still serves a useful purpose, especially where the owner rounds up his cattle but once a year. The brand has unfavorable points which are quite important. Possible harm to the young calf or colt may occasionly occur. The main loss through branding is in the effect upon the hide through the killing of a part of it by the hot iron. This dead hide is permanently noticeable since an old brand may often be detected in the tanned shoe leather and as a result the value of the hide is decreased.

In the past there were wide stretches of range country, and cattle could easily roam the hills for several years without ever being counted by the owner. The open ranges are gradually being fenced by the settler; the rancher is cutting his herds in numbers; and he is gradually tending towards a select herd that he can keep in his fenced pastures the year round. It seems then that it is not improbable that, in certain parts of the more fertile range country, the brand may fall out of use entirely, for the need no longer exists in this more settled condition.

A METHOD OF YIELD REGULATION
MÉTHODE DU CONTRÔLE[1]

By M. Muret

Translated and Briefed by K. O. Ward

The method intended for selection forest was originated in France by M. Gurnaud. It has been tried successfully in France and in Switzerland, especially in the canton of Neuchatel. In this canton, M. Boilley used it on private and communal forests.

It consists in making successive reconnaissances of the whole forest, going over the whole area at short intervals of six to ten years. The reconnaissances are all made under absolutely like conditions.

The amount of increment is obtained by deducting the volume found at the last reconnaissance from that of the preceding. A stand table is made. The stand is divided roughly into three main age classes—small trees, medium, and large; corresponding to our reproduction and immature, young merchantable, and merchantable. The first class includes all trees below .30 meter in diameter (about 12 inches), the second, between .30 and .50 meter (approximately 12 to 20 inches), the third, over .50 meter (over 20 inches).

The cut is taken in per cent. of the material on the area; based on the vigor of growth at different ages (ascertained by reconnaissance). The diameters are measured by a tape and the tree is stenciled with a horizontal arrow where the tape rested. Measurement is made at breast height.

The method seeks the proportion of trees in the different classes at each reconnaissance rather than the exact measurement of the timber.

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[1]A search through the foreign periodical literature for material bearing on forest organization, brought to light the articles by M. Muret on the "Méthode du Contrôle," in the Schweizerische Zeitschrift für Forstwesen (Journal suisse d'Economie forestière), vol. 48, April, May, November, 1897, pp. 148-152, 187-190, 407-410. The above brief thereof has been prepared by Mr. K. O. Ward, a student in the Department of Forestry at Cornell University, who translated the articles from the French.

None of this material has heretofore appeared in American literature or in any textbooks, either here or abroad, as far as is known.—A. B. R.

Growing stock and increment must be determined by some measure common to both, to be determined by the parties concerned. Muret advocates the use of basal area for estimating the yield, rather than the estimate of the actual cubic contents since the cubic contents varies in exact proportion with the basal area.

Calculation of Growth (Increment): Rests on the comparison of two consecutive reconnaissances. This should be found separately for each compartment of the forest. Account must be taken of the number of trees passing from one class to the next above during the period between inventories. This is found by comparison of the number of trees in each class at each reconnaissance with that of the same class at the preceding reconnaissance. The difference in volume between successive inventories, for each diameter class, divided by the number of years between the inventories, gives the periodic annual increment for each class. The whole volume divided by the number of years in the period, gives the average rate of growth of the whole forest for the period.

Regulation of Yield: One cannot establish a sustained annual yield by this method until the beginning of the second period. The more frequently inventories are taken, the more accurately can this yield be determined.

"The sustained and annual yield will fix and will justify": 1. Whether the cuttings ought to cover all the increment, more than the increment, or less than the increment; 2. How and where the allowed cut ought to be distributed among the different classes, and what proportion of the old, medium, and young trees it should contain.

Summing Up: After each period, sum up the results obtained from the different divisions, in a table. This will keep an exact account of what has been done and what should be done.

There are three unknown quantities in its application, which experience should endeavor to settle:

1. To conserve the material on the ground, we estimate in general the gross yield at 300 to 350 cubic meters per hectare (4,200 to 5,000 cubic feet per acre). We should not go below this, but seek to increase it.

2. The most favorable distribution among the different classes of the whole, according to M. Gurnaud is 50 per cent. in the old

tree class, 30 per cent. in the medium class, 20 per cent. in the young class. In the following cases, it may be advantageous to change these proportions; for example, to increase the proportion of older trees if the soil needs protection, or to lessen the older classes according to species and exposure, if more sunlight is needed for the appearance of natural reproduction.

3. As regards the rate of growth to expect, the beginners of the method counted on obtaining a rate identical with the ordinary agricultural rate, *i. e.,* to realize 3 per cent on the growing stock.

We must be careful not to fix the cut too high, so as not to infringe on the growing stock, and must know why and where to apportion the cut.

This method is *much less* a method of absolutely mathematical results, applicable to all forests, than a simple process allowing the finding of all necessary information in the forest.

Advantages of the Method are: 1. (a) An exact account of what is done can be kept, and of the effect produced by the operations carried on, so as to modify future proceedings to suit the object in view. (b) The short period between surveys allows checking, and lessens the chance of overestimating.

2. It separates growing stock and increment completely (as money invested and interest on it); so a system of really commercial books can be kept. The money value secured on the basis of reconnaissance, the cut or yield by calculating increment. All cutting exceeding the allowed cut is considered as a loan taken from the forest. The forester knows exactly how the forest stands and can cut heavily or lightly, or plant as he sees fit.

3. By use of the per cent. basis, for cut, we rid ourselves of the theoretical and hypothetical idea of an "Age of Exploitability," corresponding for the whole stand, and of notions too general and difficult of application, of fixing the probable increment by a "factor of fertility" necessarily inexact. The method relies on actual data from the forest so there is a minimum chance for error in calculating.

4. All trees cut for any reason whatever, are considered and figured in the income from the forest.

5. Though the method uses a diameter limit, this does not prevent the practice of good silviculture. It allows the cut to be made in all size classes if that is the better way.

Conditions in America, especially in the west, are not intensive enough to apply the method. It would involve too much time and expense in the west, though it might be used in the smaller forests of the east, as in New York and New England.

This method of control competes with the other established methods of yield regulation only in so far as selection forest is concerned. For even-aged forest it is not suited. But for selection forest it rests on a surer foundation than do the older methods which depend on age (as shown by diameter attained), distribution of the age classes, yield factors (*e. g.,* Hundeshagen's "use per cent."), rotation, etc.

Control eliminates everything that is uncertain. It uses only the actual growing stock and the current periodical increment. It uses frequent determinations of the growing stock (reconnaissance) and facilitates these by obviating height measurements. The figures for growing stock and increment are used to determine the increment per cent. which plays the leading rôle in the final determination of the yield.

There is only one way to determine the value and applicability of the "Method of Control" and that is by trying it out on various forests. If these experiments are carefully conducted no harm can result to the forest, even if the method does not measure up to expectations.

CURRENT LITERATURE

The Preservation of Structural Timber. By Howard F. Weiss. McGraw-Hill Book Co., N. Y. 1915. Pp. XVIII+312.

The wood-preservation industry in the United States has made wonderful advance during the last decade and there are now in operation ninety plants representing a capitalization of over $10,-000,000, turning out annually over 125,000,000 cubic feet of treated wood worth about $30,000,000. These plants use annually over 100,000,000 gallons of creosote costing over $7,000,000, over 21,000,000 pounds of zinc chloride costing about $1,000,000, and 3,500,000 gallons of various other preservatives costing about $1,250,000. "The amount of wood now annually treated represents a protection given to the annual output of approximately 20,000,000 acres of timberland." "It appears that the application of efficient protective measures to structural timber would decrease the drain on our forests by almost 7,000,000,000 board feet annually, were all such timber liable to deterioration protected."

The figures indicate the scope of the industry and its possibilities and emphasize the need for fuller and more detailed information in regard to it. Not enough time has elapsed to judge the efficiency of many of the processes which are in use or have been advocated and accurate knowledge of the whole subject is not always obtainable. Much has been written and claimed, but statements are often contradictory or biased or based upon inefficient evidence, so that the searcher after truth has a most difficult task.

It is on this account that Mr. Weiss' book is so opportune. It has sifted a great mass of material and given us in a clear, coherent and competent manner a complete summary of the essentials so far as they have been established or strongly indicated. The way in which he has gone to first-hand sources for his information and has approached every subject without bias adds weight and authority to his statements. Mr. Weiss, as director of the Forest Products Laboratory at Madison, is peculiarly fitted to write the first American book covering the subject of timber preservation systematically in its broad aspect.

The scope of the book is best seen from the readings of the twenty chapters, which are as follows: (1) Introduction; (2) factors which cause the deterioration of structural timber; (3) effect of the structure of wood upon its injection with preservatives; (4) preparation of timber for preservative treatment; (5) processes used in protecting wood from decay; (6) preservatives used; (7) construction and operation of wood preserving plants; (8) prolonging the life of cross-ties, (9) of poles, (10) of fence posts, (11) of piling and boats, (12) of mine timbers, (13) of paving blocks, (14) of shingles, (15) of lumber and logs; (16) protection of timber from fire, (17) of wood from minor destructive agents; (18) strength and electrolysis of treated timber; (19) use of substitutes for treated timber; (20) appendices.

This book should be heartily welcomed by all persons interested in timber preservation, and teachers of the subject will find it an excellent text book.

S. J. R.

Forest Valuation. By Herman Haupt Chapman, M.F. Wiley & Sons, New York. 1915. Pp. 310, 8°.

Teachers and students of forestry will welcome the appearance of Professor Chapman's new book, "Forest Valuation." Heretofore this subject has been a rather difficult one to grasp, due largely to the fact that it has not always been preceded by a course in general economics, at least in sufficient detail to enable the student to understand the principles underlying the business of forest production. This has necessitated the spending of considerable time in very elementary discussions of these economic principles. Too much time also has been devoted to the explanation and derivation of necessary formulae.

This volume will overcome these difficulties to a great extent, and will enable the students to spend more of their efforts on the interpretation or analysis of practical problems which arise in forestry.

Professor Chapman begins with four chapters on economic principles—brief, it is true, but still sufficient to recall the teachings of economics. The first chapter is devoted to a discussion of "Values"—different forms of value and what determines them.

Chapter II deals with outlay and income and their relation to each other.

Chapter III is a discussion of interest: simple and compound. The rate of interest for a business investment is that interest which a lender will accept on the security of the business. This rate should be used in calculating cost and in valuing the business. There is no standard of comparison for forestry because the returns are so long deferred. Life insurance has an average of thirteen and one-half years' risk, and as a rule earns about 4 per cent. The rate to use in forestry should not be appreciably higher, for the economic law is that the rate of compound interest becomes lower the longer returns are deferred. The difficulty at present is largely due to the insecurity of the investment, as is explained in Chapter XIII on "Risks." The efficient organization of fire protective associations in different sections is doing great work toward reducing the risk.

Assets and their valuation is the subject of Chapter IV. A property or business can be valued on its cost or sale value, but its "economic" value is based on income. This is called "capital" or "expectation" value, and is the difference between gross receipts and future expenses discounted to the present. As an example showing why past costs do not enter into the calculation the author says: "Two parcels of land cost $25 each to clear, one is suitable for truck gardening and sells for $500; the other will not bring more than $5.

The text changes with Chapter V, "Formulae of Compound Interest." This chapter shows how to compute the amount of a principal at compound interest; find the present value of a future sum; the sum of a geometrical progression in general, capital value of annual or intermittent rentals, both temporary and permanent; annual equivalents, and ratio of income to cost.

"Investments and Costs in Forest Production" (Chapter VI), takes up the separate items of cost: permanent investments—land and permanent improvements; expenses or temporary outlay, including reproduction costs, silvicultural and protective measures, overhead expense, taxes, interest and maintenance, and shows how to calculate the total cost of growing an even-aged or many-aged crop of timber and a normal forest. One article compares costs of forestry with those of destructive lumbering.

Chapter VII is the specific application of the principles in Chapter IV. Formulae are developed to show the value of forest property for destructive lumbering; the value of an even-aged forest just previous to cutting and in any year of the rotation as well; the value of forest soil; the value of many-aged forests producing regular and irregular incomes; and finally the value of timber separate from the soil.

"Profits and their Determination" are discussed in Chapter VIII. Formulae are developed to show profits of destructive lumbering, profits on a crop of timber, profits from continuous forest production; the anticipated profits on young timber, anticipation of continuous profits, profits as a soil value and the rate of interest the investment earns. These are followed by six reasons why private forestry cannot now be practised on a large scale. In order to arrive at true results, Professor Chapman has introduced a number of forms to be used in "Forest Bookkeeping," including a "Balance Sheet," "Trading, and Profit and Loss Account," "General Outlay and Income Account," and an "Economic Balance Sheet."

Chapter IX is called "Appraisal of Damages." The legal principles of damage assessment are summarized and suggestions made for determining the value of damages as the cost of replacement; sale value, and capital value. Formulae are given for determining damages to mature timber and immature timber, both wholly and partially destroyed. It is also shown how damages may be estimated when injury occurs to single trees, many-aged stands, forest soil, watersheds and aesthetic values.

Chapter X deals with "Forest Taxation." The application of the general property tax is discussed and results compared with those of scientific basis: namely, forest property tax, forest land tax, products or income tax, and combined capital and income tax. The new tax laws in Connecticut and Massachusetts are mentioned.

Chapter XI describes briefly the main points necessary in determining stumpage values: costs of logging, of milling, depreciation on equipment, profit on each logging and milling, and the f. o. b. price of lumber at mill. The article determining stumpage values for different species in mixture is interesting, but is open for considerable argument.

Chapter XII, "Future Value of Forest Products," gives a look into the future at what may happen if population continues to increase, prices rise, transportation facilities become better, wood substitutes find a wider use, and other changes predicted by economists should happen.

"Risks" (Chapter XIII) from wind, insects, fungi, fire, etc., protective measures and their effect on the rate of interest which should be earned are briefly discussed.

Chapter XIV is a review of timber estimating and mapping. An outline is submitted which calls for about all the information necessary to determine stumpage values.

The last chapter compares "Forest Values" with "Agricultural Values." Soil expectation or capital value for each purpose is the basis of comparison.

In order to make the volume more readily usable, an appendix has been added giving the formulae summarized, symbols used, compound interest tables and a six-plate logarithmic table with proportional parts.

A number of points are brought up which might well have received more detailed treatment; for example, the author says:

"The true 'economic' per cent. earned by an investment is the rate paid on all capital invested for periods of one year or over, regardless of ownership" (p. 112). If one assumes, as is recommended in the United States Department of Agriculture Bulletin 11, p. 21, that an owner invests his own capital in land, initial expenses, silvicultural operations, etc., but borrows money (at a fixed rate) to pay annual expenses, the rate of interest earned by his investment will be the relation existing between his capital and his "net" income. This "net" income is the difference between gross receipts and the borrowed money with interest. One could follow up this line of reasoning until the owner (?) borrowed all but one cent of the capital necessary for forest production. What would his investment then earn? The principle involved is that of dividends to a shareholder and not profits to a corporation. The "economic" per cent. indicates profits correctly. Dividends and profits should be distinguished because sums returned on capital invested by owners is not earned solely by this capital.

On pages 117 to 119 are forms for "Forest Accounts." For students it is desirable that a description of financial operations be made and then entered on the forms for illustration.

All that is said in Chapter IX, "The Appraisal of Damages," is good, but concerns present conditions. When the time comes that forests are regulated, damage to a certain area will cause disorganization of management, and will bring in another element.

Should expectation value be used in assessing damages? Theoretically, it should not be unless expenses must continue to the end of rotation, and a new crop cannot be established until that time.

Cost of replacement is defined as the cost of growing a crop of timber to the time damage occurs. This should not be used in assessing damages, unless the rate of interest used in the calculation is the true economic per cent. and one must have sufficient data to determine it.

The problem of taxation has received a great deal of discussion during the past few years. Chapter X, "Forest Taxation," should be preceded by a good statement of the general system of taxation, when the author's chapter will follow as a specific application of the tax system. There is no question as to the need of reform in the entire system of taxation. Scientifically, taxes should be collected on property (wealth) because it produces an income. The total amount of tax to be collected depends upon the amount needed for revenue. The amount paid by each "property" should be proportionate to its value, or producing capacity. People do not agree as to what value should be used in assessing taxes on property. In his discussion, Professor Chapman does not propose a definite scheme of taxation, but leaves one believing a forest should pay some tax, but not too much!

There is no apparent reason for the order of arrangement of Chapters XI to XIV inclusive. A more desirable sequence would be XI, XIV and XIII, while Chapter XIII might well have been included in Chapter III. Except for this stricture, and it is not at all serious, the book is well written and clear throughout. As a book for class use it will be of great value, because each point made is a part of a *full outline,* not an exhaustive treatment.

There is but one error noted—page 190, line 14:

$$\frac{\$3.80}{\$8.46}=\$.45\text{, instead of }\$.045$$

E. C. P.

Studies of Trees. By J. J. Levison. Wiley and Sons, New York. 1914. Pp. 253.

This volume touches in a brief and non-technical way many of the phases of tree study. It includes chapters on the identification of trees, their structure and biological habits, and their care and protection against diseases. There are also chapters on the treatment of woodland, what trees to plant and how, and on the identification and properties of the commoner woods.

The text is elementary and intended for the beginner. To facilitate such use in nature study classes, schools, etc., the book is also obtainable in separate pamphlets, each pamphlet dealing with one of the phases mentioned above.

The rigid uniformity of treatment of all tree species in the first three chapters leaves the reader with no conception of their relative importance—a perspective which would appear to be desirable for beginners. Some of the statements are either misleading or uncalled for, which could be avoided even in such an elementary book. The illustrations are not always of value.

J. H. W.

Exercises in Forest Mensuration. By Hugo Winkenwerder and E. T. Clark. Published by the authors, Seattle, Wash. 1915. Pp. 146. Price, $1.35.

This is a manual of field and office exercises designed for use by students of forest mensuration, as a guide to laboratory instruction. It does not purport to cover the entire field of mensuration in detail, but presents a total of thirty-nine type exercises, selected so as to be illustrative of the general field of the subject as presented in Graves' "Forest Mensuration," upon which the exercises are largely based. The general arrangement of the exercises follows that of the textbook above mentioned. Each exercise gives a statement of the prerequisite study, a brief explanation of the purpose of the problem, and detailed directions for carrying out the field or office work involved, including under each problem a list of references and usually a few questions designed to bring out the important conclusions to be derived from the exercise.

There is also an appendix containing a list of references to American works and periodicals, illustrations of forms used in forest mensuration, a number of useful tables and some data for use in connection with the office exercises. The last is designed to meet the needs of those schools that are so located as not to be able to secure original data for the office exercises.

The special value of this manual lies in the concise way in which the directions for working out the various problems are stated. In this respect it is the nearest approach to a condensed handbook of mensuration that we have yet seen, and on this account will be useful to the practitioner as well as the student, for whose use it is specially designed. In fact, we are inclined to be a little doubtful whether the manual will find a very wide field of usefulness in the particular purpose for which it has been written, because of the wide range of conditions under which mensuration is taught in different institutions. Forest mensuration differs materially on the laboratory side from such subjects as chemistry or physics. The location of the forest school with respect to accessible timberlands and with respect to weather; the adjustments in the manner of presentation made necessary by these important considerations as well as by the demands of the time table, would seem to introduce factors that make necessary special arrangement of laboratory exercises to meet local conditions. This manual is particularly adapted for use by those schools that have good facilities for field demonstration, as is the case at the University of Washington with which the authors are connected. Schools which are not so fortunately located in this respect will probably find it more convenient to arrange their own outline of exercises to meet their own particular needs. Wherever it is possible to place special emphasis on the field and office exercises in presenting the subject of forest mensuration, this manual will be extremely useful. This, we believe, is the correct way to teach mensuration. Where the exercises are very largely subordinated to the text book or lecture work for any of the several reasons which sometimes make this necessary, the manual will find less application.

W. N. M.

Geography and Vegetation of Northern Florida. By R. M. Harper. From Sixth Annual Report of Florida State Geological Survey. 1914. Pp. 165-451.

The report covers the northern tier of counties of the State of Florida, an area of some 22,600 square miles, of which 89 per cent. is forested. For purposes of description, the area is subdivided into twenty geographical regions. The geology and soils; topography and hydrography; the vegetation types of each region are briefly described. This description is followed by plant lists which are subdivided into five parts as follows: Trees large enough to make lumber; small trees and large shrubs; woody vines; ordinary shrubs, and the herbs.

The east Florida flatlands is the largest region, covering 23 per cent. of the area examined. The surface soil is mostly grayish sand; then comes several feet of sandy clay resting on calciferous marly strata. The region is 90 per cent. forested, the chief trees being Longleaf pine and Slash pine (*P. elliottii*), the two species comprising 45 per cent. and 20 per cent. respectively of the rather open stands. The Slash pine is more abundant here than in other places in Florida. The other trees in order of abundance are: Pond cypress (*T. imbricarium*), Black cherry (*P. serotina*), Black gum, Sweet gum, Black-jack oak (*Q. Catesbaei*), bay, Loblolly pine and Red maple.

The west Florida pine hills is the next largest region, and it occupies 17 per cent. of the total area. The region includes the highest land in Florida, running up to 300 feet. The surface soil is sandy, and it passes into reddish sandy clay at a depth of a few inches or feet. The prevailing type of vegetation is an open forest of Longleaf pine. On the driest uplands, or where the sand is deepest, there is considerable admixture of small Black-jack oak, and this species stands second in abundance. The wet slopes of the broader branch-valleys have a characteristic bog or wet barren flora more richly developed than elsewhere in Florida. The forests cover 90 per cent. of the area; some of these are virgin and have not even been turpentined. The region does not contain enough people to cut down the pine as fast as it grows.

The Apalachicola flatwoods occupy 11 per cent. of the total area, and they are nearly three-fourths coniferous, with Longleaf pine the leading tree in spite of the prevailing damp soil. Cypress and Slash pine stand next to it in abundance.

There are four other regions containing 1,000 square miles or over. The Peninsular lime-sink region (2,000 square miles) is the source of the hard rock phosphate mined in Florida. There are whole townships without any running water, and many square miles without any surface water. The rain water sinks into the sand almost immediately and gradually finds its way into the subterranean channels of the porous limestone. At least nine-tenths of the region was originally covered with park-like stands of large Longleaf pine with an understory of Black-jack oak and Turkey oak (*Q. cinerea*), and these three species now make up over 85 per cent. of the forest. The gulf hammock region (1,470 square miles) is similar in tree vegetation to the flatwoods described above, but is separated because the surface soil is not distinctly calcareous. The middle Florida flatwoods (1,000 square miles) are non-calcareous as to surface soils and are covered by the usual Longleaf pine forests and cypress swamps. The west Florida lime-sink region (1,000 square miles) is calcareous, and again the leading trees are Longleaf pine and cypress.

A pine, usually the Longleaf, heads the list in regard to abundance in eleven of the nineteen regions for which lists are given. In three regions, two species of pine, and in four of the regions three species of pine, head the list. Pines are not only numerically dominant, but, as is evident from the descriptions, they are also biologically dominant. Oaks stand second in six, and cypress in four of the regions. The author attempts to separate his regions to a certain extent upon the chemical composition of the soil. Although there may be local differences in the composition and structure of forest stands when some food element is in excess or absent, it would seem, from the prevailing dominance of pine in this case, that the author had not succeeded in making the application general for his regions, at least in respect to forest trees.

C. D. H.

Soil Acidity. By J. E. Harris. Technical Bulletin 19, Michigan Agricultural College Experiment Station. 1914. Pp. 1-13.

The theory that soils become acid through the accumulation of complex insoluble organic acids had its beginning with Sprengel in 1826, when he separated from a soil solution a brown precipitate to which he gave the name humic acid. During the next few years, to humic acid were added ulmic acid, crenic acid and apocrenic acid, as ingredients of acid soils. Although chemical formulae were given these substances, it was demonstrated about thirty years ago that their component parts held to no definite ratios. At the present time most agricultural chemists, who have done the most work upon them, do not regard the so-called humic acids as definite compounds at all. Some of them hold that the humus substances are colloidal in nature and that the so-called humates are adsorption compounds.

When acid soils are tested with blue litmus paper, it very quickly turns red. Now the peculiar thing about this reaction is that the litmus paper must be brought in direct contact with the soil particles for the change of color to take place. When a clear water solution of an acid soil is tested with litmus paper, it is usually found to be neutral. If, however, we substitute for water a solution of a neutral salt such as potassium nitrate, a considerable quantity of free acid will be found in the resulting solution. These phenomena have been usually explained on the ground that the soil acids are insoluble in water and that in the case of the neutral salt, a double decomposition takes place between the insoluble acid and the salt, the base of the salt combining with the humic acid and the acid of the salt being set free.

Numerous experiments showing that in the presence of colloids certain bases are adsorbed with a setting free of their constituent acids, have led chemists to doubt the explanation given above for the behavior of soil acids. They point out that blue litmus will turn red in contact for a short time with acid free cotton. This phenomenon can be explained by ascribing to the cotton a selective adsorbing power for the base of the blue litmus salt, the base being adsorbed while the red acid dye remains in the paper. Now the action of acid soil towards litmus may be explained in exactly the same way. Also in the action of the soil towards the salt solution, described in the paragraph above, we may assume that the soil adsorbs the base, leaving a corresponding amount of acid in solution. If an acid soil, for example, were treated with a solution of sodium chloride, it would absorb a certain amount of sodium hydroxide, leaving hydrochloric acid in solution. The fact that there is so much colloidal matter in the soil makes this theory seem reasonable. In support of this theory, it may be pointed out that certain experimenters have shown that the acid reaction of peat moss and of peat soils in general is caused by the selective adsorption power of the colloidal matter in the hyaline sphagnum cells.

The author of the present report describes various experiments which he made in an attempt to determine whether the acid reaction of certain upland soils is caused by the presence of humic acids or by the adsorption of the bases by the colloidal matter present. The following are among his conclusions:

> The results indicate that the reaction of so-called acid soils of the sandy loam type is one of selective adsorption by the soil of the basic constituents of the neutral salt solution. It is not due to a double decomposition with adsorbed acids or insoluble "humic acids."
>
> The quantity of the base adsorbed by the soil varies with different salt solutions, thus rendering unreliable the results of any analytical method for determining the "lime requirement" of a soil unless the method employs the same material that is to be used in the field.
>
> The "acidity" of soils of the type investigated probably arises from the formation of soluble salts through the interaction of weak acids, such as carbonic acid, in the soil solution and the basic material naturally held adsorbed by the soil and their subsequent removal by leaching and by crops. This leaves the soil free to absorb more basic material from any source with which it may come in contact.

Here is another point at which we must "unlearn" certain things we have been taught by soil textbooks, and which have been taken over from them into silvical literature.

C. D. H.

A Botanical Survey of the Sugar Grove Region. By R. F. Griggs. Bulletin 3, Ohio Biological Survey. Columbus, Ohio. 1914. Pp. 248-340.

The region of the survey is representative of the hill country of southeastern Ohio, an area of rolling uplands cut up by numerous deep ravines, giving a total relief of from 300 to 400 feet.

The underlying rock is sandstone and conglomerate. Owing to the differential erosion of these rocks, numerous caves, canyons and gullies are formed. The coldness of these places, accentuated by the slow melting of accumulated snows in the spring, makes them a congenial habitat for many northern plants which here find their southern limit. Since the region lies below the boundary of glacial drift, the soils except in the stream valleys are residual, varying from light clay to pure sand.

With respect to the forests of the region, we find that the bottom lands may contain Red maple swamps in pure stands or mixed with elm in the damper situations; in the drier situations, the maple is associated with Pin oak, Swamp White oak and Shingle oak, or with both species of Juglans, Red ash and White ash. On certain limited areas one may find Yellow birch, Sweet birch and River birch growing together in the stream bottoms. The heaviest forests are hemlock, which are most luxuriant along the lower slopes and bottoms of the deepest ravines. Sweet birch is often mixed with the hemlock, and the forest floor is frequently carpeted with yew. A liriodendron forest flourishes in conditions but little different from those of the hemlock forest which it is replacing. The forest in which the tulip dominates is richer in number of species than any of the others; among the most abundant are chestnut, hemlock, butternut and beech.

Proceeding back from the edge of the cliffs, one finds first a lichen tundra in miniature, then a zone of pine (*P. rigida* and *P. virginiana*), and finally an oak forest where the ridges become wider and the soil deeper. The oaks are Chestnut oak, White oak and Black oak. With them are frequently associated chestnut hickory, Sour gum and Red maple. These two types of the upland forest are the extremes between which are all intermediates and the various intermediates make up most of the upland forest.

The book is illustrated by photographic reproductions much above the average in quality, especially in showing detailed structure of the various plant habitats.

C. D. H.

A Preliminary Report on the Progress in the Remeasurement of Sample Plots on the Coconino and Tusayan National Forests, Arizona. By G. A. Pearson.

Mr. Pearson's manuscript progress report, dated December, 1914, brings first results of the permanent sample plots which have been established by the Fort Valley Experiment Station. The methods used in establishing these plots are set forth in Mr. Woolsey's article, "Permanent Sample Plots," in FORESTRY QUARTERLY, Vol. X., No. 1, pp. 38-44. The establishment of plots was begun by the Fort Valley Experiment Station in 1909 and, in all subsequent ones till 1913, only one method of cutting (the standard method employed on timber scale areas[1]) was used. These early plots, therefore, do not give a comparison of the results under different methods of cutting Western Yellow pine, but they do furnish data on what may be expected in the way of growth and reproduction following the standard method of cutting pure stands of this species in Arizona and New Mexico.

The plots on the Coconino and Tusayan National Forests, Arizona, consist of large areas, usually from 160 to 480 acres, on which only diameters are measured, and one or more small plots of from four to twelve acres within the major plot, on which more detailed work, such as height measurements, crown descriptions, and reproduction studies are made.

The four plots established on the Coconino and Tusayan in 1909 were remeasured and remapped in 1914. The aggregate area of the major plots is approximately 1,180 acres, and of the minor plots (within the major plots) approximately seventy-eight acres. The field work occupied a crew averaging three men about four months. The cost will total $2,500 or $2.12 per acre. This, it would seem, is rather expensive.

A large portion of the data remains to be compiled. Owing to the fact that the computation of volumes requires the construction of special volume tables for different areas, this work will require a considerable amount of time. The following partial data for the plot S-3 on the Tusayan National Forest serves to illustrate the character of the information which will be obtained.

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[1]See "Forest Service," U. S. Dept. of Agr., Bull. 101, pp. 49-51; also "Cutting Western Yellow Pine in Arizona and New Mexico," T. S. Woolsey, Jr., Proc. Soc. Am. Foresters, Vol. IX, No. 4, pp. 479-503.

A more detailed report giving the results on all areas remeasured in 1914 will be prepared this winter. It is to be hoped that it will appear in the "Review of Forest Service Investigations" or elsewhere, since the results deserve the widest publicity among technical foresters in view of the interest attaching to methods of determining the increment in uneven-aged stands as evidenced by such a symposium of articles on this subject as that in Vol. IX, No. 2, of the *Proceedings of the Society of American Foresters*.

DATA ON PERMANENT SAMPLE PLOT S-3, TUSAYAN NATIONAL FOREST, ARIZONA

	1909	1914	*Increase in 5 Years*
Area of plot, 456 acres			
Number of trees 4 inches or over d.b.h.			
Living, total	8,255	8,400	145
Yellow pine[2]	623	647	
Black jack[2]	7,632	7,753	
Dead, total		180	
Yellow pine		22	
Black jack		158	
Total volume, ft. b.m. 12 inches or over	1,550,910	1,756,328	205,418
Total increment for five years = 13.2 per cent. = 2.64 per cent per year.			
Volume Yellow pine, ft. b.m.	493,290	547,060	53,770
Volume Black jack, ft. b.m.	1,057,620	1,209,268	151,648

The current annual increment per cent. of this average stand is, therefore, 2.64. Measurement made in 1907 on the same forests and using the method of predicting growth by the applying diameter growth tables to the stand on an average acre gave an increment per cent. of 1.88.[3] The comparison of these results is most interesting and bespeaks the need of just such data as are now being secured if the allowed annual cut is to be determined accurately.

REPRODUCTION

Counts on twenty (5 x 10 feet) plots give an average of 3.75 seedlings of the year 1914 per plot. Only two older seedlings (entered since 1909) were found on all the plots. A few seedlings over five years old are scattered over the area. The pres-

[2]The terms "Yellow pine" and "Black jack" refer to the mature and immature forms, respectively, of the Western Yellow pine. See U. S. F. S. Bull. 101, pp. 5-6.

[3]See U. S. F. S. Bull. 101, p. 32.

ence of considerable numbers of seedlings on old logging roads and on spots where brush piles have been burned is significant, although there are also seedlings in the tall bunch grass. The occurrence of thrifty two and three year old seedlings on the edges of unburned brush piles indicates that such situations furnish favorable conditions once the seedling gains a foothold underneath the litter.

CLASSIFICATION OF DEAD TREES

Cause of Death	*Number of Trees* Yellow Pine	Black jack
Fire	1	0
Mistletoe	0	44
Mistletoe and insects	1	59
Mistletoe and porcupine	0	9
Mistletoe, porcupine and insects	0	1
Mistletoe and suppression	0	2
Insects	1	13
Porcupine	0	9
Porcupine and insects	0	8
Squirrels	0	2
Squirrels and porcupine	0	1
Windfall	7	12
Suppression	0	2
Lightning	6	5
Unclassified	5	3
Total number of dead trees	21	170

The total number of dead trees is thus 192 or 11 more than the total dead as given in the table above. This discrepancy is not explained.

The large amount of damage which is being done by mistletoe is striking. Thirty-four per cent. of the living Black-jack and 35 per cent. of the Yellow Pine on the area are now affected by the parasite. During the past five years 1½ per cent. of the Black-jack have been killed by mistletoe alone or in conjunction with other agents, mainly insects. It is believed that mistletoe is directly or indirectly responsible for by far the greater number of deaths in which it appears as only one of the factors. The marking on this area was done by the District Marking Board in 1909. At that time the policy was to cut mistletoe-infested trees only when the infestation was rather serious, since it was thought that a small or moderate amount of mistletoe would not injure the tree for many years. It is apparent that mistletoe develops rapidly after cutting since many trees left in 1909 have been killed by it and many which, though still classed as living, will die in a few years. The results on this area indicate that *mistletoe-infested trees should be marked mercilessly, regardless of whether openings in the forest result.*[4]

The results on this area as well as on other areas on the Coconino and Tusayan, cut from five to ten years ago, indicate that natural reproduction is at best a slow process from which nothing tangible can ordinarily be expected in less than fifteen or twenty years. This must give us pause. To a rotation of at least 160 years is added another twenty years during which one waits for reproduction. One-eighth of the rotation! It is interesting to note how accurately Mr. Woolsey predicted this in United States Forest Service Bulletin 101, where he says (p. 48): "It is not known how long the reproduction period must last, but probably fifteen years, and perhaps twenty will pass before satisfactory regeneration takes place."

A. B. R.

Basket Willow Culture. By George N. Lamb. Farmers' Bull. 622, U. S. Dept. Agr., Washington, D. C., 1914. Pp. 34. Ill.

This publication discusses the various kinds of basket willows and the methods of growing them which have been found best as a result of experiments conducted at the forest service willow farm at Arlington, Va., and a study of private holts throughout the country. It also deals with the cost of establishment and maintenance of willow holts and the opportunities for marketing the products.

The Forest Service has distributed thousands of willow cuttings during the last few years and enough successful plantings have resulted to indicate that basket willow culture on a commercial scale is feasible in all parts of the country, except in the arid and semiarid regions, at high altitudes, and in portions of the South. Along the Mississippi, however, they have grown well almost to the Gulf. At present the industry is not extensive.

According to this bulletin, the most difficult problem in basket willow culture in America is that of getting the rods peeled by

[4]In contrast note instructions for marking as quoted by Woolsey in article *loc. cit.*, pp. 496 and 497.

hand at a moderate cost. What is urgently needed is an inexpensive machine to peel sap willows. The machines now in use are designed for peeling steamed willows which are not so valuable on the market. Moreover, the high cost of the machine operates against the small growers and dealers and limits the industry. Many suggestions are offered for improving the situation.

S. J. R.

Fire Retardent Paints for Shingles. By Henry H. Gardner. Bull. No. 42, Educational Bureau, Paint Manufacturers' Assn. of the U. S., Phila., 1914. Pp. 26. Ill.

The writer of this paper is the assistant director of the Institute of Industrial Research, Washington, D. C. There has recently been much publicity given to the campaign against the wooden shingle and this article is in refutation of many of the charges. It is Mr. Gardner's belief that the wooden shingle will always be used to a considerable extent. "Its moderate cost, light weight, low heat conductivity, wide application and durability, are properties which recommend its use upon dwellings, barns, and other structures of this type."

The disadvantages of the wooden shingle are considered in detail, but "very few materials have ever been made which have proved satisfactory for roofing or other building purposes without some surface treatment." The main trouble with wood is that it is used in the natural state. The object of the paper is to point out the advantages to be gained by applying various kinds of fire-retarding paints. He concludes that "shingled structures of all types, when properly painted, are not only fire resistant, but they are moisture proof and highly ornamental."

Various methods of testing fire-retarding paints are discussed and standards recommended.

S. J. R.

Heart-rot of Oaks and Poplars Caused by Polyporus dryophilus. By George E. Hedgcock and W. H. Long. Reprint from Jour. Agr. Research. U. S. Dept. Agr., Washington, D. C. Vol. III, No. 1, 1914, pp. 65-77. Ill.

The larger and older oaks of the southwestern and western United States are so affected by heart-rot that they are not used to any extent for lumber and are, as a rule, valuable only for fuel. The chief cause of this deterioration is *Polyporus dryophilus,* which produces a whitish piped rot in the heartwood. The species known to be attacked are *Quercus alba, arizonica, californica, digitata, emoryii, gambelii, garryana, marilandica, minor, prinoides, prinus, texana, velutina, virginiana,* and *Populus tremuloides.* The disease is very widely distributed, having been found in twenty-three States and reported from several European countries.

The rots produced by this fungus in all the species of oak examined had the following characters in common: (1) a water-soaked, discolored area in the first stage; (2) a general association of the earlier delignification with the medullary rays; (3) later a more general delignification of all the wood fibers; (4) the formation of white mycelial lines; (5) the presence of cinnamon-brown areas in the older rotted wood.

It is interesting to note that "the cells of some of the medullary rays and of the wood parenchyma often contain starch grains even after the absorption of the inclosing cell walls," thus proving that it is the cell wall rather than the contents which is the primary object of attack.

Polyporus dyrophilus is believed to gain entrance into the wood of the host trees only through wounds in which the heartwood is exposed, such as broken or dead limbs and fire scars. When it enters the stub of a limb it grows downward through the heartwood to the trunk and spreads both upward and downward through the heart of the tree. When it enters a basal wound it sometimes spreads upward throughout the heart of the entire trunk. In the aspen the fungus will attack the living sapwood when the disease becomes far advanced.

S. J. R.

Timber Conditions of the Little Smoky River Valley, Alberta, and Adjacent Territory. By J. André Doucet. Bull. 41, Dominion Forestry Branch. Ottawa, Canada. 1914. Pp. 52.

The area considered by this bulletin lies in a southwesterly direction from Lesser Slave Lake and extends down nearly to the Grand Trunk Pacific Railway. The reconnaissance survey herein described is an extension of the work, in which the author participated, around Lesser Slave Lake (Forestry Branch Bulletin 29).

After a general discussion of the topographic soil and forest conditions, the author proceeds to a detailed description of the region by blocks which are in reality mostly cover types, such as the poplar forest, old spruce forest, young mixed forest, pine forest and broulé. The information concerning the area, soil conditions, composition, age and yield of these types is presented in precise tabular form.

From the tables we find that the 7.3 thousand square miles covered by the survey are estimated to contain 4.5 billion feet of merchantable spruce and pine and 20 million cords of poplar and birch. It would seem from the author's statements that less than one-twentieth of the area was actually covered with continuous mature forest. The total yield as given above includes patches of mature timber in areas of second growth. Polewood from thirty-five to seventy-five years old, mostly Lodgepole pine, occupies over 2,000 square miles; poplar nearly mature 1,300 square miles, while young mixed growth already carrying some commercial timber covers 1,500 square miles.

Eleven per cent. of the area has been burned in the past twenty years, over 25 per cent. in the last fifty years and 77 per cent. in the past 100 years. "Fires do not seem to be less imminent today than they were twenty-five or fifty years ago. The only difference is that there is less to be burnt." Satisfactory reproduction is taking place on areas not reburned, but this is the condition on only about one-fifth of the total area. The author discusses the necessity for adequate fire protection and suggests places for patrol, lookout stations and the building of trails on the 5,500 square miles which he recommends to be created a forest reserve.

As a whole, the bulletin is written in a remarkably clear and concise style, but some of the statements in regard to the amount of merchantable timber are not clear. For example, if his term mature means commercially mature timber, then, according to a statement on page 19, the total area is 250 square miles, while on page 43 it is given as 364 square miles. And again on page 43, the sums mentioned for the various blocks give a larger amount than the grand total stated in the same paragraph.

C. D. H.

Farm Forestry. By Alfred Akerman. Athens, Ga. 1914. Pp. 1-54. Paper, 60 cents.

Although the sub-title of this book is: A textbook dealing with the wooded parts of Southern farms and the problems growing out of them, for use in agricultural high schools and colleges, the book is written primarily for the State of Georgia, where more than half of the area of farm holdings is in woodlands and more than half of the wooded area is in farm holdings. Thus the future of the forests of the State depends largely on the attitude of the farmers toward the wooded parts of their holdings. The object of this book is to awaken their interest and to give it intelligent direction.

The text of the book is divided into three parts: Production of Timber; Use of Timber; and Place of Woodlands in Farm Management. The first part is introduced by an outline of the functions of trees, followed by brief botanical descriptions and the wood uses of some twenty trees. Then comes a discussion of methods of reproduction, protection, thinnings, and the cutting of mature timber. These discussions occupy 44 of the 54 pages of the book. The chapters in the second part deal with farm saw-mills, wood preservation and firewood. The third part is not sub-divided, as it occupies only two pages.

While a critic might reasonably find fault with the arrangement of the material and the relative importance of various topics, judged by the space given them, yet the subject matter is so clearly and simply presented, the arguments re-enforced by so many illustrations directly applicable to the farm, one feels that the book is admirably adapted to the purpose which it is intended to serve. There ought to be more books of its kind.

C. D. H.

Timber and Soil Conditions of Southeastern Manitoba. By L. C. Tilt. Bull. 45, Dominion Forestry Branch. Ottawa, Canada. 1914. Pp. 36.

The bulletin is the result of a preliminary survey of 3,500 square miles by two men during one summer, the object being to investigate the soil and forest conditions with a view of ascertaining whether the country was better suited for agriculure or for forestry.

The author discusses the character of the country under three divisions, namely, the prairie region, the transition area and the Laurentian region. Naturally, the two latter contain the forest and most of the bulletin deals with them. The transition area lies between the prairie on the west and the western edge of the Laurentian formation on the east. Geologically it is related to the prairies, being covered by layers of cretaceous sandstones and limestones dressed with glacial deposits which become increasingly thinner as one approaches the Laurentian. The forests of the area are brought together under three types: Jack pine type, occupying 7 per cent.; the Poplar type, 20 per cent., and the Muskeg type, 73 per cent.

The Jack pine type, occupying the gravelly and sandy ridges, is for the most part not over twenty-five years old and 80 per cent. of it is not over 4 inches in diameter. The area averages only 114 trees per acre and consequently the trees are bushy. Repeated fires have converted 20 per cent. of the area into prairie-like openings. The Poplar type is found on the heavier soils and the density of the stands is about the same as that of the Jack pine. The trees are scrubby, fire-wounded, frost-bitten and fungus-eaten. About 80 per cent. of them are not over 6 inches in diameter. It is evident that the Poplar occupies areas once chiefly possessed by White spruce and young spruce is abundant beneath the poplar where burning has not been excessive.

The Muskeg type of the transition area is subdivided into three conditions, namely, the heavily timbered, the lightly timbered and the open muskeg. These terms are apparently used only for the sake of comparison, for on the heavily timbered muskeg less than 10 per cent. of the tamarack, forming 80 per cent. of the stand, and none of the Black spruce, is over 1 foot in diameter.

The Laurentian region considered in this report is like that of other regions of the same kind in Canada, being characterized by low ridges of uniform sky line, an abundance of lakes and a scarcity of soil. The author estimates that over 90 per cent. of the area has been burned. The greater part of the forest cover is not over twenty years old. It is divided into the Jack Pine type, Poplar-Spruce type and the Muskeg, the first two occupying 50 and 30 per cent., respectively, of the area.

The area occupied by Jack pine in the transition area and all of the Laurentian region examined are recommended to be placed under forest reserve, for none of the soil is agricultural and the young forest growth has future value if protected from fire.

The author gives considerable attention to the possibility of draining the muskegs for agricultural purposes and refers to successful work of this kind in the adjoining State of Minnesota. There is little doubt that many of the muskegs could be transformed into profitable truck gardens. This is a subject worthy of much more attention than it is receiving in Canada.

C. D. H.

Forest Products of Canada, 1913: Pulpwood. By R. G. Lewis and W. G. H. Boyce. Bull. 46, Forestry Branch. Ottawa, Canada. 1914. Pp. 17.

The production of pulpwood in Canada during 1913 totaled 2,144,064 cords, worth over 14 million dollars. Of this amount, 52 per cent. was manufactured into pulp at home, the remainder being shipped in the raw state to the United States. British Columbia pulpwood is practically all manufactured into pulp within the province; in Ontario and Nova Scotia less than one-fourth of the cut is exported unmanufactured; but in Quebec and New Brunswick much more is exported raw than is manufactured into pulp.

Forty-eight firms operating sixty-four mills in Canada used 1,109,034 cords of pulpwood, an increase of 28 per cent. over 1912. Quebec mills manufactured 57 per cent. of this, and Ontario mills 29 per cent. The average price paid for the raw material was $6.53 per cord, an increase of 51 cents over 1912.

Of the total quantity of pulpwood used in Canada, spruce formed over two-thirds, Balsam fir one-quarter, and hemlock, Jack pine and poplar the balance. The amount of Balsam fir has been steadily increasing each year, its percentage of the whole in 1911 having been only 17.5.

Mechanical grinding consumed 54 per cent. of the wood, about 33 per cent. was converted by the sulphite process, and 12 per cent. by the sulphate process.

About two-thirds of the wood pulp produced is manufactured into paper at home. Approximately 300,000 tons of pulp are exported, about two-thirds of this to the United States and one-third to Great Britain. This is a decrease of 22 per cent. from the quantity exported in 1912. At the same time the imports of pulp from the United States, Sweden, Great Britain, Germany, Norway and Switzerland doubled in value in 1913 over 1912.

The bulletin contains a map of Canada showing location of all pulpmills. An appendix gives a list of active mills—thirty-four in Quebec, seventeen in Ontario, six in Nova Scotia, four in New Brunswick, and three in British Columbia.

J. H. W.

Forest Products of Canada, 1913: Poles and Cross-Ties. By R. G. Lewis and W. G. H. Boyce. Bull. 47, Forestry Branch. Ottawa, Canada. 1914. Pp. 16.

I. *Poles*—These statistics are based upon reports from 424 pole purchasers in Canada in 1913. These consisted of 218 telephone companies, eighteen steam railways, four telegraph companies, twenty-nine electric railways and 155 electric light and power companies.

These companies purchased in all 534,592 poles, worth $1,188,-331. One-half the poles were of Eastern White cedar, over one-quarter of Western Red cedar (Thuja), and over one-fifth of Eastern tamarack. The group of telephone and telegraph and steam railway companies purchased some 88 per cent. of the total number.

Of the number purchased, about 12 per cent. were imported from the United States. Among this we note a small shipment of cypress poles.

Nearly two-thirds of the poles were in the 20 to 25-foot class, and only 15 per cent. were over 30 feet. White cedar is the most in demand up to 35 feet in length, above which it, of course, gives way to the western species.

The average prices paid for eastern cedar poles were $1.21, $2.36, $3.55 and $5.42 per pole for each 5-foot class, respectively, from 20 to 40 feet.

II. *Cross-Ties*—From reports from forty-seven steam railway and thirty-two electric railway companies, it is shown that nearly 20 million ties were purchased in 1913 at a cost of around eight and three-quarter million dollars. These companies purchased over 16 per cent. of their ties outside of Canada.

The ties purchased by the steam railways were Jack pine to the extent of 39.5 per cent.; Douglas fir, 12.4 per cent.; White cedar, 11.8 per cent.; hemlock, 6 per cent.; oak, 5 per cent., and Eastern tamarack, 4.3 per cent. About 12 per cent. of the ties received preservative treatment.

The electric railways purchased around 400,000 ties, or 2 per cent. of the total number. Of these, 37 per cent. was eastern cedar, 24 per cent. western cedar, and 17 per cent. Jack pine.

J. H. W.

Statistical Yearbook. Section C: Forests; Section D: Forest Industries. Province of Quebec. 1914. Pp. 243-268.

This publication, which can also be had in French and as a separate, for the first time brings a very complete statement of the resources of Quebec, replete with statstical information on 455 pages. The two sections on Forests and Forest Industries occupy only twenty-five pages.

The first section, prepared by Mr. P. C. Piché, head of the forest service, shows that Quebec furnishes about 30 per cent. of the $182,000,000 worth of forest products marketed by the Dominion in 1912, employing at least 22,000 men in the woods.

The forest area is estimated at 130 million acres. Only 6 million acres, mostly in the St. Lawrence Valley, are privately owned, old seigniories, lands sold to settlers or granted to railways, the lots only seldom exceeding fifty acres. Under license there are 44.5 million acres; not in timber limits 78 million acres; 1.3 million acres under location tickets; and 215,000 in township forest reserves.

The revenue from the private forests is stated as at least $3,000,000, the maple sugar industry alone furnishing $700,000 and pulpwood, with 500,000 cords at $2, another million.

Since 1906 no limits have been offered. The method of disposal is the same as in other provinces of Canada, involving a bonus, secured at auction, a groundrent of $5 per square mile, and royalties for timber cut per thousand feet. A diameter limit is set, of 13 inches for pine (at 2 feet from ground) and 12 inches for spruce, except swamp spruce, which may be cut down to 7 inches.

The revenue now exceeds $1,500,000, and since 1867 (date of confederation) the timberlands have furnished over $35,500,000 income. Complete tables give the detail for the whole period since 1870.

An estimate of the forest wealth of the province places it at 330 billion feet, board measure, worth $600,000,000 for stumpage; pine representing 50 billion feet figured at $4.00; spruce, 125 billion feet, at $2.00, besides 100 billion feet pulpwood at $1.00; cedar and hardwoods representing the balance.

For the timber limits not under license, which are mostly fir and spruce, poplar and Banksian pine, the stand is stated as running from five to nine cords.

The Government sells 100-acre lots to settlers under location tickets, half the price in cash and the balance in four annual instalments, with interest at 6 per cent. This method has given rise to much fraudulent speculation in timber, which, it is claimed, has been stopped through the action of the forest service.

The formation of township reserves has been inaugurated since 1911. They are designed to supply timber to inhabitants of neighboring villages under certain regulations.

The forest service, consisting of a chief forester and assistant, two civil engineers, sixty forest rangers and fourteen cullers, has charge of the exploration of the unsurveyed territory of the province, the classification of soils, the supervision of lumbering operations on crownlands, reforestation and other technical work in connection with forests. The present appropriation is $100,000.

A list of the principal commercial trees in English, French and botanical names shows thirty-eight, a number of which certainly could not be called "principal."

In Section D, tables and diagrams exhibit the statistics of lumber mills and pulp mills; making no mention of other forest industries.

For the five years 1908-1912 the mill product has averaged about 700 million feet, and the values between $10,000,000 and $11,000,000.

Spruce is by far the greatest producer, White pine representing less than 20 per cent. of the spruce cut, either in quantity or value, the two together representing five-sevenths of the total cut; hemlock, Red pine, cedar and fir following; hardwoods being negligible except birch and basswood, with 50 and 18 million feet.

A table of values per thousand feet makes the average vary during the five years between $14.20 and $15.79, a slightly higher figure than prices for spruce alone, White pine at prices of $20.09 to $22.85 being responsible for this excess.

The twenty-four pulp mills in 1912 produced 460,000 tons of pulp, of which 340,000 were mechanical, using 580,000 cords valued at $3,386,700, or $5.85 per cord, slightly less than in 1911.

Exactly one-half the pulp mills of Canada are located in Quebec, but they turn out 61 per cent. of all the pulp and 65.7 per cent. of the mechanical pulp made in Canada.

B. E. F.

Report of the Fifth Annual Meeting, Commission of Conservation, Canada, Held at Ottawa, January 20-21, 1914. Ottawa, Canada, 1914. Pp. 287.

The Commission of Conservation of Canada is purely investigative and advisory in character, it having no administrative functions whatever. Its work is sub-divided, under seven committees, those of Minerals, Lands, Public Health, Forests, Waters and Water Powers; Fisheries, Game and Fur-Bearing Animals; and Press and Cooperating Organizations.

The Committee on Minerals has carried on investigations calculated to bring about better methods of mining and closer utilization of the mineral resources of the Dominion. Especial attention has been paid to the coal-mining situation, and a report has been published, entitled, "The Conservation of Coal in Canada," by W. J. Dick, mining engineer for the Commission.

The Committee on Lands has occupied itself with promoting better methods of farming, chiefly through the conduct of an agricultural survey and the establishment of illustration farms. The illustration farm work is now to be taken over by the Dominion Department of Agriculture, its value having been demonstrated by the Commission.

The activities of the Committee on Public Health include the promotion of better health laws, prevention of the pollution of waterways, town and city planning, housing legislation, etc.

The report of the Committee on Forests pays especial attention to the railway fire situation, marked progress having been made in this field under the fire regulations of the Board of Railway Commissioners, issued in 1912. Other measures advocated include brush disposal, land classification, forest reserve extension, appointment of provincial foresters, formation of cooperative forest fire associations, better protection of cut-over and burned-over forest areas, continuation of census of forest resources already begun, establishment of game preserves, and the adoption of the merit system of appointments in the fire-protective organizations of the Dominion and provincial governments. During the year, there was published a report entitled, "Forest Protection in Canada, 1912," by Clyde Leavitt, forester to the Commission.

The Committee on Waters and Water Powers is engaged upon a power survey of the Dominion, especial attention having been paid during the year to British Columbia and the prairie provinces.

Under the direction of the Committee on Fisheries, Game and Fur-Bearing Animals, a report has been published, entitled, "Fur-Farming in Canada," by J. Walter Jones. This is the first book of its kind ever published in Canada, and the demand for it has been so great that a second edition, revised and enlarged, has been issued. This report is of especial interest in connection with the remarkable development of the fox-farming industry which has taken place in various portions of Canada, particularly in Prince Edward Island.

C. L.

OTHER CURRENT LITERATURE

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Standard Classification of Activities and Procedure in Forest Service Accounting. U. S. Department of Agriculture, Contribution from the Forest Service. Washington, D. C., 1914. Pp. 47.

The Sequoia Pitch Moth, a Menace to Pine in Western Montana. By Josef Brunner. Bulletin 111, U. S. Department of Agriculture. Washington, D. C. 1914. Pp. 11.

Norway Pine in the Lake States. By T. S. Woolsey, Jr., and H. H. Chapman. Bulletin 139, Department of Agriculture. Washington, D. C. 1914. Pp. 42.

Describes the life history, site requirements, growth, yield and best methods for its management.

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How to Attract Birds in Northeastern United States. By W. L. McAtee. Farmers' Bulletin 621, Department of Agriculture. Washington, D. C. 1914. Pp. 15.

Longevity of Pycnospores of the Chestnut-blight Fungus in Soil. By F. D. Heald and M. W. Gardner. Reprint from the Journal of Agricultural Research. Washington, D. C. April 15, 1914. Pp. 67-75.

Birds as Carriers of the Chestnut-blight Fungus. By F. D. Heald and R. A. Studhalter. Reprint from the Journal of Agricultural Research. Washington, D. C. September 21, 1914. Pp. 405-422.

Natural Regeneration of Range Lands Based Upon Growth Requirements and Life History of the Vegetation. By A. W. Sampson. Reprint from Journal of Agricultural Research. Washington, D. C. November 16, 1914. Pp. 93-147.

Lumber Markets of the Territory of Hawaii. By F. H. Smith. Daily Consular and Trade Reports, No. 276. Washington, D. C. November 24, 1914. Pp. 881-890.

The author discusses the present and prospective uses both of native lumber and that imported from the United States, prices, credit systems, etc. It is stated that there is little promise of a marked increase in consumption during the next ten years.

Brief List of Meteorological Textbooks and Reference Books. (3d ed.) By C. F. Tolman. U. S. Weather Bureau, No. 512. Washington, D. C. 1913. Pp. 22.

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Contains: Forest Planting in Arizona and New Mexico, by G. A. Pearson; Cutting Western Yellow Pine in Arizona and New Mexico, by T. S. Woolsey, Jr.; An Afforestation Scheme for Southern California, by J. C. Smock; Organization of Forest Fire Control Forces, by C. Du Bois; Some Observations on the Variation in Length of Coniferous "Fibers," by H. B. Shepard and I. W. Bailey; A Conspectus of North American Firs (exclusive of Mexico), by W. H. Lamb; Is Abnormal Brittleness in Wood Caused by a Lack of Some Essential Mineral Element in the Soil? by H. D. Tiemann; Reviews.

Fourth Annual Report of the New Hampshire State Tax Commission. Concord. 1914. Pp. 146.

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The Management of Second Growth Hardwoods in Vermont. By A. F. Hawes and B. A. Chandler. Bulletin 176, Agricultural Experiment Station. Burlington. 1914. Pp. 31-88.
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Pennsylvania Trees. By J. S. Illick. Bulletin 11, Department of Forestry. Harrisburg. 1914. Pp. 231.

Fire Retardant Paints for Shingles and Other Wooden Structures. By H. A. Gardner. Bulletin 42, Educational Bureau, Paint Manufacturers' Association of the United States. Philadelphia, Pa. 1914. Pp. 26.

The Chestnut Blight in Virginia. By Flippo Gravatt. Ninth Report of the State Entomologist and Plant Pathologist of Virginia. 1912-1913. Richmond. 1914. Pp. 21-25.

"The Chestnut blight has a firm hold in northern Virginia, having been found in nineteen counties. If the disease continues to spread at its present rapid rate, and if no determined efforts are made to hold it back, the major portion of the chestnut growth of the State will be killed within a comparatively few years."

Forest Fires in North Carolina during 1913, and State Forest Fire Prevention in the United States. By J. S. Holmes. Economic paper No. 37, Geological and Economic Survey. Raleigh, N. C. 1914. Pp. 82.

Car Window Observations on the Vegetation of the Upper Peninsula (of Michigan). By R. M. Harper. Reprint from Fifteenth Report of Michigan Academy of Science. Pp. 193-198.

Fourth Biennial Report, Department of Game and Fish of the State of Alabama, October 1, 1912, to September 30, 1914. By John H. Wallace, Jr. Pp. 21.

The Preservation of Ties, Poles and Timbers by Antiseptic Treatment. By W. F. Goltra. Paper read before Central Electric Railway Association November, 1914, at Fort Wayne, Indiana. Pp. 11.

Annual Report of Potlatch Timber Protective Association. Potlatch, Idaho. 1914. Pp. 44.

The report states that the year 1914 was the most disastrous which the association has ever experienced. The area burned covered 19,734 acres, of which 6,988 acres were covered with green timber and the remainder was brush land and cut-over land. The merchantable timber loss was 110,310,000 board feet. In addition there was a loss of 26,344 M board feet on unprotected property within association limits. The assessments on members were over eleven times greater than in 1913, being 25 1-4 cents per acre. The total expenditures were slightly in excess of $100,000.

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Western Hemlock: Its Forest Characteristics, Properties and Uses. By E. J. Hanzlik and H. B. Oakleaf. Reprint from the Timberman, October, 1914. Portland, Ore. Pp. 9.

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Creosoted Douglas Fir Paving Blocks. West Coast Lumber Manufacturers' Association. Pp. 32.

The modern pavement for roads, streets, bridges and crossings.

The Planting and Care of Shade Trees. By F. E. Buck. Bulletin 19, Second Series. Dominion Experimental Farms. Ottawa, Canada. 1914. Pp. 24.

Tree Planting for the Schools of Saskatchewan. Department of Education. Regina, Sask. 1914. Pp. 27.

This is a commendable pamphlet intended for the use of the teacher in connection with lessons in nature study and agriculture. Its scope is indicated by the headings: Saskatchewan as a timber producing province; Distribution of tree species throughout the province; Advantages of forests and forestation; What has been done in Saskatchewan; Value of prairie tree planting and planting in connection with schools; Care of plantations; Suitable varieties for different purposes; Propagation of trees; Time for planting; Species suitable for Saskatchewan; Bibliography.

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Ipil-Ipil—A Firewood and Reforestation Crop. By D. M. Matthews. Bulletin 13, Bureau of Forestry. Manila, P. I. 1914. Pp. 18.

Progress Report on Forest Administration in the Jammer and Kashmir States, for the year 1912-1913. Lahore, India. 1913. Pp. 22.

Handbuch der Forstwissenschaft. Begründet von Dr. Tuisko Lorey. Third edition. Laupps, Tübingen. 1914. Four volumes. 84 Mark.

A review of this excellent work in which perhaps not less than forty authors had a hand under the editorship of Wagner, is found in *Centralblatt für das gesammte Forstwesen,* May, June, 1914, pp. 231-234. The chapters on Sites, of 120 pages, and on Biological Dendrology, of 284 pages, are specially praiseworthy.

Theorie der Riesen. Von Dr. Leo Hauska. Wien: Franz Deulike. 1914. Pp. 74.

Discusses in detail and exhaustively all factors which have an influence on the travel of logs in a logslide, and furnishes valuable advice for the practical construction of slides.

Durchforstungs- und Lichtungstafeln. Von Dr. Hemman. Berlin: Springer. 1913. Mk. 2.60.

Contains 16 yield tables for oak, beech, birch, alder, pine, spruce, fir, calculated from regular yield tables the amount of thinnings material from five to five years for various densities from .6 to 1.

PERIODICAL LITERATURE

FOREST GEOGRAPHY AND DESCRIPTION

Swedish Wood Industries

The sawmill industry of Sweden is very fully described by Dr. Janka of the Austrian forest school as a result of personal inspection in the continuation of his record of an excursion, in part briefed in F. Q., vol. XII, p. 617. Sweden exports annually about 1,500 million feet B.M., valued at $62,500,000, and 200 million cubic feet of other wood. Most of it goes to England. There are 1,400 sawmills employing 67,000 workmen, producing a first-class product, of fine grain, showing from one-half to one-third the annual ring width, and 20 per cent higher specific gravity than samples from middle Europe. This latter figure is for spruce, while for pine the weight is 5 per cent less, owing to a smaller summer wood per cent.

The logs are made 16 feet and an average of 8-inch diameter at the small end, care being taken that the gangsaws are supplied with the sizes which are most advantageous for each as it is set, which obviates unnecessary adjustment. Electric power is commonly used, produced by the very many water-falls. The mills are mostly located at the mouths of rivers near seashore, a most advantageous location. The logs for winter and summer cut are separately stored, the winterwood on land, the summerwood piled in the water so that it is kept under. Assorting is done by half-inch classes by a marking hammer, while still in the water. All work, even this marking, is done by the piece. The sorting of sizes for the different gangs is also done in the water by boys. The stouter logs are slabbed in a special gang.

The details of the works of several mills are given. At Korsnäs mill, where 200 men are employed, these are paid under contract which is revised every three years. The sawyer makes about $1.15, other laborers 75 per cent. of this (85 cents), and boys 50 to 60 per cent.; the wage being based upon the cost of sawing up an average log. Houses, fuel, doctor and chances for amusement are furnished by the Company.

The most modern saws (no band saws anywhere!) make a kerf of only 1.5 to 2 millimeters and run very fast, 360 turns per minute.

The output is 65 per cent. of the raw material. Pine lumber is sorted into six quality classes and the cut averages 8 per cent. I, 25 per cent. II, 30 per cent. III, 20 per cent. IV, 17 per cent. V and VI class, the sorting being done rigorously. Spruce is sold without assorting.

The Korsnäs company owns nearly 600,000 acres of productive forest besides 200,000 acres of unproductive land, but buys large quantities of logs, and with a capital of over $3,000,000 pays 8 per cent. dividends.

Many other details are given.

Eine forstliche Studienreise nach Schweden. Holzindustrie. Centralblatt für das gesammte Forstwesen, May-June, 1914, pp. 235-248.

Forests of Argentina

The importation into Argentina of lumber and articles made of lumber amounts to about $26,000,000 gold annually, of which southern yellow pine comprises one-third. The exports of quebracho in 1913 were 342,000 tons of logs worth $12 gold per ton, and 91,000 tons of extract, worth about $57 gold per ton.

Of about 360 tree species in the forests of Argentina about 50 occur in great number, forming mixed forests, as a rule with one or several species predominating. Logging operations are primitive, transport is by animals and road carts, and sawmills are lacking in the woods so that the timber has to be squared with the ax and shipped in that form. As a result of the poor handling of the native logging and lumber business, foreign lumber at present almost monopolizes the market.

The southern or antarctic forest in Argentina extends along a strip from 5 to 10 miles wide parallel to the Chilean boundary from the 37th degree on the south to the Fire Islands. The trees are five kinds of beeches (*Nothofagus*); araucarias (*Araucaria imbricata*) between degrees 37 and 39½; patches of cedar between 37 and 43½ degrees south; and between degrees 41 and 43 are stands of larch (*Fitzroya tetragona*) which resembles in general appearance and in quality of lumber the redwood of California, and is one of the best trees in the country. These species occur in the limited areas between the beech forests.

The forests are at present exploited only for the local market and about ten small sawmills are now operating betweent the 37th degree and the Fire Islands, a strip about 1,300 miles long. The article suggests that it would be advisable for "lumbermen who have already done some logging themselves in the States" to look over the opportunities in Argentina.

S. J. R.

Argentina's Export and Import Trade. By Max Rothkugel. American Lumberman, Jan. 16, 1915, p. 40.

Logging in Brazil

In the rather hilly country of Southern Brazil, the forests of this particular operation, are principally of Parana pine and a little hardwood—Imbuia and Canella. The stands run about 7,000 to 8,000 feet per acre, and 16-foot logs scale about three to the thousand feet.

The logs are taken out by steam skidders and a railroad. The camps consist of both houses and cars. The crews are native Brazilians, Russians and Poles.

Topographic maps of the holdings are made and the railroads are laid out with transit by a man kept for the purpose. Considerable details of equipment, costs, upkeep and methods used, are included in the article.

O. L. S.

Lumber Trade Journal. November, 1914.

Hawaiian Forests

It is commonly thought that the Hawaiian Islands are devoid of native merchantable timber; this idea is due to lack of development which is prevented by expense of logging and manufacturing the native hardwoods. The forests are distinctly tropical, no pines, firs, spruces, oaks or maples. There is, however, one representative each of Sophora, Sapindus and of Zanthoxylum and two of Acacia. Koa, one of the two principal species, belongs to the last-mentioned genus. There are five distinct types: pure stands of Ohia-lehua, Koa, Mamane, Kukui; and mixed forests which contain Koa, Koaia, Kopiko, Kolea, Naio and Pua. Koa and Ohia are the two of commercial saw-timber importance.

The Ohia-lehua (*Metrosideros polymorpha*) comprises nearly three-fourths of the native forests. It forms pure forests in the regions of heaviest rainfall, *i. e.*, on the northeast slopes and the mountain tops under 6,000 feet. It grows from 30 to 100 feet high and in best forests often reaches 4 feet in diameter and 100 feet in height. They are thin crowned trees and grow far apart in pure stands. The trunk is straight though often twisted and deeply ribbed near the ground, and frequently divided into several roots 10 to 12 feet above the ground. The root system is shallow, often spreading on the surface of the mineral soil. Although the stand of trees is thin, the luxuriant undergrowth of vines and ferns is almost impenetrable. Climbers grow into the crowns and lace together the trees of an entire forest. Fern species range in height from a few inches to 30 feet and run the whole scale of tolerance, adding much to make the virgin Lehua forest a dark impenetrable jungle. Great quantities of humus are formed by this undergrowth, which remains saturated even in the drier times.

In so dark a forest it seems anomalous to find an intolerant tree like the Lehua reproducing itself generation after generation. It does so through its singular habit of germinating on both standing and fallen trees and especially on the fibrous trunk of the tree fern. Only in such places can it get the light it needs. It sends several roots down which enter the ground and later perform the functions of support and nutrition. When the host decays the tree is left standing on these roots which appear as divisions of the trunk.

Above 4,000 feet elevation the rainfall is less, and the Lehua there relinquishes its prominent place and mingles with other tree species.

The Lehua forms the tallest and most impenetrable forests on the Islands, and since they occur in the regions of greatest rainfall and on steep slopes they form the protective forests for the sources of irrigation water and for fluming purposes.

The Koa (*Acacia koa*) forms extensive forests of pure stands on Hawaii and Maui. The trees are scattered in the stand; broad crowned and short trunk, occasionally reaching a 6-foot diameter and 75 foot height. In crowded stands the stem is long and slender but rarely straight. It is intolerant at all ages and will not reproduce without a large amount of light. The forest also has a fern undergrowth but not so luxuriant as in the Lehua, for here it is drier. The best Koa now existing is at elevations of 4,000 to 6,000 feet where it contains some magnificent timber and is in a good state of reproduction. The wood of the Koa is highly prized for cabinet work. Its color varies through rich shades of red and brown; its grain is fine and indistinct.

The wood of Ohia-lehua is of reddish brown color; is very hard and strong, and takes a high polish. Railroad ties made from Ohia have been in position for twenty years and are still in good condition.

O. L. S.

Timberman, Aug., 1914.

Timber Industry in Manchuria

The Province of Kirin is one of the three provinces of Manchuria. It has an area of about 100,000 square miles, about one-third of Manchuria, and a timberland area of about 2,110 square miles. During the three years, 1910-1912, about 7,500,000 trees were cut of pine, cypress, walnut, chestnut, willow and oak. The Chinese statistics are not available for the other two provinces.

There are two species of oak cut; Mongolian Oak (*Q. mongolica*) and the Chinese Oak (*Q. castanifolia* or *sinensis*). The former is met with practically all over Manchuria; in size it reaches a height of 70 feet and diameter of 2 to 4 feet. The Chinese Oak is found only in North Manchuria, is smaller and has leaves like the Chestnut. Transportation charges on railroads are excessive, costing 7.7 cents per cubic foot for about 300 miles, whereas river transportation costs about 4.5 cents for a distance three times as far. Based on 1 cubic foot, the costs of logging operations are about as follows:

Stumpage	$.11
Felling	.13
Cutting to 21-foot lengths	.70
Total in woods	$.94

The hauling, made only on frozen ground by carts, costs 2 cents per cubic foot for 6.5 miles.

Lumber tax in Kirin province is 18 per cent. of the selling price—10 per cent. is paid by the buyer and 8 per cent. by the seller. Firewood is taxed 8 per cent. The regulations of the Department of Agriculture provide for a royalty to the National Governments of 8 per cent. of market value of the lumber.

Administration is one of the policies of the Government, and the Department of Agriculture and Forestry are framing a bill to provide for replanting all timberlands when cut. Timber concessions are granted only to citizens of the republic, and they cannot be transferred or mortgaged without the sanction of the Bureau of Forestry.

In North Manchuria there are two classes of lumber taxes; Royalty of National forests of 8 per cent. of market value, collected by Department of Agriculture and Forestry and used for National Forest administration; Government tax of 10 per cent. market value, collected through Department of Finance, and used by the General Government. Another tax may be imposed in the nature of a local tax.

O. L. S.

West Coast Lumberman, August, 1914.

SOIL, WATER AND CLIMATE

Snow in Forests

According to Lambert, forests show less depth of snow than adjoining fields in the early part of winter, but from midwinter on their snow conserving effect is clearly shown in a series of parallel measurements of snow depth in forests and in adjacent fields extending over a series of twenty winters. Coniferous stands offer greater impediments to the accumulation of snow but also retain most tenaciously that which does accumulate.

Die Höhe der Schneedecke im Walde und im Freien. Zeitschrift für Forst- und Jagdwesen. Oct., 1914, pp. 567-572.

BOTANY AND ZOOLOGY

Seed Color and Races

An investigation similar to that by the Russian Kurdiani and by Zederbauer on Scotch pine referring to the variety of color of seeds (briefed in F. Q., vol. VI, pp. 287 and 415) has been carried on by Dr. Pittauer on Austrian pine with a view of establishing biological varieties or races. As in Scotch Pine, he finds seeds all dark colored (black), all light colored and those that are variegated. An elaborate account of the procedure illustrated by curves is followed by a summary of results.

1. The percentage of light colored seed in a sample from the northern field (10.56 per cent.) was twice as large as in the sample from the southern field (5.13 per cent.).

2. The weight of a thousand seeds of light color was in the average 17 per cent. lighter than that of dark seeds, and lost its weight more rapidly by keeping than the dark seeds.

3. Light colored seeds germinate in the dark more slowly than dark seed except when placed under blue light, when the progress was alike; and after a year's storage it germinated under blue light even much more rapidly than the dark. The deduction from this behavior is that the after-ripening is more slowly accomplished in the light colored seed.

The hypothesis is ventured, that light color is an adaptation to light conditions in northern latitudes and in dense shade of stands, dark seed the adaptation to open sunny stands and southern latitude.

Studien über die Vielfarbigkeit von Schwarzkiefernsamenkörnern. Centralblatt für das gesammte Forstwesen, May, June, 1914, pp. 185-202.

Value of Geographical Varieties

A study and experimentation through many years on the behavior of the European larch from the Alps and from the Sudetic Mountains (Silesia, Bohemia and Saxony) by Dr. A. Cieslar furnishes striking evidence of the importance of seed supply for planting. The same species develops in these climatically different regions quite differently, and its progeny shows in a more than 24-year planting trial an inheritance of the characteristic differences in heightgrowth, shaft and crown form, bark, leaf period, weight of wood and in silvicultural directions.

A detail description of the plantings and investigations and their result is given. The résumé is as follows:

1. The larch from the Sudetic Mountains is more tolerant than that of the Alps; it can therefore be grown in denser stand, protects the soil better and can maintain itself in mixture with tolerant species—this especially because

2. It is more rapid in heightgrowth (up to the twenty-seventh year at least) by 20 per cent.

3. It forms an extraordinarily straight shaft contrasted with the noted sabre-like form of the Alpine variety.

4. The bole of the Sudetic form shows little taper as compared with the tapering alpine form, which also has a thicker bark.

5. Heart formation proceeds sooner and more rapidly in the Sudetic form, which is explainable by the less broad crown; and this difference in crown development also explains the shaft form.

6. The wood of the Sudetic form is heavier throughout, and especially in the lower bole, but the decrease in weight from base to top is more rapid.

7. The volume production in single trees does not differ essentially, but in stands the possibly denser position of the Sudetic form should furnish a larger product.

Studien über die Alpen- und Sudetenlärche. Centralblatt für das gesammte Forstwesen. May-June, 1914, pp. 171-184.

Climatic Conditions and Plant Activities

Zon points out that the seasonal grouping of temperature data is without significance to the proper understanding of plant life. This might apply even to Mayr's four growing months, the "tetrahore." The period of vegetative activities varies from five months to twelve months in the United States, as shown by Zon's map. The author might have gone a step farther and said that different species of trees have different periods of cambial activity, of food manufacture, food storage and digestion. Until we know the lengths of these periods in each case, we shall not properly understand the adjustment of a species to its temperature conditions.

The relation of plants to heat is expressed not in the absolute amount of heat required by them, but in a certain combination of time and heat. At its optimum of temperature each plant requires a definite number of days in order to complete a given phase of its development. Any deviation from the optimum in one or another direction will lengthen this period. Based upon these facts, the author suggests the following grouping of temperature data.

Freezing days, with a daily average of 32° F. or less. (a) Freezing days without thawing; (b) freezing days with thawing. *Cold days*, with an average daily temperature ranging from 32° F. to

40° F. (a) Days with frost, and (b) days without frost. *Cool days*, with an average daily temperature from 40.1° F. to 50° F. (a) Days with frost, and (b) days without frost. *Moderate days*, with an average daily temperature from 50° F. to 59° F. These are the days of moderate growth. *Warm days*, with an average daily temperature from 59° F. to 72° F. These are the days of most vigorous growth and the ripening of fruits in temperate latitudes and altitudes. *Hot days*, with an average daily temperature above 72° F. (a) Dry, hot days, which act depressingly upon vegetation; (b) moderately humid hot days, which expedite the ripening of southern fruits; (c) humid hot days, which produce a tropical growth of plants of the humid subtropical region.

Similar classifications might be made for the humidity of the air, precipitation, snow cover, sunshine, soil temperature and soil moisture. All but the last two could be obtained from the data given by the ordinary weather station. The trouble with applying such data to forest trees, however, is that stations of the Weather Bureau are not located in forest regions.

Meteorological Observations in Connection with Botanical Geography, Agriculture and Forestry. Monthly Weather Review, April, 1914, pp. 217-223.

Measurements of Light

Dr. Knuchel of the Swiss Experiment Station reports on a series of measurements of light in forest stands through four years to determine answers to the three questions, to what degree different species in single specimens and in stands retain light in their crowns; what color composition the light passed through the crowns has; what influence the light in the interior of a stand has on soil flora and regeneration.

First discussing the history and methods of measuring light, exhibiting their defects, especially since under crown cover the quality of the light varies as well as the degree, necessitating consideration of the various spectral fields, he describes a new spectrophotometer which was used in these investigations, and the method of procedure. The instrument is bulky, heavy and expensive, but works accurately, and can be considered standard (by which to compare efficiency of simpler methods of measurement) and capable of securing basic knowledge of light quality.

The instrument measures only diffused light, hence the first inquiry is how much the diffused light radiation amounts of the total light, and its significance. A short chapter reviews light conditions in general.

In high altitudes the significance of the diffuse light is minimal, hence measurements were made in lower altitudes, where the diffuse light becomes prominent especially on cloudy days; cloudiness also influences color composition of light, so does water vapor influence the intensity. Even with apparently unchanging sky, daylight shows great variation, which does not depend on the position of the sun. For best results, in these measurements of light in stands there should be two measurements made in the open, one before one after, if not simultaneously, and the result percentically related to these. The measurements for good results must be made on cloudless days.

As regards filtration of light through green leaves, it is mainly the veins which are permeable, the green cell tissues are almost impermeable. The green and yellow parts of the spectrum are allowed to filter through to a greater degree, while the blue parts are almost entirely absorbed. "Shade" leaves are more permeable than "light" leaves.

In filtering through crowns. only a small percentage of the light is permitted to pass through; under fir and spruce, only fractions of 1 per cent. filter through without reference to color, while under broad-leaf trees the yellow and green rays filter more readily. The small amount which filters is due to the large leaf surface which in a 100-year beech stand is two to three times, and in a 55-year spruce stand as much as ten times the area surface.

The author comes to the conclusion that at least in broadleaf stands for finer investigations the different colors must be measured separately, which is not as necessary with conifers, where therefore simpler methods which measure total light intensity may be used.

As regards practical deductions the author very modestly points out that these investigations may help to explain why spruce and fir under the cover of even-aged stands regenerate with such difficulty, while in the mixed beech forest, and generally in mixed conifer and broadleaf stands they regenerate readily if the stand is slightly opened, and the young crop maintains itself for decades. The beech stems reflect much light which the conifer boles absorb, besides the broadleaf foliage permits more light to filter through.

The necessity of opening up more freely in the pure conifer stands, in order to get sufficient light for regeneration, easily leads to weed-growth and failure of the regeneration, while in mixed stands the necessary light is secured by lighter opening up.

Spectrophotometrische Untersuchungen im Walde. Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen, XI, 1, 1914, pp. 1-93.

Sun Eclipse and Temperature of Trees

The effect of the eclipse of the sun which occurred last August 21st upon the temperature of trees has been studied by Danberg, a Russian forester. He was particularly prepared for such observations because he was carrying them on for nine months before the eclipse of the sun occurred. The observations were conducted by means of specially devised thermometers inserted in the trees. The trees under observation were three live pines, one dead pine, one live spruce and one live birch.

In the locality where the observations were made the sun eclipse began at 1:24 P. M. and ended at 3:31 P. M. It thus lasted two hours and seven minutes. The sun eclipse was not complete. However, the sun disk's occultation reached its maximum to the extent of nine-tenths at 2:29 P. M. During the sun eclipse the temperature of the air in the forest dropped 4½° F., from 50° to 45.5°. The temperature of the living pines dropped 2.2°, from 47.7° to 45.5°. The temperature of the spruce and birch dropped 1.1°, from 51.1° to 50°. Only the temperature of the dead pine remained without change. The fall of the temperature of the air was sudden. The drop of 4½° occurred within thirty-five minutes. The living pines responded also very rapidly to the sun eclipse while the birch and spruce proved less sensitive and the dead pine did not react at all.

The observations conducted for the previous nine months have established very conclusively that the temperature of the living trees is characterized by comparative stability, that it does not respond to slight fluctuations in the temperature of the air, while radical changes produce only a gradual change in the temperature of the trees. The marked sudden effect of the sun eclipse upon the temperature of the trees must, therefore, be due to some other still unknown influence connected with the eclipse of the sun.

R. Z.

Root Fungi on Forest Trees

The author found fungus filaments associated externally with the rootlets of basswood, beech, Paper birch, Shagbark hickory, hophornbeam, ironwood, larch, Black oak, Red oak, and White oak, while the internal association of fungus with root-tips was found in case of Black maple, Red maple, Silver maple, Black walnut, and horse chestnut. No root fungi were found upon the Flowering dogwood, American elm and Sassafras. Six forms of mycorhiza based on color, arrangement of the filaments and the structure of the enclosed rootlet are described. Four different kinds of mycorhiza were found on one White oak tree, and they undoubtedly arose from four different fungi. The basswood roots have a fungus that is both ectotrophic and endotrophic. Four species are added to the list of fungi known to produce mycorhiza. This brings the number up to nearly two dozen, and they nearly all belong to the "toadstool" producing forms.

The external mycorhizas appear to behave as annuals. They begin to develop during the latter part of July; they are most abundant in the fall and keep bright and healthy through the winter, although the soil is frozen. By the middle of April they begin to die off from the roots of some trees; from others by the middle of May. Throughout June and the fore part of July they are very scarce on all species. In August they begin to be more plentiful again and by September they are as plentiful as in September of the previous year.

The author believes that the presence of the fungus filaments on the external surfaces of root-tips results in no mutual benefit association, but is a case of parasitism on the part of the fungus. An abundance of mycorhiza on tree seedlings may, indeed, prove injurious to the extent of death. The conclusion that the fungi are not beneficial is based on the fact that they occur most abundantly when the roots have the least need of them, namely, in late summer and fall when the roots are relatively inactive and that their occurrence at any time is purely accidental; trees get along just as well without them. The conclusion that they do not help in the absorption of nutrient salts is based on the fact that the filaments disorganize the cortical cells of the rootlets and so make absorption more difficult, if not impossible. That the fungi are after food for themselves is indicated by the fact that they attack the roots at the time they contain the largest amount of stored materials, and at the time also when the fungi are in most need of food, for it immediately precedes their fruiting period.

Thus our preconceived ideas in regard to the functions of ectotrophic mycorhiza again receive a jolt. It is to be wished, however, that the author had based his conclusions, as to the absorptive relations of the mycorhiza, upon physiological experiments rather than upon structural appearances.

In regard to the endotrophic mycorhizas of the maples, the author concludes they are sometimes symbiotic associations and sometimes associations in which the fungus can only be considered as an internal parasite upon the roots.

On the Mycorhizas of Forest Trees. By W. B. McDougall. American Journal of Botany. February, 1914, pp. 51-73.

Length of Tracheids

Shepard and Bailey studied the stems of *Pinus strobus. P. palustris, Tsuga canadensis* and *Abies concolor* with a view of testing the wider applicability of Sanio's finding in *Pinus sylvestris* that "in the cross section of a stem or branch the tracheids increase in size for a certain number of annual rings until a maximum is reached, after which the size remains constant." Fifty length measurements in each case were made from material taken from every tenth ring throughout a section 1 foot from the ground. In all four species the average tracheid length increased rapidly for a period varying from twenty-five years in the case of the White fir to sixty years in the case of Longleaf pine; after that it fluctuated. In the Longleaf pine (230 growth rings) a maximum average tracheid length occurred at 160 years, followed by an irregular decrease in length. The White pine, fir and hemlock, aged respectively 120, 80 and 80 years, were apparently not mature enough to have reached the stage of average maximum length. Thus in no case was a constant maximum length found, although in Sanio's investigation this was found within the fiftieth ring.

2. The average length of tracheids of the same annual ring at various heights in a stem of *Picea rubens* (50 years) was also studied, to a height of 30 feet from the ground. In this case the results agreed with those of Sanio that "the length of the tracheids in a given annual ring in the stem increases from the ground upward

until a maximum is reached, after which it decreases toward the top." It is pointed out that this maximum occurs higher from the ground in rings nearer the bark.

3. Study of an eccentric section of White pine failed to indicate any close relation between ring width and tracheid length. The same was true in the Longleaf pine.

4. Tracheids in the *rothholz* portion of a ring were consistently shorter than those in the *zugholz*, in the case of an eccentric stump of White pine.

As a result of these variations, the care that must be exercised in using "average fibre length" for identification purposes is emphasized.

From a study of one White pine, Miss Gerry obtained the following results: (1) The shortest tracheids were found near the pith, with an irregular increase in length from the centre outward; no constant length was obtained. (2) A tendency toward an increase in average tracheid length was apparent from butt toward top for about two-thirds the height of the tree. These two results agree with the foregoing investigation. (3) No relation could be determined between tracheid length and the strength values of the wood. The above findings are based on 6,600 measurements from sixty-six specimens.

From 2,600 measurements on twenty specimens (Longleaf pine and Douglas fir) the general range of variation in tracheid length was not found to be greater within the species than in the individual tree. The longest elements were found in the earliest spring wood, with a gradual decrease to the last formed layers of the ring.

The relationship of these findings to wood pulp is noted.

J. H. W.

Some Observations on the Variation in Length of Coniferous "Fibres." Proceedings Society of American Foresters, IX, No. 4, 1914, pp. 522-527.
Fiber Measurement Studies. Science, 29 January, 1915, p. 179.

Classification of Firs

Of North American conifers, the species of Abies are probably the most troublesome to the forester to distinguish. This conspectus of the genus, by Mr. Lamb of the U. S. Forest Service, is accordingly very timely.

It is pointed out that color of foliage and cones, and shape and size of cone scales, are unreliable, and that the form of the bract accompanying each scale furnishes the best means of distinguishing the species. Of the ten firs in the United States only *A. concolor* and *A. grandis* can not be so separated, but these are easily recognized by their foliage. A compact key based upon the bract characters summarizes this information for field use.

Another key is given, based upon leaf characters alone, but only six species can be so separated. A feature of both keys is that no characters are used which are not readily observable by the unaided eye.

Following the systematic portion of the paper, the text includes a serial treatment of each species, covering characters of foliage and fruit, tree size, and geographical distribution. A page of excellent drawings makes clear the leaf and bract characters used. A very valuable check list of nomenclature is appended.

A Conspectus of North American Firs (exclusive of Mexico). Proceedings of Society of American Foresters, Volume IX, No. 4, October, 1914, pp. 528-538.

Effects of Girdling

A case of girdling a forked pine tree, similar to that described in FORESTRY QUARTERLY, vol. XII, p. 559, is cited by Hartig.

"The tree was 118 years old, and the trunk was forked at 4½ meters above the soil into two approximately equal stems. The bark was peeled off all round one of these stems at about 3 meters above the point of forking. When the tree was felled eighteen years after this ringing operation had been performed, it was seen that the crowns of both stems were still sound, but that the foliage of the ringed stem was thinner and weaker than that of the other stem. It was also found that growth in thickness had practically ceased after ringing on the side of the trunk situated below the ringed branch. The reason for the long-continued life of the ringed stem is that the roots attached to the base of the trunk on the side below the intact stem had received normal nourishment, and therefore, having remained healthy, had been able to supply the trunk with a good supply of water."

In case the girdling is not confined to the bark but takes in some of the wood, the result, according to Strasburger's experiments, depends on whether a sapwood tree or a heartwood tree is involved. "Two beech trees 150 years old had trunks 32 centimeters in diameter. These were girdled to a depth of 8 centimeters, and the trees still bore foliage a year and a half later. The trunk of an oak fifty years old was girdled into the heartwood, and its foliage withered in a few days. Another oak of the same age, which was cut similarly but not quite through the sapwood, did not wither for some weeks. The trunk having been cut to the heartwood in a tree of *Prunus avium*, and in a Robinia, wilting of the leaves took place in two days in the first case and in a few hours in the second."

The Ringing of Trees. Gardeners' Chronicle, 14 November, 1914, pp. 320-321.

Artificial Production of Vigorous Trees

This paper is a summary account of Professor Henry's experiments of the last four years in the production of new trees by hybridization. The end in view was to show that new fast-growing species could be obtained. The basis of experiment was the exceptional vigor often shown by first crosses.

The most striking success has been among the poplars. Very vigorous growth (10 feet in two seasons) has been shown by hybrid seedlings raised from seed of *P. angulata* fertilized by *P. trichocarpa*; the hybrid has been named *P. generosa* by its originator. It is worthy of note that the two parents belong to different subsections of the genus. A corresponding hybrid with *P. nigra betulifolia* as the male parent showed much less vigor.

Numerous crossings made with Alnus present some interesting features, the seedlings being now three years old. *Alnus cordata* X *A. glutinosa japonica* produced a hybrid seedling of much faster growth and more frost resistant than pure seedlings of the female parent. It is already 5 feet high. Various other crosses showed evidence of similar vigorous growth, averaging nearly two feet in height growth annually. The failures are recorded also.

Since the first cross does not come true from seed, these hybrids can only be propagated vegetatively by cuttings, layerings or grafts.

A complete list is given of the various crosses that have been tried, with results. These include Fraxinus, Ulmus, Fagus Quercus, Larix, Cupressus, Chamaecyparis.

Journal of the Department of Agriculture and Technical Instruction for Ireland, Volume XV, No. 1.

Production in Mixed Stands

The statement has long been accepted in silvicultural discussions that mixed stands produce more than pure stands because they are capable of more fully utilizing the factors of site. This dictum has had no other basis than general observation until now Dr. Schwappach has undertaken a careful investigation of the subject and here gives some of the current results of his as yet unfinished work.

There are many inherent difficulties in the investigation. Actual production in mixed stands must be compared with the average production of pure stands of the component species on the same site class as read from yield tables. While such a scheme is open to theoretical objections the concordance of the results secured speaks for its practical value.

Mixtures of oak and beech and of pine and spruce are compared with pure stands on the basis of fourteen and thirteen examples. Three spruce-beech mixtures are studied and one stand of pine and beech.

Mixtures of pine and spruce under eighty years of age yield less than is produced when the two species are segregated into pure stands, but after the eightieth year the production of the mixed stand becomes greater. Such behavior, of course, indicates that such mixed stands call for management on a longer rotation than is demanded by pure stands of either component. Although this appears to be generally true, local conditions are not without their influence. In dry, sandy soil, an underwood of spruce with its superficial root-system may absorb the entire precipitation during critical periods of the year and seriously reduce the growth of the pine. Again in mountainous regions where the spruce is much more at home an admixture of pine may not be beneficial.

The solitary pine-beech mixture reported shows one-third greater current growth at one hundred and fifteen years than yield tables indicate for pure stands.

Mixed stands of oak and beech show in every instance but one a greater increment than is indicated for pure stands of the two species segregated. There is some indication that a portion of this at least is due the silvicultural care given the mixed stands under investigations.

Mixtures of spruce and beech also appear more productive than pure stands although comparison can here be secured only by extrapolation of the yield tables. The value production falls with the rise of the proportion of beech in this mixture.

An investigation of the relative proportions of the two species in these mixtures at successive stock-takings shows the tendency of the beech (or spruce) to increase in volume, number of trees, and basal area. The absolute changes found depend of course on the particular silvicultural treatment the stand has received.

The practical advantages of indigenous mixtures over artificial pure stands is clearly shown in the Silesian districts of Breslau and Oppeln where the managed forests are almost entirely Scotch pine with an understory of spruce in the lower country and of spruce with very little pine in the mountains. Careful search, however, reveals many isolated small areas where larch, beech, oak and fir, and even other species occur in amounts large enough to affect the stand and their effect is always favorable. Here measurements merely confirm what the eye recognizes at first glance.

Untersuchungen in Mischbeständen. Zeitschrift für Forst und Jagdwesen. Aug. 1914, pp. 472-491.

Influence of Thinnings

The function of thinning in stands in which the height growth has culminated is to promote diameter growth. "Thinnings" in this discussion by Oelkers is used in the sense of Michaelis' "Bramwalder Anleitung." While the effectiveness of thinning may indeed depend upon the manner in which it is carried on, it remains none the less dependent upon the severity of the thinning.

Thinning admits sunlight, precipitation and wind to the stand. Precipitation affects chiefly the soil and roots and Metzger has shown the influence of wind on the bole. Light affects crown, bole and forest floor. While we know considerable of photosynthesis in the green leaf, we know nothing of the influence of direct sunlight on the bole. The investigations so far made of the influence of sunlight on the flora, the fauna and the physical structure of the forest soil have proven very enlightening.

Thinning increases the increment of individual trees, but of course reduces the number of trees. Accordingly for best results it cannot be carried too far. There is then for each stand an optimum. For beech, Michaelis has found this such as maintains a crown density of 0.7 to 0.8. The best practice in thinning is such as results in a stand with the most valuable increment possible under the given environment. The utilization of these site factors, one of which is light, will finally lead to the only definite solution of the thinning problem.

Various investigators have measured various physical quantities in their study of light in the forest. Some have used the polarization photometer, some selenium cells; some photosensitive paper. None have discussed the question whether their instruments were sensitive in the same way as the green leaf. The problem simmers down to a study of the composition of light before and after passing through the crown of a stand.

Absorption and assimilation of light are not necessarily the same thing while reflection enters to complicate matters.

Most studies of light have been made on the ground under stands and the light measured compared with the average found in open fields. Reflected light is here lost track of. The true state of affairs can only be learned by simulanteous measurements of light above the forest and at different levels within and beneath the crowns. Moreover, it is only reasonable to conclude that some light penetrates the crown unaltered.

The author's comparative studies have been made in stands of beech and spruce of the same age and growing at the same altitude, on the same soil and exposure and so close together as to receive the same precipitation. The thinning alone varies and this is controlled arbitrarily.

Such an introductory recognition of the inherent difficulties of the problem would seem to warrant high expectation of better results. Such expectations fall when the author selects the so-called radiometer of Crooke's to measure light. The choice appears to have been made because of convenience of manipulation, and there is no discussion of its advantages over other instruments hererofore used.

Each radiometer is calibrated against a standard candle. Plotting speed of revolution against intensity of light the results are found to lie upon an equilateral hyperbola, and by extrapolation values for daylight intensities are obtained.

The author makes extensive use of the theory of errors in discussing the reliabilities of his results going rather fully into his procedure as is still necessary in writing for foresters, in Germany as here. And here it may be remarked that should there remain any who are unconvinced that the characteristic spirit of modern research consists in the careful observation of quantities chosen with the apparent arbitrariness, the mathematical digestion of the results and the formation of modest conclusions let him read this paper.

Direct sunlight was not measured as the instrument is too sensitive and all readings were made of diffuse skylight only. Each observation in the forest was checked against a reading in an opening nearby. Readings were made with and without a screen of 30 per cent. solution of ferroammonium sulphate which served to exclude practically all of the infra-red rays.

Under crowns of different densities there are of course differences in the total amount of diffuse radiation, although in heavily thinned stands the skylight is found to be as intense as in the open, losses being entirely compensated by reflection. There is also a different spectral distribution of the skylight under crowns of different densities because the infra-red is intercepted more largely than the luminous radiation. Beech appears to intercept much more than spruce of the same density. The intensity of the radiation is the same at all points along the merchantable bole as at the surface of the ground.

For most perfect disintegration of the leaf litter the crowns of beech should be opened up by the removal of one-third to one-fourth of the volume of the stand, while in spruce only about one-fifth should be removed.

So too, while greatest volume growth is made in beech after the removal of one-fifth to one-fourth of the volume, spruce requires the removal of but one-seventh to one-sixth to produce the same result. Thinnings in beech must accordingly remove one-half to two-thirds more material than in spruce in order to produce the same result.

In closing, the author emphasizes the fact that these measurements are as yet incomplete and should be very largely multiplied for other stands, other regions, and other kinds of thinnings and that their results must be closely correlated with practical observation before the final conclusion is reached.

F. D.

Jahrring und Licht. Zeitschrift für Forst- und Jagdwesen. August and September, 1914, pp. 445-472; 519-538.

Exotics in Germany

Europe has been importing American tree species since 1601. So far White pine and fir have proven most successful. *Pinus strobus* has now become practically a native of Southern Germany, so successful has been its acclimatization. Red fir was introduced in 1831 and has proved itself a valuable species for German conditions showing the same rapid growth as it does in the Northwest.

Other species which have been successful in Germany are *Pinus monticola*, *Sequoia gigantea*, *Thuja plicata*, *Chamaecyparis lawsoniana*. Among the hardwoods the walnuts and hickories have been most successfully planted. Red fir and White pine (*Pinus strobus*) are about the only species, however, that have been planted on a large scale. So many stands of White pine are there that Germany now sends over to this country seeds and seedlings of this species. Four hundred hectares have been planted with Red fir in Prussia and one million hectares in Bavaria.

The acclimatization of exotic species has shown clearly that there are four factors to be considered in such work:

(1) Species must be chosen from the right climate and in determining this there should be little trouble where Mayr's climatic parallels are used.

(2) The second factor of importance is in the securing of seed from a suitable part of the range of species. For example, Red fir from northwest Washington has proven most satisfactory for German conditions whereas it is a waste of time to use seeds from the Rocky Mountain form.

(3) Proper site conditions.

(4) Proper handling of seed and seedlings.

K. W. W.

Anbau von Exoten. Forstliches Centralblatt. August and September, 1914. Pp. 405-434.

Western Hemlock

E. J. Hanzlik and H. B. Oakleaf have published in The Timberman, October, 1914, a monograph on the "Western Hemlock." It consists of about ten pages and adds considerable to the data given in U. S. Forest Service Bulletin 33, on the "Western Hemlock." This article takes up the silvical characteristics, growth and yield, methods of management, properties and uses of the wood and bark; and includes tables and photographs to illustrate the points brought out.

O. L. S.

Planting Yearlings with Ball

In tropical, expecially dry situations, as in East Africa, planting with naked root is hardly ever practised. To avoid the drying of roots the plants are carried in baskets (banana fiber) and planted with a ball of earth. Another method, used with *Pinus halepensis* in Algeria, is to set the seedlings in petroleum cans filled with good soil and transplant them with a ball of earth. Or else the plants may be grown in loose (lath) or easily disintegrating packages, the plants being set with the package.

This method has been suggested to be used on areas infested by the Melolonta larva, and for specially difficult and exposed situations.

Ballenpflanzung einjähriger Sämlinge. Naturwissenschaftliche Zeitschrift für Forst- u. Landwirtschaft, August, 1914, pp. 394-398.

Pruning Rules

In this article Doctor Thaler of Darmstadt reports the results of inspecting the effects of some pruning which was done fifteen years ago. After summing up the advantages and disadvantages of pruning limbs in general certain definite conclusions are reached in regard to methods. The cutting should always be longest parallel to the axis of the tree and not over 7 centimeters wide. The smoother the cut the quicker it will heal over. Broadleaf trees heal quicker than softwoods. With the latter a cut into the heartwood should always be tarred if disease is to be prevented. Pruning can be most advantageously done in November and December, should be confined to the lower two-thirds of the stem, and should not commence before the stand is ten years old.

A saw has been found to be the most effective tool to cut with and the best results are obtained when a stump not more than two centimeters long is left. Where a cut is made into the sapwood incrustations of pitch follow which spoil the technical qualities of the wood.

K. W. W.

Baumästung. Forstliches Centralblatt, Aug. and Sept., 1914, pp. 434-443.

Protection Forests along Railroads

Dr. Eberhard reviews an interesting address by Inspector Burri of the Swiss railroads before the Swiss forestry association. The forest on steep slopes along railroad tracks is both a safeguard and a menace. It is a safeguard in that it prevents avalanches and earth-slides and moderates the effects of cloudbursts. On the other hand, it is a menace in that, during logging, trees and rocks may fall on the right-of-way. Since, however, the protective belt of forest must be maintained along the railroad, the latter must protect itself against this possible menace.

This may be done in two ways: (1) through regulation of the lumbering operations, leaving the ownership of the forest as it is; (2) through purchase of the forest by the railroad and adapting the management so as to secure the maximum of protection from the forest with corresponding safety to the traffic.

The second case occurs if: (*a*) The safety of the railroad cannot be secured by regulations, or by other protective measures; (*b*) if these measures are more costly than direct purchase of the tract.

A. B. R.

"*Die Behandlung der Gebirgswälder im Bereich von Eisenbahnen.*" Allgemeine Forst- und Jagd-Zeitung, September, 1914, pp. 300-301.

Border Cuttings in Scotch Pine

At the 40th meeting of the Prussian Forestry Association (1913), Oberförster Schering reported on the possible application of Wagner's "Blendersaumschlag" in the Prussian pineries and reached the conclusion that it could be used successfully but at unwarranted sacrifices. It is far more expensive than the Clear Cutting

Methods.* Wagner's idea, that the present clear cutting methods are the ruination of the forest, he could not accept. Undoubtedly the mixture of tolerant and intolerant species is desirable. For Scotch pine this means chiefly spruce and blue beech which can be secured either naturally or artificially under present cutting methods.

Oberforstmeister Koenig opposed the introduction of Wagner's method with Scotch pine chiefly on the ground of its incompatability with the present arrangement of the age classes in large areas of even-aged stands. Forstrat Trebeljahr spoke in favor of Wagner's system in Scotch pine, and urged experiments therewith on an extended scale.

A. B. R.

Allgemeine Forst- und Jagd-Zeitung, October, 1914, pp. 332-334.

MENSURATION, FINANCE AND MANAGEMENT

Forest Valuation in Germany

An interesting detailed statement of a forest valuation by Gärtner referring to the indemnity to be paid to the municipality of Bad Orb (near Cassel in Western Germany) for part of its city forest, about 3,000 acres, gives an insight into forest values in Germany. The forest was to be turned over to the military authorities for a drill ground. The valuation for the city made the total indemnity $896,220, around $300 per acre, while the valuator for the miltary department made it only about $165, and the compromise value arrived at by two other valuators on an area reduced to nearly one-half was made $240 per acre.

The forest consisted of oak, under 100-year rotation; beech, under 90-year rotation; pine and spruce stands, both under 70-year rotation.

The interest rate used in the expectancy calculations was 2.5 per cent. for beech and oak, 3 per cent. for pine, and 3.5 per cent. for spruce, which are rates by about one-half per cent. higher than usually applied, hence giving conservative capital values.

The actual cultivation costs of the last 10 years with $20 to $25 were considered abnormally high, and hence for most stands normal

* See "Management of Pine in Prussia," Forestry Quarterly, Vol. XI, No. 2, pp. 135-143.

average costs were used. These were for spruce $14.50, for pine $7.70, for oak $10.60, for beech (natural regeneration) $2.40 per acre.

Administration costs hitherto had been very much lower than normal, namely, for the last decade not quite 20 cents per acre per year. Instead, a rate of 43 cents was used as nearer normal. It was assumed that expenditures on roads, etc., would be taken care of by better returns.

The maximum gross soil rent values were determined as (rounding off figures):

For oak	II site	$103.50
	III "	63.00
	IV "	27.00
For beech	I "	85.00
	III "	40.00
For pine	I "	67.00
	II "	50.00
For spruce	I "	146.00
	II "	67.00
	III "	36.00

The stands from 1 to 20 years old (620 acres) were calculated by *cost* values, also the larger nurseries, with a stand value of around $50 per acre and the soil value of $113 per acre.

The stands from 21 to 60 years (1,670 acres) were figured by the expectancy value, totaling a stand value of $145, with a soil value added of $60. It is interesting to note how these stand values for different species vary: oak and beech obtaining a value of $81, pine of $162, spruce of $270.

The values of stands above 60 years of age (700 acres) were determined by sale values. These averaged $360, to which is to be added for the soil $77. A few acres of blanks were entered with their soil value based on spruce.

Adding all these values together the value of stands per acre was found to be $177 and the soil value $71.50 or the forest value a little less than $250; the soil representing one-third, the stock two-thirds.

In addition, there was a loss of rent for the hunting privileges of $40,000 and a loss of by-products to the amount of $3,000 to round off the value to $300 per acre.

Professor Wimmenauer commenting on this exposition considers the cost values of the lowest age-classes in comparison with the stand expectancy values too high.

Wertberechnung der von der Stadt Bad-Orb an den Militärfiskus zur Anlegung eines Truppenübungsplatzes abzutretenden Waldfläche. Allgemeine Forst- und Jagd-Zeitung, May, 1914, pp. 160-166.

Forest Values in Switzerland

In connection with the consolidation of several small private forest properties into a corporation—70 owners, holding 110 parcels, agreeing to such consolidation of a territory not larger than 160 acres—a valuation of the property was made. The forest area consisted of 57 per cent. spruce, 20 per cent. fir, 5 per cent. pine and larch, 18 per cent. broadleaf trees, the whole in rather poor condition. The age-classes were represented by:

1 to 20 years	21 to 40 years	41 to 60 years	over 60 years
25 per cent.	41 per cent.	20 per cent.	14 per cent.

The timberwood stock was found to be 6,220 cubic feet per acre and the increment 93 cubic feet, which by a proper thinning practice could be greatly improved. The soil values varied from $56 to $80, average $66, while the open farmland was appraised at $130.

The stands up to forty-five year age were calculated at their cost value, assuming $32 as cost of planting and cultivation, an interest rate of 3 to 3.5 per cent. according to stock density, and deducting for imperfect stands. The sixty to sixty-five year stands were appraised by sale or stock value as they became saleable at that age; for the forty-five to sixty year stands also, sale value was used with additions up to 10 per cent.

In this way the value per acre came to $357, of which a little less than 20 per cent. was for soil. This valuation was, however, admitted by the experts themselves to be rather high.

Privatwald-Zusammenlegung Meilen. Schweizerische Zeitschrift für Forst- und Jagdwesen, November, 1914, pp. 294-298.

Foundations of Forest Valutaion

The appearance of Chapman's "Forest Valuation" will undoubtedly stimulate interest in this branch of forest finance. Our American literature on this subject has been surprisingly meager. Not so the European, as a glance through the Periodical Literature reviews of the FORESTRY QUARTERLY will show.

A good example of this is Oberförster Fischer's article on the most important economic and legal foundations of forest valuation.

Fischer is a firm believer in the soil-rent theory but feels that there is still a gap between this theory and its practice. This gap he seeks to bridge by a review of the economic and legal factors which are the basis of forest valation.

He starts with a discussion of soil expectancy value as the generally accepted basis of determining soil value. The differences in value which result from assuming different methods of management and different rates of interest are well known. This has resulted in a juggling of management methods and interest rates until the formula gives acceptable results. Of course, this is a makeshift and has long been recognized as such. It resulted from a practice which took the sale value of the soil as the basis of values and from this calculated the rate of interest earned under management. And yet economics and law have condoned this practice, indeed not until the latter half of the nineteenth century did the soil expectancy value receive practical recognition due to the uncertanities of the calculations. The Prussian Courts have held that there is no, or, at least, should not be any fundamental difference between sale value and expectancy value. Each determines the other. A considerable difference between the two, therefore, indicates that one of them is in error. Which of the two to use in a given case must be decided for that case; a compromise between the two values is sometimes possible.

A. B. R.

"*Ueber die wichtigsten volkwirtschaftlichen und rechtlichen Grundlagen der Waldwertrechnung.*" Allgemeine Forst- und Jagd-Zeitung, October, 1914, pp. 309-314. (To be continued.)

Composition of Normal Stock

A very interesting study by Flury furnishes a new insight into the amount and composition of the normal stock, which he pertinently declares the best, most pregnant, numerical expression of sustained yield management. To attempt an approach to normal stock conditions in some way must be the aim of the manager for sustained yield.

Theoretically the normal stock is, of course, the sum of the stands of a normal ageclass series, but the practical determination of it meets some difficulties especially in the absence of reliable normal yield tables.

The simplest short cut formula, as is well known is $ns=\frac{r}{2}\times ri$, or $.05\times r\times ri$, *i. e.*, the average increment at normal felling age multiplied by the number of stands in the felling series and by half the rotation. This formula is incorrect inasmuch as each ageclass grows at a different rate as would appear from any growth curve. It is only correct for one rotation, namely, the one in which the deficiencies (deviations from i) of the first half of the rotation are balanced by the excesses of increment in the second half, which would, of course, be different for every species and site. To be more generally correct, the formula should read $ns=ri\times cr$, in which c is a variable constant. To determine this constant, normal yield tables are necessary, which may be summed up by the well-known formula $ns=s_1+s_2+\ .\ .\ +s_{r-1}+\frac{s_r}{2}=S$, when, from $ri\times cr=S$, $c=\frac{S}{ri\times r}$. The author has in this way calculated c from a number of yield tables for spruce, fir, pine, beech and oak, for various rotations and sites, and claims that for practical use and judgment the knowledge of c is of more value than the absolute amount of ns. The results are tabulated in various ways and curves for c are drawn, and these give at least interesting insight into the character of normal stock.

First of all the tables show how very great the error of the formula can be, and even the correction to $.45\times r\times ri$, which had been used for fir in the budget regulation of Baden is by no means satisfactory. For rotations from 80 to 120 years the values of c vary for spruce III site (Swiss mountains) from .464 to .554; for fir, from .327 to .472; for pine, from .548 to .691; for oak from .408 to .454; for beech, from .394 to .511. These values are based on total wood volume; figured for timberwood alone, the constants are considerably lower, owing to the fact that the stands attain timberwood size only from a certain ageclass, when the actual timberwood stock becomes relatively larger, so that a smaller value of c satisfies the formula. For the same positions as above, the ranges become then .392 to .508; .267 to .437; .454 to .596; .292 to .392; .316 to .428.

These values for c express at the same time the general relative increment conditions of the five species, the most rapid, pine and spruce, having the highest, the slower correspondingly lower values. The slower the development the longer time does it take to bring the constant c to the value .5; before that time the theoretical formula gives too high, after that too low a normal stock.

The rotations at which the formula becomes correct, if based on timberwood, lie for pine between 90 and 100, for spruce between 90 and 120, for beech between 120 and 140, for fir the same, for oak at 160 years.

There is then a certain lawfulness expressed in these figures, which brings to expression the specific character of the species. Even widely separated geographical regions and methods of management exhibit a considerable parallelism in the constants, which is of significance in regulatory work.

The trend of the curves for the constants are particularly instructive in comparing the progress of normal stock changes from decade to decade. This is dependent on the specific progress of increment of the species and not on the form of bole or more or less taper. The rapidly growing but early declining pine has reached the value for $c = .5$ in fifty years, while the slow fir has not reached it in 140 years.

In a brief discussion, the author points out that the addition of yield tables with periodic instead of annual data is itself incorrect, but he shows that the error of various methods of addition is not large except for pine, in which owing to the rapid early development the early accumulation of stock influences the result more decidedly, and the error may for some positions exceed even 10 per cent.

The author then investigates the distribution of the normal stock over age and diameter classes, or the participation of these in building up the stock. A tabulation and graphic illustration gives for different species and sites for rotations of 100 and 120 years the percentic contribution of each ten-year ageclass to total and to timberwood stock. It shows that the ageclasses 61–100 and 61–120 furnish 70–80, and 80–90 per cent. respectively, accentuating the importance of ascertaining more carefully the stock condition of these ageclasses. The regularity of the percentic stock distribution in the same species according to different yield tables gives confidence in the lawfulness of this participation of the ageclasses in building up stock, and in the reliability of the tables. The graphic method of analyzing the normal stock contribution of different ageclasses can be most usefully employed for comparing with actual stock conditions, and basing thereon especially periodic revisions of working plans. But for questions of forest valuation and statics, the knowledge of the distribution of the stock among sizeclasses of a working block is more to the point.

Upon the basis of extensive caliperings on sample areas of each ageclass the data for the answer to this problem for spruce and beech are tabulated by 4 *cm* classes and by five broader sizeclasses. This is done for a rotation of 120 years, which can also be translated for a 100-year rotation. For the broader sizeclasses on a medium site class in Swiss mountains, the data for spruce are given as follows:

Size Class	*Total Value*			*Value Per Cent. According to Ageclasses*			
cm.	*Per Cent.*	I	II	III	IV	V	VI
4-12	12.8	1.1	5.6	4.0	1.7	.4	....
14-24	36.7	....	1.4	10.0	12.1	8.9	4.3
26-40	40.9	....	....	1.1	7.6	14.0	18.2
42-60	9.6	....	....	....	.3	2.7	6.6
over 60	....	....	....	....	....	....	....
	100.0	1.1	7.0	15.1	21.7	26.0	29.1

I=1-20 years; II=21-40 years, etc.

Curves and graphic illustrations of this distribution show that the beech behaves percentically very similarly, although the absolute values differ greatly.

On site I, the sizeclass 26–40 (10–16 inch) is for both species most prominent with nearly 50 per cent.; on site III the two middle classes 14–40 (5–16 inch) are almost equally represented with 40 per cent. each; while on site V, the second sizeclass 14–24 (5–10 inch) is the prominent one with over 40 in beech, and over 50 per cent. in pine.

These data in a way incorporate the ideal aim of the management regarding the wood capital quantitatively and qualitatively which a working block should contain. All these data have reference to pure, even-aged stand management.

For selection forest, Flury, who is an advocate of the same, acknowledges the lack of reliable data and the difficulty of securing them, but offers some provisory ones collected by the Swiss Experiment Station on six experimental areas in spruce and fir, each representing characteristic types.

"How large the ideal or normal stock to be attained should be in order to produce the quantitatively and qualitatively highest sustained increment, we do not dare decide." "The *méthode du contrôle* assumes for the main stand (over 8 inch), say 6,100 cubic feet total wood per acre or 5,000 cubic feet timberwood, of which 20 per cent. of 8–14 inch, 30 per cent. of 16–22 inch, 50 per cent. of 24-inch and over." Whether, when and how far this is correct, is still open to question. Comparing with the experimental areas we find that 50 per cent. of stoutest wood is attainable only on best sites. Stands on poor sites cannot come up to this requirement even with the highest practicable rotation. On medium sites, the experimental areas show about 29, 50, 21 per cent. for the three sizeclasses, and if the five sizeclasses as above are taken the percentages run 3.3, 10, 28.7, 45, 13, showing very much higher percentages than the 120-year spruce forest in the stouter sizeclasses.

If these figures represent what normally should be in the normal stock of the selection forest, the reviewer would conclude that it is capital-expensive, but the author does not draw such conclusion, declaring merely that the selection forest is characterized by sawlog and stoutwood production and that "even on poor sites the selection forest can produce percentically as much or more stoutwood as the best spruce forest in even-aged timberforest," which may be readily granted.

Finally, the author exhibits the error in the formula of the use per cent. $p=100\frac{ri}{ns}$, which by substituting $ri\times\frac{r}{2}$ for ns becomes $p=\frac{200}{r}$. This would mean that the use per cent. is equally large for all species, which cannot be right, since the different species differ in the rate of increment, so that even with the same rotation the relation of ri to ns varies from species to species. But by substituting $ns=ri\times cr$, formula becomes $p=\frac{100}{cr}$ which takes care of the specific character of each species.

From the tabulation of use per cents. figured in this way we see that for spruce, fir and beech for 100–120-year rotation the use per cent. averages about 2 per cent.; somewhat lower for higher rotations, and higher for timberwood alone. The simple formula of Mantel for the felling budget based on actual stock, $b=\frac{as}{\frac{r}{2}}$, is found quite satisfactory for timberwood of the three species, at least no fear of overcutting needs to be entertained, especially since the lower ageclasses are usually underestimated. But for pine, this per cent., even with tolerably normal ageclasses, leads to overcutting, the normal use per cent. lying below 1.6, and also with the other species if the old ageclasses are deficient. Here $b=\frac{as}{cr}$ would give better results.

These formulae presuppose that the stands are kept in tolerably close crown cover till old age. If early thinning practice is applied the stock is being decreased and the use per cent. must have a rising tendency, and the question arises how far this rise may go without endangering sustained yield principles.

While the direct use or the formula for budget determination is not recommended, it furnishes at least a control of the budget. Applied to actual stock under usual conditions the budget should for sustained yield management never exceed the product: actual stock multiplied by use per cent.

Grösse und Aufbau des Normalvorrates im Hochwalde. Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen, XI, 1, 1914, pp. 97-148.

French Forest Management

Giving an account of the forest of Lyons visited by the International Forestry Congress, Barbey points out the faulty management of the same from the economic point of view.

The forest, located in Normandie, has an area of around 25,000 acres. It is a broadleaf forest of 54 per cent. beech, 18 per cent. oak, 25 per cent. blue beech and 3 per cent. ash, and other hardwoods. Reference is made to the magnificent streets and roads laid through the forest.

From 1669 to 1785 the primitive method of *tire et aire*, a seed tree method, leaving 10 seed trees per acre was employed, a portion in 90-year rotation, another in 60-year rotation for fuelwood.

From 1826 to 1876 a change in method, introducing thinnings, was substituted. But in 1876, a shelterwood method was introduced. The rotation was increased for some parts to 150 years in six periods of twenty-five; later in 1905, a rotation of 180 years in six periods of thirty was adopted for some parts. The felling area comprises now about 2,200 acres, the timber being partly sold *en bloc*, partly by measurement. The total cut amounts to 62 cubic feet per acre. The prices obtained range as follows: oak 14 cents and beech 10 cents per cubic foot of workwood; split cordwood about $2.30 per cord; branchwood, $1.25; and charcoalwood 35 cents.

The gross income was $4 per acre, the net $3.44 or 5.5 cents per cubic foot. This to the Swiss forester appears very small compared with similar sites in Switzerland, where a similar forest cited produces with 70 cubic feet per acre, a net result of $6.30, or 9 cents per cubic foot.

The change to oak forest is recommended or else planting in of fir, which succeeds excellently in the mild climate of the locality, in 100-120-year rotation, when 70 to 80 per cent. workwood and a net yield of over $8 might be expected.

Eine Exkursion in einen Buchenwald der Normandie. Schweizerische Zeitschrift für Forstwesen, September-October, 1914, pp. 265-268.

UTILIZATION, MARKET AND TECHNOLOGY

Deterioration of Blight-killed Chestnut

In the Spring of 1913 the Forest Service made an investigation of the deterioration of blight-killed chestnut timber. The age of the trunk sprouts was taken as the number of years since the death of the tree, since, in most cases, such sprouts do not appear before the tree dies.

It was found that the sapwood is honeycombed with insect burrows in three years after death, rotted in four years, and begins to dry and peel off in the fifth year. The bark falls off the trunk during the fourth and fifth years, and checking does the most serious damage during the fifth and sixth years and probably later. The heart is sound at the sixth year, except for heart rot or insect injury, which in many cases noted, seemed to have preceded the blight.

The rate of deterioration depends largely upon the age and size of the tree. The larger the proportion of sapwood the more extensive the damage during the first two or three years. Checking, which is in many cases the most serious cause of deterioration, is maximum in the young smooth-barked trees and in the topwood of older trees.

The wood of diseased trees may safely be used for any purpose where chestnut is suitable, since it is not injured by the disease. Strength tests conducted by the Forest Service indicate that sound wood from blight-killed trees is fully as strong as wood from healthy trees. Disease cankers or lesions on chestnut poles are no reason for rejecting material. In the experiments conducted at Mt. Gretna, Pa., it was found at the end of a year that all lesions on poles cut from blight-killed and infected trees were hard and sound even below the ground line where adjacent sapwood was rotted and burrowed by white ants.

S. J. R.

The Use of Blight-killed Chestnut for Poles, by J. C. Nellis. National Electric Light Assn. Bulletin (N. Y.), Dec., 1914, pp. 693-695.

Properties of Wood

A rough but convenient comparison of the properties of many commercial woods is condensed in the following tables:

HARDNESS

Hard	*Medium*	*Soft*	*Very Soft*
Hickory	Ash	Chestnut	White Pine
Dogwood	Oak	Tulip Poplar	Sugar Pine
Sugar Maple	Elm	Sweet Gum	Redwood
Sycamore	Beech	Douglas Fir	Willow
Locust	Cherry	Fir	Paulownia
Hornbeam	Birch	Yellow Pine	
Persimmon	Mulberry	Larch	
	Sour Gum	Basswood	
	Longleaf Pine	Horse Chestnut	
		Hemlock	
		Cottonwood	
		Spruce	

CLEAVABILITY

Hard to Split	*Medium to Split*	*Easy to Split*
Sour Gum	Oak	Chestnut
Elm	Ash	Pines
Sycamore	Larch	Spruce
Dogwood	Cottonwood	Fir
Beech	Basswood	Cedar
Holly	Tulip Poplar	
Maple	Hickory	
Birch		
Hornbeam		

ELASTICITY

Very Elastic		*Less Elastic*	
Yew	Red Cedar	Cottonwood	Walnut
Larch	Lancewood	Birch	Yellow Pine
Fir	Spruce	Maple	Tulip Poplar
Locust	White Pine	Alder	Beech
Chestnut	Ash		
Hickory	Oak		
Osage Orange			

HEATING POWER PER CORD

Best	*Good*	*Moderate*	*Bad*
Hickory	Oak	Spruce	White Pine
Beech	Ash	Fir	Alder
Hornbeam	Birch	Chestnut	Basswood
Locust	Maple	Hemlock	Cottonwood
Heart Pine		Sap Pine	

DURABILITY

Very Durable	*Durable*	*Least Durable*
Walnut	Ash	Beech
Locust	Larch	Sycamore
Redwood	Yellow Pine	Birch
Cedar	Spruce	Basswood
White Oak	Fir	Cottonwood
Catalpa	Tulip Poplar	White Pine
Sassafras	Douglas Fir	
Chestnut		
Cypress		
Longleaf Pine		

O. L. S.

Woodcraft, August, 1914.

Relation of Strength to Specific Gravity

During the past three years the Forest Service has made 90,000 tests on small clear specimens of American woods. These, together with other comparable tests by the Service, bring the total number to about 130,000, and comprise 110 species.

"From the tests of green and air-dry material approximately fifty different average values are derived for each species. Many of these are closely related. The relation of each property to specific gravity has been considered in order to compare one species with another, to determine the relation between the different properties, and wherein each species is exceptional. In general, not only are the denser pieces of a given species the stronger, but the relation of specific gravity or dry weight to strength gives an indication of what strength might be expected from pieces of an entirely different species. The average values of the different properties for the various species when plotted as ordinates with the corresponding specific gravity as abscissae have shown in some cases practically a straight line relation. In other cases the strength increases more rapidly than does the specific gravity. The most satisfactory form of equation for expressing the relation for both green and air-dry material has been found to be that of the parabola $F = PG^n$, where F = shrinkage or some mechanical property. P = a constant: G = specific gravity based on oven-dry weight and volume as tested; n = power of curve."

"The following properties gave approximately straight line relations when plotted against specific gravity:

Shrinkage: Volumetric, radial, tangential.

Static bending: Fiber stress at elastic limit, modulus of rupture, modulus of elasticity, work to elastic limit.

Impact bending: Modulus of elasticity.

Compression parallel to grain: Fiber stress at elastic limit, crushing strength, modulus of elasticity.

Shear parallel to grain: When surface of failure is radial, when surface of failure is tangential."

"The following properties showed decided curves. The strength or mechanical property increasing more rapidly than the specific gravity:

Static bending: Work to maximum load, total work.

Impact bending: Fiber stress at elastic limit, work to elastic limit, height of drop causing complete failure.

Compression perpendicular to grain: Fiber stress at elastic limit.

Hardness—load required to imbed a .444-inch ball to one-half its diameter: End surface, radial surface, tangential surface.

Cleavage strength per inch of width: When surface of failure is radial, when surface of failure is tangential."

Tension perpendicular to grain: When surface of failure is radial, when surface of failure is tangential."

"While in most instances the various properties follow the general relation quite closely there are but few species which are not exceptional in one or more properties. Not infrequently the exceptional property of any species indicates the use to which it is best adapted."

S. J. R.

Deductions from Strength Tests of Woods. By J. A. Newlin. American Lumberman, Jan. 16, 1915, pp. 32-33.

Wood of Buckeye

Buckeye has properties so similar to Basswood and Tulip Poplar that it is acceptable in many places as a substitute. It is practically the same weight, is soft and fine grained, but is difficult to split. On account of this and its light color it gets into the market as Tulip Sapwood and finds its way into high grade boxes, such as used for candy. Also it goes into trunks and sample cases. Some of it is made into ceiling, cornice, sash, door and window frames; a little goes into headings in slack cooperage, veneer for baskets, and excelsior. The census of 1912 shows 14 million board feet used, but this is probably somewhat under the actual amount consumed.

O. L. S.

Hardwood Record, October, 1914.

Dry Kiln Information

Fifty practical questions answered by 179 Yellow Pine operators regarding kiln drying are compiled in the November 1, 1914, issue of the Lumber Trade Journal. Among the answers some of the prominent points that stand out are as follows:

1. Size of rooms—20 by 104 feet and 20 by 120 feet seem to be in favor; fifty different sizes are reported.
2. Kind of building—60 per cent. brick, 30 per cent. wood and 10 per cent. concrete. Two-thirds have composition roofing.
3. Green stock kiln dried by eighty-five firms; partially air dried by two firms.
4. Seventy-one firms use crosswise piling; sixty-seven use endwise piling.
5. Length of time to dry 1 inch lumber:
   48 firms, 60 to 80 hours.
   10 firms, 80 to 100 hours.
   1 firm, over 100 hours.
6. Weight of dried 1-inch lumber:
   10 firms dried to 2000 to 2500 pounds per thousand.
   24 firms dried to 2600 to 3000 pounds per thousand.
   44 firms dried to 3100 to 3500 pounds per thousand.
   6 firms dried to 3600 to 4000 pounds per thousand.
7. Air passage through lumber:
   124 firms leave air passage.
   20 firms do not.

8. Temperature of Kilns:
   13 firms, 150 to 180°.
   59 firms, 180 to 210°.
   11 firms, 210 to 240°.
9. Practically all use live steam.
10. Steam pressure in kilns:
    8 firms, 50 to 80 pounds.
    68 firms, 80 to 110 pounds.
    12 firms, 110 to 140 pounds.
11. Recording steam gauges:
    Fifty firms use them and ninety-two do not.
12. Recording thermometers:
    Ninety-one firms use them and forty-nine do not.
13. No pine plants steam or wet lumber when put in kiln.
14. After leaving kiln pine lumber is left in air 12 hours or more before machining, by practically all firms.

O. L. S.

Electric Drive for Sawmill

The Timberman for August, 1914, publishes a two-page article summarizing the advantages of an electric drive for sawmill and comparing electric and line shaft drives. Several specific cases are analyzed and the advantages shown in costs of installment and upkeep, and in waste of power and time. The conclusion reached is that where any considerable amount of timber is to be cut, a thorough analysis of the case will show that proper electrical equipment will give a substantial return on the capital required to electrify.

O. L. S.

Electric Drive Shingle Mill

At Everett, Washington, a shingle mill, equipped with ten upright machines capable of cutting 400,000 pieces per day, is electrically driven throughout. This is the only mill of its kind known to exist.

O. L. S.

West Coast Lumberman, August, 1914.

Electric Signal Whistles

In Washington an electric signal whistle is being used in logging operations, where it is found to be a great improvement over old arrangements, in that no relay of men is needed for long distances. Also the same wire is used for telephone line for communication with men way out at the end of the skyline in rough country.

O. L. S.

West Coast Lumberman, November, 1914.

Logging in the South

At the recent meeting of the Southern Loggers Association many interesting and instructive matters were brought out in the papers and the discussions, for example, such topics as the following were included:

1. Under general logging operations in Yellow pine, Cypress and Hardwoods: Railroad main line and spurs; location costs, details of construction; Pullboat operations, strength of ropes, sizes used, logs left, etc.
2. Prevention of accidents; first aid, snake bites, sanitation and drinking water, prevention of minor accidents.
3. Bonus System.
4. Steam skidding operations.
5. Logging with teams.
6. Vegetable gardens and water works in camps.
7. Economic feeding of work animals used in logging operations.
8. Scaling rules of Louisiana explained.

A number of the papers are printed in full and make about a dozen pages of worthwhile information.

O. L. S.

Lumber Trade Journal, October 15, 1914.

Cypress Logging Costs

At the Southern Loggers' Association meeting the following costs of an operation in cypress were reported: (The costs varied from $2.73 per thousand from tree to pond, to $3.70).

Detailed Cost Sheet of a Cypress Operation for Six Months, January 1 to June 30, 1914

Supplies	*Total*	*Cost per M*	*Total Cost per M*
Wire rope	$2,664.20	.324	
Chains, shackles, toggles	84.04	.010	
Fuel	1,605.51	.195	
Oils (lubricating)	39.62	.005	
Repair supplies	428.13	.052	
Machinery repairs	771.19	.094	
Sundry supplies	78.35	.009	
Tools	90.15	.001	
Dynamite	2,846.81	.347	
Rafting supplies	500.10	.062	
Motor boat supplies	440.14	.063	
Total supplies	$9,548.24		$1.162
Labor			
Management	$1,349.00	.164	
Clerk and timekeeper	450.00	.055	
Pull boat crew	2,765.75	.337	
Line crew	2,595.11	.316	
Dynamite crew	1,041.75	.127	
Rafting	1,423.23	.173	
Deadening timber	1,306.10	.159	
Road cutting	6,244.50	.760	
Timber cutting	4,331.79	.527	
Motor boat engineer	407.25	.050	
Total labor	$21,914.48		2.668
Total cost per M for supplies and labor			$3.830
Less inventory credits:			
Deadening	$900.00	.109	
Timber preparation	691.50	.084	
Boat supplies	420.07	.051	
Fuel	350.00	.043	
Total credits	$2,361.57		.287
Actual cost per M for operating pull boat			$3.543

Figures based on amount pulled as follows:

	Logs	*Feet*	*Days*	*Average*
January	1,404	1,078,971	23	46,912
February	1,531	826,842	22	37,584
March	1,422	1,506,198	25	60,248
April	1,240	1,118,868	20	55,943
May	1,674	2,028,152	27	75,117
June	1,199	1,656,408	23	72,018
	8,370	8,215,439	140	58,685

Number of days worked, 140; average per day, 58,685 feet; average log, 982 feet.

NOTE: Office records show an additional estimated overhead charge of 30 cents per thousand covering general office expenses, marine insurance and accident liability insurance.

O. L. S.

Lumber Trade Journal, November 1, 1914.

Manufacture of Clothes Pins

Clothes pins are made from several species of wood but beech is used to a greater extent than any other. Elm, oak, Yellow pine, cedar, locust and White or Paper birch are also used. The raw material is procured at a clothes pin factory in the form of logs. The logs are sawed into bolts about 16 inches long; the bolts are sawed into boards ¾-inch thick by an ordinary shingle saw; the boards are converted into ¾-inch squares by a gang saw and then cut into 5-inch lengths. These pieces ¾-inch square by 5 inches long are then turned into clothes pins by automatic lathes. The slot is next cut by a peculiar arrangement of knives inserted into a circular saw which gives the slot the proper flange. The clothes pins are then polished by a friction process. This is accomplished by putting the clothes pins in cylinders or drums which revolve, each cylinder holding about forty bushels of clothes pins, and the rubbing of the clothes pins against each other makes them as smooth as if polished with the finest sand paper. A few minutes before the polishing process is complete, a small amount of tallow is thrown into the cylinders which gives them a gloss.

Forest Service Notes.

STATISTICS AND HISTORY

Russian Timber Export to Germany

The trade treaty between Russia and Germany was about to expire and a new one was in contemplation when the war broke out. The trade treaty between these two countries throws some sidelight on their economic relations and may explain to some extent the present conflict.

For the last few years there has been a growing resentment in

Russia against Germany. The trade policy was to exploit the natural resources of Russia and treat her as Germany's colony. Germany's policy was to stimulate the export of raw materials from Russia, hamper the development of manufacture in Russia and build up with Russian raw materials large manufacturing industries in Germany. This policy showed itself most clearly in the case of forest products exported from Russia to Germany. Coniferous timber occupies the third place in the list of all raw products exported from Russia to Germany. During the last year for which statistics are available, Russia exported $29,000,000 worth of timber to Germany. Of this only $7,000,000 worth of timber was in the form of a semi-manufactured product, such as pulpwood, hewed timbers, etc. The Russian logs were sawn up in Germany into boards, made into pulp and paper and other finished products, and three-fourths of it was resold to England and Holland, only one-fourth remaining in Germany. One of the important rivers which flow from Russia into Germay, the Niemen, which has been extensively used for floating timber in its lower extension toward the sea, passes through Germany. From a point on this river where it enters Germany, the Germans have built on both sides of the river a large number of sawmills, pulp and paper factories, which are operated with Russian logs.

One of the provisions of the trade treaty between Germany and Russia was that Russia must not impose any export duty upon logs and pulpwood, while Germany protected itself from Russian lumber by an import duty of $3.65 per ton upon lumber manufactured in Russia. The effects were very clear. While Russia was cutting off her forests, especially her private forests, without developing any important lumber industry, Germany built up a great lumber and pulp industry with Russian raw material. Especially disastrous was the effect of the export of pulpwood on private forests in Russia. The export of pulpwood alone amounted on an average to more than $4,000,000 a year.

R. Z.

U. S. Wood Exports

The Southern Lumberman, August, 1914, goes to considerable length to show that we export only 7.1 per cent. of our annual cut. This distributed over several different woods shows for the annual cut of each:

Redwood	13.5 per cent. exported
Fir	12.5 per cent. exported
Gum	10.0 per cent. exported
Yellow pine	9.8 per cent. exported
Oak	7.0 per cent. exported
Poplar	5.0 per cent. exported
White pine	1.7 per cent. exported
Spruce	1.5 per cent. exported
Cypress	1.5 per cent. exported
All other woods	2.2 per cent. exported

The European countries received 41 per cent. of all that was exported or about 3 per cent. of our total lumber production.

O. L. S.

Swiss History

Dr. Coaz, the veteran chief of the Swiss Forest Department for forty years, to whose retirement we have referred (vol. XII, p. 309), in taking leave of his colleagues, the Swiss foresters, refers to the history of the development of forest policies in Switzerland, of which, indeed, he was the father.

In 1876 most cantons had no forest legislation, and in those that had they were mostly poorly applied. At the same time, the dangerous clearing methods had progressed from the plain and hill country into the Alpine region, and extensive forests on the steepest slopes and near timberlimit were slashed by mine companies and lumbermen without reforesting; mismanagement everywhere, and as a consequence repeated flood damage, the worst in 1868. This finally brought about the law of 1876, which gave the government of the Federation control of the forest police.

Before this time, however, the forest school of Zurich was opened in 1855, while earlier the Swiss foresters had to get their education in foreign forest schools; among them Tharandt, then still under Cotta, was Coaz's alma mater. Returned, he was employed as topographer for six years, then became head of the forest department of the canton Graubünden. Here, with one assistant, he had charge of about 350,000 acres mismanaged or virgin forest. He had to educate his own personnel in three months' courses. Clearing was forbidden and conservative selection management introduced; planting up of waste lands was begun, etc. After twenty-two years activity here, he served from 1875 as head of the new forest department of Bern. He was then charged by the

Federal Government to formulate the law under which the federal forest service was established in 1876. Although no other State has a forest law of so wide powers, no serious opposition has ever been experienced. Yet the execution of the law is by no means generally carried through, some cantons hanging back, due to political trickery and ignorance.

An das schweizerische Forstpersonal. Schweizerische Zeitschrift für Forstwesen, September-October, 1914, pp. 241-245.

MISCELLANEOUS

French Foresters

All students of the forest school at Nancy and most of the instructors assumed their military duties in the army at the outbreak of the war, since there is a direct relation between the Forest Service and the school.

The buildings of the school have been turned into a military hospital. None of the buildings had been injured by the end of December by the bombardments and throwing of bombs on the part of the Germans.

A correspondent suggests that the knowledge of the foresters as guides is so important that they should be used specifically in that capacity rather than ranged together in special companies. A list of foresters killed, wounded and missing is given, apparently no prominent names among them.

The question of the rights of forest owners to indemnity for damage to their properties by military operations is discussed at length by Génean. Distinctions are made as to the ownership (State or otherwise) and as to the manner, in which the damage came about. Thus the cutting of trees around Paris in the interest of defense—a preventive measure—is liable to indemnity, so is the cutting by the military authorities for immediate use, but in case of declaring a place in the condition of siege (*état de guerre*) or in other actual conditions of war (*faits de guerre*) no indemnity can be asked for. As regards public domain agreements between the Ministers of War and of Agriculture settle the character of indemnity.

Revue des Eaux et Forêts, January 1, 1915.

OTHER PERIODICAL LITERATURE

American Forestry, XX, 1914,—

French Forests in the War Zone. Pp. 769–785.

Wood Pulp for Sausage Casing. P. 804.

The European War and the Lumber Trade. Pp. 881–886.

[XXI, 1915]—

Selecting Shade Trees. Pp. 18–21.

The Forests of Belgium. Pp. 22–32.

The Fire Protection on the National Forests in 1914. Pp. 47–50.

Bonding National Forests. Pp. 59–63.
Explanation of the plan to advance money to communities entitled to receipts from National Forests, but on which there are few or no timber sales.

The Botanical Gazette, LVIII, 1914,—

Fasciation. Pp. 518–526.

Science, XLI, 1915,—

The Place of Forestry among Natural Sciences. Pp. 117–127.

Canadian Forestry Journal, X, 1914,—

Forest Insect Investigation in British Columbia. Pp. 102–103.

Birds and Forest Protection. Pp. 104–107.

[XI, 1915]—

Planting Spruce for Commercial Purposes. Pp. 3–7.

Pulp and Paper Magazine of Canada, XIII, 1915,—

Forest Products Laboratories of Canada. Pp. 9–11.

Western Lumberman, January, 1915,—

The Future of the Lumbering Industry. Pp. 17–19.

Dominion Forest Work in British Columbia. P. 28–30.

Steam Machinery II, 1914,—

Report of the Fourth Annual Meeting of the Southern Logging Association at New Orleans, October, 1914.

Small Timber and Logging Costs from Profit Standpoint. Pp. 364–367.

Canadian Engineer, XXVII, 1914,—

The Battle Against Rot. Pp. 664–668.
A description of a modern creosoting plant with a brief statement of the extent to which treated timbers are utilized in Canada.

Quarterly Journal of Forestry, IX, 1915,—

Forestry and the War. Pp. 1–7.
Taking the present situation in regard to the pitwood supply as a starting point, the writer argues for action on the part of the Government to increase the productive forest area instead of the recurring appointment of investigative Commissions and Committees.

Average Returns from the Afforestation of Waste Lands. Pp. 18–33; 34–44.

Transactions of the Royal Scottish Arboricultural Society, XXIX, 1915,—

Wood Charcoal—Its Manufacture and Use. Pp. 8–16.

The Planting of the Sand Dunes at Culbin. Pp. 19–28.

Continental Notes—France. Pp. 45–55.

Extra-Tropical Forestry in Portugal. Pp. 70–73.

German Forest Notes. Pp. 79–89.

Methods of Nursery Work. Pp. 94–97.

NEWS AND NOTES

On page 653 of volume XII of the QUARTERLY, the school of forestry at the Georgia College of Agriculture is referred to as "newly established." We hasten to correct the impression which this phrase implies. This school was established in 1905, Mr. Alfred Akerman taking charge as professor of forestry in the spring of 1906. In 1909, the funds for this institution, which had been provided by the generosity of Mr. George Foster Peabody, were exhausted, but the State continued the work. The phrase "newly established" refers merely to a change of status: until October last the forest school was a department of the College of Agriculture, it then became the "Georgia State Forest School," with all the privileges of an independent institution.

The Minnesota Forestry Association had prepared an amendment to the State Constitution, having in view the setting aside of the school and other State lands better adapted for the production of timber than for agriculture as State forests, and had vigorously supported the proposition, especially through its organ *The North Woods*. An unusual amount of propaganda was commenced June 1. Editors of larger newspapers were taken to the woods; smaller ones were supplied with weekly stories; women's clubs with a membership of 17,000 distributed literature and posters, and did electioneering; the clergy was engaged to exercise itself; motion pictures showing the conditions in the north woods were exhibited in 250 theaters and lanternslides in 315 shows; a State Forest day was appointed by the Governor, some 400,000 children with 14,000 teachers participating and appealing to the voters for support; exhibits at sixty-nine county fairs and the State fair were utilized; 300,000 booklets were distributed and 37,000 posters; fifteen speakers delivered 250 speeches throughout the State; bankers sent out literature to their customers with the monthly statements; manufacturers and ministers, telephone and gas companies, and commercial clubs canvassed their members, workmen and clientele.

Altogether 1800 citizens lent their active support to these measures of influencing the vote, and the result was the passage on November 3 of the amendment, the only one out of eleven passed. Some two and a half million acres of State land are involved, which will come under a management under forestry principles, and place Minnesota in the front rank of progressive States.

The month of January saw a number of forestry meetings in the United States and Canada.

On January 11, the American Forestry Association was bold enough to hold a meeting without attachment to any other body, accomplishing a large program in one day, in which experts attempted to give advice on what the Association could do in various directions.

In the afternoon of the same day the Society of American Foresters held an executive meeting at the same place. A considerable number of members, some twenty-five, participated in a lively discussion started by the address of the president, Dr. Fernow, on various propositions to increase the activities and improve the value of membership.

There were six propositions brought forward, namely: 1, broadening the membership through classification of members into juniors and seniors; 2, incorporation of the Society to assure its members special standing in the community; 3, amalgamation of the *Proceedings* with the FORESTRY QUARTERLY; 4, return to the original membership dues of $5; 5, a paid permanent secretary; 6, organization of sections with the privilege of accepting members in the section which are not to be members of the Society.

All propositions were referred to the new incoming Executive Committee for action. The amalgamation of the QUARTERLY with the *Proceedings* was apparently not favored.

The New York meeting was followed on the subsequent day by a meeting of the Association of Eastern Foresters at New Haven.

On January 19 and 20, the Commission of Conservation, the Canadian Forestry Association and the Canadian Society of Forest Engineers held their meetings in Ottawa.

The portions of the program of the Commission of Conservation interesting to foresters are reported in this issue. The only resolution passed by the Forestry Association was in reference to extending the protection against fire along railroad tracks to the Government-owned railroads in the same manner as is enforced by the Railway Commission on private roads.

The Society of Forest Engineers revised its constitution in a thorough manner, the important features of the revision being the extension of the time of service for its officers to three years, and the incorporation of the society, which patents its name and the use of it by its members.

Prof. Stanley Coulter, of Purdue University, a careful student of tree growth, writes: "I have found in my own studies in Indiana as regards the White ash that the rate of growth on well-drained soil was very much greater than on that which is less well-drained. On two tracts so similar that they were at first regarded as identical a difference of 17 per cent. was noted, which was only explainable by the fact that the tract showing the greater growth had a good underground drainage, while the other tract had practically none. Where our tile drains, however, have been put in on a large scale, we find that the water table is being lowered so rapidly that some of our shallow-rooted forms are unable to adapt themselves to the changed conditions and the composition of our forests is therefore changing."

Prof. O. L. Sponsler, of Michigan University, writes: "The botanical distinction between *Pinus strobus* and *Pinus monticola* seems to be based upon comparative differences in rigidity of needles, or size of cones, or relation of seed to its wing; all of which are difficult to use and require considerable familiarity with those characters. A year or so ago in examining a few hundred cones of each of these species, I noticed that there was considerable difference between the two species, in the distance from the outer end of the seed-wing to the outer end of the scale. In measuring thirty or forty of each, this space, from the end of the wing to the end of the scale, ranged from 7 to 15 millimeters on *P. monticola* cones; generally, however, the distance was close to 8 or 9 millimeters. *P. strobus,* on the other hand, had a very short space and was much more uniform. In practically all, the distance from the end of the wing imprint to the end of the scale was from 2 to 3 millimeters, only occasionally reaching 4 millimeters, and very rarely going below 2 millimeters. This distinction is much more striking than the figures would lead one to think, and is easily used."

Handles for axes, picks, etc., are now selected by weight as influenced by the density of the wood, Red as well as White hickory being included, since the Red has been found by experiment to be just as serviceable for this purpose. The new specifications were prepared by the Forest Service, the result of much study, covering strength tests, investigations of the growth of hickory in the woods, processes of manufacture, and market conditions. They have been adopted by the War and Navy Departments, by several of the leading railroads and by the Panama Canal Commission (who have already found that a saving of one-fourth will be effected in expenditures for this material), and have been approved by manufacturers and dealers.

A large cargo of creosoted Douglas fir ties has been shipped by the Dominion Creosoting Company, of Vancouver, to the Bengal and North Western Railway, at Calcutta.

The forest branch of British Columbia was instrumental in obtaining this trial order, and acted as inspectors of the ties before shipping.

Ash, being strong and light, and because it will not split under vibration or shock, is used for the propellors of aeroplanes, such as are used in the present war. The frame-work of the machines is frequently made of wood, spruce being used on account of its straight grain and freedom from defects. Built-up layers of spruce with mahogany centers is also used for the propellors.

The operators of one of the largest departmental stores in the Northwest, at Seattle, present a strong endorsement of wood paving in place of the brick pavement formerly used, by stating that the effect upon their employees of the resultant lessening of noise has for them a commercial value which would permit of their relaying the pavement when it becomes necessary.

White pine and Yellow pine are the woods most used for boxes, and each contributes more than a billion feet to the box industry annually in the United States.

A news note from the Forest Service, referring to the widespread use of fuel wood in Utah, Nevada, and Idaho, points out that the fuel value of wood generally is in proportion to its specific weight; that makes also slow-growing woods have a greater fuel value than rapidly-growing. A ton of coal is equal to a cord and a half to two cords of wood in fuel value.

For quick, intense heat, sagebrush is most serviceable; it can be grown in regular crops of coppice, and can be handled for a given amount of cooking as cheaply as oak in the East.

The United States Forest Service has recently adopted the policy of sending out to forest schools brief reports of the results of its forest investigations in advance of publication, or when information is not of such character as to warrant the expense of special publication. Some very interesting and instructive information is thus distributed, and in view of the enormous facilities at the command of the Forest Service for investigations, it may be anticipated that many important discoveries will be made. The Service has also very kindly extended the same facilities to such Canadian forest schools as care to avail themselves of this service.

The arboretum established at Washington in Rock Creek Park, through cooperation between the Forest Service and the District of Columbia, now contains 1,200 trees, comprising 92 different species.

The Society for the Protection of New Hampshire Forests has begun the publication of a four-page sheet of propagandist character under the title, *New Hampshire Forests.* It concerns itself entirely with the forestry interest of the State. The second number contains a brief statement of what the Society has done. It consists of six items, namely: bringing about the Weeks law for a national forest in the White Mountains; securing a State forest of 6,000 acres in the Crawford Notch; securing effective organization for fire protection; securing a State nursery; maintaining a trained forester to keep up the campaign of education; acquiring five forest reservations, including more than 2,200 acres.

There has come to our desk a pamphlet giving a list of export timbers from the Philippine Islands, to be exhibited at the Panama-Pacific International Exposition, San Francisco. It contains also descriptions of the woods and the uses for which they are best suited, together with comparisons to species known to American dealers. Samples, 3/8 by 4 by 6 inches, bearing label with scientific and common name of the wood, may be had from the Director of Forestry, Manila, P. I., or from the Bureau Exhibit at the Exposition, for 10 cents, with the exception of twenty-one species, which sell at 20 cents—postage prepaid.

As a result of the war, the supply of pit props for British mines has become deficient.

It has been said (an extravagant statement!) that if the whole of the forests of Scotland were cut down, there would not be sufficient timber to supply pit props for the collieries of Scotland for a fortnight. A much more conservative estimate states that the requirements for this purpose for the colleries of the British Isles for one and a half years are equal to the total of *extraordinary* fellings from the forests of the United Kingdom. Substitutes are being sought in the hope that a suitable one may be found, and steps being taken with a view to increasing exports of pit timber from countries not affected by war operations in the Baltic.

The West Virginia State Board of Trade has passed a resolution favoring the passage of legislation for forest conservation, and has instructed the Committee on Development and Protection of State Resources to draft such legislation as it may deem desirable to aid in securing the passage of suitable forestry legislation by the next legislature.

At the annual meeting of the *Commission of Conservation of Canada,* held at Ottawa, January 19 and 20, a number of points were developed of general interest to the profession of forestry.

The inventory of forest resources of British Columbia, begun in 1913, has now covered over 200,000 square miles, at an average cost of about 6 cents per square mile. The explanation of this low cost lies in the fact that a very large amount of detailed information had been previously collected at great cost by the British Columbia Forest Branch, the Dominion Forestry Branch, the Canadian Pacific Forestry Branch, and a great many limit-holders. Practically all this information has been placed at the disposal of the Commission's investigators, and has been supplemented to a limited extent by further data collected by them at first hand, on the ground. It is expected that the collection of data for the balance of the province will be completed by the end of 1915. This work is being conducted by Dr. H. N. Whitford and Mr. R. D. Craig.

In Saskatchewan, the similar work under Mr. J. C. Blumer has covered some 60,000 square miles, for a part of which only partial data have been collected. This work is now temporarily discontinued, on account of lack of funds. The indications, from this uncompleted investigation, are that of spruce saw timber there are in that portion of the province of Saskatchewan accessible by present logging methods some 2,100,000,000 feet, board measure. This area comprises 27,000 square miles and includes all the timber limits, for which specific estimates have been secured from most of the limit-holders. Between this timber-limit belt and the Churchill River is another area of 33,000 square miles, with no timber limits, and for which the incomplete data available indicate a total stand of 1,200,000,000 feet of spruce saw timber, generally inaccessible under present conditions. North of the Churchill River is another vast area of 88,000 square miles, on which the timber is generally poor and scattering. Assuming this vast inaccessible area to contain 200,000,000 feet of spruce saw timber, we have roughly for the whole of Saskatchewan a total of only 3,500,000,000 feet of spruce of saw timber size, of which not quite two-thirds is accessible at present.

While no detailed study has been made in Manitoba and Alberta, a very rough indication may perhaps be secured by applying the averages found in Saskatchewan. If this be done, we would have for Manitoba about 2,500,000,000 feet of spruce and for Alberta some 6,000,000,000 feet, making a rough total for the prairie provinces of 12,000,000,000 feet of spruce saw timber.

While these figures are for the most part only rough approximations, they indicate clearly the depleted condition of these forests, which, beyond a doubt, contained many times their present stand of timber before the advent of the white man, which has so generally been followed by large and destructive fires. With adequate protection from future fires, these great areas would gradually reestablish their former productivity of timber wealth.

During the past summer an investigation was made by the Commission to determine the conditions under which the reproduction of commercial tree species is occurring most advantageously in the coastal region of British Columbia. Particular attention was paid to the effect of fire upon the reproduction of Douglas fir, which is the most valuable and most widely distributed species in the province. The study was conducted by Dr. C. D. Howe, of the Faculty of Forestry, University of Toronto. The investigations made by Dr. Howe show, in the first place, that the burning of logging slash, at selected times and under proper supervision, not only greatly reduces the fire hazard, but favors the reproduction of Douglas fir by exposing the mineral soil. However, repeated fires, and fires occurring during dry periods, not only destroy the young growth, but the seed trees as well, thus preventing or greatly retarding the establishment of a stand of commercial species. As a general rule, a sufficient number of seed trees is left after logging, so that one fire leaves enough for seeding purposes. Each fire thereafter, however, reduces them in proportionately larger quantities. Thus, through the diminution of seed trees, each fire makes it increasingly difficult to reestablish, by natural means, the forest on the successively burned areas. On this account, in many sections, reproduction of valuable species is wholly inadequate in amount, or is entirely lacking, since each successive fire diminishes the earning capacity of the area, from the point of view of timber production, unless artificial planting be resorted to; and this is impracticable at the present time, on any large scale, on account of the great expense involved. The same results can, however, be secured at relatively slight expense, by providing more adequate protection from fire on cut-over lands, especially those bearing young forest growth at the present time.

Under the fire regulations of the Board of Railway Commissioners, the railway fire protection work has been continued along the lines of organization and policy established during 1912 and 1913. Steady progress has been made, and the railways are becoming increasingly efficient, not only in handling their own fires, but in cooperating for the extinguishment of outside fires. A small beginning has been made by some of the provincial governments and by private individuals, in the removal of inflammable débris on lands adjacent to railway rights of way. However, as a general proposition, this problem remains for the future. The merit system of appointments in Dominion and provincial fire protective organizations was advocated, such appointments being at present on the patronage basis.

While the Dominion Forestry Branch is well equipped with men technically trained in forestry, and is administering the Dominion forest reserves in the west, as well as affording fire-protection both within and outside these reserves, it has absolutely no connection at the present time with the administration of cutting regulations on the licensed timber berths, although many of these berths are included within the boundaries of the reserves. This is because the timber berths are not legally a portion of the forest reserves. At the same time, the Timber and Grazing Branch, which is charged with the administration of the timber berths, has not, so far as known, even one man in its employ who has had any training in forestry whatever.

The licensed timber berths naturally include the bulk of merchantable accessible timber on crown lands, and it is obviously illogical and thoroughly undesirable in every way to permit the cutting of this timber without the most careful and intelligent enforcement of the existing regulations, which have for their object the perpetuation of the forest, by wise use. Such enforcement is, however, not now provided, and is impossible under existing conditions of organization.

This situation is closely parallel to that which existed in the United States prior to 1905, when the Federal forest reserves were administered by the General Land Office, the Bureau of Forestry then being only an investigative and advisory organization.

Action was advocated which should place the non-agricultural crown lands on the Trent Canal Watershed, in Ontario, under the Dominion Forestry Branch. Of the 2,000 square miles in this watershed, about one-third still remains in the ownership of the provincial government. Considerable areas have been cut over and badly burned, and are in urgent need of restoration. The Dominion Government has expended some $10,000,000 upon the construction of the Trent Canal, which fact gives it a vital interest in the preservation of this watershed. The suggestion is that the Dominion Government buy or lease these provincial lands and turn them over to the Dominion Forestry Branch for protection and restoration. It is proposed, in the event of favorable action, that an experiment station be established upon this area, to serve also as a demonstration of proper methods of handling such depleted lands in the White pine belt, of which there are vast areas in both Ontario and Quebec. Should this proposal be carried through, it will be somewhat parallel, on a much smaller scale, to the establishment of national forests in the eastern states, under the Weeks law.

In this connection, Dr. Fernow presented a plan of establishing a demonstration forest in the Trent Watershed, showing that in fifty years the property of 100,000 acres would have repaid the expenditure of one and three-quarter million dollars, with interest at 3 per cent., and then be worth $10,000,000 by its yield. The possibility of such results was argued by exhibiting the experiences of France in waste land planting and New England experiences.

C. L.

Legislation is now being advocated in the State of Maine which would require the disposal of all brush and slashings on logging operations within 50 feet of any railroad right of way, highway, or woods road traveled by the public, within the State. The proposed alternative is the leaving of the forest growth uncut on a strip of similar width along all such roadways. The proposed law also provides for the disposal of all inflammable débris resulting from the construction of all railroads, highways, and woods roads to be traveled by the public. A measure of this kind would undoubtedly be efficient in reducing the fire hazard.

Upon the initiative of the Dominion Parks Branch, the E. B. Eddy Company, of Hull, Quebec, are printing notices upon thousands of their match boxes, warning the public against the danger of forest fires resulting from carelessness with matches in the woods. This would be a most excellent example for all match manufacturers to follow.

Canadian railways are taking a constantly increasing interest in the matter of forest-fire prevention along their lines. Both the Grand Trunk and the Canadian Pacific Railways have provided public notices in smoking compartments, warning against the throwing of lighted matches, cigarettes and cigars from the train. The Canadian Pacific has printed fire warnings on the menu cards. The Canadian Pacific and the Canadian Northern Railways print fire prevention matter in their advertising literature, particularly in the circulars intended for campers, tourists, etc. A large percentage of the fire loss is preventable, and there is a steadily increasing realization of the fact that most of the loss can be avoided through the creation of an intelligent public sentiment along this line.

The Grand Trunk Pacific Railway has announced that contracts have been let and other arrangements made for the installation of crude oil as locomotive fuel on their passenger engines to be operated between Prince Rupert, B. C., and Jasper, Alberta, a distance of 718 miles. It is expected that this installation will be complete by next June. The announcement does not cover the use of oil-burners on freight engines, it being understood that these will continue to use coal, at least for the present.

The entrance of the Grand Trunk Pacific into the list of oil-burning raiways will nearly double the oil-burning mileage of Canada, the total of which is 726 miles at the present time, all in British Columbia. This is made up of 477 miles of Canadian Pacific lines, 134 miles of the Esquimalt and Nanaimo, and 115 miles of the Great Northern.

The use of oil fuel by the Grand Trunk Pacific Railway will undoubtedly reduce the fire hazard along its lines, but will by no means do away with it altogether. Experience has shown that if oil-burning engines are properly handled, the danger of starting fires from them is practically eliminated. But engines are, of course, not the only source of fire danger along railway lines, many fires being started by tramps, settlers, the carelessness of section men, etc. On the other hand, with even the best fire-protective appliances on coal-burning engines, there is still some danger of starting fires. In practice, however, under the present requirements of the Railway Commission, this danger is to a very considerable extent overcome by special patrols, removal of inflammable débris from the right of way, use of modern spark-arresters, and the issuance of instructions to all regular railway employees relative to the reporting and extinguishing of fires occurring in proximity to railway lines.

The Fire Inspection Department of the Dominion Railway Commission gives the following important information. The department was not organized until June, 1912, so that data given are for only part of that year.

The total number of fires reported to have started within 300 feet of the railway tracks in Canada was 196 in 1912, the area burned over being 25,008 acres, and the destruction of property amounting to $83,380; for 1913 the statistics are, respectively, 462 fires, 2,360 acres, and $12,250 worth of property. Thus, the year 1913 showed an improvement in the handling of the railway fire situation, as evidenced by the great reduction in the area burned over and the value of property destroyed. Further, of the 196 fires reported for 1912, 160, or 82 per cent., were due to trains, whereas in 1913 only 295 of the 462 fires were traceable to this cause.

According to reports from the Chief Forester of British Columbia, over 300,000 acres—principally old slashings—were overrun by forest fires in British Columbia during the past season. The merchantable timber destroyed or seriously damaged was 8,000,000 feet. The season was an unusually dry one, and at one time a force of almost 5,000 men was engaged in forest protection work. One very regrettable feature about this season's fires is the fact that a large area of reforested land was burned over.

Following the trip of Mr. R. H. Campbell, Director of Forestry in Canada, to Great Britain and the Continent, on a tour of European forests, the Dominion Forestry Branch has decided to place more emphasis on the investigation of technical forestry problems in Canada. Thus far, work of this character has been confined to explorations and to forest products work in the recently established laboratories in Montreal. The Forestry Branch now contemplates extending its investigations into all lines of forestry which are at present important in Canada, or in which reliable information will shortly be necessary for the carrying out of technical operations in the Canadian forests. Prof. W. N. Millar, of the Faculty of Forestry at the University of Toronto, has been requested by the Forestry Branch to outline a scheme for organization of this investigative work, and will probably give to it considerable attention in the field during the coming field season.

The New Brunswick Government has removed the ban which prohibits the exportation of timber for pulp purposes cut on the crown lands of New Brunswick, so far as it relates to the British Isles. This suspension of the regulation will probably remain in force until the close of the war.

The provincial government of Alberta has given notice to its treasurer that, on or before June 1 of every year, owners of timber berths in the province will be required to pay to the Minister of Municipal Affairs a tax of 2½ cents per acre with a maximum tax of $25. The land affected includes all lands owned, leased, held under license, etc., for the special purpose of cutting or removing timber therefrom, or which are held as an investment, or for the accruing value of the timber growing thereon.

As a result of the meeting of lumbermen called by the National Lumber Manufacturers' Association at Chicago, December 17, 1914, a mass meeting of lumbermen, representing associations of all branches of the trade, was held at Chicago February 24 and 25, with a view to organizing the Forest Products Federation, whose aim will be to educate the public in the proper use of lumber and forest products. The slogan is "*The Development of Demand*

The Education of the Consumer." Enthusiasm is strong among producers and distributors. Mr. E. A. Sterling has been appointed to act as secretary in arranging the program and publicity propaganda.

The mass meeting resulted in the creation of a new department of the National Lumber Manufacturers' Association, which will have as its sole object the education of consumers and the promotion of the use of wood for all purposes to which it is best adapted.

The Southern Pine Association has completed all the preliminary arrangements of the new organization. Mr. J. E. Rhodes, formerly secretary of the National Lumber Manufacturers' Association, has accepted the secretaryship of the new association, and has outlined his preliminary plans. These cover the creation of several departments, including trade extension, inspection, research, accounting, statistics, traffic, and forestry. Although forestry is named last, the fact that it is named at all in the largest lumber trade organization in the country is decidedly an advance. Not only is there an ambitious outline of work scheduled under the Forestry Department, but under the Research Department, are many other topics such as wood preservation, timber tests, kiln drying, fungi studies, etc., which the Forest Products Laboratory at Madison has seen fit to include in their forest investigations. Mr. E. A. Sterling has been appointed consulting forest engineer for the Association, and Dr. Herman von Schrenk, consulting engineer in charge of the Research Department. The Association is starting out with a membership representing about six billion feet, on which five cents per thousand is paid, thus insuring an initial income of $300,000 per year.

The *West Coast Lumberman* now carries a Forest Fire Fighters' Directory during the summer months. About 500 towns are listed in the coast States and British Columbia, and after each, the man is named who will take charge of organizing the fire fighters when notified of a fire.

Beginning with the January, 1915, issue, *Steam Machinery* changes its name to *Logging,* and the subscription price is raised from $1.00 to $2.50 per annum.

The Biltmorean is a new entrant in the field of American forestry periodicals. Its primary function is to keep alive the Biltmore spirit and to serve as a news medium between the graduates of the Biltmore Forest School. In addition, short articles on subjects of interest are included. In the present number are articles on efficient management, forest fires and winter timber cruising. The magazine is published quarterly by the Society of Biltmore Alumni.

One of the oddest associations of over 300 members is the *Verband zur Klärung der Wünschelrutenfrage,* which tries to find out the truth and philosophy of the use of the willow wand for finding water. It has already published four reports, having been founded in Hanover in 1911. In 1913, an international *Verein der Wünschelrutengänger* was formed in Leipzig, which publishes a magazine *Die Wünschelrute,* and still another such association as mentioned above was lately formed in Vienna for Austria.

The first of the cited reports records the willow wand performances of von Uslar in southwest Africa, who located 800 spots as water-bearing. Of 206 borings, 171 were successful (83 per cent.). The second report refers to trials in the potash mine Riedel (Hanover), when four water searchers and six observers worked not only with willow but steel and iron wands on a given day at the 500 and 650 meter levels; the object being to test the influence of geological formations. All searchers experienced "strong reactions"; especially at the contact of anhydrid and rocksalt the wands marked the places.

The *Revue des Eaux et Forêts,* which had stopped its publication at the outbreak of the war, revived its issues by the first of December. The copy of that date contains, however, no technical matters, confining itself to personalities and mainly war news of foresters who have joined the armies, who were killed or wounded, advanced in grades, etc. We do not find many names well known to the general forestry public.

A brief page refers to the forests of Alsace-Lorraine, giving the organization of State forests and enumeration of some private forest owners.

Dr. John Nisbet, forestry adviser to the Board of Agriculture in Scotland, died on 30th November last. Dr. Nisbet was a pioneer in forestry work in the United Kingdom, and, although he was absent from 1875 to 1900 in the Indian Forest Service, he was responsible for much of the present interest in forestry in Great Britain.

The news reaches us somewhat belated that one of the leading foresters of Austria, Hofrat Adalbert Schiffel, died in March, 1914. He was well known to American readers through the FORESTRY QUARTERLY, for he was one of the fertile writers whose contributions were important, especially on the field of mensuration, finance and organization. It had only been two years since he left the active forest service for a professorship at the Austrian Forest School. A volume on Forest Finance, in which he develops new ideas and methods, is promised as a posthumous work.

On February 27, there died, through heart failure, at Lincoln, Nebraska, one of the Nestors of the botanical profession, Dean Charles Edwin Bessey. Dr. Bessey was a botanist of note, one of Dr. Asa Gray's students, and author of several botanical works of educational value. As Professor of Botany, and later Dean of the Agricultural College in the University of Nebraska, where he officiated since 1884, and since 1909 as Dean of the University, he developed not only the botanical department, but was largely instrumental in establishing a strong forest school. Among his writings of special interest to foresters contained in the sixteen reports of the State Board of Agriculture are "Grasses and Forage Plants of Nebraska; The Forest Grasses and Fungi of the Great Plains and Conditions Governing Their Distribution; Migration of the Bull Pine and Other Trees."

The many students and friends of Dr. Bessey will miss his genial face and discourse at the meetings of the American Association for the Advancement of Science, of which he was president from 1910 to 1912.

PERSONALITIES

It is only natural that readers will be interested more in the news from one region than from another. Realizing this, the personal news are arranged in geographical order as follows:

1. Northeastern United States and Eastern Canada. 2. Southeastern United States. 3. Central United States. 4. Northern Rockies. 5. Southwest, including Mexico. 6. Pacific Coast, including Western Canada. 7. Hawaii, the Philippines and the Orient. 8. Europe. 9. Unclassified.

1.

Mr. Bristow Adams, of the Department of Information of the Forest Service, has resigned to take a newly established position of a similar nature at Cornell University.

The Association of Eastern Foresters held a meeting in New Haven, Conn., on January 12. Rain prevented the planned trip to the plantations and cuttings on the Saltonstall tract. The meteorological adversity did not, however, interfere with the business meeting and dinner.

E. C. Hirst, State Forester of New Hampshire, was married on December 1 to Miss Mary Walker Stillings of Concord, N. H.

Julian T. Rothery is giving a course of five lectures at Cornell University on forestry work in Canada.

Guy C. Cleveland, of the North Jersey Excelsior Company, was married on November 24 to Miss Gladys C. Townsend, of Orange, N. J.

A daughter, Virginia, was born to Mr. and Mrs. D. C. A. Galarneau, of Sault Ste. Marie, Ontario, on November 26.

Christopher Swezey, Biltmore, 1911, was married on October 12 to Miss Ruth Winslow, of Brookline, Mass. Mr. Swezey is associated with the United Forestry Company, of Niverville, N. Y.

C. W. Armstrong, Biltmore, 1913, was married on October 14 to Miss Hazel G. Woehler. Mr. Armstrong is manager of the St. Paul branch of the Shelvin Carpenter Lumber Company.

2.

The senior field work of the Yale Forest School will be on the lands of the Kaul Lumber Company, in Bebb and Hale Counties, Alabama. The mill work will be at Tuscaloosa, about 30 miles from camp.

NOTE.—Members of the profession are requested to send data for this department to Prof. A. B. Recknagel, Department of Forestry, New York State College of Agriculture, at Cornell University, Ithaca, N. Y.

Alfred Akerman, who, through ill health, was forced to give up the headship of the Forest School of the State College of Agriculture at the University of Georgia, is at Greensboro, Georgia. His health is steadily improving.

The Central West Virginia Fire Protective Association has as its field manager W. Hoyt Weber, of the Mensou-Whitaker Company, of New York. This association has a membership covering between 700,000 and 800,000 acres, has twelve patrolmen and also cooperates with the State and Federal service under the Weeks law.

A new departure in woodlot work has been inaugurated in Maryland, where Walter G. Schwab, of the State Forester's office, is establishing demonstration forests and putting forestry into actual practice on hundreds of acres of woodland. The State has adopted the plan not only of advising the woodland owners what to do but, if there is doubt about their going ahead on the recommendation, of supervising the work and even furnishing means at cost to do it, handling the operation right through to a definite conclusion, including, if necessary, the marking of the trees, measuring and estimating the timber as well as finding a market for it, and supervising the cutting. This means accomplishment; whereas under the old plan advice only was given and the majority of woodland owners did practically nothing.

3.

James B. Berry, the new head of the Georgia State Forest School, at the University of Georgia, was married on December 26 to Miss Elizabeth G. Jones, of Wilkes-Barre, Pennsylvania.

The Biltmore Alumni Society plan to place a permanent marker at the old school house in the Pink Beds, North Carolina, and, if possible, convert the old school into a model camp, having it plainly marked that all are expected to leave the camp in as good condition as they found it.

C. W. Griffith, Biltmore, 1905, is department manager in charge of estimating with the firm of Gardner and Howe, forest engineers, Memphis, Tennessee.

Ralph Keeler, Biltmore, 1913, is Manager of the Columbia, South Carolina, branch of the Lucas E. Moore Stave Company.

4.

Dwight S. Jeffers, of the Medicine Bow National Forest, was married on December 9 to Miss Helen Annette Nelson, of Laramie, Wyoming.

J. Warrington Stokes, of the Targhee National Forest, was married on December 17 to Miss Edna Louise Smith, of Harlan, Iowa.

William G. Baxter, of the Sopris National Forest, was married on December 2 to Miss Lucille M. Burns, of Aspen, Colorado.

Dana Parkinson, of the Boise National Forest, has been promoted to Deputy Forest Supervisor. He was married on January 9 to Miss Lucy R. Bacon, of Waltham, Massachusetts.

James H. Hull, of the Caribou National Forest, has been promoted to Forest Examiner.

Samuel E. Bower, of the Wasatch National Forest, has been promoted to Forest Examiner.

Charles F. Evans, of the Palisade National Forest, has been promoted to Forest Examiner.

Alfred B. Hastings, of the Clearwater National Forest, was married on January 19 to Miss Helen Fellows, of Newton Center, Massachusettes.

5.

T. S. Woolsey, Jr., Assistant District Forester at Albuquerque, New Mexico, is recovering from a serious operation for appendicitis.

John D. Guthrie has been transferred from his old station on the Apache National Forest and is now supervisor of the Coconino National Forest with headquarters at Flagstaff, Arizona.

J. Wilbur O'Byrne, Forest Examiner on the Jemez National Forest, was married on November 10 to Miss Ethel McK. Thomas, of Conners-ville, Ind.

6.

P. G. Redington, of the Sierra National Forest, is giving the regular course of lectures on National Forest Administration at the Yale Forest School this winter.

C. S. Hahn, associated with the firm of Lyford and Clark, of Vancouver, B. C., was married to Miss Laura Leonard, of Auburn, N. Y. The couple are now living in Portland, Oregon.

George A. Bright, of the Umatille National Forest, has been promoted to Forest Examiner.

Lawrence B. Pagter, of the Siuslaw National Forest, has been promoted to Forest Examiner.

C. H. Watzek, Assistant Manager of the Crossett Western Lumber Company, is the father of a boy, born on November 15, at Wauna, Oregon.

Neal T. Childs, besides doing consulting forestry and landscape engineering work, has opened a store at Oakland, California. for the marketing of ornamental trees, plants, shrubs and cut flowers.

D. T. Mason has been appointed a professor in the newly created Division of Forestry at the University of California. Mr. Mason is a graduate of the Yale Forest School in the class of 1907, and for several years has held the position of Assistant District Forester in the office of Silviculture in the Forest Service office at Missoula, Montana.

7.

C. S. Judd has recently accepted the position of Forester for Hawaii and Executive Officer of the Board of Agriculture and Forestry with headquarters at Honolulu. Mr. Judd is a graduate of the Yale Forest School in the class of 1907, and for several years has held the position of Assistant District Forester in the office of Silviculture in the Forest Service office at Portland, Oregon.

8.

The QUARTERLY gladly contradicts its report of Dr. Schenck's reputed death as published in the last issue. Inquiry through the *New York Staats Zeitung* revealed that the Doctor was with the German army of the East. For several weeks he was stationed near Mainz, in charge of an engineering corps engaged in the construction of forts.

About the middle of October he left for the Russian front with this message to his American friends: "I have lived my life and had a full share of it, more full than most of us; the rest of it belongs by rights to my country."

On December 15 he was shot through the abdomen at Lodz, but by January 11 he was up again and expected to join his regiment by February 1.

The QUARTERLY echoes the wish of *The Biltmorean* that Dr. Schenck may return to Darmstadt unharmed and in perfect health.

9.

The Intercollegiate Association of Forestry Clubs, formed at Ithaca last May, in connection with the opening of the new forestry building, now includes in its organization the forestry clubs of Cornell, Yale, University of Michigan, Penn. State College, Michigan Agricultural College, Ohio State University and Oregon Agricultural College.

Invitations to join the association have been sent to all forestry clubs in the United States and to the club of the University of Toronto. It is expected that all clubs will soon become members.

Annual meetings and the publishing of an association paper, are among the few things already planned for promoting closer relations among the various clubs, and among their members.

The Society of American Foresters has elected the following as officers for the ensuing year: President, W. B. Greeley; vice-president, R. Zon; secretary, K. W. Woodward; treasurer, L. S. Murphy; executive committee, R. S. Hosmer, F. Roth, H. O. Stabler, F. A. Silcox, R. Y. Stuart.

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THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

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

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FORESTRY QUARTERLY

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THE FORESTRY SITUATION IN GREAT BRITAIN

BY B. E. FERNOW

One thing of interest to foresters that the war is likely to bring about in Great Britain is the realization of the awkwardness of her dependence for wood supplies on other countries, which may increase the efforts to arouse attention to home supplies and afforestation of waste lands. Of the eight billion feet B.M., which roughly is the output of softwoods reaching the European markets, Great Britain takes just about one-half, besides a large amount of unshaped material, the total import in 1912 being around $180 million.

The first pinch was felt in October with reference to the supply of pit props for the coal mines, when imports of this material had fallen to less than 50 per cent of normal. Especially the supply from Russian Baltic ports, which usually represents 20 per cent of the total pit prop supply, was curtailed, in this case for lack of labor, as well as that from the pineries of the Landes, Spain and Portugal, which together supply 40 per cent. This set the authorities to making a survey of home supplies, and it was found that in England and Wales by extraordinary fellings about 7,900,000 tons or two years' requirements could be secured. Excessive railroad rates seem to have prevented hitherto the development of a home market. To assist in a rational manner the utilization of mine timber the "Board of Agriculture's Forestry Advisory Officers" have issued instructions to guide woodland owners, and the English Forestry Association is active in the same direction.

The deficiency which was felt next, was with respect to telegraph and telephone poles, the Postmaster-General making an effort to stimulate home sources to supply it. Also as a result of the war, the demand for charcoal both for heating purposes and for ammunition has greatly increased. The Board of Agriculture has issued a special leaflet on the manufacture of charcoal, which details the common practice in meilers. The cost of producing charcoal ready for shipping is set at between $9 and $10 per ton, and the price paid on large assignments in normal times $10 and $10.50—not leaving much, if any profit—but at present the price paid per ton on rail is up to $20.

These rumblings remind us of the special effort that was begun by the government of Great Britain some six years ago, in 1909, when, as a result of a report by the "Royal Commission on Coast Erosion and Afforestation," a Development Fund was established and a Development Commission instituted to recommend projects for which the Fund might be applied.

The Coast Erosion Commission's report developed a most ambitious scheme of afforestation, by which eventually either 6,000,000 or 9,000,000 acres of waste lands (the latter figure including poor farm lands) were to be planted up. At the same time, it was believed and argued that the problem of the unemployed, which was then a burning one, might be solved at the same time. The statement advanced by the advocates of this planting scheme was accepted by the Commission, that of the $160,000,000 of wood imports all but $20,000,000 could be produced by home sources, and according to Dr. Schlich, one of the foremost advocates of forestry in England, the 6 million acres could produce it. A good road system was advocated in connection with these proposals.

An annual outlay of $10,000,000 for the next 40 years, which with interest in 80 years, when the fellings may begin, will have grown to two billion dollars, was advocated.

The problem of unemployed labor was elaborately discussed by the Commission. "On the average, every 100 acres afforested provide employment for twelve men for six months," the planting season extending from October to March. Since unemployment is at its maximum in winter, the suitability of afforestation for solving the problem was strongly argued. If, annually, 150,000 acres were planted, as proposed, about 18,000 laborers would find employment during this period for the next 60 years. The average cost of planting per acre was estimated at around $30, of which $20 was for labor. Profit calculations are also elaborated on the supposition that for the 9-million-acre scheme $10,-000,000 must be borrowed annually at 3 per cent for 40 years, that from 41 to 60 years this sum is met by receipts and then, increasing until the 80th year, when a sustained annual yield of around $85,000,000 may be expected making the property worth, at somewhat over 3 per cent nearly two billion dollars, a half million more than its cost. A similar calculation was made for the six-million-acre proposition.

As a result of this report, in 1909, the Development and Roads Improvement Funds Act was passed, and, in May, 1910, a Development Commission was appointed to recommend projects to which this fund might be applied.

In general terms, the fund of $14,000,000 set aside in the Treasury was to be devoted to the promotion of agriculture, forestry and rural industries.

In outlining their policy regarding the disposal of the funds, the Commission proposed to follow somewhat the Carnegie library idea: "So far from recommending advances in relief of existing expenditure, they contemplate using the Fund within reasonable limits as a means of provoking expenditure from other sources."

The policy in regard to development of forestry recognizes three directions in which the Fund may be used.

a. The first requirement for such development is effective education in forestry at suitable centers, regulated by organized research and demonstration.

b. No scheme of State afforestation on a large scale can be considered until investigation has shown where State forests might be economically and remuneratively provided, and until a trained body of foresters has become available.

c. That, for the present, applications for grants for the above purposes should include provision for the creation and maintenance of such staff as may be necessary to give practical advice and assistance to those who desire to undertake afforestation or to develop existing afforested areas.

It appears that the three realms, England with Wales, Scotland, and Ireland are to be treated somewhat differently. For England and Wales the Board of Agriculture and Fisheries, through a forestry committee, made propositions of a comprehensive scheme of forestry. For Scotland a similar board and committee are formulating projects. In Ireland advances for the purchase of lands to be afforested by municipalities is proposed.

In the first nine months of their existence the Commissioners allotted one-third of the annual income guaranteed to the Development Fund for five years, and express themselves of the apprehension "that unless Parliament comes to the aid of the Fund its position in a very few years will not be a strong one."

It should be stated here, that the assistance may not be given to private individuals or corporations organized for profit, but is limited to institutions, especially of learning, and to municipalities, and requires the recommendation of government departments.

Thus the "Lords Commissioners of his Majesty's Treasury" on the recommendation of the Development Commissioners sanctioned in 1912 a sum of $12,500 per annum for three years to the Board of Agriculture as grants to certain institutions in England and Wales to enable them to supply technical advice to landowners and others interested in forestry. It was then proposed to attach experienced forest experts to the forestry departments of two universities and three colleges, whose chief duty it should be to give such technical advice. In this connection, the establishment of experimental plots dealing with thinning, underplanting, regeneration, etc., were to be established. The grant provides for salaries for special men, but not already instituted instructors, approved by the Board; but the advisors may do some teaching. Ordinarily no charge is to be made, but where desirable a charge not exceeding one guinea per day for field work may be exacted for the advice. The country (England and Wales) is divided into five districts each to be served by one of the institutions (Oxford, Cambridge, Cirencester, Bangor and New Castle).

An additional grant of $11,000 was made to these institutions for research work.

Besides such grants, the Commission proposes loans on easy terms to "local authorities" to afforest suitable lands under their control, such as water catchment areas. Thus the corporation of Liverpool received, in 1913, a loan of $125,000 to plant up an area of 4,000 acres of catchment basin.

There is also a proposition to establish in various parts of the country, State experimental forests of about 5,000 acres each.

By March, 1914, the total allotments for forestry purposes, besides the loan of $125,000 above mentioned, amounted to around $280,000, and it was estimated that by 1916 the appropriations for forestry and afforestation would have totaled to about $2,000,000 and would have exhausted the allotment for forestry. This sum, the commissioners say, "will not permit of afforestation upon any large scale, as it is scarcely sufficient to deal effectively with 100,000 acres unless other funds are available."

Hence they propose to restrict themselves, besides offering loans to municipalities who might afforest waste lands, to the purchase and planting of demonstration areas in five or six districts.

The great schemes of planting the 6 or 9 million acres of waste areas are, then, postponed, and the idea of employing the unemployed on such schemes has not materialized. It may be added that since the afforestation scheme was first launched labor conditions appear to have considerably improved.

NORMAL FOREST AND ACTUAL FOREST
NORMAL GROWING STOCK AND ACTUAL GROWING STOCK
NORMAL STAND AND ACTUAL STAND

(With apologies to the knowing ones!)

By Filibert Roth

Munger's interesting and concise article in the Proceedings of the Society of American Foresters, 1915, page 18, makes me venture a few suggestions.

When a farmer looks at a field of growing corn he says, "It is a good, fair, medium or poor stand." How does he know it? Evidently he has in his mind a *measure* by which to judge. This measure is not exact; if it is for Michigan it is not the same measure as used in Missouri and Iowa. But it is a measure generally accepted, useful and very much relied upon by millions of farmers. This measure is not the best possible crop, but rather an average crop, a good, full stand of corn for the particular age and for the particular district. It is the farmer's *normal stand* of corn, and is one link in his *normal corn-yield table*, for he has a measure for corn three weeks old and from there up to harvest time.

The same process of measuring is applied to other crops, to live stock, and it is applied to the forest crop. The *actual stand* of corn is what he sees before him in the field, the stand he is judging, comparing, measuring by his measure, the *normal stand.*

With the development of even-aged, planted stands of timber in Europe it became practicable to develop just such a measure in forestry as is used by the farmer. The peculiarities of the forest, large size, difficulty of seeing a whole field, etc., made it necessary to do more than was needed by the farmer, it became necessary to measure the stands on different sites, to compile averages and to record them. The result is the *Normal Yield Table.*

This yield table is the measure by which we judge any given stand. The actual stand before us usually falls below this standard or measure, but not always, for the *Yield Table* is a measure, like the farmer's, not merely of the best, but of a number of good, fully stocked stands. (What is "fully stocked" cannot be discussed at this time or place.)

This yield table is not fixed. Just as the farmer changes his standard or measure in keeping with progress in agriculture, so the forester changes his measure, his normal yield table, as he learns more of silviculture. Schwappach's tables of 1902 are not the same as his earlier tables, and we may expect considerable change as the years go by.

But his tables are now standard, made so by acceptance; they are the best measure we have, they are useful and used; hundreds of stands are judged every year by them and they say whether a given stand is good or poor, 60 per cent or 85 per cent normal.

The normal stand is a measure; it is based on a number of actual though selected, stands, it is not merely an ideal; it is a result actually obtained with a given species and site in a given time.

As a measure it serves to judge the *actual stands* as they occur in the forests. Mistakes, accidents, etc., prevent, ordinarily, that the many stands on a large property should all be normal. In most good forests, some stands are better than normal, *i. e.*, they have larger or more timber than is called for by the normal yield table. But the majority fail below normal so that in the Bavarian instructions, it is considered *satisfactory* when stands of spruce 80–100 years old are .8 normal. The farmer is no better off; he, too, is satisfied if his crops are .8 "good," when ten years average is taken.

The normal yield table, stating as it does, the size of trees and the volume per acre at the age of 10, 20, 30, etc., years is also a *table of growth* from which may be computed current growth, average growth, etc., of any stand or of a series of stands, and the results thus obtained are figures of *normal growth*, or the growth of a stand of timber which we accept as standard, as measure, or as normal.

The normal yield table then serves, among other things, to (*a*) judge, or measure, an actual stand before us, as to size of trees and volume per acre, by comparing it to a normal stand; (*b*) estimate the crop which may be grown on a given site by assuming that under the given conditions (method, care and probable injuries), we may secure, say, .8 as much timber as was produced by the stands (of the same species on similar land) which were used to make the yield table, or our standard.

The normal *forest* is a model rather than a measure. It developed as a necessary part in the plan to work to in forest regulation.

As soon as the forest was required to furnish timber every year and of a certain (obtainable) size and quality it became evident that old and young and middle-aged stands must all be properly represented on the property. This led to the model or *normal forest* with as many age classes as there are years in the rotation, each age class occupying equal area. In this plan or model the stands are generally assumed even-aged and fully stocked. This is almost a necessity, to do otherwise would make this extremely useful model into a perfectly useless "muddle." Nevertheless it is at this point that more or less confusion comes to the mind of the beginner.

The normal forest may be, for instance: Spruce; Site II; method, clear cut and plant; rotation 100 years; yield table as per Schwappach, all stands fully stocked. This forest can be represented by 100 acres, with conditions, in the fall of the year, as follows:

One acre, planted in the spring and hence one year's growth, 1 acre, 1 year old; 1 acre, 2 years old; 1 acre, 3 years old; etc., up to 1 acre, 100 years old.

Here we have a combination of two quite distinct things:—a mathematical arrangement of age classes based on a yearly cut and a rotation agreed upon; and a silvicultural condition of each stand in keeping a certain accepted standard as to site, species, method and age.

This normal forest, like the normal yield table, serves to judge the actual forest. But it compares or judges it in two distinct ways, namely: as to age classes, and as to the conditions of each stand. Ordinarily this last condition is simply assumed, hardly mentioned and therefore easily lost sight of.

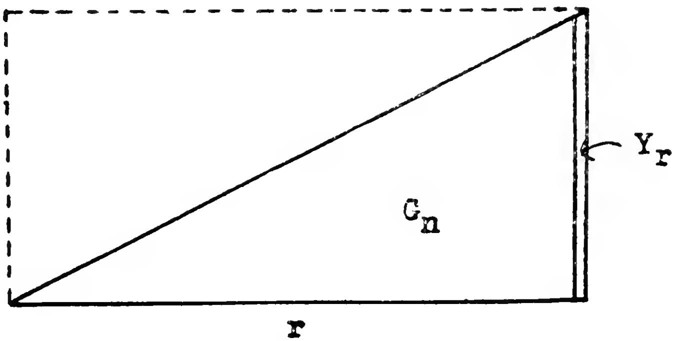
The actual forest then, when compared to the normal forest, may and usually does, fail in these two distinct directions:

1. Its age classes are not all represented, or at least not properly or regularly represented (equal or equivalent areas).

2. The stands of the actual forest are, for the most part, not in a normal condition as to growth, size and volume of timber.

The examination required is one of survey and maps as to the areas in each age class and also a study of each stand as to volume and condition.

But just as the normal yield table is useful as a table of growth, etc., so the model or normal forest is useful far beyond the mere comparison of the conditions of age classes. It is the only means of learning the relations of growth, growing stock and yield from a forest business under given conditions.



The simple triangle is still one of the most helpful diagrams used in the study of forestry. And it makes little difference whether we are satisfied to take G_n, the *normal growing stock*, as being equal to $Y_r \times \frac{r}{2}$ or whether we calculated it from the yield tables.

In any case we get a *normal growing stock* to which the *actual growing stock* in any given forest may be compared. Naturally, where satisfactory yield tables are still wanting and where we can decide on the rotation and on the yield of a fully stocked mature stand (Y_r) the simple: $G_n = Y_r \times \frac{r}{2}$ will have preference.

But once Y_r and r are decided upon or, what amounts to the same thing, when we decide upon the normal average yearly growth per acre and the rotation, the value of G_n is fixed. Merely as an aside, it may be said that a reasonable figure for Y_r is easily secured from the usual cruise, while a satisfactory growth study of stands of different age from one to *r* takes much time and money and deserves little confidence unless it agrees closely with figures based on Y_r.

From the very nature of the growing stock as a growing crop of plants, it is evident that any modification in amount or character (age, condition) will modify the growth and change this from a normal to an abnormal growth. This change may be and usually is in two directions: a change in volume, and a change in quality (age, size, etc.).

If the rotation, for instance, is 100 years and the growing stock, instead of being made up evenly of all age classes, is changed to one in which older timber (80 to 100 years) predominates, the growth in volume will be less than normal; if the 30–60 year old stands predominate it may be larger than normal. But if 30-60 year old stands predominate it is evident that the cut must get along with smaller material, etc., and the quality suffer.

Normal growth, and after all it is growth that is wanted in growing a timber crop, depends on the normal growing stock, and any serious reduction or modification changes the normal growth to an abnormal and therefore less desirable one.

But while these conditions are quite apparent and easily understood in the case of a forest made up of even-aged stands, they are much less evident or apparent in the case of the selection forest of all-aged or many-aged stands. In the textbooks, too, this form of forest is not treated fully, and for obvious reasons. With less than 2 per cent of the State forests in selection forest, the importance in Germany of this form is certainly small. But in our large mountain forests and millions of acres of other wild woods, the selection method is likely to have importance for a long time to come. For this reason a few words here may be justified.

Generally, the condition of age classes, the growing stock in volume and character, the relations of growth and cut are apt to be misunderstood, and if the following looks like the very A B C, it is certainly not so to the majority of beginners.

To understand a selection forest it is again necessary to assume a model, a perfectly regulated forest, such as might be developed by a century of careful cutting. It is also necessary to assume that the site is uniform, that we deal with a single species, and finally that the silviculture is good, *i. e.*, that the period of return is not too long and that the cut is made with an eye to good reproduction and growth. The reproduction, say in good South Michigan hardwoods, would come in easily during the first five years and all later comers would fail for lack of light and room.

For sake of simplicity the following premises are assumed: area 1,200 acres; rotation 120 years; period of return 20 years; principal reproduction at once, *i. e.*, during one year; average yearly growth 500 ft. *B. M.* and Y_r, *i. e.*, 1 acre of trees 120 years old would cut 60 *M.* ft. *B. M.* That these trees are scattered among the younger growth need not disturb the consideration. Each year's cut would cover $\frac{1200}{20} = 60$ acres and we might divide this forest into 20 equal tracts of cutting areas of 60 acres each. The following diagram would then indicate the order and the year of cutting each of these cutting areas.

Area No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
First round...........	1914	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Second round.........	1934	35	36	37	38	39	40	..	..	etc.		..	etc.		..	..	50	51	52	53
Third round..........	1954	55	56	57	58	59	..	..	..	etc.		..	etc.		..	..	70	71	72	73
Fourth round.........	1974	75	76	77	78	79	..	..	..	etc.		..	etc.		..	..	90	91	92	93
Fifth round..........	1994	95	96	97	98	99	..	..	..	etc.		..	etc.		..	..	10	11	12	13
Sixth round..........	2014	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

From this table it appears that: The cut comes to each lot every 20 years. Reproduction of the cleared spots and with this a new growth on any lot every 20 years. For the whole forest the cut is a yearly cut, reproduction is a yearly affair and the age classes are all fully represented just as much as if the trees of different ages were on separate areas in pure, even-aged stands; there are *r* age classes and the triangle diagram applies here as well as in the usual case.

If the working is done right, as is here assumed, then we may think of the trees on any one cutting area separated, *i. e.*, collected on separate areas, and we then would have the following conditions of age classes on the different cutting areas:

In the fall of the year with the oldest or ripe timber in Lot 1 ready to cut:

	Age of Timber in Each Lot				
	Lot 1	2	3	etc.	20
10 acres..........	20 years	19	18	etc.	1
10 acres..........	40 years	39	38	etc.	21
10 acres..........	60 years	59	58	etc.	41
10 acres..........	80 years	79	78	etc.	61
10 acres..........	100 years	99	98	etc.	81
10 acres..........	120 years	119	118	etc.	101

Evidently, each cutting area has as many age classes as there are periods of return in the rotation. The age of the trees on any lot differs by the number of years in the period.

The cut of the coming winter would then take from this forest (leaving out thinnings) the 10 acres of 120-year-old trees in lot No. 1. That these trees are not in nature separated on a tract of 10 acres is self-evident, but that there should be about 10 acres of such ripe trees is part of the conditions of a regulated selection forest.

In the above case the 10 acres of ripe material would make 10×60 *M.* ft. or 600 *M.* ft. *B. M.* Using Hundeshagen-Von Mantel formula here would give us: $Y_r = 60$ *M.* ft.; average $G_n = \frac{Y_r}{2} = 30$ *M.* ft.

$$\text{Cut} = \frac{2G}{r} = \frac{2 \times 30\ M. \times 1200}{120} = 600\ M.$$ ft. which are taken by cutting over lot No. 1.

In practice the cut in the selection forest takes the ripe and the poor, it thins, and is to assist reproduction.

It may and may not take all merchantable material. If cordwood is merchantable and all merchantable material were to be cut it would mean clear cutting and not selection. What the cut may take and what it should leave is more a question of silviculture than of regulation. It, first of all, must leave a growing stock, large enough in volume and right in age classes, to assure proper growth. (The fact that poor market, etc., may prevent good forestry has nothing to do with these discussions.)

The following case illustrates this:

White pine in New York State has been reported to grow as follows:

Yield at 60 yrs. = 45 *M.* ft.; *D.B.H.* = 12 inches (merchantable).

Yield at 100 yrs. = 70 *M.* ft.; *D.B.H.* = 20 inches.

Using these figures with our triangle diagram we have: Growing stock, average per acre, $\frac{Y_r}{2} = \frac{70\ M.\text{ft.}}{2} = 35\ M.\text{ft.}$ If the period of return is twenty years and the rotation 100 years then the cut takes at each return:

$$\text{Cut} = \frac{2G}{100} \times 20 = 40\% \text{ of the growing stock.}$$

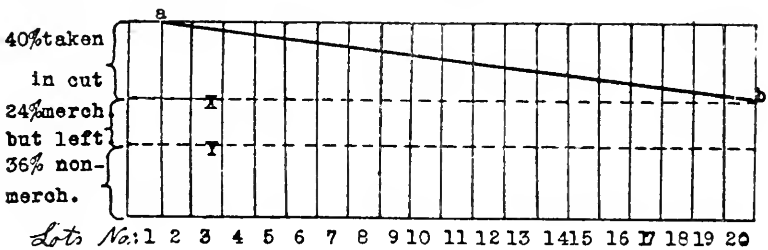
But since the 12-inch material at 60 years is merchantable, the total merchantable here makes 64 per cent, so that we have the growing stock, just before cutting a lot made up of three parts:

1—the 40% merchantable to be removed in the cut;

2—the 24% now merchantable but left to grow;

3—the 36% of material smaller than 12 inches.

This may be illustrated by the following diagram:



In this diagram lot No. 1 is assumed ready for cutting and line a-b indicates the condition of growing stock in the different lots at this particular time.

The line X between the 40 per cent and the 24 per cent in the above case should be dominated by good silviculture, *i. e.*, it is fixed by the period of return.

The line Y depends on market and is of no real consequence or value.

To call the growing stock left after cutting a "reserve," and speaking thus of a reserve of 24 per cent (in the above case) is both unfortunate and misleading. A reserve is usually something ready and available but held back merely to have it readv for use. It does not give the impression of a growing crop necessary to have the growth for which the enterprise is kept. It misleads in so far as it ignores the very important non-merchantable part of the growing stock (36% in the above case) without which the whole business must fail.

If, in the above case, the forester cuts all of the merchantable material, *i. e.*, the whole 64 per cent, and keeps the performance up, he simply changes from a rotation of 100 years to one of 60 years, and if done well and the reproduction keeps pace, etc., he changes his growing stock from that of a 100 year forest to that of a 60 year forest. All intermediates are possible.

But if the rotation is set at 100 years and the growth is 700 feet the *normal growing stock* is fixed, and a forest in which the forester cuts more than 40 per cent at his 20 year return is simply no longer normal, but lacks in the *volume* element of the growing stock.

If, in this way, the growing stock per acre in above case is reduced from 35 *M*. ft. to, say, 20 *M*. ft. per acre, the growth, too, will be modified, in most cases reduced, both in quality and volume.

But the forester might go on with this way of doing and even be satisfied with it and speak of this *actual*, *reduced* growing stock as a normal growing stock. If he does, the *measure* is gone and any forest, regardless of conditions of age classes, volume and quality may then, with equal propriety be called a normal forest and its actual growing stock, a normal growing stock.

How things appear in the usual wild woods, what is rotation, Y_r, growth, and G, and also what data might be used as Y_r, growth, and rotation when the natural rotation is reduced to a man-made rotation, all this is interesting, but space forbids going into this at this time.

FURTHER NOTES ON THE EFFECT OF EXPOSURE ON WHITE PINE SEEDLINGS

By E. A. Ziegler

Since the earlier experiments (See F. Q. Vol. XII, pp. 31-33) in exposing White pine seedlings to determine the amount of drying out they may safely undergo, a new series of tests was made in the Pennsylvania State Forest Academy nursery at Mont Alto during the fall of 1913 and summer of 1914. Mr. Thomas C. Harbeson, of the class of 1914, carried out the tests as a thesis assignment in a very painstaking and accurate way, and the results are taken from his manuscript.

Since the earlier experiments noted above applied to exposure on an average sunny day, an effort was made to examine the effect of differing weather conditions. In the earlier sunny day experiments the loss became marked beyond an exposure of forty minutes, the data of the two experimenters being corroborative.

The outline in the latest experiment provided for three series of exposures as follows.

Series I. On a calm sunny day.

Series II. On a calm cloudy day.

Series III. On a sunny day with high wind.

These series cover the general weather conditions met with in planting seedlings, excepting the rainy day when the loss due to exposure is at the minimum. If the limits of exposure are established for the less favorable weather conditions, they obviously will be safe for the more favorable conditions.

The trees for the three series were taken from the seed beds in the fall and heeled in over winter, thus differing from the earlier experiments where the trees were taken from the seed bed in the spring immediately before exposing and planting. To study the effect of fall and spring exposure on heeled-in seedlings, each of the above three series was subdivided into:

a) A single fall exposure with no spring exposure

b) A single spring exposure

c) A fall exposure and a second exposure in the spring.

Each of these three exposures for each of the three different days (sunny, cloudy and windy) consisted of seven lots of 100 trees each, respectively exposed 10 minutes; 20 minutes; 40 minutes; 1 hour; 2 hours; 3 hours; and 4 hours. The total number of trees exposed will be seen to be (3 x 3 x 700) 6,300, besides the row of 25 unexposed check trees for each 100 (4 rows) exposed trees, or a total of 1,575 check trees, making a total of 7,875 trees in the whole experiment. The check trees were placed systematically and made up each fourth row, so that any localized influences might be detected. This was very wise, for it enabled Mr. Harbeson to immediately detect the advent locally of *Lophodermium pinastri*—and to accurately reject the few lots thus attacked.

The planting stock used was a very strong two-year seedling taken up and tied loosely in bundles of 50 and heeled in with no appreciable exposure to await the sunny, cloudy, and windy days determined upon for exposure.

When the bundles were taken up for exposure, the roots were spread out on the sloping side of a compost heap so that the sun's rays would strike them about perpendicularly. They were turned carefully so that the drying out might be as uniform as possible.

After the fall exposure the bundles were carefully tagged, as were the unexposed check bundles, and heeled in in trenches in a well sodded site with good drainage and a northwest slope. The exposures were stopped on the minute and the seedlings puddled and heeled in.

Series I.—Exposure on a Calm Sunny Day.—The fall exposures were made during the afternoon of November 22, 1913. It was an ideal calm sunny day, temperature 72° to 57° F. The four-hour exposure ran from 1.30 to 5.30 p. m.

The spring exposures were made on April 6, 1914, clear and sunny with a perceptible air movement from the northwest. Temperature 30° to 55° F. Wet bulb 40°, dry bulb 48° at 12.30 a. m. indicating a relative humidity of 48 per cent. At 5 p. m. the temperature rose to 55°, and the relative humidity consequently fell to 39 per cent.

Series II. Exposure on a Calm Cloudy Day.—The fall exposures were made on the afternoon of November 8, 1913, the four-hour exposure running from 1.30 to 5.30 p. m. The sun was completely obscured all day. There was a low barometer with rain the next day. There was a perceptible easterly air movement. Temperature 56° to 50° F.

The spring exposures were made April 7, 1914, forenoon and afternoon, the four-hour exposure running from 8.50 to 12.50 a. m. The day was cloudy, temperature 40° to 60° F. Wet bulb thermometer 52°, dry bulb 59°, relative humidity 63 per cent at 12.30 o'clock. At 5 p. m. the relative humidity had increased to 77 per cent with the temperature falling slightly to 56°.

Series III. Exposure on a Clear Windy Day.—The fall exposures were made during the afternoon of November 1, 1913, the four-hour exposure extending from 1.30 to 5.30 p. m. The temperature ranged from 47° to 40° F. There was a 10-mile northwest wind. The strongest rays of the sun were somewhat obscured by a hazy atmosphere in "Indian summer."

The spring exposures were made on April 9, 1914, forenoon and afternoon, which was a clear day. The four-hour exposure lasted from 11.10 a. m. to 3.10 p. m. There was a steady northwest wind of about 14 miles per hour. Temperature 40° to 33° F. The ground was frozen in the morning. Wet bulb thermometer 33°, dry bulb 36°, relative humidity 73 per cent at 12.30 o'clock. By 5 p. m. the temperature had risen to 38° and the relative humidity to 91 per cent.

Transplanting.—The transplant beds are on high ground with northwest slope and a resulting good drainage. The soil is a rather heavy clay loam. The 4 by 25 feet beds were spaded in the spring. The plants were two inches apart in the row, with rows six inches apart. The planting was done with a planting board on April 7 and 9, 1914. On April 8 there was an all-day rain of 1.4 inches. The April 9 planting was followed by light rains on April 12 and 16, with a heavy rain on April 20. From April 1 to June 28 there was a total rainfall of 11.7 inches. Except for a two weeks' drouth during the last half of May the summer was very favorable for the success of the planted seedlings. The beds received no subsequent cultivation, although they were weeded. The final count was made at the end of July.

The tabulated results follow.

TABLE I

SERIES I. CALM SUNNY DAY

TREES SURVIVING OF EACH 100 (%) ON FINAL COUNT—FALL, 1914.

Exposure *Min.*	*Hrs.*	*Fall* *Per Cent.*	*Spring* *Per Cent.*	*Fall and Spring* *Per Cent.*
10		75	90	86
20		81	86	89
40		88	72	82
	1	88	62	78
	2	76	69	66
	3	77	56	45
	4	66	76	54
Surviving out of 175 unexposed check trees		80	90	92
		SERIES II. CALM CLOUDY DAY		
10		83	..[1]	..[1]
20		90	78	..[1]
40		88	81	58
	1	79	67	60
	2	56	89	26[3]
	3	61[2]	53	62[2]
	4	..[1]	43	..[1]
Unexposed check		84	85	84
		SERIES III. CLEAR WINDY DAY		
10		80	82	68
20		82	69	41
40		77	68	55
	1	82	56	43
	2	67	39	29
	3	66	36	10
	4	50	26	6
Unexposed check		93	84	87

The results in Table I show some irregularity, which is to be expected. In order to make the general tendencies stand out more prominently, this table is contracted (with doubtful results omitted) in Table II. Fractions are rounded off.

[1]Data omitted on account of Lophodermium attack.
[2]Trees somewhat larger than average.
[3]Trees somewhat smaller than average.

TABLE II

Exposure	*Fall* *Per Cent.*	*Spring* *Per Cent.*	*Fall and Spring* *Per Cent.*
	SERIES I. CALM SUNNY DAY *Surviving*		
10-40 min.	81	83	86
1-2 hrs.	82	66	72
3-4 hrs.	72	66	50
Check, unexposed trees	80	90	92
	SERIES II. CALM CLOUDY DAY		
10-40 min.	87	80	..
1-2 hrs.	68	78	..
3-4 hrs.	..	48	..
Check	84	85	84
	SERIES III. CLEAR WINDY DAY		
10-40 min.	80	73	55
1-2 hrs.	72	48	36
3-4 hrs.	58	31	8
Check	93	84	87

Discussion of Results.—The nine check series of 175 trees each, or 1,575 (diminished by 125 where Lophodermium was found), show a survival of 80 to 93 per cent. As long as the survival of 80 per cent or more of the exposed trees, therefore, is shown the exposure cannot be regarded as serious.

A 10- to 40-minute exposure, whether occurring in the fall, in the spring, or in the fall and again in the spring, is not serious except on a windy day with low relative humidity. This supports the result of the earlier experiments. (F. Q. Vol. XII, pp. 31-33.)

A comparison of fall exposure with spring exposure fails to show an entirely consistent difference, although the spring exposure in general seems to show the greater loss. In the absence of a comparison of relative humidity on the days of exposure between fall and spring definite conclusions should hardly be drawn as to the season factor alone. Since the injury to the seedling due to exposure comes from both evaporation and transpiration, spring exposure late enough for active transpiration, would logically seem the more injurious.

The effect of the air movement seems to be marked, as the clear windy day exposures show a much greater loss, even though the relative humidity (73% to 91%) is higher than on the calm days. The fall exposure here up to 40 minutes or even one hour again shows no marked loss, though the spring exposure of 20 minutes, and the double exposure (fall and spring) of 10 minutes even, each show a marked decrease in vitality. This supports entirely the somewhat indefinite, but nevertheless general, experience among nurserymen and silviculturists that the windy day is the dangerous day for the exposure of coniferous stock.

As between the calm cloudy day and the calm clear day the case is not so plain. The clear-day spring exposure was made with a relative humidity of 39 to 48 per cent, while the cloudy day had a relative humidity of 63 to 77 per cent. Yet the cloudy day seems to show the greater loss, although the results here are again not quite consistent. Mr. Harbeson suggests that the transpiration loss on the cloudy day may account for this, since in the sun the stomata are apt to close and secure more effective insulation for the needles.

The heeling in over winter does not seem to weaken plants of this character, as is shown by the high survival percentage among the check trees, which is just as high as with the spring raised seedlings used a year ago.

As suggested in the article last year, the ill effects of exposure do not manifest themselves only through the total loss of plants, but even though they survive, their vigor may be impaired. Trees exposed 40 minutes and less showed an average current growth of 2¾ inches, while those surviving the longer exposures showed less than half this growth or about 1¼ inches.

The following notes on a rough attempt at the same problem are submitted by Professor O. L. Sponsler, of Michigan University:

About 200 seedlings, three-year-old White pine were exposed. It was observed that the evaporation during the first 20 minutes was much greater than later on, the rate of loss decreasing rapidly up to an hour, when exposure ceased and the plants were planted and left without attention until fall; then the following conditions were noted:

Exposure Min.	*Number Planted*	*Number Surviving*
20	20	7
30	20	13
40	20	9
50	20	14
60	20	13

An attempt was also made to determine the rate of loss with the same kind of stock. Twenty seedlings were washed free of soil and shaken until all free water seemed to have been evaporated, and were weighed at intervals of about 10 to 15 minutes, being exposed between weighings on a transplant board to a slight draught in an open window; temperature being 28° C, hygrometer 100 per cent. The following series resulted:

Exposure Min.	*Loss per cent of Fresh Weight*
13	4.1
25	7.4
38	8.2
52	9.1
66	10.8
82	12.0
100	13.0
126	14.5
167	16.0

Continued with changeable humidity and temperature:

Hours	*Per Cent Loss*
46	53
70	56
100	60
220	61.3

Only twice as much evaporation had taken place after an hour as during the first 13 minutes. To determine whether the roots or the tops were responsible for this retardation 10 plants were cut at the root collar and weighed, roots and tops separately, from time to time. The following interesting results appeared.

Root Evaporation

Exposure	*Per Cent. of Fresh Weight Lost*
14 min.	3.2
24 "	9.0
38 "	16.0
52 "	19.2
68 "	22.4
85 "	26.3
112 "	30.0
155 "	35.0
46 hrs.	47.0
100 "	47.0

Evaporation from Tops

Exposure	*Per Cent of Fresh Weight Lost*
8 min.	0.62
21 "	1.46
35 "	2.50
49 "	3.10
65 "	3.75
82 "	4.8
109 "	5.8
150 "	7.0
46 hrs.	46.0
70 "	54.0
100 "	59.0
220 "	61.0

In another connection some interesting figures developed from loss of weight of the white root tips. The data given below are not a fair figure for comparison, but are suggestive nevertheless. Long white roots grown in water from a willow cutting were weighed at intervals of about 10 minutes, between weighing they were left on the balance pan.

after	13 min.	lost	35.4%	fresh	weight
	23 "	"	58.2%	"	"
	31 "	"	71.6%	"	"
	37 "	"	80.3%	"	"

At the end of 50 minutes they had lost all the water that would evaporate under the existing conditions of temperature and humidity.

I have not attempted to interpret these figures yet, as to what they may mean in connection with vitality of seedling due to loss of water. It seems as though the White pine seedlings three years old could withstand at least a 10 per cent loss of fresh weight, and that by far the larger part of the loss occurs from the roots. From some other work that we have done I am led to suspect that the age of the seedling will affect the rate of loss, and very probably the condition of the roots at the time of taking from the ground exerts a large influence upon the rate of evaporation, the more white tips the more rapid the loss.

THE MANAGEMENT OF LODGEPOLE PINE

By D. T. Mason

Lodgepole pine (*Pinus contorta*) is the most important tree of that portion of the Rocky Mountains included in northern Colorado, Wyoming, central and southwestern Montana, northeastern Utah, and southeastern Idaho—often called the "Lodgepole region." The species also occurs in sufficiently well developed stands to be of more or less commercial importance in western Montana, northern Idaho, Washington, Oregon, and California. The "Lodgepole region" is, of course, mountainous, but frequently interrupted by broad, open valleys or plains. The forests are confined to the mountains, where there is sufficient precipitation to permit tree growth. Practically all of the forest land of the Lodgepole pine region is included in 25 National Forests and the Yellowstone National Park, an area of about 27 million acres.

Lodgepole has an altitudinal range in northern Colorado extending from about 7,000 feet to about 11,500, and in central Montana from about 4,500 to about 9,000 feet. Within this range well developed stands occur in a belt from 2,000 to 2,500 feet wide. In such stands, at about the age of 140 years, most of the trees are from 7 to 13 inches in diameter and from 60 to 80 feet tall. The species characteristically forms dense, even-aged stands of tall, slim trees with comparatively narrow crowns. It rarely occurs where the annual precipitation falls below 18 inches, and well developed stands generally enjoy a precipitation ranging from 21 to 30 inches. The tree is not fastidious as to soil if there is enough moisture present; the best growth is made on deep, fresh, well-drained soil. Temperature extremes from plus 100° F. to minus 55° F. are endured. The growing season is short, averaging from three to four months; in the Lodgepole zone killing frosts usually occur every month in the year. The mean annual temperature is about 35° F. The mean annual snowfall varies from 100 to 250 inches; and snow usually lies on the ground continually for a period of from five to seven months. For the region the prevailing winds are westerly.

The species is intolerant of any considerable degree of overhead shade, such as produced by its more tolerant associates, Douglas fir, Engelmann spruce, and Alpine fir. Under dense, pure stands of Lodgepole very little reproduction is found. However, when Lodgepole does get a start either at the beginning or later in the life of a fairly pure stand of its own species, it is extremely persistent and is able to survive for almost indefinite periods in a very badly suppressed condition. Furthermore, it is very frequently able to recover and greatly increase its rate of growth when released from suppression.

Lodgepole is a prolific seeder, producing a fair amount of seed each year, and unusually large crops at frequent intervals, probably from three to five years apart. Seed production begins at an extremely early age; in a few cases cone-bearing trees only 5 years old have been observed. Seed has been collected from trees less than 10 years old, and tests of this seed have shown a germination per cent as high as that of seed from mature trees. Some Lodgepole cones open at maturity and discharge their seed; on the other hand, very many cones remain sealed indefinitely, retaining the seed, which slowly deteriorates in quality, although a surprisingly large amount of it remains viable, as has been definitely proven, for 75 or 80 years. In some cases the cones become imbedded in the wood as the result of the growth of the tree. These sealed cones open from time to time, as the result of the drying of the cone scales, which may happen following the breaking of the pedicel of the cone due to the growth of the tree, following the death of the tree, through the action of fire, or when the cone is left lying on the ground exposed to the sun after it has been knocked from the tree, as often happens when a tree is cut. Hence a dead Lodgepole may be a good seed tree. Seed disseminated by the wind seldom falls farther than two hundred feet from the parent tree in sufficient quantities to restock open areas satisfactorily. Well lighted mineral soil, with plenty of warmth and moisture, forms the best seedbed. Such a condition is found under the partial shade of recently fire-killed stands. A mineral seedbed prepared by fire is not a necessity, however, for seedlings do start satisfactorily on unburned areas in small patches of mineral soil, or in tufts of grass.

Owing to the great persistence of Lodgepole the characteristically over-dense stands do not decrease in numbers at a satisfactory rate. It was formerly the opinion that about eight thousand seedlings per acre were required for a well stocked stand. It is now known, however, that under ordinary circumstances such a stand is entirely too dense, for the mortality rate of the species is too low, the persistence is too great; a seedling stand of such density will, without artificial thinning, remain over-dense indefinitely. It is now considered that about one thousand seedlings per acre, well spaced, give a very desirable degree of stocking. Of course, such a stand does not secure the pruning that would take place in a more dense stand, but the production of stems of large diameter is decidedly more important than clean stems of very small diameter.

Owing to its notable ability to retain good seed in sealed cones, rather frequent fires in the past have enabled Lodgepole to replace to a considerable extent all other species in its range. Fires repeated at short intervals, however, eliminate even the Lodgepole. Fire, an aid but not a necessity to reproduction, is usually followed by over-dense seedling stands. On unburned cut-over areas reproduction is usually much more satisfactory than on burns because it is less dense. Plenty of reproduction is usually secured without fire on areas cut absolutely clean.

Lodgepole is a slow growing tree, particularly slow in its diameter growth in dense stands. Even dominant trees grow comparatively slowly, reaching on the average in 140 years a diameter of only 12 inches with a height of 75 feet. Individuals with moderately good crowns respond well to thinnings made in the stand.

Fire easily kills Lodgepole, for the bark averages only about two-tenths of an inch in thickness at the stump.

Insects do considerable damage in a few localities.

Fungous injury is usually slight, owing to the dry climate, excepting in the case of decidedly old trees.

Windthrow, even in stands heavily thinned, is not nearly so common as is generally believed. Excepting on greatly exposed situations such windfall as does occur is usually due to defective root systems, a wet or shallow soil, or an unduly heavy cutting in an over-dense stand. On fairly deep well-drained soil trees of fair crown development are usually reasonably wind-firm.

Sun scald sometimes destroys the cambium on the sunny sides of isolated individuals suddenly exposed to full sunlight; this seriously injuries or even kills the tree.

Frost cracks are occasionally a serious source of injury to old timber.

Snowbreak sometimes brings about a beneficial thinning in over-dense pole stands, but injures poles left in selection cuttings.

Lodgepole characteristically occurs in pure, or nearly pure, stands through the greater part of its altitudinal range. Toward the lower limit of the zone, where the minimum necessary amount of moisture is approached, it occurs in mixture with and finally gives way to Douglas fir. Toward the upper limit of the zone, owing mainly to the decreasing average temperature, Engelmann spruce and Alpine fir tend to replace the Lodgepole. All three of these species are more tolerant than the Lodgepole and would doubtless long ago have replaced it over much, if not all, of its present range if it were not for the frequent occurrence of fires in the past. It is, however, a very ancient species, as has been shown by the study of the palaeobotany of Yellowstone Park, where it appears to have occurred in the Tertiary Age (*Pinus premurrayana*), as a contemporary of species of Sequoia, Juglans, Hicoria, Fagus, Castanea, Ficus, Magnolia, etc., none of which are now found in the Park.

In Lodgepole stands the ground cover usually consists of pine grass, weeds, huckleberry, etc., affording fairly good range. Usually very little duff accumulates. The stands, typically even-aged as the result of fire, are usually found to be well distributed among the various age classes, when a good-sized area, such as a National Forest, is considered, thus presenting a splendid condition for the introduction of regulated management. Fire usually renews the stand before it reaches an age of more than 160 years, although stands having an age of 200 years or more are found in places over areas several thousand acres in extent. The oldest stand of which there is record is one on the Beaverhead National Forest in Montana, which is now about 450 years old. Many-aged stands sometimes occur as the result of having started as very wide spaced reproduction on double burns, the blanks of which have gradually reproduced.

The yield of a stand of a given species depends, of course, upon site quality, age and density. In the case of Lodgepole density is of exceedingly great importance. Several sample acres of hundred-year-old Lodgepole were taken on sites of the best quality, the stands varying in density from 500 to 1,800 stems per acre. A maximum yield of about 20,000 board feet was secured with about 800 stems, the yield falling off rapidly to less than 1,500 board feet when the number of stems increased to 1,800. The data for the plots show a similar effect upon the cubic foot yield of the stand, and upon the average height and diameter of the trees. In one case a 70-year-old stand was observed on a site of at least average quality, in which there were slightly over 100,000 green "trees" per acre, averaging about 4 feet high and less than a half inch in diameter at the ground. The stand had completely stagnated.

The average yield for merchantable stands, which are ordinarily from 100 to 200 years old, is from 5,000 to 8,000 board feet per acre, scaling to a minimum diameter of 6 inches in the top; when the average stand is scaled to only 8 inches in the top the yield is reduced by almost one-half. Timber sale areas in the Lodgepole region usually yield about twice as much as the average merchantable stands, for the sales are usually located in the heaviest timber. Maximum stands on single acres vary from 24,000 to 36,000 board feet. The heaviest acre recorded is one on the Deerlodge Forest in Montana, which, at 200 years, contained 36,000 board feet of green Lodgepole, 4,600 feet of other green timber, and 8,000 feet of dead Lodgepole—a total of 48,600 feet on the acre.

Thinnings are decidedly beneficial in Lodgepole stands. Measurements taken in stands ranging in age from 50 to 150 years, thinned from 15 to 25 years ago, due to incomplete logging operations, removing, on the average, slightly more than half of the cubic foot volume of the stand, show that the majority of the trees left standing have increased considerably in their rate of growth. In most cases the total amount of wood produced per acre since the thinning is as much, if not more, than would have been produced if the stand had been left unthinned, and the wood so produced is decidedly more valuable since it is distributed upon fewer stems. If accidental thinnings made by loggers give such results, thinnings carefully executed from a technical point of view will undoubtedly prove even more satisfactory.

The supply of Lodgepole in the Lodgepole region is very largely in the possession of the United States on the National Forests. Some timber of this species has passed from the Federal Government by grants to the States and to the Union Pacific and Northern Pacific Railways. Very rarely did any individual consider Lodgepole sufficiently valuable to secure it at $2.50 per acre under the Timber and Stone Act, although Forest Service sales are now frequently bringing in a stumpage return ranging from $50 to $125 per acre. The stand of Lodgepole on the National Forests is estimated at approximately forty billion board feet, of which a little more than one-half is in the Lodgepole region.

The wood of this species is slightly heavier and slightly more resinous than that of White pine. It is soft, easily worked, and fairly strong. In the Inland Empire its lumber is frequently mixed with White pine or Western Yellow pine, and is not sold under its own name. When properly manufactured it makes an excellent grade of common lumber.

For the year ending June 30, 1913, the total cut of Lodgepole, as nearly as it can be determined, was 82 million board feet or its equivalent, consisting of mine timber 25 million, saw timber 20 million, cordwood 16 million, standard ties 14 million, and fencing 7 million. Of this cut 77 per cent came from the National Forests. Of the total amount over one-third was cut in Montana, while Colorado and Wyoming cut a fifth each, and Utah an eighth. It is probable that the present annual cut of Lodgepole from the National Forests may be increased 9 or 10 times without danger of over cutting. The market ordinarily requires that about 70 per cent of the timber have a minimum top diameter of eight inches; the average well-stocked stand at 140 years contains less than 40 per cent of such material. With the decline in the available cedar it is probable that Lodgepole will, in the future, be largely used as a pole timber, especially in the country between the Rockies and the Mississippi, where the comparatively short haul will offset the greater weight of Lodgepole. It is also suitable for pulp.

The forests of the Lodgepole region occur in the mountains, where the precipitation is much above the average for this part of the country as a whole, and where the slopes are comparatively steep; thus the Lodgepole forests are of unusually great importance for watershed protection. They should, therefore, be managed in such a way as to maintain a high efficiency in regulating stream flow. These forests should also be managed so as to produce a maximum amount of timber of desirable size. A study of the yield and rate of growth of Lodgepole indicates that under average conditions a rotation of approximately 140 years is satisfactory.

METHODS OF MANAGEMENT

Before discussing the system of cutting now in use it will be instructive to consider the systems which have been used in the past. Butte, Montana, the great copper camp, offers the best market in the Lodgepole region. In addition to about ten million board feet of "stull" timber, mainly over 8 inches in diameter, this market, together with the Anaconda smelter, uses annually about 130,000 lagging poles (16 feet long with a 2 to 3 inch top), about 40,000 converter poles (26 feet long with a three to four inch top), and four or five thousand cords of wood. This market has permitted very close utilization of the timber cut on the French Gulch sale, on the Deerlodge National Forest, which supplies most of the material just mentioned; thus it has been possible at French Gulch to use any system of cutting in Lodgepole which has seemed worthy of trial—and many have been used.

For a month or two at the beginning of the sale the selection system of cutting was used on one small area, and in other places a single seed tree system. In October, 1906, the first definite marking rules were promulgated. They provided for leaving 75 foot square groups of seed trees standing at regular intervals on one-sixth of the area. These groups were thinned, leaving on the entire area from 5 to 10 per cent of the original number of trees. In exposed situations over 90 per cent of the trees so left have been blown down, and many of the standing trees have died from sun scald or the drying out of the soil. On the more sheltered situations, particularly where the individual trees left had formerly been growing in a somewhat open stand, the windfall was much less. Where the trees were very tall and slim, the result of growing in crowded stands, as was the case over most of the area treated under this system, windfall was destructive. The wind soon demonstrated the impracticability of both the single seed tree and the seed group systems for general use in Lodgepole, and at the same time those who saw the results became thoroughly convinced of the lack of windfirmness of the species. The test is not a fair one, however, for it is asking too much of any species to reduce the number of trees per acre from 500 or 1,000 to about 50 and expect them to stand in an exposed situation, particularly when the individual trees are tall and slim. The next change in the marking system naturally aimed to adopt some plan which would eliminate the disastrous windfall. In the spring of 1909 the strip system was chosen. Under its operation about one-third of the area was left in seed strips from 100 to 150 feet wide. These strips were left absolutely intact between clean cut areas of from one to three times the width of the seed strips. The system proved successful in reducing windfall to a practically negligible amount.

The seed tree, seed group and strip systems largely disregarded watershed protection and both silvicultural and market requirements. The first two practically resulted in the destruction of the trees left through windfall and sun scald; the third left many over-mature trees; all three failed to secure the thinning of over-dense young stands, and caused an over-production of small size material. None of these systems took into account the variety of situations and the various ages and conditions of stands found on the sale area. The system next to be adopted aimed to eliminate previous difficulties, so far as practicable, by recognizing the limitations and taking advantage of the possibilities of both the species and the market, and harmonizing all factors in such a manner, under the conditions imposed, as to secure the best in the way of watershed protection and the maximum increase of increment for the National Forest considered as a whole, although not necessarily for each particular acre cut over taken by itself.

Reviewing hastily the chief characteristics of the species and the market, it has been shown that Lodgepole stands and reproduction tend to overdensity, satisfactory reproduction is secured without fire on clean-cut areas and under a stand when sufficient light is admitted, the individual is extremely persistent, both seedlings and good size trees are frequently able to recover from severe suppression, thinnings increase the rate of growth of the trees left, the species is sufficiently windfirm under reasonable conditions, the market demands much large size material and is able to absorb considerable material of small size.

In the fall of 1910, mindful of the points just mentioned, a system was given a trial, which with a few modifications developed into the plan now in effect. The present rules for handling Lodgepole stands on the Deerlodge Forest, approved in the summer of 1913, provide, first of all, for the classification of the stands on the basis of their age and with reference to the average size of the trees, which, of course, depends upon the density of the stand, into "over-mature," "mature," and "immature," the last named being further subdivided into "converter pole" and "lagging pole" stands. The different situations are also classified as to wind exposure into "safe," "medium," and "great" exposures.

"Over-mature" stands are those over 160 years old and in which from 35 to 60 per cent of the trees are 10 inches or over in diameter. Here a clean cutting is made including all trees 7 inches and over in diameter, merchantable under the terms of the contract, with the object of harvesting a crop which is at, or approaching, a standstill and replacing it with vigorously growing reproduction. No attention is paid to windfall which may take place among the small trees left, for it is better to lose a number of them than to leave on the ground a sufficient number of the larger trees to protect the smaller from windthrow. Reproduction is amply provided for by the groups of seedlings and poles already started in the openings, by seed from the trees left standing, and by seed from cones knocked from the tops of the trees removed.

"Mature" stands, from 120 to 160 years in age, while containing from 25 to 40 per cent of trees over 10 inches in diameter, consist mainly of trees of smaller sizes which still, for the most part, have fairly thrifty crowns. These stands are cut in accordance with the selection system, using a flexible ten-inch diameter limit. Here it is the aim to cut the larger trees and to reserve the smaller ones for further growth. Reproduction is not an object, but it will be secured in the frequent small openings, resulting from cutting groups of larger trees, and also in other places where the stand is opened sufficiently. Constant attention is paid to danger of wind damage, since it is the purpose to leave the stand in good condition for further growth without danger of windfall. On the "medium" exposures, which include the greater portion of the cutting area, there are left approximately 70 per cent of the trees 3 inches and over, 62 per cent 6 inches and over, and 20 per cent 10 inches and over; of the cubic foot volume 44 per cent, and 36 per cent of the board measure volume is left. A second cutting may be made in from 20 to 40 years. A larger proportion of the stand is left on the "great" exposures and less on the "safe." A negligible amount of windfall has resulted from this method of cutting—probably less even than with the former strip system.

In both the clean-cut and selection cuttings it is the definite policy to allow the cutting of converter poles and lagging poles only when they are obtainable from tops of marked trees or when it is necessary to cut them in making roads, etc. The object of this prohibition is to force the cutting of such material in young stands badly in need of thinning. It is estimated that if all the lagging and converter poles required by the local market each year were secured in thinning over dense young stands, still only about one-fourth of the areas in need of thinning annually would receive attention.

"Immature—converter pole" stands, from 80 to 120 years old, and consisting mainly of trees under 8 inches in diameter suitable for converter poles, receive an "improvement thinning." The method of marking is to select on each square rod an average of two (this is at the rate of 320 per acre) of the very largest and most promising trees to be left. All other trees suitable for converter poles are then cut, leaving all trees too small for this purpose.

"Immature—lagging pole" stands are usually from 50 to 80 years old; most of the trees are under 6 inches in diameter. Here also it is the purpose to make an "improvement thinning," reserving on each square rod about three (about 480 per acre) of the most promising trees, and cutting all of the others suitable for lagging poles. One 60-year-old stand cut in this manner had 2,044 trees per acre originally; 484 of the best trees were left well distributed over the area, 1,022 poles were cut, and there were left also 538 trees too small to interfere with the rapid growth of the larger trees; this thinning netted over $30 per acre and changed the stand from one in which many trees were growing very slowly to one in which a few trees are growing rapidly.

The principal points of advantage of the present over the preceding systems are: better watershed protection, trees left will grow faster, needed thinnings are secured in young stands, windfall is negligible, the total cut of large timber is increased, and the over producton of small material is stopped.

In the Lodgepole region it is considered advisable as a fire protective measure to dispose of brush by burning it currently as the cutting proceeds in the safe season, as is entirely feasible, or by piling it in the summer for future burning.

LODGEPOLE PINE
DEERLODGE NATIONAL FOREST, MONTANA
FRENCH GULCH AREA

SELECTION CUTTING—AVERAGE ACRE

D.B.H.	*Number of Trees*		
Inches	*Total*	*Cut*	*Left*
3 to 7	257	25	232
8	54	8	46
9	44	10	34
10	31	16	15
11	28	23	5
12	20	17	3
13	22	19	3
14 to 23	27.5	27.5	0
Totals..............	483.5	145.5	338

Age, 140 years.
Average diameter of trees cut, 11.2 inches.
Average diameter of trees left, 6.8 inches.
Thirty per cent of trees 3 inches and over cut.
Thirty-eight per cent of trees 6 inches and over cut.
Eighty per cent of trees 10 inches and over cut.

Comparison of Selection and Clean Cutting Areas

For the total cubic foot volume cut showing the per cent in various size products.

Material With a Top Diameter	*Clean Cutting*	*Selection Cutting*
8 inches and over..................	36.5 per cent	60.7 per cent
6 and 7 inches....................	28.6	21.8
Under 6 inches....................	34.9	17.5
	100.0	100.0

THE SUBDIVISION OF FORESTS

By J. S. Illick

One of the first requirements of the orderly management of the soil, whether it be in agriculture, horticulture, gardening, or forestry, is the division of the aggregate area into convenient and practical parts. Agriculture, gardening and horticulture are the older members of the above group of businesses, while forestry—at present in its formative period of development in America—is the youngest. The older members have already blazed and, to a degree, cleared a route of development which forestry, in part at least, will follow. Just as farms are divided into fields and patches, orchards into blocks, gardens into beds, so forests should be divided into working units.

The fundamental economic principles of forestry differ very little from those of any other business. A systematic management of any business requires a careful organization of both personnel and material. A careful organization of a forest property requires a division of it into working and treatment units, without which it is practically impossible to build it up and keep it in order. More than a century ago Heinrich von Cotta, one of the greatest and probably the most prudent of the early German foresters, appreciated the significance and the great value of a good permanent subdivision of a forest. Today, Dr. H. Martin, Professor at the Tharandt Forest Academy which Cotta founded in 1811, and one of the best known and most versatile forest authorities in central Europe, emphasizes the value of the subdivision of a forest in the following words: " The subdivision of a forest into permanent managerial figures, usually known as compartments, must be regarded as the most difficult and yet the most important task of the field work and should precede the other preparatory activities of forest working plans."

It is important to know what advantages will be derived from the subdivision of a forest. In the light of European experiences and of our own understanding of the subject the fundamentals which recommend an orderly subdivision of a forest may be summarized as follows:

1. An orderly subdivision makes orientation within a forest and the use of maps easier. It enables persons to locate themselves and reach their destination. It is invaluable to persons who are not "woods wise." Everyone who has traveled in the forest can appreciate the value of an ordinary blazed trail. Accurately located, carefully cleaned, and clearly demarcated subdivision lines have certainly a greater value and a wider range of usefulness than blazed trails.

Just as it is easier to locate a town upon a map if the county in which it is located is known, so it is also easier to locate a place or an operation upon a forest map if the compartment in which it is located is known.

2. It makes bookkeeping much easier and more accurate. Systematic and detailed records of all activities in the forest are among the most valuable assets of a forest property, and consequently should be started as early as possible. Bookkeeping should embrace not only a record of receipts and expenditures classified according to stands, but also full data concerning the forest property, operations, and results of operations. The keeping of such detailed and complete records is difficult in the absence of a careful subdivision of the forest. A regular system of bookkeeping was started in the famous Sihlwald, belonging to the city of Zurich, in 1630. Accurate and detailed records of all forestal activities covering such a long period—almost three centuries—alone suffice to make a forest famous.

3. It makes administrative control and inspection more effective. Every forest should be visited frequently by some administrative officer. A careful subdivision will enable this officer, who is logically a forest inspector, to economize time in the field and office, and in addition increase the accuracy of his report. Satisfactory inspection and supervision require a definite location of all forestal activities.

4. It insures an orderly prosecution and continuity of work, especially in the case of change of personnel. A well conceived, carefully prepared, and closely watched working plan should be developed without interruption. It is difficult to prepare a complete and specific working plan without a careful subdivision of the forest.

5. It makes the forest accessible to the forest manager, the personnel under him, and the public. It enables the manager of a forest to plan, report, and book his work better and direct it easier. It permits a better organization of the work of the protective personnel. It also enables the public to enjoy the surroundings,

shelter, and benefits of the forest for recreation and health. The public should not only be allowed to enter upon public-owned forests, but special inducements should be given to them to enjoy the manifold benefits which nature has stored up and is holding for them. Subdivision lines will enable them to enter forests with ease and without fear of being lost. All important routes through the forests should be posted, giving the direction and distance to the principal points of interest and exit. It is practically impossible for even a novice to lose himself in the German forests, on account of the numerous directive signs found at almost every junction of roads, lanes, subdivision lines, and trails. In many cases the subdivision of a forest also facilitates hunting and shooting.

6. It establishes the basis necessary for stand differentiation as well as quantitative and qualitative surveys, all three of which are very important tasks in any forest business. The differentiation of stands is a prerequisite to both quantitative and qualitative surveys. A quantitative survey determines the amount, kind, and distribution of material present upon a given area. Such a determination enables one to ascertain values for the purpose of sale and taxation, and what is still more important, it gives the owner or manager a fair idea of the amount of his investment. It is similar to what in ordinary business is known as "taking stock" or "takng an inventory." A qualitative survey determines the site-quality or the degree of productivity of the different parts of a forest area. The performance of these tasks is easier and the results more accurate if a forest is subdivided.

7. It forms a base or framework to which all interior surveys can be tied, and assists in the maintenance, verification, and relocation of points and parts of land and boundary surveys. It also helps to make the topographic surveys more useful by locating various land features more accurately.

8. It enables one to demarcate clearly the boundaries of all operations within the forest. These include planting, improvement, protection, and utilization. It is of special value for beginning and continuing cutting operations. Cutting operations can be properly started, allotted, and systematized, if a subdivision is at hand. It is also of great value in connection with camping permits, applications, reports, and contracts of timber sales because each one of them refers to an exact location or area.

9. It makes possible the introduction of a regulated forest system which is based upon a continuous or sustained yield management and has as its goal the normal or ideal forest.

10. It possesses an instructional and experimental value, especially at the present time, when forestry in America is still in its formative period.

11. The subdivision lines afford a place for stacking wood and a means of transporting it.

12. The subdivision lines afford a means of getting to forest fires, and form a base for controlling them and such other destructive agents as wind, insects, and fungi.

Anyone who undertakes the subdivision of a forest will naturally try to inform himself concerning the experiences and conclusions of others. At least a few of their many experiences may have found their way into print. A study of the literature in the English language upon this subject will soon reveal the fact that it is limited in extent and superficial in treatment. On the other hand, an attempt to study the German literature upon this subject will soon disclose the fact that it is just as voluminous and digested as the English is limited and superficial. German foresters have been engaged in this special kind of work since 1750, but in particular from 1810 to 1850, when H. von Cotta and G. L. Hartig were at their height. It is in their writings, and to a more limited extent in that of their contemporaries and immediate successors, that one finds a complete and clear discussion of the general procedure followed in subdividing a forest area. Most of the later writers concern themselves more with the improvement of existing subdivisions and the coinage of new terms, than with the fundamental procedure followed in subdividing a forest.

The German foresters learned at an early date that the division of the aggregate forest area into units was a prerequisite to orderly procedure. Four kinds of grades of units are usually recognized, viz: directive, inspective, executive, and protective. The State-owned forest land of Saxony is divided into nine districts and each district is subdivided into twelve forests (*reviere*), making a total of 108 forests. The State forest land of Austria is divided into seven districts, which are in turn subdivided into 196 forests and 1,078 ranges. Each forest or executive charge is subdivided for managerial reasons into numerous compartments and subcompartments. The compartments and subcompartments may in turn be grouped together into annual cutting areas, cutting series, blocks, divisions, and working sections. No two States in Germany use exactly the same method of subdivision, and the different German writers rarely use a uniform terminology in discussing the fundamentals of subdivision work.

In America, some administrative units have been created. The United States Forest Service for the better administration of its land has divided it into six Districts with 163 National Forests. The forest land owned by the State of Pennsylvania, now aggregating 1,000,000 acres, is divided into forty-nine State forests with an average area of a little over 20,000 acres per forest. A forest, whether it be National or State, is an area under the charge of one executive officer or general manager, known as a forest supervisor in case of a National Forest, and a forester in case of a State forest in Pennsylvania. Practically nothing, however, has been done in America in the way of subdividing the administrative units or executive charges into units of management, generally known as compartments. This article aims to present some of the German and Austrian experiences upon this subject as one learns them in books and observes them in traveling through and studying their forests in person, together with a plan of procedure which has been used on a part of one of the State forests of Pennsylvania.

The earlier German foresters could not agree regarding the meaning of the word compartment. Some considered the compartment as a "unit of silvicultural treatment," while others considered it as a "unit of working or management." In the former case the compartment was dependent upon the condition of the stand and the length of the rotation. After a century of experience most of the German foresters are convinced that the subdivision of a forest should be kept independent of the rotation and the condition of the stand, except where these agree with the topographic and other natural features. Differences may occur within a compartment with respect to species, silvicultural system, age, site-quality, and density of stocking, which will require a differentiation of stands. In this event, it will be necessary to divide the compartments into stands or subcompartments. Subcompartments may be defined as "units of treatment," because each stand comprising a subcompartment usually requires a special kind of silvicultural treatment. The subcompartments may be temporary if their distinctive features will soon disappear, or permanent if the distinctive features will remain for a longer period of time.

The size of compartments is one of the most important questions to consider. Their average size varies with the following factors:

a) Ownership and coherence of the forest.
b) Intensity and kind of management.
c) Degree of danger from fire.
d) Species.
e) Topography and means of transportation.

In case of small holdings the compartments naturally fashion themselves smaller than in case of larger holdings. If artificial regeneration is used they should be smaller than in the case of natural regeneration. In protection forests upon steep mountain slopes, where some method of natural regeneration must be used, they fashion themselves larger than in level regions. In forests with extensive management they are larger than in those with conservative management, and much larger than in those with intensive management. In coniferous forests they should be smaller than in hardwoods. In mountainous regions their size is also influenced by topography and the distance between roads. To the above enumerated factors concerning the size of compartments, one may add, in case of cultural forests under intensive management such as one finds in parts of continental Europe, the size, gradation, and distribution of the cutting series.

A consideration of the size of compartments in countries where forestry has been practised for some time may help us and serve as a guide. According to Dr. Martin, Professor of Forestry at the Tharandt Forest Academy, Saxony, compartments should have the following average size:

Broad-leaf species	60 acres
Pine	50 "
Spruce	37 "

In the beech forests of Prussia the compartments are made not larger than 75 acres; in the pine forests they have an average area of 60 acres, and go to as low an average as 50 acres in case of spruce forests. Dr. von Guttenberg, the foremost Austrian authority on Forest Organization, states that in case of large forests with extensive management, in which one usually finds large cutting areas, it might not be advisable to make small compartments at present, but that compartments of 125 to 150 acres would be practical, and in the future as the management becomes more intensive and refined they could be further reduced through subdivision. On the other hand, he states that in case of average-sized forests with intensive management, compartments with an average area of 50 to 75 acres would be practical, and in case of small forests with very intensive management, especially in coppice forests, their average area may be from 25 to 40 acres. Prof. Filibert Roth, one of the foremost American authorities in forestry, states in his recent book on *Forest Regulation* that: "It is feasible even in high mountainous districts to stay below 200 acres in the average size of the lot (compartment)."

The above figures are averages and a rational interpretation of them will allow considerable latitude. The compartments laid out up to the present time upon the Mont Alto State Forest of Pennsylvania, which is primarily a hardwood forest with chestnut and Chestnut oak as the prevailing species, have an average area of about 75 acres. In making compartments one may follow one of two courses, *i.e.,* either make the compartments at once the size which you think they should ultimately have, or else make larger divisions which may be subdivided into finished compartments at some later date. The former course should be followed, if it is in any way possible. In case the latter course must be followed the larger subdivisions, which may comprise from 500 to 5,000 or more acres, should under no circumstances be called a compartment. If one is not able to subdivide the larger subdivision into finished compartments it might be possible at least to project the ultimate compartments upon the map and term them projected compartments. In any event, the larger subdivision which embraces a number of projected or ultimate compartments is temporary and should not bear the term compartment. We should be careful with reference to forest nomenclature, since at best it is difficult, and nothing is harder than the eradication of a poor or a confusing term.

The ideal form of a compartment is the rectangle. The square, however, is also desirable. Both of these practical forms are to be found in actual practice, especially in the level regions of Germany, *e. g.*, the Ebersberg Park Forest near Munich. The irregular polygon is the most frequent form one finds, especially in mountainous regions where permanent features, such as main roads, woods roads, railroads, water courses, ridges, boundaries of exterior and interior properties, are used for subdivision lines. One should always remember that too irregular compartments lessen the value of the subdivision, and increase the cost of its construction and maintenance.

In general, one must distinguish between subdivision in level and mountainous regions. In level regions there is a tendency toward straight-line subdivision, while in mountainous regions due regard must be given to topography which requires a marked deviation from the straight-line subdivision. Here, again, it is advisable to keep in mind the words of Prof. Roth, who states that the danger of subdivision in mountainous regions is twofold: To make the lots (compartments) too large, and to make the lines on all ridges too crooked. Most National Forests and State forests are located in mountainous regions, hence special consideration will be given to this type. Topographic maps are very essential prerequisites to a careful and accurate subdivision. They assist one in becoming acquainted with the character of the land and in making the provisional demarcation of boundary lines. The subdivision or boundary lines may be natural, artificial, or a combination of both, but wherever possible the lines should be placed upon permanent rather than temporary features. Of prime importance for the subdivision of forests are streams and river courses, deep ravines and valleys, mountain ridges, strips of unproductive land, fields, sharply demarcated site-quality boundaries, permanent roads, streets, and telephone lines. Ridges and valleys are the principal natural features used for subdivision. In case a number of ridges run parallel to each other and have projecting secondary ridges the subdivision is easier than where they do not run parallel. In the valley a definite water course may be taken as a subdivision line, and where it is not well defined it may be straightened out, or artificial lines may be inserted intermittently where the natural ones do not suffice.

Roads, in particular those which serve primarily for the purpose of transporting wood, bear a many-sided relationship to the subdivision of forests. They may be classified, according to their managerial importance, into primary and secondary. The latter may be further classified into those whose position is determined by the lay of the land and those whose direction can be determined only by the objects of management. Roads when properly laid out are almost as permanent as ridges, and as a consequence are of prime importance in subdivision work. Carefully graded and well constructed roads ramify through the interior and run along part of the border of Mont Alto State Forest. They were of considerable value in the subdivision work.

Natural subdivision lines do not always suffice, hence artificial ones must be introduced in order to complete the subdivision. In case of a subdivision of a forest located upon one slope of a ridge, a road or stream is very apt to be found at the bottom of the slope and a road may run along the top. If no road is found there, it will be necessary to cut open a subdivision or compartment line along the top of the ridge. At one end of the slope one may find a road which joins with the road running along the base of the slope and also meets the subdivision line running along the top of the ridge. At the other end of the slope no existing subdivision lines may be at hand. In this event it will be necessary to cut out a subdivision line extending from the top of the slope to its base. When this is completed, the whole slope will be surrounded by the subdivision lines and roads. It may be that the aggregate area of the slope is about 750 acres. It may also have been decided that the average area of a compartment should be about 75 acres, hence it is necessary further to subdivide the slope into about 10 compartments. This may be done by opening straight and parallel subdivision lines at rather regular intervals along the slope. These should extend from the bottom of the valley to the top of the ridge. The area between two such lines will comprise a compartment. The subdivision lines should pass between and not through forest types and stands. If the width of the slope between the top of the ridge and the valley is more than one mile, then it seems advisable to divide the length of the slope into two parts at about the middle point. Reasons for dividing the slope may be at hand even when the slope is only one-half of a mile or less in length.

The general procedure followed in the application of the fundamental principles of subdivision to a portion of the Mont Alto State Forest is outlined below. The work was done by the students of the Forest Academy under the direction of the writer. Messrs. W. Erdmann Montgomery and W. B. Bartschat devoted considerable time to this subject in connection with their graduation theses. This does not attempt to show how a forest should be subdivided, but rather how a forest may be subdivided.

1. Preliminary Walks and Talks.—Before beginning field work the forest organizer, whether he be the forester who has charge of the area to be subdivided or a specialist detailed to do this work, should hold a conference with the owner or administrator of the forest. During the conference he should learn the desire and purpose of the owner or administrator with special reference to the degree of desired detail and the allowed cost of field work. In addition, a general discussion of the proposed future management would in many cases not be amiss, but might facilitate subsequent field activities. He should also gather and digest all available data contained in the records of the forest.

After the conference the forest organizer should proceed to the forest with his collected data and with a topographic map, if possible. A special topographic map of the region is preferable, but in the absence of such a map a topographic map made by the United States Geological Survey may be available. In the absence of any map it will be necessary to construct a map, which need not be elaborate but should be accurate. Supplied with the necessary information and accessories the forest organizer should walk over the forest. If the forest organizer be a person other than the forester in charge of the area he should be accompanied by the forester and, if possible, in case of second growth forests, by a jobber who helped lumber the area some years ago. In the course of these informative walks and talks he should familiarize himself concerning the general topography, soil, composition of the forest, silvicultural systems of management, road system, markets, and special destructive agents such as storm and snow. Much of the desired information can be obtained by visiting lookout towers and high natural prominences, and making ocular surveys from them. During winter when the dense leaf canopy and undergrowth is absent this work is easier than in summer when one's outlook in the forest is limited. One cannot over-emphasize the value of these preliminary walks and talks. They are the real foundation stones of the subsequent superstructure.

2. *Provisional Representation of Subdivision Lines upon a Topographic Map.*—The forest organizer now understanding the desire of the owner, and having acquired a working knowledge of the forest to the extent of being able to orient himself with ease and accuracy, should proceed to make a provisional representation of the developed subdivision upon a topographic map. This representation should not be attempted without a thorough knowledge of the characteristic features of the area such as valleys, ridges, and peaks, and the condition of the existing roads such as their frequence, grade, and structural condition. These provisional subdivision lines can be placed upon the map with an ordinary lead pencil. After the developed subdivision lines have been placed upon the map the acreage of each projected compartment should be determined. This may be done by means of a planimeter. If the determined area of the projected compartments is satisfactory, then the lines are left in their present position, but, if this is not the case, then the lines are shifted until the area of the compartments becomes satisfactory. Compartments of an approximately equal area are preferable, but in no case should an attempt be made to establish compartments of equal size if such a procedure requires sacrifice of practical advantages or extra expenditures. In level regions compartments of equal size can often be established over a large area without any sacrifice, but in mountainous regions this is rarely possible. In mountainous regions it is not unusual to have a compartment of 25 or even 10 acres adjacent to one of 85 acres.

3. *Transfer and Provisional Demarcation of Subdivision Lines.*—After the developed subdivision lines have been provisionally fixed upon the topographic map, they should be transferred to the forest. This transfer can be accomplished by determining the point of origin and the bearing of each line on the map. At first a staff compass was used in running out these lines, but with very unsatisfactory results. Later the transit was substituted for the staff compass and the results were satisfactory.

In transferring the subdivision lines to the forest a partial clearing of the lines is necessary, so as to facilitate subsequent activities, or in general to fulfill all the subsequent duties to be imposed upon them. The running out of the lines and the clearing may be done in one operation. Three men may form the crew, an instrument man and two axe-men, one blazing the trees lightly and the other cutting brush. If it is not known whether the lines will remain in their present position it will not be advisable to clean them out too carefully. The lines should be cleaned out just enough to sight with the instrument and to aid in the subsequent stand differentiation by affording bases from which to work. The cost upon a part of the Mont Alto State Forest for making this transfer and provisional demarcation varied from $1.04 to $4.28 per mile of line. The average cost was $2.81 per mile of line. These charges are somewhat high because it was necessary to re-run a number of lines on account of required shifting following the inspection of the first provisional lines.

4. Differentiation of Stands.—Every large forest area usually comprises a great number of stands. By the term stand is understood any part of a forest having distinctive characteristics. It is a very versatile term and has a wide field of application. Expressions such as a dense stand, a mature stand, an even-aged stand, a mixed stand, a young stand, etc., are used very commonly. In the systematic organization of a forest it is not sufficient to admit the existence of stands, but they must be separated carefully from each other. Such a separation of the aggregate forest area into stands may be known as stand differentiation. The chief bases or determining factors of stand differentiation are:

a) Difference of species.
b) Age.
c) Silvicultural system of management.
d) Site-quality.
e) Density of stocking.
f) Minimum size of a stand.

The use of these differentiations is familiar enough not to require elaboration.

5. Inspection of the Provisionally Located Subdivision Lines and the Stand Differentiation.—After the provisionally demarcated subdivision lines have been placed and the stands differentiated, it is very important that a careful and critical inspection of both should take place. The forester in charge of the area should accompany the forest organizer and if possible other persons learned in the principles of subdivision should also accompany. In some cases it may be necessary to shift the lines, so that they will run between two stands rather than through a stand. A stand should not be cut in two by a subdivision line if it can avoided. The boundaries of compartments and stands should coincide. One of the chief reasons why stands should be differentiated before the final demarcation of the lines takes place is because of the ease with which the lines can be shifted if necessary. It is more difficult and expensive to shift lines which have been finally demarcated than lines which have been only provisionally demarcated.

6. Definite or Final Construction of Subdivision Lines.—After all the provisional lines and differentiated stands have been examined and are considered satisfactory and able to fulfill the duties imposed upon them, the definite or final construction of the lines should be undertaken. A transit should be used for this purpose. The crew, as a rule, should consist of five men, an instrument man, two men with axes, one with a small axe, and one with a bill hook. In case of a shrubby growth like Scrub oak one axe may be replaced by a long-handled pruning shear with short stout blades, a very effective instrument. These lines may be cut from 6 to 10 feet wide. They might be narrower, but it is difficult to make a narrow line, especially in medium-sized second growth. In case of young material the lines should be cut clean, but where the lines pass through older material most of the thrifty specimens should be left standing. The retention of these large, thrifty, and scattered specimens until the end of the rotation may be a valuable asset in holding the undergrowth upon the lines in check, due to the shade which the large trees produce. In hardwood forests in particular, all thrifty trees upon the lines should be retained. All the lines should be carefully marked with temporary stakes. The cost of this final construction and cleaning of the lines upon the Mont Alto State Forest varied from $7.95 to $14.59 per mile, or an average of $10.38 per mile. The total average cost of both the provisional and final construction was $13.20 per mile. The average cost per acre for the area covered was about six cents.

7. Demarcation of Compartments, Subcompartments, and Subdivision Lines. The compartments, subcompartments, and subdivision lines must be carefully marked. The compartments should be marked with consecutive Arabic numbers. The same number must not be repeated in the same forest. Only in distinctly separate forests is it permissible to begin the designation of a compartment with the number "one." In case a number of distinct forest forms or forest types occur in the same forest, then the lowest numbers should be attached to the prevailing type and the highest numbers to the least abundant type, since such an allotment of numbers will make the recording easier. The number given to each compartment should be posted in the forest at conspicuous places along the border or at the corners of the compartments. It may be painted upon trees or placed upon line markers.

The stands or subcompartments should be marked by means of small latin letters and should begin with the letter *a* in each compartment. A subcompartment is a part of a compartment requiring a special kind of treatment, hence it is defined as a "unit of treatment." The subcompartments will be designated by means of a compartment number and a subcompartment letter, e.g., 13 *a*, 13*b*, 17*c*, meaning subcompartment *a* in compartment 13, subcompartment *b* in compartment 13, and subcompartment *c* in compartment 17. In case a subcompartment needs to be subdivided at a later date one may designate its parts by means of index figures, as $12a$, $12a_2$, $12a_3$. The letters given to each subcompartment may be painted upon the trees along the border of the subcompartment.

The boundaries of compartments must be made and kept permanently recognizable. The exact location of the subdivision lines may be indicated by markers. The markers may be hewn stones similar to ordinary boundary stones, cement columns, wooden columns, or wooden posts. They should be erected at the ends of lines, at points where lines are broken at a sharp angle, at intermediate points on long lines, and along border lines which have a forest growth on one side only. These markers, whatever they may be constructed from, should bear the number of the adjoining compartments, and in addition may bear the consecutive number of the marker as a means of location. The consecutive numbers of markers begin with one at the beginning of each line. In case of short lines they may be omitted. Markers should always stand at all points where subdivision lines intersect permanent roads. They are rarely used along the hollows of valleys which carry water, except where other lines intersect. The corner markers should have four faces, upon each of which the number of the compartment which it faces is inscribed. This requires the placing of the corner markers so that their faces are diagonal to the lines. The corner markers when in the form of stones, cement columns or wooden columns, should be about 6 by 6 inches in cross-section and four feet long. They should be placed in the ground about two feet, leaving two feet projecting above the ground upon which to inscribe the numbers. The compartments may also be designated by means of a marker similar to the sign posts frequently found at the intersection of country roads, but instead of giving the approximate distances to nearby points it should give the exact number of the adjoining compartment. A similar way of marking the compartments is the painting of the number of the compartment on a small board 6 by 8 inches and attaching it to a tree near the corner of the compartment. If the above methods of marking cannot be used, one may paint the numbers upon the bark of trees bordering the compartment by means of a stencil outfit. Whenever the markers were painted, yellow paint was used for the background and black for the numerals and letters. Black and white would probably have been a better combination, but since white was already authorized and used as an outside boundary color for State forests, yellow was selected as a satisfactory substitute. In making reports and giving orders it is always clearer and more satisfactory to designate the subdivision lines by means of the numbers of adjoining compartments, e.g., line 11/12 meaning the line between compartments 11 and 12, than by giving the line a special name or locating it by means of topographic and other features.

The above discussion aims only to indicate a general course of procedure. The real test of organizing a forest depends to a large extent upon the common sense of the individual who attempts the organization. His power of retrospection, logical interpretation of existing conditions, and power of forecast are very potent factors. It is necessary that he possess a business acumen that sees, plans, and accomplishes the utmost that the existing conditions warrant and the means at hand will allow. His first rule should be: *Retain and use that which is present!* The forest organizer should always remember that the forester of today is primarily a builder for future generations. Hence, in drawing up his plans, he should not be satisfied with present ideals, but should attempt so to fashion his building that upon its completion in future generations it will at least approximate the ideals of the harvester.

SMALL SALE COSTS ON THE APACHE FOREST

By Clifford W. McKibbin

The Apache is one of the most inaccessible National Forests in the Southwest. In eastern Arizona, midway between the two desert railways, the Santa Fe on the north and the Southern Pacific on the south, it has gained the name of "inland." Considering that the sawtimber lies 80 to 125 miles from the nearest point of railroad transportation and that the headquarters are 100 miles from a railroad, the name "inland" is readily understood. The rough, broken character of its southern border and the wide, barren desert on the north, have proved formidable barriers to railroad or even good road building, so that none of the timber cut from the Forest has ever found its way to any but a strictly local market.

This market consists of filling the wants of small farm communities and stock raising centers of from 50 to 300 inhabitants, located within and adjoining the Forest, where the demand is chiefly for rough lumber for ranch improvements. The supply is entirely of Western Yellow pine, which until just recently was placed on the màrket unsurfaced. Near the southern boundary of the Forest the mining towns of Clifton and Metcalf furnish a demand for fuelwood which is met by pinyon and juniper from the woodland type.

While these conditions of extreme inaccessibility, restricted market and correspondingly small operations may not be peculiar to the Apache Forest alone, they are by no means general and present some rather unusual features which in a measure are reflected in the costs of operation and administration.

That the data following may be fully understood a brief description of the operations is given.

The mills are equipped with circular saws and cable feed and have a rated capacity of from 8 to 10 *M* feet a day. The actual output, however, averages only 3 *M* feet per day during the running season because of the fact that the crews are alternated in the woods and in the mill. Often the mills are not run more than two days each week on this account and operations are usually suspended during at least two of the winter months.

The crews consist of about six men working as follows: a sawyer, a sawyer's helper, an offbearer, a fireman, a teamster and a yardman and general roustabout.

The teamster, when he has placed a surplus of logs on the mill yard, hauls a load of lumber to the market and is kept busy between the woods and market hauls. The largest mill, however, keeps from one to two men hauling to market continually. Four horses and two wagons carrying approximately 2,200 feet (1,100 feet per wagon) is the usual marketing equipment. The lumber is practically green as it is hauled, weighing about 4½ pounds to the board foot.

The mills are located from 15 to 25 miles from the market communities and although small bills are often delivered to ranchers at the mill, the bulk of the product is hauled to the market by the millmen. The woods haul is from ¼ to 1½ miles, averaging about ½ mile.

The material cut is Western Yellow pine of fair quality, averaging seven logs per *M* feet B. M., and about 6 *M* feet per acre. Scattered Douglas fir within the cutting area is cut and sold with the pine, no distinction being made between the two species. Three grades are recognized, firsts, seconds and "Mexican lumber," the latter of which includes wany edges, punk knots, etc., and is bought by the Mexican population, from which its grade name is derived. The better grades of rough lumber are retailed at from $22 to $27 per *M* feet delivered at a 15 mile market, surfaced material bringing from $30 to $34. "Mexican lumber" brings $5 per *M* at the mill yard.

The following figures on operation costs were given by the most up-to-date and business-like mill men and represent an operation slightly above the average in size and "get up."

	Per M feet
Felling and Limbing	$1.25
Brush Piling	.25
Hauling to Mill	2.00
Sawing	4.00
Piling and handling (yard)	.50
Hauling to 15 mile market	6.00
Surfacing	5.00
Incidentals, wear, overhead, etc.	.75
	$19.75

Cost of road work in woods in one year	$37.00
Making lath per M laths	5.75
Making shingles per M shingles	3.00
No. feet hauled to market on average load per wagon	1,100 feet
No. men employed in woods	3
No. men employed at mill	6
No. men hauling in woods	1
No. men hauling to market	2

This operation is the only one making lath and shingles as a by-product. The unusually high cost of surfacing is due to the small amounts planed and the time consumed in changing and adjusting the knives. Only special orders of small amounts are planed and a greater part of the cost is made up in the time consumed in changing and adjusting the knives preparatory to the actual planing operation. Lath making, like surfacing, is a minor operation. Only very small quantities are manufactured at one time, so that much of the cost is for time spent in putting the machinery into running shape.

In considering the above figures it must be borne in mind that the quality of the labor available to small isolated mills is no small factor in fixing production costs. Employment is unsteady and leads to the hiring of transient and inexperienced hands. With small orders there is a continual changing of jobs, so that no opportunity is presented for specializing or for the development of skill and efficiency in handling one kind of work, as is possible in the large mills. Often the entire mill crew is made up of neighboring ranchmen and farmers who, by working in the mill during seasons when ranch work is slack, are able to turn their labor toward lumber for the improvement of their ranches. Under such conditions the quality of the product is bound to suffer as well as the production costs so that a comparison of these figures with those of large operations is drawn with difficulty.

Cost of administration figures were collected over a period of nearly two years by means of monthly time reports submitted by each officer handling the sales and are given below. In all cases the sales were handled by district rangers along with other ranger district administrative work and careful division of the time spent on sales administration was made each day. Costs were kept on five saw mills, one shingle mill and eight cordwood operations in thirty different sales.

Cost of Administration of Sawtimber Sales

Purchaser	Period Covered by Sale Months	Receipts at $2.50 per M ft.	Items of Cost: Travel	Field Exam.	Marking	Scaling	Brush Disp.	Field Super.°	Office Work	Total Cost	Profit
1	1½	100.00	1.83	.45	.80	2.64	....	.46	.88	7.06	92.94
	2	100.00	1.40	....	.47	2.72	.41	2.76	....	7.76	92.24
2	1	100.00	5.54	....	1.85	3.74	.89	....	....	12.02	87.98
3	3	100.00	2.31	1.28	.84	1.47	....	....	.84	6.74	93.26
	3	100.00	....	....	.85	2.60	.86	.88	....	5.19	94.81
	2½	100.00	....	....	2.39	2.62	.90	....	.44	6.35	93.65
	2	100.00	10.10	2.74	.77	2.75	....	4.23	5.80	26.39	73.61
	2	100.00	16.08	6.91	....	2.40	....	.80	3.04	29.23	70.77
	2	100.00	32.49	10.14	1.82	7.88	5.49	....	8.03	65.85	34.15
	3	100.00	14.60	2.27	2.28	3.65	2.73	....	....	25.53	74.47
	4	100.00	14.15	3.79	2.51	1.82	.89	....	6.57	29.73	70.27
	3½	100.00	3.28	....	2.08	4.18	....	....	....	9.54	90.46
	2½	100.00	....	....	....	1.26	.42	....	....	1.68	98.32
4	3	100.00	11.37	1.83	1.83	7.26	1.83	3.46	2.98	30.56	69.44
	15½	742.98	30.17	.85	7.90	15.15	.42	....	.55	55.04	687.94
5*	5¼	16.00	4.73	1.56	2.32	2.33	....	....	1.25	12.19	3.81
	3	15.00	2.87	.76	2.42	2.42	.45	....	....	8.92	6.08
	5½	26.35	5.24	....	....	.77	.43	....	....	6.44	19.91
	3¼	20.00	....	....	.45	.45	.44	....	....	1.34	18.66
6	2	25.00	9.03	.46	.46	1.33	1.34	2.70	1.82	17.14	7.86
	2	37.50	20.03	1.76	.44	3.45	2.16	3.46	.44	31.74	5.76
Total....	57½	2282.83	185.22	34.80	32.48	72.89	19.66	18.75	32.64	396.44	1886.39
Average	2¾	108.71	8.82	1.66	1.55	3.47	.94	.89	1.55	18.88	89.83
Cost per M feet	....	....	.20	.04	.035	.08	.02	.02	.035	.43	2.07

* Shingle mill operation. ° By supervisory officers.

These operations were located from 1 to 20 miles from the district ranger headquarters, the average distance being about 10 miles. On account of the distance the travel time is unusually high and brings up the cost correspondingly. The sawtimber sales were mostly in amounts of 40,000 feet, the operations being so unstable as to prohibit the operators from purchasing more than $100 worth of timber at one time. The stumpage rate is $2.50.

Sales to purchasers 1, 2, 3 and 4 were administered by one ranger, the mills and cutting areas being located 1, 5, 12 and 17 miles, respectively, from his headquarters.

Sales to purchasers 5 and 6 were each administered by different officers at distances of 6 and 20 miles respectively.

The time consumed in completing each sale is given for the purpose of showing in a measure the size and business nature of the operation.

The travel costs do not appear in three of the sales to purchaser 3 because of the fact that these sales were handled from a temporary camp located very close to the purchaser's mill. This is also true of one sale to purchaser 5. No means of direct communication existed between the forest officers and the mills so that many fruitless trips were made to and from the sale areas during dull seasons when the mills operated intermittently. These trips, of course, brought up travel costs for those particular sales.

In several cases the sale areas were examined and surveyed for one sale and when cutting was completed it was found that each area as run out contained sufficient timber for another sale, so that for the second sale no field examination costs were entered. A division of the costs was not made at the time, since an average was being sought. This same circumstance also occurred in the marking item in the small sales to the shingle mill operator, purchaser 5, due to an underestimate at the time of marking.

The field supervision charges are for the time spent on these sales by the Supervisor and Deputy Supervisor. The office work consisted chiefly of preparing, cutting and closing reports and in some instances so short a time was spent in this work that it was entirely neglected by the officer. The item of brush disposal represents time spent in supervising this activity on the sale area and not actual disposal, such as burning.

The cordwood sales are made to Mexican wood packers who maintain chopping camps in the very rough and broken area north of the Clifton and Metcalf mining camps and pack their wood to market over very steep trails on the backs of burros. Wagon transportation is out of the question anywhere within this area. The distance of cordwood "packs" varies from eight to twenty miles. Two choppers constitute the woods end of a cordwood operation and work out from a permanent camp. Ten burros carrying together, when packed, one cord of wood make up the usual pack train of each operator. The pack saddles used are fitted with four large upturned wood hooks, two on either side, the shanks of the hooks made fast to the front and rear saddle forks. In packing the wood is piled into these side hooks and up over the pack saddles and lashed on with pack ropes. A train of ten burros is commonly packed and "punched" by two men.

In handling these sales, wood depositories or stack yards are located by the forest officer in charge along the main trails, more or less central to the chopping areas and, if possible, at a distance of about one day's pack from the market. To these depositories the cord wood is packed from the woods and ricked up into piles for measurement. After measurement it is packed on to market. In the table which follows costs from woods to depository and from depository to market are given separately.

In the ten mile pack to market it is seen that the lowest cost per cord is had with 10 and 20 pack animals in the train. This from the fact that, with the longer haul and the easier traveled market trails, one man can handle ten animals most advantageously. In the trips from the chopping camp to the depository the number of burros advantageously handled by one man is reduced because of the steeper and more impâssible trails and the greater amount of packing and unpacking required in making two trips daily.

Each of the larger sale contracts calls for the ricking on the depository of not less than twenty cords for measurement at one time so that in 100 cord sales but five scaling trips to the depository are necessary. This provision reduces administrative work considerably and has a tendency to induce the Mexican purchaser to regular and business-like methods.

Packing Wood 2 Miles to Central Rick.
Two Trips per Day.

No. of Burros employed	5	10	15	20
Cost of burros per day	.55	1.10	1.65	2.20
Cost of labor per day	1.50 1 man	3.00 2 men	3.00 2 men	3.00 2 men
No. cords moved	2	4	6	8
Cost per cord	1.03	1.03	.77	.65
Cost per day	2.05	4.10	4.65	5.20

Packing Wood 10 Miles to Market.
One Trip Per Day

No. of burros employed	5	10	15	20
Cost of burros per day	.55	1.10	1.65	2.20
Cost of labor per day	1.50 1 man	1.50 1 man	3.00 2 men	3.00 2 men
Cost per day	2.05	2.60	4.65	5.20
No. cords moved	½	1	1½	2
Cost per cord	4.10	2.60	3.10	2.60
Cutting	1.25	1.25	1.25	1.25
Stumpage	.50	.50	.50	.50
Total cost per cord laid down	6.88	5.38	5.62	5.00
Profit at $10 per cord	3.12	4.62	4.38	5.00

The sale areas and depositories included in the table below are located from four to twelve miles from the rangers' headquarters over very rough trails. Except the sale to purchaser No. 2, all the sales were for dead wood so that marking was unnecessary. The costs of handling these sales follow:

Cost of Administration of Cordwood Sales

Purchaser	Period Covered by Sale Months	Amount at 50c per Cord	Items of Cost: Travel	Field Exam.	Marking	Scaling	Brush Disp.	Field Super.	Office Work	Total Cost	Profit	Loss
	1¼	3.50	4.10	....	....	.41	....	....	.41	4.92	....	1.42
1	11	50.00	12.67	1.99	....	5.56	....	2.99	1.59	24.80	25.20	....
2[1]	7	100.00	27.68	10.88	20.68	3.46	7.96	3.06	7.76	81.48	18.52	....
3	10	50.00	18.60	....	....	6.81	1.56	2.45	2.29	31.71	18.29	....
4	14	25.00	19.56	....	....	5.34	2.70	4.96	....	32.56	....	7.56
5	10	50.00	19.87	1.83	....	3.54	....	1.80	1.76	28.80	21.20	....
6	15½	25.00	20.86	1.73	....	4.76	....	4.44	1.69	33.48	....	8.48
7	7½	62.50	6.07	1.76	....	4.23	.85	....	1.76	14.67	47.83	....
8	16	50.00	6.67	....	....	3.34	.42	3.41	5.37	19.21	30.79	....
Total....	92¼	416.00	136.08	18.19	20.68	37.45	13.49	23.11	22.63	271.63	161.83	17.46
				[2] Green 10.88 Dead	20.68		Green 7.96 Dead					
Average Per sale.....	10.2	46.22	15.12	.91	....	4.16	.69	2.57	2.51	30.18	16.01	
Cost per cord......	....		.19	.02	.03	.05	.02	.03	.03	.37	.22	

[1] Sale to purchaser 2, was for green material at the rate of $1.00 per cord.
[2] Given for green and dead separately on account of the difference in cost in handling the two classes.

It is obvious that in the dead wood sales but little time would be spent under the item of brush disposal. All the work connected with a cordwood operation being performed by Mexican laborers, many of whom are illiterate and ignorant, requires that a very careful supervision be given each sale by the forest officer. A close watch over the cutting area is necessary to prevent the cutting of green wood and confine the operations to the area and the species specified in the sale contract. An even closer check must be kept at the wood depository and along the market trails lest wood that has not been paid for be packed away, unintentionally or otherwise. Every bit of wood that will make fuel and can be sold as such is eagerly taken by the purchasers, so that the enforcement of the utilization clause of the contract does not require any effort on the forest officer's part. The item of field supervision in the above table covers this part of the administrative work as well as the time spent by the supervisor in inspections.

A large part of the total cost is made up of travel, so much, in fact, that the distance from the officer's quarters to the cutting area and depository is often the determining factor of profit or loss in handling the sale. It will be seen that all sales for amounts less than $50 in value were handled at a loss to the Government.

For the most part, throughout this report the cost of administration figures represent time spent by a forest officer paid at the rate of $1,100 per annum.

THE WOODLOT PROBLEM

By Bristow Adams

Figures to show the extent and value of woodlots are not lacking; some 200 million acres of woodland are said to be in the hands of farmers, with a stand of 311 billion board feet of lumber, plus one and a half billion cords of wood. In area the farm woodlots are estimated to aggregate something more than a third of the total forest, but in stand no more than an eighth, because only 46 per cent of the woodlot area are reported to bear timber suitable for the saw; 43 per cent as yielding cordwood; 11 per cent as brush. Some four million people ought to be vitally interested in woodlots, because there are about that many woodlot owners.

When one comes to questions of the specific use and productivity of the woodlots, statistics begin to fail. No one knows just what they produce in quantities or values. Estimates of the annual consumption of fuelwood are guesses, safe because no one knows better. But all authorities agree on these points: that the woodlot is less useful than it should be; that the average farmer takes less care of his woodland, in proportion to its value, than he does of his other crops; that it is a neglected resource, and was so characterized by Mr. Pinchot in 1909 in a paper before the National Grange, at a time when the conservationists were very generally calling attention to resources too wastefully exploited, and too prodigally used.

We are told, however, that less than a third of the product of the woodlot reaches general markets, and that far the greater part of it is consumed on or near the farm. In 1909, the census value of the forest products of farms was reported as 195 million dollars, or 36 per cent of the value of all crops, ranking sixth of farm crops, following cereals, hay, cotton, vegetables, and fruits, but well ahead of sugar (both beet and cane) and tobacco.

The product of the woodlot could and should rank higher; everyone who has given the matter a thought realizes that, and the new development in the eastern woodlot problem is the growing recognition of the fact that many who have studied the possibilities of the farm woodlot have gone at the problem backward. We have aimed at production instead of market. However, we need not feel ashamed of that, as foresters; the newness has not yet worn off the recently established Office of Markets which is helping the farmer to sell his annual crops.

I do not need to dwell on the truisms that the average farmer does not know timber values, or the quality of timber which he possesses, and that the average traveling timber speculator can "skin him out of his eye-teeth." To too many farmers a tree is simply a tree. Often they do not know the individual species, or the use to which each can best be put. They know the value of livestock and crops, and what they should bring by recognized units of measure. Outside of the cord and the fence post, they generally do not know any unit of measure for the forest product.

But for several years various agencies have been approaching the woodlot problem from many angles; the time is ripe for them to coalesce.

An organization of woodlot owners is no new idea. In *Farm and Fireside,* November, 1909, Mr. Zon presented it. He suggested then that "if the reason for the general drift from the farm to the cities is the low return from farm products, then there seems no question but that the chief reason for the general neglect of the woodlot is that the returns for the timber make the care of the woodlot scarcely worth while." He said then that the assistance which the Forest Service and State foresters are giving to the farmer is chiefly along lines to secure bigger output of a product on which they are certain to get the short end of the deal, and he advocated an organization which would make it possible for the farmer to get a fair return.

For a long time the farmers of the middle west were at the mercy of the transportation companies in selling their grain. Cooperative organizations owning their own elevators removed railroad control. Similarly the citrus growers in California, through their cooperative asssociations, solved problems of transportation and market.

I have not learned of an organization of woodlot owners in this country; though in Germany, whence we have borrowed many forest ideas, the small owners combine and employ a forester to help care for and sell their timber, and are fully informed as to the trend of market prices. The nearest approach that we have to this is in the turpentine industry, where, although prices are controlled from the top, even the smallest turpentine orchardist knows grades, costs and returns.

What are the forces which are now working especially toward a solution of the woodlot problem? I shall not attempt to put them in the order of their importance, but possibly among the first should be the knowledge now possessed by the Forest Service, and by the State services, through the gathering and publication of information on the wood-using industries. By means of these reports we have, for each State, remarkably complete records of what timber is wanted by that State and where it can be sold. Tie this up with a knowledge of what timber is produced and where it is grown or can be grown and a big stride has been taken in one of the fundamental difficulties, that of marketing. Another federal help comes in the expenditure of money under the Weeks Law, by which the Government is matching funds appropriated by the States for the protection of their forests on the watersheds of navigable streams. Just how this works out in promoting interest in forestry is set forth in a report by L. C. Glenn, of the Geological Survey of Tennessee: "Tennessee is doing nothing for itself," he says, "and she will thus lose her share of the federal appropriation and will continue to lose it as long as she remains inactive." "It is high time that we bestir ourselves," he continues, "not for the sake of our share of this federal appropriation (of course) but to perpetuate our forests, to assure ourselves and our posterity of timber supply, and to ward off the numerous evils that the destruction of our forests will entail."

A third federal activity is the so-called reorganization of the Department of Agriculture which has really been going on for some time but is now attracting particular attention. The Smith-Lever bill will still further coordinate the work of the Department with that of the agricultural colleges. The offices or bureaus of Farm Management, Farmers' Cooperative Demonstration Work, Experiment Stations, Entomology, even of Information, and of Roads, to a greater or less degree, ought to be fully ready to cooperate. A good system of rural credits should be an additional help.

Many opportunities for cooperation with the States are already in existence but very few are being utilized. The great need is for team-work, but that I will take up later. In a general way the growing spirit of cooperation is a potent and an active factor.

Many of the States, through their agricultural colleges and experiment stations, are already in the field with practical ideas and practical men.

Two clearly defined elements lie ready to our hands. The task should be to combine and blend them. The first might be stated as the need of organization as a result of the recognition of that need. The second element includes the influences and activities which have only to be set in motion in the right direction. Let me quote from an Austrian report in the Bulletin of the Bureau of Economic and Social Intelligence, of the International Institute of Agriculture, at Rome.*

The want of organization is above all injurious to the interests of the small forest growers. As competition grows more and more intense, forest growers find themselves in fact in a position of inferiority with regard to other producers. For we know that the small forest owner generally derives but very small profit from his property, as he can not unaided obtain for himself the means for rendering the exploitation of his property more remunerative (machines and implements, wood cutting and sawing plant, etc.).

On the other hand, the interests of the large forest owners are bound up with those of the smaller, in so far as they have need of each other's collaboration, above all in the solution of important problems of forest policy; this is why the various classes of forest cultivators, uniting for one and the same object, must act in concert for their common interests.

The defense thus organized will be the more efficacious, the greater the economic force represented by the various groups of the parties concerned. The improvement of the economic conditions of the small forest proprietors will then be an advantage for the large proprietors themselves.

* * * *

At present, the proprietor of forest land, with a small quantity of wood to sell, is at the mercy of the middlemen, unable himself to get in touch with the large markets and convey his produce to them directly.

On the contrary, the cooperative society, which should be managed by technically competent persons, while ensuring to its members the just measurements and scientific selection of the

*19th Volume, 3rd year, Number 5, May, 1912, pages 4-7.

wood and its cutting at the right time, would also sell it on the large markets, to which it would convey it in large quantity, thus reducing the cost of carriage, etc. In addition, the society would also give the members credit, advancing them loans on the wood cut and not yet sold, etc. It would also have power to purchase wholesale for its members various implements, etc. It could even, when circumstances permit, instal sawmills and plant for charcoal burning, and generally utilize forest products.

* * * *

Besides the above objects, the society of which we speak should also perform a technical educational duty, that of promoting the practical knowledge of forest economics, etc.

Now, it is for the Austrian forest owners to found a large number of such societies. The movement undertaken in this field should be similar to that realized in agricultural cooperation. First of all, a network of local cooperative societies should be founded to be grouped later in central provincial organizations. These should, in their turn, federate in a single body, with the whole State for its sphere of action, thus completing the organization of forestry cooperation.

* * * *

The principal task of the Provincial Forestry Federations should be the inspection of the affiliated cooperative societies, both from the technical and the financial point of view; they would then be a guiding influence favoring the further development of cooperative organization in the field of forestry; they would purchase seeds, plants, implements, etc., wholesale for the account of the affiliated cooperative societies, for which they would at the same time serve as central banks; finally, they would represent the adhering associations and would support their interests in all questions of forestry and commercial policy. To attain this object, the small forest owners must associate with the larger; it is only in this way that forestry can assure itself a wide and firm basis for the defense of its own interests.

* * * *

(1) that the economic organization of the forest owners is an urgent necessity; the small forest proprietors require to unite in cooperative societies for sales, on the above principles;

(2) the provincial forestry associations are recommended to effectually encourage the formation of such local cooperative societies and to organize provincial forestry federations for these; the associations should also address themselves, either directly or through the medium of the agricultural organizations, to the competent authorities with a view to obtaining the means necessary for undertaking the work of propaganda and organization by the help of instructors, experienced in the matter of cooperation, and itinerant forestry lecturers.

With the substitution of the word "American" for "Austrian," this is a fair statement of what could and should be done in this country. At the beginning of the campaign, two points to be accented are, first, the coordination of three lines of endeavor—improving the product, keeping the standard up, and getting a direct market—and, second, the stimulation of community action, since it is hopeless to expect to reach the individual farmer—he is "too many for us." But most of the farmers already associated can be reached, as through the Grange or other agricultural organizations.

Now, to take up the question of team-work. At the head of every team there must be a man. Human flesh and blood is the stuff we deal with in solving any big problem. The forest problems are, to my thinking, comparatively simple. The knowable, teachable facts about woodlots for the average woodlot owner can be put on one sheet of paper. After he gets those he'll have to learn the rest by doing the rest. Dr. Spillman will admit that the fundamentals of farm management can be put into ten short commandments and that any farmer who follows these will achieve success in the far more complicated field of general agriculture. It was Dr. Seaman Knapp who sowed sound ideas on framing and raised not only crops but men. The crops of farm demonstrators and the institution which they form is his great monument. What needs to be done for the woodlot is to enthuse this same or a similar organization with ideals as to farm forestry. It may be a hard task. The man in charge of farm demonstration work in Virginia told me within a year that he had no patience with the subject and that his whole desire was to get trees out of the way; yet the South Atlantic States produced 22½ per cent of the total farm forest product in 1909.

I have an ideal of the right man to put woodlot forestry where it belongs. Possibly the same definitions fit a good farm demonstrator. In the first place, he should know and appreciate trees, which is quite as important as having a forestry education. He should know something about farming and should have a sympathy with the farmer's work, and his knowledge should extend to both production and distribution. He doesn't want to be an expert or an advisor, but a helper and a cooperator, and the man who is willing to learn more by doing things which he and the farmers want to do together.

I consider it a privilege of the Society of American Foresters to make suggestions looking towards the proper establishment of this work. I consider it a duty of the Department of Agriculture, in which the Forest Service should take a foremost part, to make that establishment. The woodlot owners will not be slow in accepting help which will make a neglected and comparatively unproductive part of their farms a source of revenue, that can be drawn on almost at will, and which can be kept in storage indefinitely without deteriorating and without storage charges. There has been some tendency, whenever State foresters were appointed, to consider that the Forest Service should stand aloof and give the States a free field. As well say that the Department of Agriculture should keep out of those States which have State departments of agriculture. I hope that it will not be long before the Forest Service has some man or men definitely in charge of woodlot management and working in cooperation with all the other agencies of the Department and of the States and with the farmers themselves in a work which needs but to be started to succeed.

JOHN MUIR—AN APPRECIATION

By J. D. Guthrie

In the recent death of John Muir the cause of American forestry has lost a pioneer friend. While it is perhaps true that his interest in forests was primarily that of a naturalist and explorer, yet his pen was used mightily in a very practical way for the cause of forest conservation at a time when help was much needed, to awaken a people unconscious of what their forests should mean to them.

From the time of his birth in Dunbar, Scotland, in 1838, through his boyhood and youth in Wisconsin and his later years in Alaska, the tropics and all the world, and his last years in California, he was a friend of the forests and all nature.

Bailey Millard, who knew him intimately, writes of Muir's personal characteristics: "Tall, lean, craggy, wild-haired, wild-bearded, with wonderful gray eyes and a soft agreeable voice, he had the indescribable charm which nature's men possess and radiate. Folk listened to him raptly because he had something to tell. He knew the forests, not only of the West, but of the world—the giant redwoods of California, the eucalyptus groves of Australia, the great pines of Siberia, the banyans of the tropics. He knew the grizzly and the deer, the coyote, the water ouzel, the oriole, and he loved them all. In all the days of his forest faring and mountain climbing he never slew bird or beast. He even treated rattlesnakes as friends and did not dream of killing one though it menaced him on the trail." After reading Muir's gentle statements about rattlesnakes in "Our National Parks," "poor creatures, loved only by their Maker," a friend of mine said, "Nobody else has ever said that since 'not even a sparrow falleth.' "

Muir published "Our National Parks" in 1901, which was made up of sketches originally appearing in the *Atlantic Monthly*. This book unquestionably helped forward the cause of American conservation when it needed all the help that it could get. Writing of the area within the forest reserves at that time, Muir says:

"The forty million acres of these reserves are in the main unspoiled as yet, though sadly wasted and threatened on their more open margins by the axe and the fire of the lumberman and prospector, and by hoofed locusts, which, like the winged ones, devour every leaf within reach, while the shepherds and owners set fires with the intention of making a blade of grass grow in the place of every tree, but with the result of killing both the the grass and trees." In the above, Muir shows his stand on grazing, certainly sheep grazing, within the forests, which as we all know presented one of our most difficult problems, but which by intensive study and common sense has now been happily solved. Showing, however, that Muir did not by any means lose sight of the very practical value of the proper care and use of forested areas of the West and that he believed in "conserving by wise use" he says, regarding the Lodgepole forests of the Rocky Mountains:

"The Rocky Mountain reserves are the Teton, Yellowstone, Lewis and Clark, Bitter Root, Priest River and Flathead, comprehending more than twelve million acres of mostly unclaimed, rough, forest-covered mountains in which the great rivers of the country take their rise. The commonest tree in most of them is the brave, indomitable, and altogether admirable *Pinus contorta,* widely distributed in all kinds of climate and soil . . ., and making itself at home on the most dangerous flame-swept slopes and ridges of the Rocky Mountains in immeasurable abundance and variety of forms. Thousands of acres of this species are destroyed by running fires nearly every summer, but a new growth springs quickly from the ashes. It is generally small, and yields but sawlogs of commercial value, but it is of incalculable importance to the farmer and miner; supplying fencing, mine timbers, and firewood, holding the porous soil on steep slopes, preventing landslips and avalanches and giving kindly, nourishing shelter to animals and the widely outspread sources of the life-giving rivers."

At all times, everywhere, Muir stood up as the friend of the woods, of wild life, of nature, and did not mince words in expressing his feeling against the fear of hardship and discomfort of the average tourist: "Most travelers here are content with what they can see from car windows or the verandas of hotels, and in going from place to place cling to their precious trains and stages like wrecked sailors to rafts. When an excursion into the woods is proposed, all sorts of dangers are imagined —snakes, bears, Indians. Yet it is far safer to wander in God's woods than to travel on black highways or to stay at home. The snake danger is so slight it is hardly worth mentioning. Bears are a peaceable people and mind their own business instead of going about like the devil seeking whom they may devour. Poor fellows, they have been poisoned, trapped and shot at until they have lost confidence in brother man, and it is not now easy to make their acquaintance. As to Indians, most of them are dead or civilized into useless innocence. No American wilderness that I know of is so dangerous as a city home 'with all the modern improvements.' One should go to the woods for safety, if for nothing else."

Had John Muir said nothing else, done nothing else, written nothing else except the words below, he would still be remembered as the friend of American conservation:

"Any fool can destroy trees. They cannot run away; and if they could, they would still be destroyed,—chased and hunted down as long as fun or a dollar could be gotten out of their bark hides, branching horns, or magnificent bole backbones. Few that fell trees plant them; nor would planting avail much towards getting back anything like the noble primeval forests. During a man's life only saplings can be grown in the place of the old trees—tens of centuries old—that have been destroyed. It took more than three thousand years to make some of the trees in these Western woods,—trees that are still standing in perfect strength and beauty, waving and singing in the mighty forests of the Sierra. Through all the wonderful, eventful centuries since Christ's time—and long before that—God has cared for these trees, saved them from drought, disease, avalanches, and a thousand straining, leveling tempests and floods; but he cannot save them from fools, only Uncle Sam can do that."

CURRENT LITERATURE

Seed Production of Western White Pine. By R. Zon. Bulletin 210, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1915. Pp. 15.

Mr. Zon points out in general the lack of knowledge regarding seed production of American species and the difficulties surrounding the problems of quantity, of frequency, of the determination of factors influencing these, and of the biological aspect of seed production.

The method employed in measuring the seed crop recognizes that a unit area, not a single tree, and that not the amount of cones but of viable seed is involved. Each sample area, from one-quarter to one-half acre according to age, density and composition, should contain at least 100 trees of the principal species. From practical consideration only the seed from sample trees may be gathered, these sample trees to be chosen according to different form and development of crown and taking into consideration the part of the crown apt to bear seed. All trees are divided into groups according to crown development (the usual classification of dominancy—7 to 10 classes) with their diameters tallied. Since the diameter is practically a function of the crown, one would think that finally diameter classes might suffice, but instead the author requires a very close scrutiny of the habitus of the crown from all sides. Curiously enough he makes the statement that "in order to avoid errors of crown classification the total number of trees on a sample plot must not exceed 100." This seems to us a novel philosophy of the law of error! or is there a *lapsus calami* to be inferred?

Each tree is provided with a tag, giving number, diameter, crown class, presence or absence of cones. Ten per cent. or more of the trees in each class of cone-bearing ones are then selected and carfully felled and cones collected for each tree separately and properly labeled, and after ordinary drying the seeds are investigated in all the directions that suggest themselves.

We would point out that by this method of collecting cones the chance of solving the problem of recurrence of seed production on the same trees is lost.

The author then describes the results of an examination of four sample plots on the Kaniksu and Coeur d'Alene Forests on Western White pine, with tables. Realizing that the material collected so far does not allow of final conclusions, the author presents conclusions as to the suitability of the proposed method.

The first find—which might have been anticipated—is that practically the first two crown classes, the dominant, produce all the seed, namely 54.3 and 44.5 per cent, the IV and V classes, none. It is then assumed, perhaps correctly, that in poor seed years only class I, in exceptionally good seed years the lower tree classes also, bear seed, so that from the fact that fewer or more crown classes bear cones the relative amount, as good, fair, or poor, of seed production may be predicted. The superiority of the I crown class and next of the II crown class showed itself also in germination per cent.

The age apparently influenced the viability of seed, the younger trees (72-100 years+) producing, besides longer cones containing more seeds, also more germinable seed than older trees; the highest germination of the youngest trees being 90, the highest in older only 67.5 per cent. The well-known fact that the larger cones produce more viable seed was borne out, as well as the other generally established fact that the heavier seed is the better. The more rapid growers seem also to produce the better seed.

Th largest single tree production was 6,000 seeds or 2½ ounces, and the per acre production varied between 2½ and 5 pounds, between 75 and 150 thousand seeds, for a moderately good seed year.

We congratulate the author on the successful start in this direction, which promises soon to give the assurance that the basis for judgment of seed production with us must be about the same as that which guides the European forester.

B. E. F.

The Trees of Great Britain and Ireland. By Henry John Elwes and Augustine Henry. Edinburgh, privately printed. Seven volumes. 1906-1913. Pp. 1,933, pls. 412, 4°.

These monumental and expensive volumes ($128.00), which came from the press in seven years, handsomely printed and illustrated, represent the most ambitious work of English writers on Trees. More than 300 species and varieties from all parts of the world are discussed from the botanical, ornamental and utilization point of view.

Coming out in parts, no order whatsoever has been kept in which genera are treated; broadleaf and conifers appear strangely mixed. The work attains its usefulness only by the Index which leads one to genus or species.

The botanical portions, including the excellent keys of the various genera, are mostly the work of Professor Henry, the practical and more general information mostly by Elwes, who has been a great traveler and collected directly much of the material on which the discussions are based. Each volume consists of text and plates, except the Index volume.

The illustrations, the most expensive part of the work, are, outside the botanical detail, perhaps of least use, consisting of plates of full-sized specimens, which are not chosen for their typical habitus, but rather for unusual features, which though interesting, especially to English readers, do not add to the practical value of the work, and of practical value to land owner, forester, nurseryman, landscape gardener it is intended to be.

The attempt at writing for the practical man or for the people, and at the same time to preserve a scientific attitude, leads sometimes to unfortunate use of language. On the whole, however, we do not know of any work in which so much information on a large list of trees is brought together since the appearance of that other classic, encyclopedic work of an Engishman, Loudon's *Arboretum and Fruticetum.*

B. E. F.

Pennsylvania Trees. By J. S. Illick. Bulletin 11, Department of Forestry. Harrisburg, Pa. 1915. Pp. 231.

The first fifty pages of this bulletin are intended for the layman and beginner, containing a discussion of elementary forestry concepts and of forests, and the form and structure of trees. The latter is accompanied by 11 plates illustrating the various types of buds, leaves, flowers, fruits, twigs, twig markings, and wood structure. These render intelligible the succeeding descriptive portion of the bulletin.

Part II is a manual of Pennsylvania trees, numbering about 125 species. Following a key to the families, a description is given of each family, genus and species, in the natural order, in each case with keys to the genera and species. The descriptions of families and genera are not limited to the botanical characters only, but much general information as to world distribution, usefulness, biological features, etc., is included. This relieves the monotony natural to purely descriptive treatises.

Each species for comparative purposes is described after a uniform schedule involving form, bark, twigs, buds, leaves, leaf scars, flowers, fruit, wood, distinguishing characteristics, range, habitat and importance. Each description is accompanied by a plate of drawings on the opposite page, some being adaptations from Sargent's *Silva*. They are well reproduced on good paper.

The bulletin also contains over 100 photographic illustrations, about 40 of which relate to forestry practice. The remainder are fine bark studies, of much value to the general public for identifying species.

This publication should stimulate the general interest in Pennsylvania in tree study, which in turn leads to an appreciation of the importance of forests. J. H. W.

Seventh Annual Report of the Washington Forest Fire Association, 1914. Seattle. Pp. 19.

The area included in this association in 1914 covered 2,669,134 acres, controlled by 203 corporations or individuals. The total cost of protection was 2.2 cents per acre.

It is estimated that there are 1,000,000 acres of private timber lands within the limits of the association's territory which are necessarily protected, although the owners do not in any way contribute to the support of association work.

The burned area and losses during the season of 1914 are as follows:

Cut-over land	241,978	acres
Merchantable green timber (killed)	2,239	"
" " "	3,042	"
Young growth, not merchantable	2,030	"
Total	252,289	acres
Merchantable timber killed	25,000	M ft. B.M.
" " destroyed	5,085	" " "
Loss in cut logs	13,048	" " "

The Chief Fire Warden reports that an agreement was made with the District Weather Forecaster of the Weather Bureau, at Portland, Oregon, to notify the Association of approaching easterly winds, which usually have been coincident with most of the devastating fires which have occurred during the past twelve years. "The results demonstrated beyond doubt that a system of forecasting dangerous fire weather could be inaugurated whereby those interested in forest fire protection would be advised of impending danger and thereby take such precautions as are deemed necessary for the protection of their interests."

R. C. B.

Fifth Biennial Report of the State Forester of the State of California. State Printing Office, Sacramento, Cal., 1914. Pp. 202.

"The . . . report is chiefly directed toward the principle of initiating a state forest protective system, and presents arguments, endorsements and legislative measures operative in other states which we believe sufficient to overcome unfounded opposition to the fundamental principles of forest protection." This quotation from the "Introduction" well describes the character of the report. Throughout may be traced the fact that those advocating the protection of California forests are divided into two camps differing in their views of the methods to be used. Evidently this has been instrumental in delaying the development of forest protection. It is to be hoped that all forces may combine in the near future and secure adequate protection of the forests.

Brief attention is devoted to a few subjects distinct from fire protection. Among these may be mentioned the chapter on "Federal versus State Control of Forests," in which federal control is advocated. A cut-over land study started in 1912 has been finished, and the data secured in the summer of 1913 are summarized.

A thorough investigation of railroad rights of way was made in the summer of 1913, giving the State Forester definite information on which to base recommendations for curtailing the number of fires originating along railroads. An admirable card system for enabling engineers to notify section crews is reported as in use by the Western Pacific Railroad Company.

R. C. H.

Fourth Annual Report of the State Forester to the Governor, State of Oregon, 1914. Pp. 63. Ill.

The report is divided into eleven chapters, all except the first two dealing with various phases of the fire protection work which is the all important state problem at the present time.

An introductory chapter on Oregon forest resources emphasizes the prominent place which the lumber industry has now and should always retain in the development and upbuilding of the State. Attention is called to the large number of owners now controlling the private timberlands. The tendency toward greater consolidation of the smaller holdings is recognized and its advisability admitted. Chapter II treats of forest taxation and urges the adoption of more farsighted methods of taxation for forest land. The remaining chapters review in a careful and critical manner the year's work in fire protection, and offer many suggestions for further increasing the efficiency of the protective organization.

During the season of 1914, 722 State fire wardens (virtually patrolmen) were employed by the State, the Forest Service, the Federal Government, associations, and individual timber owners, or served voluntarily without compensation.

The fire season of 1914 was one of the driest ever experienced in Oregon, but due to the protective organization losses were comparatively insignificant. "Although the fire hazard during the seasons of 1910 and 1914 was practically the same, during the former season $1,640,997 worth of taxable forest property was destroyed against a loss of $26,445, in 1914."

Causes of fires (outside of the National Forests) are classified as follows:

Unknown, 22 per cent; incendiary, 18 per cent; slash burning, 18 per cent; lightning, 12 per cent; hunters, 7 per cent; campers, 7 per cent; locomotives, 5 per cent; smokers, 4 per cent; logging engines, 4 per cent; stockmen, 2 per cent; miscellaneous, 1 per cent. The large percentage of incendiary fires and the small percentage of locomotive fires are noteworthy in comparison with similar statistics in other states. Apparently there is need of a campaign to decrease the number of incendiary fires.

The extent of slash burned, 45,660 acres, is an increase of 71 per cent over the area burned in 1913.

In the chapter entitled "Federal Cooperation Under the Weeks Law," is an interesting table showing in percentages the time spent by the Weeks Law patrolmen on different classes of work.

Chapter VIII, "Compulsory Patrol Law," should furnish food for thought to all foresters struggling with the problem of getting cooperation in protection work from the entire number of timber owners in a given region. In two years the acreage of private lands contributing toward forest protection increased 175 per cent, as a result of the compulsory patrol law.

R. C. H.

Report of the State Forester to the State Board of Forest Commissioners for the Period Ending November 30, 1914. Olympia, Wash. 1915. Pp. 29.

Forest fire statistics for the seasons 1913 and 1914 are given, 1913 being the most successful fire season experienced by the Department, while 1914 was a bad season. It is estimated that 95 per cent of the fires start on cut-over land and slashings which have not been burned over. The urgent necessity of burning up the brush and slash on such lands is presented as the chief problem in fire protection at the present time.

The purchase of cut-over, non-agricultural lands by the State either from individuals or from the counties which may have acquired title through non-payment of taxes is advocated. A much stronger argument for this cause would seem to be demanded as well as an attempt to secure an adequate appropriation to finance the project.

R. C. H.

Annual Report Upon State Forest Administration in South Australia for the Year Ended June 30, 1914. By W. Gill. Woods and Forests Department of South Australia. Adelaide. 1915. Pp. 11; pls. 14.

The report is taken up principally with statistical information regarding the forest reserves (42 in number, comprising 154,-232¼ acres) and their administration.

During the year, 8,537 acres were "let on perpetual lease, and on agreement with covenant to purchase . . . ceased to be forest lands." A portion of the reserves to the amount of 19,224¾ acres are listed as "areas enclosed for planting and natural regeneration," of which 1,144¼ acres were placed in this class during the last year. The number of trees planted was 640,278 (stocking 110 acres—evidently wide spaced) and 94¼ per cent of them were alive at the end of the year. From the seven state nurseries, 231,595 trees were given away to 1,525 recipients. Free distribution of trees has been the custom for thirty-two years.

Annual expenditures, including certain items not directly connected with the reserves, amounted to £25,637 14*s.* 8*d.*, while receipts were only £6,864 15*s.* 10*d.* The forest reserves still show an annual deficit.

R. C. H.

Service Tests of Treated and Untreated Telephone Poles. By C. H. Teesdale. Reprint from Telephony, April 3, 1915. Pp. 4.

Gives the results of a series of experiments conducted by the U. S. Forest Service in cooperation with the American Telegraph and Telephone Company to obtain data on efficiency of various preservatives and methods of treatment. The experiments are described in Circular 104 and Forest Service Bulletin 84. The first inspections are reported in this bulletin and Circular 198. Subsequent inspections are reported in this article.

Of the untreated poles those set green gave longer service than the seasoned; those set in crushed stone or charred at the butt showed less decay at the ground line than those set untreated in sand. There was less decay in swamps and wet places than in drier situations. Coating with tar did not increase the durability. Brush treatments with coal-tar creosote and carbolineum are well worth while, but do not give the results of deeper penetration. Climate has a decided effect on durability, chestnut poles in the North lasting considerably longer than in the South.

S. J. R.

The Resin Industry in Kumaon. By E. A. Smythies. Forest Bulletin 26. Superintendent Government Printing. Calcutta, India. 1914. Pp. 14, pls. 9.

For 25 years experiments have been conducted to determine the best means for utilizing the extensive pine forests of Kumaon for the production of turpentine and rosin. The results have proved highly satisfactory.

The French "cup and lip" method of extracting resin has been adopted. A chisel is used to make a curved cut about six inches from the ground and sloping slightly upwards. Into this cut the lip is fixed. On a nail just below the lip is hung a pot which is covered with a piece of bark or a flat stone to keep out dirt and reduce the evaporation of the turpentine. The channel is commenced by cutting with a sharp adz a curved groove about 6 inches long and 4 inches broad and not more than 1 inch deep. Beginning about the middle of March and continuing throughout the summer the cut is freshened every six or seven days by removing a thin shaving from the top.

At the end of the first year the blaze is about 18 inches long. Before commencing subsequent operations the lip and pot are removed up to within four or five inches of the top of the blaze. By this method the amount of scrape is so small that it is not worth collecting. One tapping is continued for five years and the number of channels in light-tapping varies from one to three, depending on the girth of the tree. Experience has shown that tapping to this extent is not at all injurious to healthy trees. The tapping rotation is 15 years; 5 years' tapping and 10 years' rest. In this way one-third of the forest is being worked while the other two-thirds is resting. Experiments with heavier tapping are now being tried.

The crude resin is taken to the distillery, where it is melted by means of steam coils and run through a fine wire mesh sieve to remove impurities before going to the still. The still is a large copper kettle, 6½ feet in diameter and 5 feet high. A charge consists of 1½ tons of crude resin which fills the still to a depth of a foot. Steam is passed through the charge by means of a 6-armed spray perforated with numerous holes, and in this way the vapors of turpentine are removed and the rosin left behind.

The steam and turpentine vapors are led off from the top of the still by a 4-inch copper pipe into a cold water worm-tube condenser. The distillate is separated mechanically, the turpentine being led off by one pipe, the condensed water by another. This turpentine from the separator is redistilled by steam, and the oil passed through a series of tins containing lime water which removes all possibilities of resinous impurities. This purified product is then thoroughly dried by being passed through a tray of anhydrous sodium sulphate which is a strong dehydrating agent.

The rosin from the still is filtered through a fine wire screen and cotton wool and run into wooden barrels. By far the largest percentage of the output is equal to American W. G. and W. W. grades. This is said to be due to the superior method of tapping employed, the care taken to exclude impurities and the preliminary purification of crude resin, and the low temperature of the steam distillation.

The average annual imports of India between 1907 and 1912 were 227,010 gallons of turpentine and 58,600 hundredweights of rosin. It is anticipated that the Bhowali distillery alone will, in three years, be in a position to supply about 60 per cent of the total consumption of turpentine and well over 80 per cent of the rosin consumption of India.

S. J. R.

Forest Products of Canada, 1913: Lumber, Lath, and Shingles. By R. G. Lewis, assisted by W. E. Dexter and W. G. H. Boyce. Bulletin 48, Forestry Branch. Ottawa, Canada. 1915. Pp. 55.

This bulletin gives the statistics of the production of lumber, lath and shingles by 2,187 mills operating in Canada in 1913.

Lumber.—The total cut reported was 3,816,642,000 feet B.M., a decrease of 13 per cent over that of 1912, which in turn showed a decrease of 11 per cent over 1911. The value of the 1913 cut at the mill was $65,796,483.

Of the total cut, British Columbia produced about 31 per cent, Ontario 29, Quebec 16, New Brunswick 10, and Nova Scotia 7 per cent.

In all, 27 kinds of wood were cut. Spruce, which is the only species whose cut exceeds one billion feet, furnished around 33 per cent of the total cut. Douglas fir 21, White pine 18, and hemlock 8 per cent. The cut of White pine decreased over 25 per cent, and Douglas fir by 11 per cent over 1912.

The hardwood cut was around 265 million feet, or about 7 per cent of the total lumber production. Birch formed 30 per cent. maple 28, basswood 14, and elm 12 per cent of the cut. Hardwood operations are largely confined to Ontario, Prince Edward Island and Quebec, in the order named.

The average mill prices were higher in general than in 1912. White pine at Ontario mills averaged $29.83, Quebec $22.86, New Brunswick $17.45; spruce at Quebec mills averaged $15.76; New Brunswick $14.58, Nova Scotia $13.49; hemlock at Ontario mills $16.78, Quebec $14.12, New Brunswick $12.38; Douglas fir at British Columbia mills averaged $13.73.

Lath.—The lath production was 740 million, a decrease of 18 per cent over 1912. The average value was $2.41. The leading species used were: spruce 35 per cent, White pine 30, and cedar 18 per cent, of the total quantity. Ontario mills produced 35 per cent of the lath, New Brunswick 27, and British Columbia 15 per cent.

Shinggles.—The shingle cut, totalling 1,485,279 thousand, showed a decrease of 6 per cent over 1912. Of the total quantity, British Columbia supplied 43 per cent, Quebec 24, and New Brunswick 21 per cent. The shingles were of cedar to the extent of nearly 94 per cent, and over one-half was of the eastern species.

The bulletin contains a diagram showing the main statistics in a graphic manner. A directory of Canadian sawmills is appended.

J. H. W.

Les Torrents de la Savoie. By P. Mougin. Société d'Histoire Naturelle de Savoie. L'Imprimerie Generale. Grenoble. 1914. Pp. 1,251. Price, 20 francs.

On account of the deforestation in Savoie under the government of Italy it is particularly instructive to see what France has accomplished in reforestation and conservative forest management since this province was first annexed in 1790. Savoie was in 1860 formed of Haute Savoie, Savoie, Tarentaise and Maurienne, the southern portion of the duchy of Savoy. It is divided into 4 arrondissements, Chambéry, Albertville, Moutiers-Tarentaise and St. Jean de Maurienne, comprising 29 cantons and 329 communes. The Isère is the most important drainage basin, and the difference in altitudes (Mont Blanc 4,810 meters, Rhone 212 meters) as well as the large number of summits, signifies a country of steep slopes, so that when Mougin, in his dedication to the Secretary of Agriculture, says: "Among all the problems which have had your keen attention, there is nothing more serious (or) that is more potent for the future and security of the mountain regions than the wiping out of 'torrents,'" he is well within the truth. No forester who has seen fields, roads, bridges, railroads or villages ruined by a torrential storm can say otherwise.

Mougin has had access to all original archives (Waters and Forest Service, Public Works, P. L. M. R. R., town and county, etc.) and has written an absolutely authoritative work that will be of lasting historical and professional value.

It is divided into two parts: I. Causes. II. Results, as shown by an accurate history of all "torrents" in Savoie, arranged by streams. In the appendix there is a chronological list of floods and erosin storms in Savoie, beginning with 43 B. C. and ending in 1910.

According to Mougin, a "torrent" is usually composed of three distinct parts: 1. Collection basin; 2. Flowway; 3. Cone. After almost a century of systematic study the causes which underlie the formation of "torrents" have been classified as follows: I. "Geological character of the soil." For example, crystalline or sedimentary, rocks, being compact and hard, resist erosion, while gypsums or schists, being soft, are easily eroded. II. "Climate."

The rapid melting of snow (owing to rain, warm winds and intense sun) or simple rain storms cause most of the disastrous floods. III. "Deforestation and abuse of enjoyment." Mougin still believes in the four axioms of Surrell which are so well known in France: "(a) The presence of a forest on a soil stops the formation of torrents; (b) The destruction of a forest makes the soil a prey to the torrents; (c) The development of forests tends to wipe out torrents; (d) The fall of forests revives torrents (Eteints)."

The causes recited under III are of most interest to American foresters, since I and II are so clearly applicable that no further details are necessary to a clear understanding. But the dangers of forest destruction on mountains cannot be emphasized too frequently and it is particularly instructive to examine systematically the causes of torrents in Savoie. These are summarized in the order followed by the author. 1. Increase in population: over-population forced overcultivation as well as overgrazing, and the deforestation of land that should have been maintained in forest cover. If a scientific classification of the land could have first been attempted, then these unfortunate results could have been avoided. 2. Undue spirit of gain. At first the demands of drought and war necessitated larger agricultural and pastoral areas to supply the demands made upon the local population. Then came a spirit of gain; if one village profited by extensive grazing, why not another? The convents and monasteries increased this demand for cleared land. Trespass on the forest, legalized by too liberal laws, and illegal theft, added to the ruin. Then, too, the deforestation was linked with the local military history of the country; when occupied by hostile troops a great deal of damage resulted. In 1853 two-fifths of the coppice of Savoie was cut every five or six years! One can judge of the destruction at this time when it is stated there were 8,000 trespass cases a year against 25,000 people. Most of these went unpunished because of the small number of forest officers. 3. Grazing. Unregulated and unrestricted grazing was universal; in the coppice, in the fir stands, amongst the spruce, birch and pine, especially in the youngest stands. Unfortunately for the regeneration, beef and milk stock were less numerous than goats, sheep or swine. "At the time of the annexation in 1860, one could say that every forest in Savoie was being devoured by the herds." Even in recent years the forest must be occasionally opened to stock during severe droughts, but Mougin advocates the radical suppression of all grazing in the forest.

4. "Gaspillage." A great deal of deforestation took place under the guise of free use. It meant removing wood to which people were not entitled before it was ripe, and an excess of what could rightfully be cut.

5. 6. 7. Mines and factories. Owing to its political isolation, Savoie had to drain too heavily on its natural resources to supply its local mines and factories.

8. War. Since the time of Caesar, Savoie has been ravaged by armies, first by one side (Italy) and then by the other (France). The troops used wood for fuel, for the manufacture of powder, for bettering transportation and defenses. (9) Public works. Here wood was demanded for shelters, etc. 10. Fire. 11. Avalanches and slides, etc.

All these summed up mean that the forest wealth of Savoie had great demands put upon it, often when and where it could least be spared; that it was used extravagantly and was wasted—an excellent object lesson.

The work of reclamation executed by France is so well known that it need not be repeated in this review. The present day "reboisement" aims at a combination of masonry dams, drains and plantations; neither "dead" or "living" works alone can stand. Only a combination of the two can be permanently successful.

T. S. W., Jr.

Sylviculture: Manuel Pratique. By A. Jacquot. Préface par M. Ed. Henry. Berger-Levrault, Editeurs, Paris. 1914. Pp. 243. Price, 5 francs.

Jacquot is well known in France as the author of a classic work on the estimate and appraisal of fire damages published under the misleading title of "Incendies En Forêt." He has again chosen a title which is confusing, because his practical manual of Sylviculture in this case is really an excellent work on the "Elements of Forestry." It is divided into three parts: I. Value of Forests (direct and indirect). II. The Tree (forest species). III. Treatment of Forests (management and reforestation). The chapters of especial interest to American foresters are: I. 2. Indirect Benefits of Forests; III. 3. Yield; III. 5. Upkeep and Improvement of Forests; III. 8. Reforestation.

In the preface Henry quotes Pliny to the effect that "The forests render us thousands of services, without which life would be impossible." When one reads Jacquot's enumeration of the indirect benefits of forests Pliny's broad statement seems no exaggeration. In outlining his summary to Part I, Chapter 2, the author states, "We will then study their influence on the meteorological factors which regulate climate, the flow of rivers, the public health, the aesthetic and military manoeuvers." Under (1) "Moisture-Rainfall" he states that "Forests increase the average annual relative humidity of the air" and supports this statement by citing instances where forests increased the humidity 16 to 20 per cent and where deforestation brought on water famines: "Sicily, Malta, the islands of Maurice, Reunion, and Cap Vert suffer from terrible droughts since they were deforested." He even goes so far (perhaps too far) as to say that "rainfall varies according to the per cent of forested area." Could this be scientifically proved? The generally accepted statements that forests diminish (2) hail, (3) decrease frosts, and protect from (4) wind are repeated but without such definite illustrations as are given under (5) "springs." Here the author gives interesting illustrations which have not appeared in American forest literature. "The towns of Rome, Vienna, and Constantinople, the village of Saint-Amarin (Alsace) . . . lost their springs after the deforestation of ravines where they rose. . . . At Claveizolles and at Lamure-sur-Azergues (Rhone) whenever the coppice was cut the springs fell. In Sardinia the springs have gone dry *on all points* where the mountains were denuded."

Jacquot traces the beneficial effect of forests on (6) avalanches, (7), (11) soil, (8) floods, (9), (10) rivers, (12) sand, (13) climate, (14) health, (15) depopulation, (16) military movements (especially now that scouting is by aeroplanes), and (17) "Esthétique." This glance at chapter 2 illustrates the completeness of the work.

Somewhat more detailed than the usual book on "Elements of Forestry," it is of especial value to students and teachers of forestry.

T. S. W., Jr.

OTHER CURRENT LITERATURE

Instructions for the Scaling and Measurement of National Forest Timber. U. S. Department of Agriculture. Contribution from Forest Service. Washington, D. C. 1915. Pp. 91.

In addition to routine instructions for measuring forest products, the book contains the Scribner Decimal C Log Rule; the following tables: cull for rectangular defects; cull for squared defects; solid cubic contents of logs, from 4 to 40 feet in length and from 3 to 60 inches in diameter board feet; contents of standard sizes of timber, standard converting factors; converting factors—telephone poles; areas of circles; taper; sample pages from scale books showing how records should be kept; commercial log grading rules for Douglas fir, and suggested rules for Western Yellow pine.

Tests of Wood Preservatives. By H. F. Weiss and C. H. Teesdale. Bulletin 145, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C., 1915. Pp. 20.

A partial report upon a series of tests to determine the properties and merits of various wood preservatives, 30 preservatives having been investigated.

Forest Planting in the Eastern United States. By C. R. Tillotson. Bulletin 153, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 38.

This bulletin discusses opportunities for forest planting in the region, present status of forest planting, establishment and care of plantations, and individual species suited for planting.

The European Pine-Shoot Moth; a Serious Menace to Pine Timber in America. By A. Busck. Bulletin 170, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 11.

Discusses a recent importation from Europe that is a constant menace to pine forests abroad and is likely to become so here unless prompt measures for its suppression are taken. So far the pest has been found in this country only in nurseries and private parks supplied by these infested nurseries.

Hickory Handles: Navy Department Specifications. Washington, D. C. 1914. Pp. 24.

The Navy Department has issued a neat booklet of specifications for hickory handles, copies of which can be obtained upon application to the various Navy pay offices or to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

All commercial species of hickory are admitted and no discrimination is made against Red hickory. Handles entirely of heartwood and those showing part heart and sap (mixed hickory) will be accepted. Emphasis is laid upon the weight of the wood and the number of rings of growth to the inch of cross-section. Light weight wood is excluded, and wood weighing 37½ pounds or less per cubic foot of solid dry wood is considered light wood. Wood with more than 20 rings per inch on either end is not acceptable.

Preliminary Classification of the Superfamily Scolytoidea. By A. D. Hopkins. Technical Series, 17, Pt. II, U. S. Bureau of Entomology. Washington, D. C. 1915. Pp. 165-232.

This is the third contribution toward a monograph of the scolytoid beetles which are represented in North and South America, Europe and Asia by some of the most destructive enemies of forest trees and their commercial products. Its object is to discuss the taxonomy and present a preliminary classification of the families and sub-families of the scolytoid beetles of the world.

Classification of the Cryphalinae, with Description of New Genera and Species. By A. D. Hopkins. Report 99, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 75.

This is the fourth contribution toward a monograph of the scolytoid beetles. The sub-family Cryphalinae includes a group of ambrosia beetles, also known as pinhole borers and timber beetles, which are very detrimental to forest products. This report names, describes, and classifies a lot of undescribed species and genera as a basis for a detailed study of their habits and seasonal histories, and of the methods for combating them.

Insects Injurious to Forests and Forest Products: Biology of the Termites of the Eastern United States, with Preventive and

Remedial Measures. By T. E. Snyder. Bulletin 94, Part II, Bureau of Entomology. Washington, D. C. 1915. Pp. 85.

Density of Wood Substance and Porosity of Wood. By F. Dunlap. Reprint from Journal of Agricultural Research, Department of Agriculture. Washington, D. C. Vol. II, No. 6, September 21, 1914. Pp. 423-428.

Third Annual Report of the Kennebec Valley Protective Association. Maine. 1915. Pp. 15.

At the end of the third year this association has 29 members, whose timberland holdings total 1,245,900 acres. During the past season the loss from fire was very small, and all fires that occurred were promptly reported and quickly got under control, although the average rainfall was considerably below normal.

Maine Aphids of the Rose Family. By Edith M. Patch. Bulletin 233, Maine Agricultural Experiment Station. Orono, Me. 1915. Pp. 250-280, ill.

Gives descriptive accounts with drawings of the plant lice found in Maine upon members of the rose family, including such genera as *Amelanchier, Crataegus, Prunus* and *Pyrus,* and suggests methods for their control.

Eleventh Annual Report of the State Forester of Massachusetts, 1914. By F. W. Rane. Public Document 73. Boston. Pp. 111.

Electrical Injuries to Trees. By G. E. Stone. Bulletin 156, Agricultural Experiment Station. Amherst, Mass. 1914. Pp. 19.

This bulletin is a revision of Bulletin 91, *Injuries to Shade Trees by Electricity,* issued in 1902 and now out of print. It deals with electrical injuries to trees, including a brief discussion of the electrical resistance in trees, as well as the defects of alternating and direct currents, lightning and earth discharge. The methods of preventing injury to trees are also discussed.

Dry Rot in Factory Timbers. By F. J. Hoxie. Inspection Department, Associated Factory Mutual Fire Insurance Companies. Boston. 1915. Pp. 107.

This publication discusses in detail dry rot, the factors affecting it, and methods for its control. Certain antiseptic treatments are recommended and specifications are suggested for a special grade of Longleaf pine timbers for use in Mutual Factories.

The Comparative Effect on Different Kinds of Plants of Liming on Acid Soil. By B. L. Hartwell and S. C. Damon. Bulletin 160, Agricultural Experiment Station, Rhode Island State College. Kingston, R. I. 1914. Pp. 407-446.

Proceedings of the Connecticut Forestry Association, 1912-14. State Forest Number. New Haven. 1915. Pp. 36.

Contains: The Necessity and Desirability of State-owned Forests, by J. W. Toumey; The Policy of Other States Regarding State Forests, by H. H. Chapman; Why Connecticut Should Increase Her State Forests, by A. F. Hawes; The Forest Lands of Connecticut, by W .O. Filley.

The Gypsy Moth. By W. E. Britton. Bulletin 186, Connecticut Agricultural Experiment Station. New Haven. 1915. Pp. 24.

Gives the history of the gypsy moth, its discovery in Connecticut and present extent of infested area; describes the moth, its habits, life history and enemies, and suggests means for its control.

Fourteenth Report of the State Entomologist of Connecticut for the Year 1914; being Part III of the Annual Report of the Agricultural Experiment Station. By W. E. Britton. New Haven. Pp. 198.

Lumber and the Panama Canal. New York. 1915. Pp. 18.

A series of fifteen articles republished from the columns of The New York Lumber Trade Journal, December 15, 1913, to July 15, 1914.

Report on the Street Trees of the City of New York. New York State College of Forestry. Syracuse. 1914. Pp. 28.

This report is the result of a survey of the street trees of the several boroughs of New York City and a special examination of the street trees in sections of the Borough of Manhattan, made by H. R. Francis of the New York State College of Forestry.

Certain Features of German Forestry. By H. D. House. Reprint from Report of the State Botanist for 1913. Albany, N. Y. 1915. Pp. 30.

The author states that the report embodies "sketches taken at random from his notes, with a view of presenting characteristic and interesting methods of procedure in silviculture, management and utilization, particularly of such ranges in the German forests as may well pay any student of forestry to visit who has the opportunity to travel."

The Strumella Disease of Oak and Chestnut Trees. By F. D. Heald and R. A. Studbalter. Bulletin 10, Department of Forestry of Pennsylvania. Harrisburg. 1914. Pp. 15.

This disease of the oaks and chestnut is caused by *Strumella coryneoidea* Sacc. & Wint., an old species which has not previously been accused of being a parasite. The disease is widely distributed and is believed to be a serious menace to the trees. The writers hope that their "brief description will aid and stimulate further observations and study in this interesting tree disease, so that we may have more complete information as to its range and prevalence."

Areas of Desolation in Pennsylvania. By J. T. Rothrock. Philadelphia. 1915. Pp. 30.

This report deals with the many scattered areas in the central parts of Pennsylvania which formerly were forested but have since been impoverished. These areas comprise about one-seventh of the area of the State. The author urges immediate action to reforest these lands and restore their former usefulness.

Final Report of the Pennsylvania Chestnut Tree Blight Commission, January 1 to December 15, 1913. Harrisburg. 1914. Pp. 121.

Bibliography of the Chestnut Tree Blight Fungus. By R. K. Beattie. The Commission for the Investigation and Control of the Chestnut Tree Blight Disease. Harrisburg, Pa. 1914. Pp. 32.

Official Inspection Rules of the North Carolina Pine Association, Inc. Issued by the North Carolina Pine Association, Inc. Norfolk, Va. 1914. Pp. 24.

Wood-Using Industries of Georgia. By Office of Industrial Investigations, U. S. Forest Service. Reprint from Lumber Trade Journal, New Orleans, La. March 15, 1915. Pp. 19-29.

Manufacturers of wooden products in Georgia used 557,000,000 board feet of lumber in 1911. Although 34 species are included in the list, Longleaf pine comprised 52 per cent and Shortleaf 34.5 per cent of the total. The average cost per thousand f.o.b. factory for all woods was $14.33; total cost nearly $8,000,000. Planing mill products make up over 71 per cent of the entire quantity of wood reported manufactured; sash, doors, blinds and general millwork, 13 per cent; boxes and crates, 3.9 per cent; furniture, 2.9 per cent; ten others, less than 1 per cent each.

Tree Fillings and Wound Dressings for Orchard and Shade Trees. By A. D. Selby. Circular 150, Ohio Agricultural Experiment Station. Wooster, Ohio. 1915. Pp. 3.

Discusses a method of making fillings out of asphaltum and sawdust, and of dressing wounds with gas tar and forms of liquid asphaltum.

The Preservation of Ties, Poles and Timbers by Antiseptic Treatment. By W. F. Goltra. Cleveland, Ohio, 1914. Pp. 11.

The writer makes the following recommendations: (1) The material should be thoroughly seasoned, either naturally or artificially, before treatment; (2) Ties should be adzed and bored just before injection of preservative; (3) All material should receive a thorough and full impregnation with whatever preservative is used.

Alabama Bird Day Book, 1915. Issued by Department of Game and Fish. Montgomery, Ala. Pp. 96.

A well designed and beautifully illustrated publication containing information and material for use in the public schools of Alabama in the observance of Bird Day, May 7, 1915.

Fourteenth Annual Report of the State Board of Forestry of the State of Indiana, 1913-1914. Indianapolis. 1915. Pp. 100.

Flood Protection in Indiana. By W. K. Hatt. Bulletin 4, Indiana Bureau of Legislative Information. Indianapolis. 1914. Pp. 51.

On April 20, 1914, the Governor of Indiana appointed a flood commission to consider the extent of damages due to floods in the State and to recommend measures to provide relief in the future. This pamphlet is an abstract of the findings prepared in popular form in advance of the main report.

Principles of Kiln Drying Lumber. By H. D. Tiemann. Reprint from Lumber World Review. Chicago. January 25 and February 10, 1915. Pp. 6.

This paper discusses the various factors influencing the drying of lumber and suggests practical methods of control. Although much of the information has already appeared in other publications, a number of interesting details might be mentioned.

One is in reference to the fibre saturation point. In most woods shrinkage does not occur until the free water in the cell cavities has been removed and loss from the cell walls begins. Certain species, notably *Thuja plicata* and *Sequoia sempervirens,* are exceptions to the rule, and collapse of the cell walls may occur in excessively wet spots or bands *during* the process of evaporation of the free water. Mr. Tiemann's explanation is "that the cell walls, which are practically impervious to air while wet, but through which water may readily pass, become soft and plastic when heated. Under this condition those cells which are completely full of water to start with are subjected to an internal suction or tension produced by the depletion of the water in the cavity by its evaporation through the cell walls. The cells then collapse like rubber tubes, one layer after another."

Reference is made to an unpublished report by Frederick Dunlap on "The Heat of Absorption of Water in Wood," in which it is shown that to remove moisture from wood heat in addition to the latent heat of evaporation is necessary to overcome the intimate association of the molecules of water with the molecules or minute particles of the wood substance. This has been found by experiment to be from 16.6 to 19.6 calories per gram of dry wood in the case of beech, Longleaf pine and Sugar maple.

S. J. R.

Report of the Wisconsin Special Legislative Committee on Forestry of the Senate and Assembly made to the Members of the 1915 Session of the Wisconsin Legislature. Pp. 77.

Discusses tours of inspection in northern Wisconsin to determine the alleged suitability of certain forest lands for agriculture; and in Pennsylvania, New York and Connecticut, where forest reserves and plantations of White and Red pine were given particular attention. The findings were favorable to the forestry movement.

Fourth Annual Report of the State Forester, of Minnesota. 1914. Pp. 99.

Coeur d'Alene (Idaho) Timber Protective Association, Ninth Annual Report, 1914. St. Maries, Idaho. Pp. 24

Clearwater (Idaho) Timber Protective Association, Eighth Annual Report, 1914. Pp. 29.

Second Biennial Report of the State Forester of the State of Colorado. Fort Collins, Colo. 1914. Pp. 16.

The work during the two years covered by this report has been directed principally to perfecting the county fire warden organization and to carrying on investigations in the preservative treatment of fence posts. Twelve forest stations, aggregating 1,280 acres, have been selected from Government lands and will henceforth be used as State forest reserves.

Proceedings and Addresses of 1914 Meeting of the Western Forestry and Conservation Association. Reprint from Timberman, December, 1914. Pp. 4-34.

Secretary's Annual Report of the Pend d'Oreille Timber Protective Association. By J. A. Humbird. 1914. Pp. 25.

The subscription list for 1914 shows that 27 firms, with holdings amounting to 575,824 acres, contributed $18,641.36 for fire protection. The U. S. Government spent $1,000 under the Weeks Law. The total expenditure for the same season was $17,-003.04 or $2.95 per acre. The season was very dry and 215 fires occurred; the damage, however, was for the most part very small.

Stock Poisoning Plants of California. By H. M. Hall and H. S. Yates. Bulletin 249, Agricultural Experiment Station, College of Agriculture. Berkeley, Cal. 1915. Pp. 219-247.

Describes the important poisonous plants, and suggests remedies and antidotes.

Conservation of Resources in California. (2d ed.) Issued by Superintendent of Public Instruction. State Printing Office. Sacramento. Pp. 112.

A handbook containing short articles and extracts regarding various phases of the conservation of natural resources, designed for use in schools.

The Hardwood Distillation Industry in America. By E. H. French and J. R. Withrow. Reprint from Metallurgical and Chemical Engineering. January, 1915. Pp. 32.

Discusses the history and development of the industry, the design of apparatus, yields, construction of plants, primary distillation operation, handling the crude distillate, production costs and values, costs of installation, large scale experimentation, refining, markets.

According to this report there are in the United States 53 oven plants with daily capacity of 2,909 cords; 31 retort plants, capacity 593 cords; 6 kiln plants, capacity 1,300; total, 90 plants, capacity 4,802 cords. In Canada, 9 oven plants, capacity 424 cords; 1 retort plant, capacity 48 cords; total, 10 plants, with daily capacity of 472 cords. Total for America 100 plants, capacity 5,274 cords.

The Collection and Storage of Forest Seeds. Leaflet 21, Board of Agriculture for Scotland. Edinburgh. 1914. Pp. 4.

Suggests methods of collecting and storing locally grown forest tree seeds to offset shortage of continental supply occasioned by the war.

The Large Larch Sawfly. Leaflet 22, Board of Agriculture for Scotland. Edinburgh. 1914. Pp. 7.

The exact distribution in Scotland of the large larch sawfly [*Nematus* (*Lygoeonematus*) *Erichsonii*] is not kell known, and the society is anxious to get as much information as possible regarding it in order to prevent serious damage. To this end, the insect is pictured, the symptoms of attack described, and methods of control discussed.

The Production of Potash Salts from Woodlands and Waste Lands. Leaflet 25, Board of Agriculture for Scotland. Edinburgh. 1914. Pp. 14.

Discusses briefly the results of experiments to determine the commercial possibility for the production of potash salts on a considerable scale from forest produce, as it was believed that the stocks of potassium salts in Scotland would be completely exhausted by April, 1915.

Timber for Pit-props and Colliery Requirements. Issued by the English Forestry Association. Farnham Common, Slough, Bucks. 1914. Pp. 10.

There are over 1,000 collieries in England and Wales, and on account of the war it was feared that the supply of mine timbers might be seriously reduced. This publication is a general review of the situation and discusses the classes of timber used, species, sizes, weights and railway rates, with suggestions for marketing.

Trametes Pini, Fries, in India. By R. S. Hole. Vol. V, Part V. The Indian Forest Records. Calcutta. 1915. Pp. 26.

Discusses the occurrence of this fungus in India, its manner of spreading, and means for its control. Observations indicate that infection usually takes place through the stem of the tree by wind-carried spores and not through the roots, though occasionally infection through grated roots probably does occur.

Industrial Fiber Plants of the Philippines. By Theodore Muller. Bulletin 49, Bureau of Education. Manila. 1913. Pp. 157.

A description of the chief industrial fiber plants of the Philippines, their distribution, method of preparation, and uses.

Notes on the Preparation of Indian Forest Floras and Descriptive Lists. By R. S. Hale. Forestry Bulletin 23. Calcutta. 1914. Pp. 33.

Notes on Turpentines of Pinus Khasya, P. Merkusii and P. excelsa. By Puran Singh. Forestry Bulletin 24. Calcutta. 1913. Pp. 11.

Annual Progress Report upon State Forest Administration in South Australia for the Year 1913-1914. By W. Gill. Adelaide. 1915. Pp. 11.

Report of the Director of Botanic Gardens and Government Domains New South Wales, for 1913. By J. H. Maiden. Sydney. 1914. Pp. 37.

Les Forêts de Madagascar. By R. Badin. Bulletin Économique. Tananarive, Madagascar. 14e Année, 1er Trimestre, No. 1, 1914. Pp. 33-53.

Discusses the character, resources, and conservation of the forests of Madagascar.

Bulletin de la Station des Recherches Forestières du Nord de l'Afrique. Vol. I, No. 2. Forest Service, General Government of Algeria. 1914. Pp. 70.

Contains the following: First note on the Galls of the Woody Vegetation of North Africa; Reforestation in Algeria, 1851-1914.

Vol. I, part 1, was issued 1912, and contained A Study of the "Yellow Spot" of the Cork Oak.

Die Bohrmuschel (Genus Teredo Linné). Von Dr. F. Moll. Sonderabdruck Naturwissenschaftliche Zeitschrift für Forst- u. Landwirtschaft. 12 Jahrgang 1914. Heft 11 u. 12, pp. 505-564.

A consideration of the teredo historically, anatomically and economically with special reference to methods for the control of its ravages. Includes an extensive bibliography.

The teredo bores through wood by means of the shell valves on its head. The abraded wood furnishes little, if any, nourishment to the animal. The only woods considered fairly resistant naturally to the attacks of the borer are jarrah, greenheart, and turpentine wood (presumably *Eucalyptus stuartiana*).

Impregation with salt solutions, superficial coatings, etc., have proved ineffectual or of only limited efficacy in protecting wood from the teredo. The best results have been secured by impregnating thoroughly seasoned wood with creosote containing at least 6 to 10 per cent of tar acids, the absorption to be not less than 150 liters per cubic meter (about 8 pounds per cubic foot) of wood. S. J. R.

Produktion und Verbrauch von Nutzholz. B. Der Verbrauch. (La production et la consommation des bois d'oeuvre. B. La consommation.) Bearbeitet an Hand des vom schweizerischen Forstpersonal gelieferten Materials im Auftrage der Eidgen. Inspektion für Forestwesen durch M. Decoppet. Zurich. 1914. S. 166.

This report is printed in German and French in parallel columns. Part I describes the principal tree species of Switzerland both native and introduced, as to occurrence, properties and utilization. Part II discusses the wood imports. Part III covers the wood-using industries. The appendix contains a large number of tables and two chart maps.

Die forstlichen Verhältnisse der Schweiz. Published by the Swiss Foresters' Association. (Beer and Co., Zurich.) 1914.

Owing to a subvention by the Bund, this authoritative, all comprehensive and complete description of forest and forestry conditions of Switzerland can be had for 6 francs.

Bau und Einrichtung von Anstalten zur Imprägnierung von Holz. Von Dr. Friedrich Moll. Das Hobel- und Sägewerk. III. Jahrgang, Heft 19-20, 1914. S. 205-211. Mit 13 Abbildungen.

Describes methods of timber preservation with special reference to the installation and operation of the Kyanizing and Wolman processes.

Über das forstliche Schulwesen in den vereinigten Staaten von Nordamerika mit besonderer Berücksichtigung der Yale-Forest-School. Von Dr. Friedrich Moll. Sonderabdruck Forstwissenschaftliches Centralblatt. Berlin. 1915.

This article is based on an address by Prof. Record, of the Yale Forest School, delivered at the meeting of the American Wood Preservers' Association in New Orleans in January, 1914.

Die Harznutzung in Österreich. Von August Kubelka. Mitteilungen aus dem forstlichen Versuchswesen Österreichs. Wein. 1914. XXXVIII Heft. S. 33-35.

The resinous products imported by Austria amount to over $4,000,000 annually. The writer believes that by the introduction of improved methods for extracting and distilling the resin obtained from the Austrian pine in Lower Austria the yield will be sufficiently increased to make importation unnecessary.

Ein Düngungsversuch im forstlichen Pflanzgarten. Von Dr. Peter von Rusnor. Mitteilungen aus dem forstlichen Versuchswesen Österreichs. Wein. 1914. XXXVIII Heft. S. 56-64.

Some experiments with manures for forest nurseries indicate that steamed bone-flour and basic slag have no marked influence on the growth of spruce and Scots pine seedlings.

PERIODICAL LITERATURE

FOREST GEOGRAPHY AND DESCRIPTION

Forests of Chile

Of the 186 million acres, which is the extent of Chile, according to the Inspector General of Forests, Hunting and Fisheries, Federico Albert, 39 million are woodland, but 9 million of this area is only pasture forest, 18.5 million produces only firewood, 6 million furnishes also only poles and stakes, reducing the area of commercial material to only 5 million acres, the remnant of an original forest country of 11.5 million acres. Of the total of woodland 20 million acres are on agricultural soil, 7.5 million are bearing young growth. Nearly 10 million acres of true forest country are now completely cleared, the greater part eroded and worn into gullies so that it will soon be a desert. Some 150,000 acres of sand dunes have also been created by improper denudation.

The lack of capital to develop means of transportation has preserved the remaining commercial timber. The present exploitation is of the roughest.

There are only very few softwoods, among them Fitzrohya and Libocedrus, Araucaria and Podocarpus, hence the need of an importation of 1.5 million cubic feet of Douglas fir and pine from the United States ($800,000). There is no substitute for oak, hence $40,000 worth of staves are imported. The export of the hard native woods amounts to only about $120,000.

Plantations of pine and poplar, sometimes quite extensive, have been made by coal operators and others, and small attempts at recovering sand dunes by the State are recorded with *Populus nigra, Pinus insignis* and *Eucalyptus globulus,* instead of better ones.

The woodland is very unevenly distributed, the smallest forest per cent being found in the northern parts, increasing southward.

The whole country can be divided into six forest regions, representing as many forest types. The northern region, comprising the provinces of Tacna, Tarapacá and Antofagasta, contains only 52,000 acres, composed of *Prosopis tainarugo* and *Cordia decandra* (carbon), besides minor species. The second region, south of this to the river Choapa, comprising the provinces of Atacama and Coquimbo, somewhat more densely forested with 230,000 acres, is composed mainly of *Gourliea decorticans* (Chañar), *Caesalpinia brevifolia* (algarrobillo), *Portiera hygrometrica* (guayacan), carbon, etc.

These two regions depend on importations for wood supply. An export of the pods of Prosopis for yellow tan material has begun.

The third region, still better wooded with 1.7 million acres, south to the river Maule, occupies the provinces of Aconcagua, Valparaiso, Santiago, O'Higgins, Colchagua, Curicó and Talca. In addition to a number of dry-region trees at the southern limit, three species of Nothofagus (*macrocarpa, obliqua,* and *dombeci*) appear with *Guevina avellana* and *Libocedrus chilensis.* This region also imports most of its wood requirements.

With the fourth section the real forest region is entered, lying between the rivers Maule and Valdivia, the forest per cent lying between 17.5 and 35.5 per cent for the nine provinces involved, around 6 million acres. It is the richest forest region of the country. Here, *Araucaria imbricata* and *Libocedrus tetragona, Podocarpus andina* represent the conifers, and species of Nothofagus and Laurelia, the two most important finishing woods, Myrceugenia, Persea (tan), and many others lend variety.

The fifth section from the river Valdivia to the peninsula Taitao is represented in three provinces with around 12 million acres (40%) of woods. Here, Araucaria and Laurel are absent, but Libocedrus and Fitzrohya, of large dimension, with, in the higher mountains, Podocarpus, Nothofagus, Sophora, and a long list of other hardwoods, are represented, the canal of Chacao limiting some species. Unfortunately, the least useful species abound, and grow largest, while the more useful ones are the rarest and smallest.

Finally, the sixth section comprises the territory of Magallanes, south to Tierra del Fuego, some 20 million acres (30 per cent of the territory) with, mostly, the same species that occur south of Chacao canal, the number gradually decreasing southward, finally being restricted to a few species of Myrceugenia in stunted shrubs, besides a Nothofagus and Maytenus tree species.

Boletin de Bosques, Pesca i Caza, May, 1914, pp. 533—541.

Spessart Oaks

The old oaks of the Spessart mountains (belonging to Bavaria), 400-year-old giants, are noted for the remarkable price they bring, $2 to $2.50, and sometimes over $3 per cubic foot. These fine, large-sized bolts are used for veneer cutting, while sawlogs bring $1 to $1.30.

These giant oaks, 140 feet in height and up to five feet in diameter stand in beech forests 120 to 150 years old, of not less imposing size, and in extensive stands. The type of forest forming a contiguous stand is found in three revirs of nearly 30,000 acres, of which 83 per cent is pure broadleaf forest, some 1,800 acres of 260- to 300-year stands of ideal condition.

The very old trees are, of course, remnants of the virgin woods, which have been exploited in selection system since the middle of the eighteenth century. By this system the tendency was to crowd out the oak, changing into pure beech forest.

Only in the middle of the nineteenth century a beginning was made to find a silvicultural method which on suitable location, southeast and south exposures, would guarantee oak reproduction. Since experience had shown that in single specimens oak was outgrown by the beech, groupwise mixture (by natural regeneration or sowing) was introduced, requiring diligent protection by thinnings to keep the oaks protected. Now, in the compartment system, a very open position is given, especially in oak seed years, to maintain the regeneration, helping on by seeding and holding back the beech by cutting, keeping it as soilcover and nurse where needed. The old stand is then removed in six years. If beech regeneration is absent the oak polewoods are underplanted at 50 to 60 years. The rotation for oak is set at 300 years, for beech 120 years. Conifers are used only with beech on poorer soils; possibly pine is introduced here and there to reduce frost danger, which is apt to occur in the valleys.

One difficulty with which the administration is hampered on some of the areas are rights of user to firewood, which prevent thinnings before the 60th year, and in others the right to litter.

Exkursion in die Waldungen des Spessart. Schweizerische Zeitschrift für Forstwesen, January-February, 1915, pp. 9-13.

BOTANY AND ZOOLOGY

Floristic Analysis Method

The need of an exact method of analyzing vegetative soil cover, especially in connection with gauging the effects on the soil flora of thinnings, more or less severe and from time to time, is discussed at length by Lagerberg. The relation of soil to plant cover and of plant cover to light is briefly explained, and reference is made to Cajander's four principal forest types based on soil flora, namely the *Oxalis-Majanthemum* type, the *Myrtillus* type, the *Vaccinium* type, and the *Calluna* type (see F. Q., X, p. 520). The propriety of this classification is questioned and declared unsafe. Cieslar's and Knuchel's work on relating soil flora and light are also referred to (see F. Q., XIII, p. 90, and IX, pp. 180 ff.).

The author then describes two methods of analysis of plant formations. The first by Hult, designed in 1881, was generally employed by plant geographers of northern countries. Hult recognized 10 primary biological types: conifers, broadleaf trees, shrubs, dwarf shrubs, grasses, herbs, climbers, foliage mosses, white mosses, and lichens. He recognized five frequency grades: sporadic, sparse, dispersed, plentiful, and dense or frequent. The plants occurring in the latter grade determine the physiognomy of the plant formation. To enable ready characterization, three layers of plant cover were recognized with somewhat definite dimensions: the soil-layer reaching up to 3 *cm;* the field-layer up to 8 *dm* in three floors, the lower, middle and highest, limited by 1, 3, 8 *dm;* the shrub-layer up to 2 *m,* the coppice-layer up to 6 *m,* and the high forest above. A graphic method was used to show the plant formations according to frequency degrees and layers.

The author charges against the method lack of objectivity, which makes it useless in determining changes of flora as a result of thinnings, since here investigations must be made with precision and are usually carried on by different persons.

He then describes a method by Rankiaer, published in 1909, and suitable for this purpose.[1] The main point is to rule out all

[1] The reference of this method to the authorship of Rankiaer in 1909 overlooks the fact that Pound and Clements used the method in 1898, and a full description is found in "Research Methods in Ecology," by F. E. Clements, 1905.

subjective conceptions as regards the frequency of plants, by laying out a number of quadrats within which all plants are counted and thus their "valency" mathematically determined.

The question arises how large the squares and how many must be investigated to arrive at a true valency of species. Theoretically, squares of smallest extent and a large number of them would give the surest results; practically, this is not attainable.

For the case in point—investigating floral changes on sample areas of one half to more than one acre—a systematic location of quadrats appeared desirable. Not only the relative frequency of occurrence, but the area covered by species, especially those which are of significance for humus formations (Vaccinium, etc.), it is desirable to know, hence, besides a frequency per cent, also an area per cent must be secured; this, to be sure, by estimate in each square or quarter square, as the author prefers to reduce the subjective element. As an expression of vigorousness of development, the maximum height of the species was also noted.

To determine what size area would give best results as regards species distribution, a brass frame with movable sides was constructed by which $^1/_3$, $^1/_4$, $^1/_5$, down to $^1/_{10}$ *sq. m.* could be enclosed. Squares were laid out, spacing them 2 by 2, 4 by 4, and 8 by 8 *m* in systematic manner. Since frequency and area per cent, as well as average height, are not exact figures, the average error was then established by the method of least squares.

Altogether seven sample areas were investigated, 16 tables and four diagrams showing the results.

The maximum error, if quadrats are laid out with a spacing of 4 by 4 *m*, lies usually between ± 5 to 6 per cent, rarely ± 10 per cent; with a spacing of 2 by 2 *m*, under ± 2 per cent, but with 8 by 8 *m* as high as 20 per cent. The area percentage can therefore be very exactly ascertained with a 2 by 2 spacing, and still satisfactorily with a 4 by 4 spacing. The size of the squares used was .5 *m* and .1 *m*. No attempts seem to have been made to ascertain which size furnishes best results. A short bibliography is added.

Markflorans analys på objectiv grund. Meddelanden från Statens Skogsförsöksanstalt, 1914, pp. 129-200.

Transpiration and Chemical Composition

Before the Botanical Society of America Burns reports on experiments with White pine seedlings to establish the relation of transpiration to their composition, which show that both protein contents and soluble ash per cent under full shade are, where transpiration is low, very much higher than in half shade or no shade.

Science, January 29, 1915, p. 181.

Large-sized Trees

In the German Dendrological Society record is made of several specimens of large size of various species.

In a park at Kunzendorf probably the largest White pine in Germany is found, planted between 1790 and 1800, therefore about 120 years old, with a diameter breast high of 63 inches, height 108 feet, crown diameter 69 feet, volume 1,270 cubic feet.

At Potsdam a Robinia measures 56 inches with a height of only 33 feet, but a crown diameter of 53 feet.

A hollow linden, still alive, near Upstadt measures 46 feet in circumference.

A specimen of *Corylus colurna,* 120-130 years old, in the botanical garden at Hamburg has at 6.5 feet from base a diameter of 25 inches with a height of 82 feet, a rare specimen.

Starke Waldbäume. Forstwissenschaftliches Centralblatt, February, 1914, p. 132.

Indicators of Site

In an address on Soil Cover and Humus, Prof. Helbig made the following observations on the significance of grasses and mosses in judging sites:

Succulent grasses (meadow grasses, Poa, etc.) indicate better soils in healthy, normal condition; broadleaf half-grasses (Scirpus, Juncus) prefer moist places; pasture grasses (Aira) are inhabitants of raw humus layers and indicate soil conditions inimical to tree growth.

Branch mosses (Hypnum) indicate healthy soil conditions; clinging to haircap mosses (such as Polytrichaceae and Dicranaceae) indicate the beginning of soil compacting; Gray mosses (*Leucobryum glaucum*) seriously suggest the beginning of dry turf formation; White mosses or peat mosses (Sphagnaceae) indicate dry turf.

Allgemeine Forst- und Jagd Zeitung, June, 1914, p. 214.

American Species in Chile

In an article on White pine, Albert comes to the conclusion that comparing it with *Pinus excelsa* of the Himalayas, producing a wood of equal quality, the latter is more readily cultivated in the central and south central portions of Chile and in higher altitudes. Only in better soils and climates is the rate of growth of *Pinus strobus* superior. Hence it should only be planted in the better sites.

Taxodium distichum the same author compares with *Eucalyptus robusta,* which equals it in durability, and advises its planting in the climates where the Eucalyptus is ruled out an account of frost down to 8° C.

The cultivation of hickory is recommended, *H. glabra* on less fertile and drier soils than will support *ovata. H. alba* may be planted on still drier soil, but is there of slow growth, while *H. laciniosa* is pronounced too exigent.

Boletin des Bosques, Pesca i Caza, February, March, 1914, pp. 428-437 463-466.

SILVICULTURE, PROTECTION AND EXTENSION

Alder as Soil Cover

In a discussion on the recuperation of a torrential correction in the canton Tessin, the praise of the White alder (*Alnus incana*) is sung by Aubert, as adapted to all soils, even the poorest, without humus, although it prefers lime and loose clay soils and good water supply. Especially on the coarse gravelly and sandy overflow soils, the alder has exceeded all expectations.

The planting was done with 1- to 2-year transplants, cut back to 12 inches, set in ditches dug in the gravel 6 to 10 feet apart, filled with sand at 20 inch spacing. In two years the plants will have reached a height of 3 to 6 feet and produce the desired mechanical influence in retarding the waterflow and binding the soil, accumulating silt.

Some 400 acres have been planted in this way during the last 15 years; not more than 20 to 30 per cent of the plants being lost as against 40 to 50 per cent when planted at wider spacing, and due to the frugality of the species the plantations are astonishing. The development of mycorhiza is specially prominent in this poor soil.

This alder, to be sure, can only be used for coppice growth, but as first cover and nurse for more valuable species to replace it, it has proved invaluable.

As soon as 4 to 8 inches of silt has accumulated, prolific root formation takes place and the soil accumulation from overflow increases in a few years to 20 and 40 inch depth.

Weisserle und Tessinkorrektion. Schweizerische Zeitschrift für Forstwesen, December, 1914, pp. 307-314.

Growth Rate and Branch Form in Spruce

Some years ago Nils Sylven found that in the same stand Norway spruce developed side by side different branch systems, of which he recognized five, and suggested that these forms differed also in silvicultural characteristics due to the difference in light condition which the different forms enjoy, the exposure of the foliage varying. Now by a careful investigation on over 3,500 spruces he has established the fact that the rate of growth and hence the volumes, vary in these different forms.

He recognizes five branching types; namely, (*a*) the pure comb type with regular long pendulous side branchlets looking like the teeth of a comb; (*b*) the irregular comb type with shorter, irregular yet comb-like side branchlets; (*c*) the band or ribbon type with short flat branched main branches, ribbon-like; (*d*) the broad flat (Platten) type with spread out ramifications; (*e*) the brush type with close short ramifications, especially of the upper branches giving a brush-like appearance.

Even-aged, contiguous, uniform stands were selected for measurement. As a rule, the brush type was in great majority, next came the regular comb type, while the irregular comb type was in decided minority, and the other two types also less prominent. A comparison of the results shows the comb type decidedly ahead of all other types in diameter, height and volume.

The greatest diameter difference between this and the brush type was nearly 13 per cent, or almost 2 inches, down to 4 per cent. The average height was found to range between 10 per cent (2.1 inches) and 2.9 per cent (.7 meter) in favor of the comb type; the volume between 9.5 and 39.4 per cent ahead of the brush type. The difference is so great that any errors cannot change the relation much.

Comparing brush, band and flat types, it is found that the first in general are more vigorous growers than the other two types.

The author finds that age has nothing to do with the percentic distribution of the various types; nor does the density of the stand shift the difference, nor the soil. The branch habit is racial and is heritable. The better development of the comb type also finds expression in the greater number of this type in the forest, mostly over 40 per cent.

The author also observes that this type is most resistant to snow pressure and to fungous disease.

This investigation is another important step toward distinguishing racial differences and making selection of seed material.

A very full tabulation, pictures and diagrams accompany the article.

Om kubikmassa och form has granar av olika förgreningstyp. Meddelanden från Statens Skogsförsöksanstalt, vol. 11, 1914, pp. 9-60.

Derivation of Seed

Additional data to the discussion on the question of the derivation of seed supply are brought by Gunnar Schotte, of the Swedish Experiment Station, as a result of trial plantings made in 1904 with pine seed from various parts of Sweden. The experiments were first reported in 1911 (briefed in F. Q., vol. IX, pp. 488 and 626). The present measurements refer to the fall of 1914 to 11 years after sowing.

No influence of the age of the mother trees from which the seed was derived on the height is noticeable in the 11-year plants, although originally the plants from older trees appeared to be weaker. But the plants from Norrland remain shorter than those from more southern localities, the difference being nearly one foot on the average, and even up to 28 inches.

There are also other differences; the whole habitus of the northern plants is more slender with shorter and fewer branches, and shorter needles, while the southern approaches a shrub-like aspect and not quite as straight boles. Tabulated measurements show the detail. The persistency of needles on the shoots for several years seems, however, to depend on the climate in which the plant grows, the original difference observed in the younger trees having worn away. But the earlier and more thorough yellowing of the needles in the pines of northern and alpine derivation is striking.

Another trial seeding was made with seed derived from Germany. The latter produced considerably more height growth, nearly double that of the Norrland pines, and also double the diameters. Also the general habitus differs. The variation curves bring out these differences between the three sets strikingly. This difference of stronger development is pointed out as important in reforesting heaths and weedy places.

Tallplantor av frö från olika hemort. Meddelanden från Statens Skogsförsöksanstalt Skogsvardsförenigens Tidskrift, 1914, pp. 61-107.

Seed Supply

Having recognized that the derivation of seed from certain climatic localities is undesirable in certain other climatic localities on account of inherited characteristics, the German authorities laid an embargo on pine seed imported from outside Germany. The impropriety of this ruling is being shown up by Schultze and Pfeil.

Within Germany itself "the climatic conditions are as 'particularistic' as the Germans themselves," so that seeds from the mild climate of southwestern Germany would be objectionable in Eastern Prussia. As a result of the exclusion of imported seed the yearly requirement of 200,000 to 300,000 pounds cannot be met, since the necessary labor for collecting cannot be had. And this condition has increased prices—$5 per pound—beyond expectation. Belgian and Russian seed has been found acceptable and, therefore, no reason for keeping it out exists. The exclusion was ordered only on account of the fear that other seed might find their way into the country by way of these countries. It is suggested that "every reliable seed-dealer will guarantee for five years the derivation of the seed, when the plants permit a judgment of the derivation."

Similar conditions in the spruce seed supply exist. A change in the method of procedure is most necessary.

Weshalb ist der Kiefernsamenjetzt so teuer? Naturwissenschaftliches Zeitschrift für Forst- und Landwirtschaft, July, 1914, pp. 368-374.

Thinning Douglas Fir

This is a report of experiments in progress from 1905 to 1910 in thinning a stand of Douglas fir in the district of Aurach (Gmunden). Three sample plots were thinned, one lightly in the upper story, the second moderately in the lower story, and the third severely in the lower story. Measurements were made annually. The absolute growth in section and volume was nearly the same during the five years, though the relative growth was naturally greatest on the third plot.

In 1910, the average increment per class according to age, that is, when the plantation was 23 years old, was 137 cubic feet per acre for the first plot, 171 for the second and 150 for the third.

The writer considers Douglas fir a good tree for spruce soils, and suggests that, starting with rather dense plantations, 1,800 to 2,000 trees per acre, thinning should be practised, especially in the upper story, leaving the underwood.

S. J. R.

Ein Durchforstungsversuch in Douglas-Tanne (Pseudotsuga Douglasii Carr). Mitteilungen aus dem forstlichen Versuchswesen Österreichs, 1914, XXXVIII Heft, S, 9-34.

Effect of Grazing

Zederbauer of the Austrian Experiment Station reports on the behavior of plantations with and without exclusion of cattle.

The results show that: (1) "spruce plantations enclosed or with supports made a stronger growth than those without this protection; (2) enclosed spruce plantations at 10 to 20 years contained about two-thirds

(61-63%) of the original plants, whilst plantations without enclosure had only 12 to 45 per cent; (3) 20-year plantations of spruces protected by supports contain 38 to 71 per cent of the original trees, as against 3 to 13 per cent in plantations without supports; (4) 16-year stands of untransplanted spruces are less resistant to the movements of live stock than those of transplanted trees, while the differences in height are very slight; (5) the expenditure incurred in enclosing or providing supports appears to be justifiable from a forestry as well as financial point of view. Protection by means of supports is also an advantage to pasturage."

Mitteilungen aus dem forstlichen Versuchswesen Österreichs, 1914, pp. 78-83.

White Pine Blister Rust

Dr. Tubeuf and Eckley Lechmere furnish additional notes to the life history of the blister rust. Lechmere confined himself to the study of the parasite of the rust, *Tuberculina maxima*, which it was hoped might be effective in subduing the rust, but this hope does not seem to have been fulfilled. The parasite follows the development of the rust and comes too late.

Tubeuf discusses the theories of the origin of the pest, which had been unknown in its native habitat. It seems that most of the Strobus section of pines are attacked by the rust, but that *P. cembra,* which may be the original carrier of the parasite, is more resistant than the exotics, which did not need to protect themselves against its attacks. Neger explains this partial immunity of the native *cembra* in the development of an "antitoxin"; Tubeuf considers it due to difference of "disposition." A suggested physical condition is that *P. strobus* forms long, tender summer shoots without hairs, while *P. cembra* forms short shoots covered with woolly hairs and hidden in the needles. Difference in rate of growth, in density of bark, in water requirements may also help to explain the difference.

Neuere Versuche und Beobachtungen über den Blasenrost der Weymouthskiefer Tuberculina maxima, Rost. Ein Parasit auf dem Blasenrost der Weymouthskiefer.

Naturwissenschaftliche Zeitschrift für Forst- und Landwirtschaft, September-October, 1914, pp. 484-493.

Budget Regulation and Silviculture

Budget regulation fails as a rule to adjust the felling budget to silvicultural requirements. It is conceived for a clearing and planting system with a definite predetermined year for the fellings—the normal felling age or rotation—the budget being based upon the yield of that year, and the allotment of stands (the oldest) for the felling budget being confined to a short period, say ten years.

If, as the author, Forstmeister Klumm, maintains, a really sustained yield management, with proper safe guarding of the soil, can be secured only by means of natural regeneration, then the adjustment of the budget regulation must be made with reference to the regeneration period, the requirement that fellings be made only when the stand has reached the age of the rotation must be abandoned; and the budget calculation and allotment must be extended to the entire regeneration period. Natural regeneration is gradual, requires time, its progress is slow and only when the regeneration is safely established can the final cut be made. The regard for the needs of the regeneration requires that younger stands than those of the rotation, whose increment has not yet reached that of the normal felling age, must be brought into the budget calculation and some of the ripe stands must, for a time (until the young crop permits their final removal), be left unused, which then have surpassed the age of best increment: to secure the same budget different-sized areas according to the age of the stands will have to be cut over: the whole budget calculation has become futile. These difficulties, present even under normal progress of regeneration, are aggravated if regeneration does not proceed favorably, and the whole scheme of management gets into trouble.

To overcome this trouble, brought about by having the budget calculation based upon the age of the rotation, the author proposes the following plan.

The budget is to be calculated not upon the one term of the rotation, but on several terms. To this end first the needful regeneration period must be determined (by experience and judgment), and this period also represents the time from the beginning of the utilization of the stands to the time when they reach the age of the rotation. Rotation means then the end of the regeneration period, and at the same time of utilization of the stand. The regeneration period, which then is also the utilization period of the stand, may be divided into "management periods," which are best made equal in length to the age periods and to the usual revision period.

For instance, with a rotation of 120 years in age periods of 10 years and a regeneration period of 30 years, this would be divided into three management periods. The budget calculation would then be based upon the I management period (which is the same as the tenth age period, 91-100 years), instead of the age of the rotation.

The expected yield of each of the stands of the regeneration period is then calculated for and in the working plan allotted to the management periods; and there are added the corresponding increments for the later periods, a 10-year addition to the II period, a 20-year increment addition to the III period. Thus, for each of the last three age periods the normal sustained yield and proper felling budget is determined. In this way when stands reach the tenth age period they begin to be utilizable with a budget only figured for that period. When the stands reach the 101-110 age period they are utilizable to the extent of a different yield portion, namely shortened by that used in the first ten years; and so in entering the third period again the budget for 111-120 year period is utilizable less the portions cut in the two preceding periods.

For the utilization of the portions utilizable in each period, of course, the stands of all three periods are available, the three sets of stands being under operation at the same time, and affording freedom of movement with regard to the needs of regeneration.

The author adds a plea for a rational management ledger and management map, in which are recorded in detail the operations in the woods, and gives hints how to do it.

Wie kann die forstliche Ertragsberechnung zur Ermöglichung der Anpassung der Etatsnutzungen an die waldbaulichen Erfordernisse gestaltet werden? Allgemeine Forst- und Jagdzeitung, May, 1914, pp. 153-159.

MENSURATION, FINANCE AND MANAGEMENT

Selection Forest Management

Since the beginnings of forestry, there has been a fundamental difference in selection forest between regulated and unregulated management. Unregulated management consists in the cutting of those trees which happened to suit the needs of the owner. Regulated selection forest demands a careful choice of individuals, depending on their mutual relation and seeks a continuous betterment of the stand, with a corresponding increase in volume and value.

Many of the more artificial concepts of even-aged stands can be discarded in the organization of selection forest. The essentials are: 1. Complete stocking with suitable species. 2. A proper inter-relation of the diameter classes. 3. A complete estimate as basis of determining the allowed cut. 4. Suitable division of the forest. 5. The establishment of a well-developed system of roads.

The working plan itself may be kept very simple, chief stress being laid on proper silviculture. In general the preparation of a working plan is the same in selection as in even-aged forests. There are, of course, no cutting series.[1]

In place of age-classes one forms in selection forests, size (diameter) classes. These are not distinct by area but occur singly or groupwise. The limits of each size class are determined according to local exigencies. The size classes serve as the basis of the estimates, and are a guide in silvicultural operations. A correct relation of the size classes does not in itself constitute a normal condition of selection forest, but merely contributes to it. The development of the individual tree is of prime importance.

In close connection with the relation of the size classes is the volume of growing stock, thus growing stock gives one an index of the size class relation as well as serving to determine the increment and the allowed cut.

Since growing stock is the only factor which can be accurately and directly measured in selection forest, it stands to reason that the estimates must be made with great thoroughness. These will give the actual growing stock. The normal growing stock cannot be determined for the selection forest by either of the customary

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[1] These are, however, recommended and attainable by periodically returning to the same area, distributing the age classes systematically.—Ed.

methods. Nevertheless it is essential to determine for each stand whether the actual growing stock should be increased or diminished.[2] In practice one can best judge of the normal growing stock by comparison with the actual on the basis of the condition of the stand and by comparison with other stands similarly situated.

Unfortunately, age of the trees does not furnish a basis of regulation in selection forest. Trees of the same diameter vary greatly in age. All attempts to use average age bring artificial results. In selection forest one must get along also without a definite rotation age. The condition of the individual tree governs its time of cutting.

Since uniform age classes are lacking, that is, since individual stands do not belong to a definite age class one does not need a yield table in the usual sense. The ordinary yield table bases on age of stands. But what can be used in place of age in a yield table for selection forest? Only empirical tables which give the estimate of certain selection stands and show the size classes, the growing stock, the current annual increment and the actual volume secured in cutting.

Since the average age of a well regulated selection forest remains practically the same, it stands to reason that the current annual increment and the mean annual increment are the same. Two ways are possible of determining the current annual increment.

1. By periodic remeasurement of the stand with identical methods. (For example see F. Q. XIII, pp. 60-63.)

2. By measurement of sample trees as average of the stand.

The former method is that of the Méthode du Contrôle and depends for its accuracy upon the accuracy of measurement. The latter is too well known to require comment.

The determination of cut in selection forest must depend on volume alone, that is, on the growing stock and the increment which have been determined separately and hence check each other. Such methods are:

1. Divide the volume of the oldest size classes by the annual increment of the entire stand. This will give the number of years

[2] The author of the Méthode du Contrôle has empirically determined an average growing stock of 350 cubic metres per hectar (5,000 cubic feet per acre). See F. Q., XIII, pp. 43-46.

during which the volume of the oldest size classes must last. If this be forty-five (45) years then the cut for the next decade would be from one-fifth to one-quarter of the volume of the largest size classes.

2. Hufnagl's method by volume based on diameter classes.[3]

3. Based on increment by Heyer's formula.[4] The period of distribution should be determined according to local conditions.

Future revisions of the working plan and remeasurements of the crop will serve to indicate what modifications must be made. In any case the cut should be handled conservatively. After all, an exact determination of the allowed annual cut is not essential. What is wanted is a reliable guide thereto. As already stated, the determination of the cut becomes more accurate with each revision of the working plan. A. B. R.

Die Betriebsordnung im Plenterwald. Schweizerische Zeitschrift für Forstwesen, August to November incl., 1913, pp. 234-238, 265-272, 307-313, and 339-346.

New Light on Budget Regulation

In a very clearly written essay Gascard throws new light on some phases of budget regulation by formula methods, with special reference to the most rational of all methods, Heyer's.

Fundamental to determining a felling budget is the determination of the desirable average felling age (rotation). All other factors which influence the budget are functions of this factor and of the area of the forest.

In the area allotment method the mere division of the total area by the rotation effected "in a brutal and radical manner" the normal ageclass distribution, sacrificing the interests of the present. With the formula methods came a realization that it may be desirable to cut over the area in a shorter time than the rotation, especially with abnormal ageclass conditions; instead of $\frac{A}{r}$ the annual felling area would be $\frac{A}{e}$. If the ageclass conditions are normal, then $e=r$, and if a forest is composed of all mature or near mature stands, this e must be at least equal to the natural regeneration period (if managed under natural regeneration).

[3] See Method 12, Var. II, pp. 75-78, "Theory and Practice of Working Plans," John Wiley and Sons, N. Y., 1913.

[4] Ibid, pp. 63-65.

Otherwise, if the mature stands are deficient and other stands too young have to be used in eking out a budget, there is no necessity of determining a rotation, during which the forest is to be cut over. Then, only the regeneration period of the mature stands is to be determined, and budget regulation for the whole can be deferred until the younger stands are advanced enough to make a systematic cutting over possible, when a mere ageclass table may suffice to determine sufficiently closely the rotation by trial.

If F is the total area, f_1, f_2, f_3 the areas of different ageclasses, then an assumed cutting over period r determines the cutting over periods (or ageclass rotations) of the different ageclasses (c_1, c_2, c_3, . . .) by the relation $\frac{F}{r}=\frac{f_1}{c_1}=\frac{f_2}{c_2}$, or in general, $c=\frac{rf}{F}$. Then if a_1, a_2, a_3, . . . are the average ages of the ageclasses, beginning with the oldest, the average felling ages will be $a_1+\frac{c_1}{2}$; $a_2+\frac{c_2}{2}+c_1$; $a_3+\frac{c_3}{2}+c_2+c_1$; etc. And, when the whole is cut over the ages of the new ageclass series will be

$$a_1=\frac{c_1}{2}+c_2+c_3+ \;. \;. \;. \;; \quad a_2=\frac{c_2}{2}+c_3+ \;. \;. \;.\;; \quad a_3=\frac{c_3}{2}+ \;. \;. \;. \;; \text{ etc.}$$

By comparing the probable felling age of the stands with the new ageclasses, a judgment can be had as to the desirable r or cutting-over period.

This is made clear by the following example, assuming a 100-acre stand with three ageclasses of 80, 60 and 11 years average, and trying three rotations of 60, 80, 100 years.

		Ageclass Rotation (c)			*Average Felling Age (a)*			*Final Ageclass Age*		
		Under Assumed Rotation								
Areas	*Age*	60	80	100	60	80	100	60	80	100
20	80	12	16	20	86	88	90	54	72	90
40	60	24	32	40	84	92	100	36	48	60
40	11	24	32	40	59	75	91	12	16	20

This shows that for a rotation of 60 years the felling ages are only partially acceptable. The third class would have to be cut at 59 years, and after the forest is cut over, the oldest ageclass would only average 54 years. The relations are better for 80 and best for 100 years, so that 90 to 100 years would be the most acceptable rotation for the whole forest, although, if an equalization of volumes is also desired, the periods of utilization of the different ageclasses may change.

In the better formula methods, which have in view an attempt to secure the normal stock in shorter or longer time, the question is how to determine rationally this period of equalization (e). Hundeshagen's formula, which is faulty in its original conception, is also impractical because it gives no idea of this time element. Heyer's formula is the best; only the cumbersome volume determination is objectionable. This, the author tries to simplify and at the same time to give points of view for determining the length of the equalization period. This last should rest on factors which have permanent significance and principles behind them, just as the rotation. The equalization of the normal and actual stock must be made within a period which permits holding on to the determined rotation, for there is only *one* most favorable cutting over time. Hence, the relation of rotation to equalization period must be considered.

The difference of the stocks S_a–S_n can be expressed in terms of the actual increment I_a, namely nI_a; then Heyer's formula for the budget (b) becomes $b = I_a \pm \frac{nI_a}{e} = I_a(1 \pm \frac{n}{e})$. If the actual stock is larger than normal the budget is $I_a(1 + \frac{n}{e})$; its utilization reduces the stock as much as will be equalized by the increment during the period e; annually the stock decreases by $I_a(1 + \frac{n}{e}) - I_a = I_a \times \frac{n}{e}$. The negative expression denotes the opposite effect.

During the rotation the stands grow before their utilization an addition of $\frac{r}{2}I_a$. In order to be able to hold to the determined r with a given equalization period e the following condition must obtain:

$$r = \frac{S_a + \frac{r}{2}I_a}{I_a(1 \pm \frac{n}{e})}, \text{ from which } \quad e = \mp \frac{rI_a n}{\frac{r}{2}I_a - S_a}$$

when the negative expression refers to excess, the positive to deficiency of stock. To a given rotation and with a known stock difference, the rational equalization period can be determined.

As regards the figuring of the normal stock, the author quotes Heyer's conception, commending it: "For purposes of budget determination it is more nearly correct to base the normal stock not on the normal but on the actual felling age increment, whereby the difference between S_a and S_n is reduced to an unequal sum of age units." And he adds: "It is not the function of budget regulation to increase the increment of open and poorly stocked stands but that of silviculture. By assuming a certain yield capacity and reducing the budget to correspond, poorly stocked stands do not become closer; but the danger is invited of delaying the removal of the poor stands or of accumulating over mature stands: the introduction of the yield capacity (normal increment) in budget determination should be abandoned."

Having determined the felling budget in general on the basis of the rotation, it should hold in general for the next two or three decades, and the author prefers three because variations in conditions of stands, market and needs of owner are more easily balanced in the longer time. Silvicultural considerations may make it desirable to distribute the budget unevenly over the decades. Altogether, the mathematical sanction of the budget and formula determination, as Heyer pointed out, is to serve only as a general guide.

The above example is then extended under the assumption that the manager has chosen $r=80$, and wants to change to 100. The annual felling area becomes $\frac{100}{80}=1.25$ acres; the S_a figures up 350,000 cubic feet; the S_n for 100-year rotation figures by formula $\frac{r}{2}I_n$ to 420,000; the I_a based on the average felling ages as in the above table sums up to 8,000 cubic feet. Placing these values in Heyer's formula

$$b=8000+\frac{350{,}000-420{,}000}{e}=8000-\frac{70000}{e}.$$

To determine e, we have the equation

$$e=\frac{rnI_a}{\frac{r}{2}I_a-S_a}=\frac{80\times 70000}{40\times 8000-350000}=-187$$

This shows that the 80-year rotation is not adapted to securing the S_n; we would overcut the I_a and increase the stock difference.

If, instead, 100 years is chosen, S_a and S_n remain the same as above, I_a with changed felling ages should change. It amounts to 8400 feet, the formula now becomes

$$e=\frac{100\times 70000}{50\times 8400-350000}=100=\text{positive.}$$

Hence $b=8400-\frac{70000}{100}=7700$ cubic feet. If now we examine the average age which the stands will have after 100 years, it will be found that this age distribution corresponds to the normal stock.

Beitrag zu den Fragen der Ertragsregelung mit besonderer Berücksichtigung des schlagweisen Hochwaldbetriebes. Schweizerische Zeitschrift für Forstwesen, January–February, 1915, pp. 13–24.

UTILIZATION, MARKET AND TECHNOLOGY

Home Creosoting

This paper gives the results of experiments with saponified creosote and naphthalene by the open tank (soaking) method. The experiments were conducted mainly to determine whether the process of preservative treatment of timber by creosoting as now practised on estates could be modified and cheapened without loss of efficiency.

"It has been observed that treated timber used as fence posts, absorbing a relatively small quantity of creosote, has been proved after a quarter of a century's trial to possess lasting qualities, *if the preservative has been carried well through the timber.* This suggests that in the quantities absorbable by various timbers there may be a suitable *maximum* beyond which it is unnecessary to go, and also a *minimum* quantity below which it is not wise to go, if the desired lasting qualities are to be obtained."

For the purpose of controlling the amount of creosote used in any case, the oil was saponified by the addition of a very small proportion (¼ per cent or less) of caustic soda. This saponified creosote can be diluted to any desired extent by the addition of water. This results in improved penetration of the preservative into the timber, particularly in the case of refractory woods.

"For the treatment of estate timber by the simple open tank method, saponified diluted creosote may be claimed as a cheap effective substitute for the 'Rueping' process of professional creosoters. Average creosote may be diluted to half its full strength with good results."

It is claimed that naphthalene has been used with good results for at least twenty years, that it penetrates the timber readily, can be used with green timber quite as effectively as with air-dried, that it appears to evaporate very slowly, and, unlike creosote, gives the timber a nice color and does not make it disagreeable to handle. On the other hand, it was found that at present prices the process is not less costly than cresoting.

S. J. R.

Preservative Treatment of Timber for Estate Purposes. Quarterly Journal of Forestry, vol. VIII, pp. 169-186.

Creosoted Wood Block Pavements

Based upon experience in Hamilton, Ont., and other cities, Macallum furnishes an article on the proper method of laying creosoted wood blocks.

The first cost of wood block pavement is undoubtedly higher than that of most other paving materials, averaging in Hamilton from $2.85 to $3.00 per square yard, exclusive of grading. But, when its cheapness of maintenance, ease of cleaning, low tractive resistance and durability are taken into consideration, this pavement will compare favorably and prove ultimately cheaper than one lower in first cost.

Creosoted Wood Block Pavements. The Canadian Engineer, April 15, 1915, pp. 456-457.

Preservative Treatment of Wooden Silos

The amount of lumber used annually in silo construction is estimated to be 100,000,000 board feet. As this is all high grade material, its preservative treatment is important. Coaltar creosote is recommended, and no appreciable contamination of silage by contact with creosoted staves has been noted. It is important to air-season the staves thoroughly after treatment.

American Lumberman, March 13, 1915.

Weakening Effect of Drying Wood

This article embodies a summary of results of different methods of drying on the strength of wood. Over 2,000 mechanical tests were made on carefully selected and matched specimens of White ash, Red oak, and Loblolly pine, and 37 drying processes were employed.

"Two general effects were noted: (1) that all processes used in this research reduced the strength of the wood, when it was resoaked and compared with the untreated green-soaked standard; and (2) that the hygroscopicity was reduced by most of the treatments and the color darkened, particularly in the higher temperature treatments."

Four tables of results are given, which reveal some very significant comparisons. The weakening effect of steaming at high temperature or for too long is clearly shown. The subjecting of wood to high temperatures increased its brittleness when subjected to impact.

S. J. R.

The Effect of Different Methods of Drying on the Strength of Wood. Lumber World Review, April 15, 1915, pp. 19-20.

Manufacture of Charcoal

This article describes the method of charcoal burning followed in the Forest of Dean, which is fairly typical of the practice of English charcoal-burners. The usual size of kiln is 7 feet high, 18 feet in diameter, giving a capacity of about 8½ cords. (A cord equals 128 (piled) cubic feet, or about 64 cubic feet solid of cordwood.) The weight of charcoal produced from oak has been found to be approximately 20 per cent of the weight of the wood used.

The burning is usually given on contract at from 18 to 25*s.* per ton. The cost of the wood at the kiln is 5*s.* per cord, so that to the sum paid for labor about 15*s.* per ton of charcoal may be added for the value of the wood. Besides labor, the only other considerable items of expense are sacks for packing (40 to the ton, but used several times), and cartage.

Under normal conditions charcoal in large consignments sells at from £2 to £2 10*s.* per ton on rail, while for small quantities (say 2 or 3 tons), such as are used for drying hops in the south of England, as much as £4 per ton may be obtained. At the present time, owing to the war, prices are higher, and large quantities are being sold at from £3 10*s*. to £4 per ton on rail.

S. J. R.

The Journal of the Board of Agriculture. February 25, 1915, pp. 1032-1037.

STATISTICS AND HISTORY

Wood Movements in Germany

Dr. Wimmer reports that in 1910, 21 per cent of the wood movement (5.2 million tons) was on the interior waterways, of which there are about 10,000 miles; railroads (36,000 miles) transported 19.2 million tons. The water transportation represents 44 per cent of inland traffic, 55 per cent of import and only 1 per cent export, while the railroads handled 83 per cent as inland traffic, 13 per cent of import and 4 per cent of export of wood. While of the water traffic 30 per cent was logs, 22 per cent mill product, 40 per cent paper pulp and pulpwood, 8 per cent mine timber; the railroad traffic handled 23 per cent in logs, 38 in mill product, 39 per cent of the other materials. The main centers of consumption are Saxony, the Rhenish provinces of Prussia and Berlin. Bavaria is an export country with 1 million tons, so is Württemberg. On the other hand, Baden and Alsace-Lorraine had to import. The great lumber market of this region is Mannheim, but lately Karlsruhe and Kehl are running strong competition.

Germany imports annually over 5 million tons, of which 49 per cent on waterways, 27 per cent by sea, 24 per cent by rail. Austria furnishes 29 per cent, Russia and Finland 54 per cent, Sweden 7 per cent and America 6 per cent. Exports comprise only 350,000 tons (outside of manufactures), mainly from East Prussia to Great Britain and lumber to Switzerland.

Allgemeine Forst- und Jagdzeitung, June, 1914, p. 215.

Bavarian Statistics

In 1908, a great commotion was made in the legislative assembly of Bavaria, charging that old stock was allowed by the forest administration to accumulate in the woods, the felling budgets being too low (see F.Q., vol. VII, pp. 91 ff.). A commission of experts was instituted to ascertain the correctness of the claim and the amount of surplus. At the same time before the findings of the committee the cut was increased from 58 cubic feet in 1907 to 80 cubic feet per acre in 1912, which brings it near the yields of Baden and Württemberg. The commission eventually ascertained that the permissible budget is about one half what had been claimed in the assembly, and the leaving of which was stated by Dr. Endres as representing a quarter million dollars loss annually. The new budget, to be sure, in part represents reduction of old stock, and may not be taken as continuously possible.

The 2.3 million acres of State forest now furnish over 170 million cubic feet (54% workwood), netting 13 million dollars; the average gross yield per cubic foot of workwood being about 12 cents, for cordwood a little over 4 cents, and 8.5 cents on the average for all wood, the harvest cost (1¼ cents per cubic foot) making the net result 7.25 cents, or around $6.50 per acre. Minor incomes and the cost of administration bring the total net result to $3.38.

The overhead charges for personnel are 95 cents per acre, of which about 9 per cent for the central bureaus. Cultures and roadbuilding participate in the expenses at nearly equal rates, namely with 21 and 20 cents per acre each.

The average earnings of woodchoppers vary between 60 cents and $1.00 in different regions.

The communal forests with around one million acres produce only 55 cubic feet per acre.

Bavaria, with .89 acres per head, being 60 per cent more heavily forested than the German average, is still an export country. Cutting 50 cubic feet per capita as against 24 cubic feet for Germany on the average, and consuming only 36 cubic feet, Bavaria exports between 80 and 90 million cubic feet to other German States and to Switzerland. Only Württemberg is in a similar position.

Aus Bayern. Schweizerische Zeitschrift für Forstwesen, January-February 1915, pp. 37-40.

Austrian Statistics

Total forest area of Austria, 24,420,000 acres; State forest, 1,750,000; Fonds forest under State administration, 825,000; municipal, institutional and other public forests, 5,000,000; private forest entailed 2,640,000; other private forest, 14,000,000 acres. In 1910, a decrease of the forest area by 17,400 acres for farm and other purposes was almost fully made up by planting of waste lands. Conifer forest represents about 60 per cent, broadleaf 20 per cent, and mixed forest another 20 per cent. Very nearly 60 per cent is high forest., 27 per cent selection forest, the rest coppice and composite. In the high forest the yield per acre (increment) was only 45.7 cubic feet, of which 58 per cent was workwood; the lower yield of coppice (33 cubic feet) reduces the total increment to 44.3 cubic feet.

Besides the 8,400,000,000 cubic feet of wood (with 53% workwood), the forests furnished 1,300 hundred weight of oak bark and 75,800 hundred weight of spruce bark; 1,244,000 hundred weight of litter, over 4 million pounds of rosin and turpentine, and 10,000 pounds of seed.

Fire destroyed 900 acres of old stands and 1,150 acres cultures; some 90,000 acres suffered from insect pests, and 250,000 acres from wind and snow.

The chase alone occupies some 40,000 professional hunters. Over 130,000 pieces of "high game," some 2 million hares and rabbits, more than 1.7 million game birds represent the game bag.

Statistisches Jahrbuch des K. K. Ackerbau-Ministeriums für das Jahr 1910. Allgemeine Forst- und Jagdzeitung, May, 1914, pp. 167-168.

Forests of Switzerland

Amplifying the data brought together by the committee on the status of Swiss forests, of which Prof. Decoppet is chairman (see F. Q. XII, p. 286 ff.), the following statistics are taken from the committee's report.

Of the productive area of Switzerland 30 per cent is covered with forests and three-fourths of these are productive forests. Four and one-half per cent are controlled by the State, 68 per cent belong to communes, and 27 1-2 per cent are in private control.

On account of the heavy precipitation and the favorable climate the growth is rapid. Furthermore the diversity in soils and range in elevation give a variety of species. However, only 30 per cent of the forests are deciduous. In order to obtain their maximum value 90 per cent of the forests are handled as high forests. The present tendency is toward mixed stands, since the former practice of clear cutting and artificial regeneration of pure stands has not always led to good results. The canton is the administrative unit and for 52 per cent of the public forest definite working plans have been prepared. Preliminiary plans are in force on 18 per cent and for the remaining 30 per cent of the public forests no plans have yet been prepared.

Educational instruction and research are centralized at the forest academy of Zurich. Here the higher officers spend three and a half years in study followed by one and one-half years of field practice. For the rangers there is an eight weeks field course.

The present forest legislation dates back to the floods of 1868, although final action was not taken until 1876. In 1902 the law was extended so as to apply to the low country as well as the high mountains. A general inspector with four assistants has general control of the local canton administration. Supervisors receive from $600 to $800 per annum generally, although in some cases the salaries run up to $1,700. There is no pension system.

Since 1872, $2,400,000 has been spent on reforesting and $50,400,000 on stream control. Much remains to be done.

At present the imports far exceed the exports, but better management will go a long way toward making the country self sustaining as far as timber is concerned. More roads are needed and more intensive marketing should be practised. The forests are a very important part of the country's economics, useful alike to the capitalist and laboring man as well as having large hygienic and esthetic value. K. W. W.

Die Förstlichen Verhältnisse der Schweiz. Forstliches Centralblatt, November, 1914, pp. 594-599.

Forests of Alsace-Lorraine

Adding to the statements, briefed in F. Q. XII, p. 119, the following data on the forest of Alsace-Lorraine may be of interest. As regards ownership the acreage is divided into State forests, 38,000 acres; Communal forests, 489,000 acres; institutional forests, 6,000 acres; private forests, 214,000 acres.

The yield per acre per annum was highest on the communal forests, exceeding the State forests by 11 cubic feet per acre. The average yield of the latter was 62 cubic feet. The timber wood per cent was slightly higher on the State Forests, although both were about 40 per cent.

Prices for 1912 were somewhat depressed. The average for all classes of material in the State forests was $17.00 per thousand.

The average cost of administration for the forests under management was 1 1-2 cents per acre.

K. W. W.

Beiträge zur Forststatistik in Elsass-Lothringen. Forstliches Centralblatt, November, 1914, pp. 601-602.

Statistics French Forests.

A summary gives the following acreage for French forests for 1908:

	Hectares.
Federal	1,194,439
Communes and public establishments	1,948,632
Private, etc.	6,738,630
Total	9,881,701

This means that 18.06 per cent of France is forested, while the average for the whole of Europe reaches 30.06 per cent. It is interesting to note that there are only nine departments in France where the forested surface exceeds the average per centage for Europe. These departments are: Landes, Var, Gironde, Vosges, Ariege, Belfort, Jura, Haute-Saone, Haute-Marne.

T. S. W., Jr.

Société Forestière de Franche-Comté et Belfort, December, 1913, pp. 272-273.

MISCELLANEOUS

Veteran Retired

With the end of the year 1914, Dr. Ulrich Meister, the well-known manager of the celebrated Sihlwald (the forest of the city of Zurich) for almost 40 years, retired. He studied in Zurich and Giessen, and when in 1875 he assumed the management in the Sihlwald—a forest under good management since 1680—a new survey and working plan was begun. The historical development of this interesting forest during over 250 years was the subject of Meister's contribution to forestry literature, published in 1883 and 1903.

Schweizerische Zeitschrift, December, 1914, pp. 336-8.

OTHER PERIODICAL LITERATURE

Pulp and Paper Magazine of Canada, XIII, 1915,—

America's Pulp and Paper School. Pp. 167–171.
Description of the new course at the University of Maine.

Conservation Commission Annual Meeting. Pp. 72–86.
Gives the leading addresses relating to forestry.

The Inventor of Ground Wood. Pp. 94–96.

Quarterly Journal of Forestry, IX, 1915,—

Forestry in the British Empire. Pp. 95–112.
A review of conditions and progress, replete with statistics.

Monthly Bulletin of Agricultural Intelligence and Plant Diseases, V, 1915,—

The Present Condition of Forestry in Hungary. Pp. 1391–1400.

The Resin Pine (P. massoniana) of Tonking. Pp. 1458–1459.

The Manchurian Timber Industry. Pp. 1459–1460.

The Forests of Chile. Pp. 1535–1541.
Regional distribution of forests, statistics, and discussion of the wood industry.

China's Young Men (English Edition), V, 5, 1915,—

The Need of Forestry in China.

Conserve Life through Reclamation of Waste Lands.

Forestry in the Philippines.

NEWS AND NOTES

In a lecture on *Trees and their Varieties,* Prof. A. Henry, of the forest school at Dublin (whose work in producing new trees by hybridization was briefed in this volume, p. 97), accentuates the theory that species and varieties of one and the same genus are as a rule geographic adaptations, one species being adapted to dry, the other to moist or wet conditions of soil or climate. Sports are solitary phenomena, freaks not forming starting points of a new species and speedily becoming extinct by nature, but possible to propagate by grafts, layers, or cuttings, they are, however, apt to revert to the type. A number of such sports are described, like the one-leaf ash, the fastigiate Irish yew and Lombardy poplar, weeping beeches, elms and spruces, etc.

Hybrids on the other hand, mostly due to man's interference, arise from cross fertilization, and exhibit as a rule exceptional vigor in the first generation, but reproduce a second generation of individuals all different from one another, splitting up into a great number of varieties. Reference is made to a hybrid poplar, *Populus robusta,* which in 14 years attained the height of 45 feet. The lecturer concludes that the creation of first crosses is possibly of great economic importance, for an ash tree salable at 35 years would, if 5 per cent interest is figured, be worth four times as much as one that would attain the same dimensions in 63 years.

An exhibition of the importance of the derivation of seed in the success of plantations was found by the Silviculture class of the Faculty of Forestry, of Toronto University, on their visit to the Provincial nurseries at St. Williams, Ont.

A White pine plantation of several acres, four years old, planted with stock imported from Germany was so severely injured by a June frost in 1912 and again in 1914 that its entire final destruction is to be anticipated. The terrace is rolling sand hills covered with grass sod, the planting was done in furrows. The depressions were undoubtedly frost holes, for the plants on the slopes and tops suffered much less, but even here a striking difference in individuals could be observed, some specimens, having made an unusually vigorous growth and being absolutely unaffected by the frost, standing between the undersized frost-bitten specimens. Undoubtedly a mixed lot of seed had been used to produce the stock.

The chestnut bark disease has become so serious that in the opinion of the United States Department of Agriculture it is desirable to quarantine New England, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, North Carolina, Iowa, and Nebraska, or such portions thereof as may be found to be essential. A public hearing on this question was held in Washington on May 18. The proposed quarantine will restrict the movement from this territory of chestnut nursery stock and chestnut lumber with the bark on.

At the present time the native chestnut grows in practically all of the territory east of the Mississippi except a section of the coastal plain of the Southern States, the northern half of Maine, and parts of Illinois and Michigan. For two years after the tree has been killed by the fungus the timber remains valuable, but deterioration sets in after that time.

The interesting statistics brought out in Mr. Graves' Report of the Forester for 1914, may be briefly stated as follows:

The National Forests were reduced in area by over one million acres, leaving a net area of around 164 million acres. Land classifications within the Forests and boundary re-adjustments, as well as alienations to private ownership, are responsible for the decrease.

Administration and protection cost $4,750,000 and an additional $620,000 was spent on improvements. The receipts amounted to about 50 per cent of the expenditures, and nearly half of these came from grazing and special sources, the other half from timber sales. The timber sold amounted in the two years, 1913 and 1914, to 3.6 billion feet, valued at around 8 million dollars, while the quantity cut in the two years was little over 1 billion feet, valued at 2.3 million dollars. From 30 to 40 per cent of the annual cut supplies local demand, the result of 8,300 small sales in 1914, an increase of 33 per cent over the preceding year with an increased stumpage price, $2.32 per M feet B. M. In addition, from 30 to 40,000 permits for free use of wood are granted, representing some 120 million feet at a value of around 190 million dollars.

There were some 2 1-4 million acres mapped and estimated and near 7 million acres rapidly cruised. Some 14,000 acres were planted at an average cost of about $9 and 6,400 acres seeded, the sowings of Lodgepole and Yellow pine having been successful in some parts. Some 3,160 pounds of seed were collected at $2 per pound on the average and 10,000 pounds were sown. Some 9,400,000 trees were planted, and the nurseries contain some 31 million plants; the average cost of producing seedlings was $3.62, of transplants $5.66 per M.

Fires destroyed some 58 million feet valued at $81,000, besides young growth and forage valued at $109,000; expenditures in fighting fires amounting to $102,000. About $10,000 were spent in fighting Dendrodonus in Yellow pine timber.

Some 29,000 permits for range were issued, involving 1,600,000 cattle and horses, and 7,600,000 sheep and goats, besides colts, calves, lambs and kids; ranging over 100 million acres.

Some $400,000 were spent on improvements, roads, trails, telephone lines, fire lines, lookout stations, bridges, fences, etc.

Some $100,000 were spent on cooperative fire protection in 18 States, the States spending $450,000.

A large amount of investigative work is being done, but the amounts spent on it are not mentioned.

The Eastern forest reservations in the Appalachians and White Mountains have now grown to over one million acres approved, but as yet only 190,000 acres have been acquired.

The Carnegie Steel Company has recently announced their intention to erect at Homestead, Pa., a steel tie plant, to cost $500,000. The new plant will manufacture steel ties and tie specialties, and is, according to the President of the company, fully justified by the improvement in the steel tie business, which has resulted from the ever increasing scarcity of tie timber.

Mr. R. M. Watt, of the Duck Mountain Forest Reserve, Manitoba, makes the following suggestion for putting a wick in a Minnesota brush burning torch.

"First, remove the small bent pipe forming the lower end of the torch. Secure two one-quarter-pound balls of cotton candle wicking and drop the loose end of the wicking through the pipe.

Tie this end back on the wicking between the pipe and the ball forming a loop through the pipe. The wicking may then be drawn through the pipe, each time adding a new strand until the pipe is completely filled. When this stage is reached, cut the loop and replace the small pipe on the reservoir. Two balls will provide one filling for the usual sized torch.

The Canadian Northern Ontario Railway are arranging to instal an efficient fire protective system along their new line between North Bay and Port Arthur, in accordance with the requirements of the Canadian Railway Commission. There will be twenty-three special patrolmen with track velocipedes and two head patrolmen with power speeders covering portions of the line where the fire hazard is greatest. Where the situation will permit, the sectionmen and other regular employees will perform such patrol and fire fighting work as may be necessary.

Upon the application of the Canadian Pacific Railway, the Canadian Railway Commission held a hearing April 6 at Ottawa, in connection with that portion of the Board's General Order No. 107 which places upon railways the responsibility for extinguishing fires which occur within 300 feet of the track, unless in each case the railway in question shall show that it was not responsible for the origin of the fire. The contention of the C. P. R. was that this clause should be eliminated from the order, so that the railways would be primarily responsible for the extinguishing of only such fires outside the right of way as should be positively known to be due to railway causes. The showing made by the railways was not sufficient to convince the Board, and the application was dismissed, with, however, the understanding, that, should they see fit, the railways might later reopen the matter on the basis of requesting a reduction in the 300 foot limit, should they be able to secure sufficient evidence to justify such action. It has been suggested that possibly a reduction to 200 feet might be justified, and the matter may be reopened later on something like this basis. It would seem, however, that as a result of the hearing of April 6, the principle may be considered definitely and finally established in Canada, of placing the onus on railway companies to be responsible for extinguishing fires which occur on or near their rights of way, except where the companies can show that specific fires were due to other than railway causes. That this is a progressive and necessary provision is being recognized to an increasing extent on this continent, and it has not yet been shown that it imposes a sufficiently severe hardship on railways to justify the sacrifice of public interest which would be involved in its abandonment. There is, however, no doubt that, in full fairness to the railways, there should be a greater degree of cooperation on the part of the Dominion and Provincial Governments and timber owners, particularly in reducing the fire hazard resulting from the large accumulations of inflammable debris on lands immediately adjacent to railway rights of way. A beginning has been made in this direction, but for the most part the situation is urgently in need of attention.

Forest fire insurance which has been in operation in Norway (see F.Q., XII, p. 282) is now being organized in Sweden in the Swedish Mutual Forest Fire Insurance Company, which proposes to insure soil, ground cover, non-merchantable and merchantable timber.

Tables of much value to lumber companies and limit holders come from Mr. Piché, Chief Forester, Department of Lands and Forests, Quebec. They are the result of painstaking labor, being the contents of trees in board feet measure based on the measurement of 4,525 trees, and giving the amounts which should be deducted for different defects. There are also tables showing the total number of board feet contained in balsam, White and Black spruce trees, based on measurements of 2,187, 2,886 and 1,638 trees respectively.

Only 7½ per cent of last season's 400 fires in National Forests of Utah, southern Idaho, western Wyoming and Nevada caused losses in excess of $100.

Fires registered for this season number 15 more than for that of 1910, yet the cost of extinguishing them was only one third and the damage only one thirtieth of that of the earlier disastrous year, due to better organization, more roads, trails, telephones.

A victory for the cause of forestry goes on record in the State of Oregon. After a sharp and prolonged fight, the principle is established that State forest work should be independent of both politics and other state activities. Almost the entire population stood to the support of the existing, non-partisan, independent system, from the Governor himself to lumbermen, business men, women's clubs, etc. Past principles and achievements showed up well in the searching light thrown on them during the last session of the Legislature.

Vermont is richer by the will of the late Colonel J. Battell, of Middlebury. Ellen Mountain has been presented to the Government, with one restriction, namely, that its thousands of acres be preserved as primeval forest.

Middlebury College has been given 20,000 acres of woodlands, with the same proviso, besides 7 farms and $10,000 in cash.

The State of Minnesota has been presented with 2,500 acres of forest land near the city of Duluth, and the purchase of an adjoining 3,500 acres, useless for general agricultural purposes, is proposed. The plan is to develop a city forest useful for camping, rest and recreation of city residents, and to build workingmen's homes in the forest. A recommendation has gone forward from the State House and Senate Committees for the passage of a bill providing for $20,000 annually for two years, to purchase land for this purpose.

October 20 is to be American Forestry Association Day at the Panama-Pacific Exposition at San Francisco.

Meetings of the Society of American Foresters, the Western Forestry and Conservation Association and of the Pacific logging Congress will also be held here during the same week.

The summer meeting of the Pennsylvania Forestry Association was held at Foxburg, Clarion County, June 23-25.

Mr. H. R. MacMillan, Chief Forester of the Forest Branch of British Columbia, has been given leave of absence for a period of about eight months, during which, on behalf of the Department of Trade and Commerce of Canada, he will travel in the far east and near east—Japan, China, India, Australia—with a view to finding new markets for Canadian and particularly for British Columbia timber, which constitutes the bulk of Canadian timber resources. The value of forest products marketed by that province in 1913 was nearly $34,000,000, but the authorities believe that there should be five times as much produced. The fact is, that the lumber industry of British Columbia is "in the dumps," due to overproduction in the absence of a ready market.

In the last issue of the FORESTRY QUARTERLY we noted that the B. C. Forest Branch had been the means of obtaining a large trial order of creosoted Douglas fir ties for a railway company at Calcutta.

The B. C. Log Scale came into use for the entire Province, in accordance with the Provisions of the Royalty Act, on 1 January, 1915. Though this rule has been in use on the Coast for a number of years, the Doyle has been the accepted rule east of the Cascades. The log scale for the Interior will be increased by this change.

The Laurentide Company is continuing planting operations on wild and burnt-over lands this year. They plan to set out three quarters of a million young trees, mostly Norway spruce, 3-year-old seedlings, planted about 1,700 to the acre. The trees planted last year are reported to have made remarkable growth.

Announcement is made that the Grand Trunk Pacific Railway will operate passenger train engines running between Prince Rupert, B. C., and Jasper, Alta., 718 miles, by means of oil fuel, arrangements having been made for commencing this method of operation by the month of June.

The cause of forest conservation in Canada will benefit by the advance in price for home grown lumber, brought about by the new war tariff on imported lumber, which has been increased by 7½ per cent.

The Forestry Department of the Canadian Pacific Railway, in charge of Eastern lines, i.e., from Lake Superior to the Atlantic Coast, has been transferred from the Department of Natural Resources to that of Operating. Mr. B. W. Winegar has been placed in charge of the forestry work.

The following officers were elected for a term of three years at the annual meeting of the Canadian Society of Forest Engineers: President, Mr. Clyde Leavitt, Vice-President, Mr. H. R. MacMillan, and Secretary-Treasurer, Mr. Ellwood Wilson.

At the Sixteenth Annual Meeting of the Canadian Forestry Association held in Ottawa on January 19, the following were some of the officers elected for the ensuing year: President, F. C. Whitman; Vice-President, J. B. Miller; Directors, R. H. Campbell, Dr. B. E. Fernow, Ellwood Wilson, G. C. Piché, J. B. White, E. J. Zavitz, H. R. MacMillan, and Clyde Leavitt; Nominating Committee, R. H. Campbell, Ellwood Wilson, and J. B. White.

Mr. Robson Black has been appointed Secretary of the Association, taking the place of Mr. James Lawler, who resigned and has entered the Dominion Forest Service as Editor of Publications.

The Empire Forester, a new annual publication devoted to the activities of forestry students in camp and college, has made its appearance, under the auspices of the student body of the New York State College of Forestry at Syracuse University.

A complete course in pulp and paper making has been added to the curriculum of the University of Maine. The course came into existence two years ago, and is endorsed by leading pulp and paper manufacturers. The work is conducted in the new science building of the University, where it is expected soon to have equipment installed for carrying on the process from the wood to the finished product.

By the will of General W. D. Gill, of Baltimore, the Johns Hopkins University is made legatee after Mrs. Gill's death, when a chair in forestry is to be established.

A lively forest club is a feature of the forestry development in British Columbia. There are not only the members of the provincial and Dominion Forestry Branches, but private foresters in the Province, who meet from time to time to discuss matters of local interest, printing and distributing the papers of more general interest presented. Mr. W. J. VanDusen of the Forest Branch in Victoria is Secretary. We are in receipt of a paper on "Dominion Forest Work in British Columbia" by District Inspector D. Roy Cameron, and one on "Agricultural Land" by Dr. Whitford, who is engaged by the Commission of Conservation in classifying and ascertaining the timber resources of British Columbia. This area, on the basis of data so far at hand, is estimated at somewhere near 15 per cent of the total area, 23 million acres in the southern part of the Province. What constitutes agricultural land is discussed at length and clearly shows that, while constituents of fertility must be present, there are other elements that go to make the possibility of successful farming, namely, the human element, the amount of capital, the transportation and the climatic element.

In a talk given before the club by Mr. Austin Cary, he recalled the beginnings of his forestry work some twenty odd years ago. We quote his words in full, which give an interesting insight into the pioneering work that had to be done at that time.

"Forestry in the United States was then represented by Dr. Fernow, as head of a division in the Department of Agriculture, about half-a-dozen men connected with his office, and a few writers and thinkers, mainly botanists by profession, in different parts of the country. My own start was made through Dr. Fernow, who gave me a job to get volume and growth measurements on pine and spruce timber, which work occupied me a large part of three winters, and took me into the woods of Maine, New Hampshire, Michigan and Wisconsin. This sort of work is familiar enough to you, but was entirely new and strange to most people whom I met in its prosecution. They frequently could not believe that there was such a thing as systematic, scientific study of forest growth, and workmen and camp foremen frequently would not believe my errand when I told them. Sometimes they thought I was a game warden or detective. I never shall forget an incident that happened in the winter of 1893-4 in northern New Hampshire. I was measuring trees and counting rings one very cold day on the west side of Mount Washington, and happened to take out my belt axe to smooth off a radius for the purpose. There was a big woodsman standing near, and the attitude of the whole crew was well illustrated by his exclamation: "Ah," he says, "I know now what that is; that's George Washington with his little hatchet."

In those three winters from 1892 to '95, I rather think I did more stem analysis work than any single man in this country has done since. At any rate, I am entirely sure I went through more hardships than any man engaged in such work has since experienced. Camps in those years and in New England were very different matters from those to which you are accustomed.

This was the start—simple work that hardly paid wages, and had to be dovetailed in with land surveying in the summer to make a living; but as one read and thought the subject grew. In fact, after a time the thing looked so big that one could not possibly leave it. I got ahead by working over the data I had gathered and applying it to problems then actually being thought about by lumbermen of the region—rate of growth of timber in percentage and per acre. Of course, methods with the small resources available were crude, and results only indicative, but we defined our ideas by the process. Finally in 1886 I wrote a report of 250 pages for the State of Maine along the general lines just above indicated, and that gave me my next opportunity—service for a big lumber company in New England. That began in 1898 and ended in 1904, covering some severe work, but productive in the way of direct results and of training through experience. I wish more of our so-called foresters—such by virtue of a diploma and particularly their teachers—could have such sobering and illuminating experience and enough of it.

My service with the old company consisted first in securing, through inspection, economy of timber in the company's logging operation; second, of putting their property under a map system which enabled them to manage it to the best advantage; third, of working out, where practicable, a system of conservative cutting on their own land. This involved living in the woods about nine months in the year, in the summer cruising or running surveying parties, in the winter beating up and down the logging roads on foot, or riding from camp to camp in a sleigh or on horseback.

It is an inspiring thing for a man to be a pioneer in anything, and to one who likes it even a small thing will do. Devising a system of topographic maps and mapping adapted to timber land of moderate value served that way in those years for me. It was great fun to think out and improve methods adapted to the special conditions, the aim being to balance costliness of work with efficiency of the result. The work itself was monotonous enough, on the other hand, for I did it mostly myself and did not turn it over to the "hired man" as is now the custom. In fact, I was the hired man. Between 1896 and 1909 I personally put about 250,000 acres of land under a system of maps showing topography and timber. That meant usually having been within 50 rods of every spot on the territory, mapping every ridge and valley, and putting an estimate on the quantity of timber. Much of that cruising was done all alone. I suppose I was a fool to do it, but I feel it to be true that the spread of a system valuable to the country was hastened in that way."

Beginning this year, on June 7, the Department of Forestry of the New York State College of Agriculture at Cornell University will hereafter offer work during the third (summer) term. The first six weeks of the term will be spent in Ithaca; the remainder of the term in camp on a forest tract in the northern part of the Adirondacks. The work offered will form a regular part of the schedule required of professional students in forestry. The courses offered for undergraduate students will constitute the first term's work in the senior year, and include forest utilization, forest mensuration, forest ecology and silviculture. They are open to students who have completed their junior year. For graduate students there is offered a course in forest management, with individual problems in advanced work and research.

Because of the obvious advantages of the season and place of work the courses offered will hereafter be given in the summer term only.

During the autumn succeeding the summer term, the seniors are expected to obtain the required three months of practical experience in the logging woods, returning to Ithaca to complete their undergraduate work in the second (spring) term. The seniors will then receive their B. S. degree in June. Candidates for the degree Master in Forestry will spend a second summer in camp and then one more term at Ithaca, in the autumn, to complete their work leading to the Master's degree. The graduate students will finish their course in February and be ready in the spring to enter on professional work under national, state or private auspices.

The alternation of class room study and practical work in the field during the latter years spent at the University is believed to be a highly desirable arrangement from the standpoint of instruction in forestry, and also one that will appeal to the men taking the professional forestry course.

At the newly established forest school of the University of California fish and game preservation will receive attention in a course given by three experts. This is reviving the original idea carried out at the New York State College of Forestry at Cornell, where the subject from the very start was an integral part of the curriculum, instruction being given at the Adirondack camp by Dr. B. W. Evermann.

An article in *American Forestry* (April) on "Foresters in the German Army" contains a number of misstatements. One of them would negate the statement made in the FORESTRY QUARTERLY, vol. XII, p. 658, to the effect that there is no direct relation between the higher forest service and the army. This statement is correct. Only 75 officers represent the special organization called the Reitende Feldjäger, all other higher forest officers serve in whatever regiments they may choose. Only the lower grade foresters are obliged to serve in the Jäger battalions.

Though basswood or linden make the best excelsior, aspen or cottonwood are the species used for nearly half the amount manufactured.

Pan Cheng King, who graduated from the Cornell Department of Forestry in the fall of 1914, returned to China and is now in charge of the Agricultural School at Wu Li mio in Anching. He is working toward developing a forest policy on the following lines, approved by the Governor of Anhiu Province:

1. Agitation for public sentiment by means of reforesting 60 acres of scattered government lands this spring and various private lands with trees furnished free by the Provincial government.
2. Establishment of a good sized nursery.
3. Reconnaissance of the forest area and forest conditions in the Province.

4. With these data, a general policy of reforestation, protection, improvement and maintenance will be outlined and enforced.

Interested readers should compare with King's article in vol. XII, pp. 578-592, of the QUARTERLY.

"The Log of a Timber Cruiser," by William Pinkney Lawson (Duffield Company, New York), just from the press, is a simple but unusually interestingly written account of the trials and tribulations, as well as of the fascination and disciplinary value of forest reconnaissance. An even, flowing style and well-chosen, sometimes poetic, language, with just enough sprinkling of Western talk, makes the book very readable. While the author represents himself as an Assistant Forest Ranger, this volume would stamp him rather as a budding literateur; yet the story has the earmarks of reality in it and portrays faithfully and vividly the characters and the life of a reconnaissance party. Especially novices can learn much of the rules of the game from this book.

PERSONALITIES

1. Northeastern United States and Eastern Canada. 2. Southeastern United States. 3. Central United States. 4. Northern Rockies. 5. Southwest, including Mexico. 6. Pacific Coast, including Western Canada. 7. Hawaii, the Philippines and the Orient. 8. Europe. 9. Unclassified.

The above classification is adopted in order to facilitate the identification of important news items. It is only natural that readers will be interested more in the news from one region than from another. Realizing this, the news are arranged accordingly.

A. B. R.

1. *Northern United States and Eastern Canada*

H. H. Tryon has joined the staff of the New York State College of Forestry at Syracuse University as instructor in forest utilization. Mr. Tryon graduated from the forest school of Harvard University in 1913, since when he has been engaged in State work in Massachusetts.

G. A. Gutches has been appointed as Director of the State Ranger School at Wanakena, N. Y. Mr. Gutches graduated from the University of Michigan in 1909, and has. for the past three years been District Forest Inspector for the province of Saskatchewan, Canada. This makes eight new appointments to the faculty of the New York State College of Forestry within the last year.

At the reorganization meeting of the Maine Forestry Association which was held in Bangor during January, Blaine S. Viles, State Forestry Commissioner, and John M. Briscoe, professor of forestry at the University of Maine, were elected directors.

At the third annual meeting of the New York State Forestry Association held in Rochester during January, Frank F. Moon and Eugene S. Bruce were elected as Secretary and Vice-president, respectively; Ralph S. Hosmer, C. R. Pettis and Hugh P. Baker were chosen for the executive committee. the first to serve for three years, the last two for two years. Samuel N. Spring was elected auditor for two years.

Samuel J. Record has been elected one of the vice-presidents of the Yale Association of Class Secretaries.

Paul G. Redington, Supervisor of the Sierra National Forest, gave illustrated lectures on the National Forests of the Pacific Coast at the Universities of Syracuse and of Michigan.

Haymond E. Hopson, forester for the Adirondack League Club, was married recently. Hopson's headquarters are at Old Forge. N. Y.

Henry S. Graves was the guest of honor and principal speaker at the closing exercises of the Senior Class of the Yale Forest School in New Haven on February 27. The thirteen members of the graduating class are now in Alabama on the lands of the Kaul Lumber Company.

W. Hoyt Weber, who, as Vice-President of the Munson-Whitaker Company, has been manager of their timber estimation department for the past seven years, has lately sold his interests in that firm and enters the business under the style of W. Hoyt Weber and Company, located at 52 Vanderbilt Avenue, New York City.

Another firm of consulting foresters has recently entered the field under the style of Empire State Foresters. The members of this firm are John Bentley, Jr., Ralph S. Hosmer, Frank B. Moody, A. B. Recknagel, E. C. M. Richards, and Samuel N. Spring. This firm has its office at 156 Fifth Avenue, New York City. With the exception of Richards, the members are all on the staff of the Department of Forestry at Cornell University and are specialists in the lines they represent. Richards is manager of the firm.

On February 13 there was formed in Boston a "Biltmore Club of New England." Twelve Biltmore alumni were present, and it is hoped that eventually all the Biltmore men in New England may be included in the membership.

Chas. J. Musante, E. L. Claasen and Donald White, all graduates of the Class of 1912 of the Biltmore Forest School, have organized a firm of forest engineers and timber cruisers, known as Musante, Claasen and White, with headquarters at Potsdam, N. Y.. and Brooklyn, N. Y.

Hammond Robertson, Biltmore, 1913, until recently Assistant Superintendent of the Newark plant of the American Creosoting Company, is established as a lumber and creosote inspector at 2270 University Avenue, New York City.

Hubbard Hastings, Biltmore, 1911, has established himself as Consulting Forester in St. Johnsburg, Vt.

Dr. H. D. House, who has been Acting State Botanist of New York, since the breaking up of the Biltmore Forest School, was recently appointed State Botanist. His first annual report contains a well-illustrated treatise on "Certain Features of German Forestry."

To State Forester and Mrs. A. H. King, of Albany, N. Y., a son was born on January 20. King is a graduate of Biltmore Forest School, Class of 1909.

J. J. Levison is Secretary of the American Association of Park Superintendents. and forester of the American Association for the planting and preservation of city trees.

A son, Robert Bruce, was born on January 23 to Professor and Mrs. W. N. Millar, at Toronto.

J. E. Rothery has been elected a member of the Canadian Society of Forest Engineers, the first non-resident of Canada to be so honored. He has also been elected a Fellow of the Royal Geographical Society, of London.

J. L. McNicol, J. G. McNichol and J. A. McRae have been appointed to positions of responsibility in the pulp and paper division of the Canadian Forest Products Laboratories.

Nineteen employees of the Dominion Forestry Branch have already enlisted for active service abroad. Among these are Forest Assistants G. E. Bothwell and A. E. Parlow; Forest Supervisor H. I. Stevenson, of the Riding Mountain Forest Reserve, Man., and Mr. W. A. Delahey; Messrs. F. W. Fraser, D. N. Trapnell and L. N. Seamon, of the Forest Products Laboratories.

A son, David Irwin, was born to Professor and Mrs. Ralph S. Hosmer, at Ithaca, on April 14.

At the annual meeting of the St. Maurice Forest Protective Association on March 4, R. L. de Carteret was elected President and Ellwood Wilson, Secretary.

2. *Southeastern United States*

At the fifth annual convention of the North Carolina Forestry Association, held in Raleigh during January, J. S. Holmes, of Chapel Hill, was re-elected Secretary-Treasurer.

Raymond W. Pullman, former Chief of the Office of Information of the Forest Service, on April 1st took up the duties of Major and Superintendent of Police of the District of Columbia.

Chapin Jones, heretofore Assistant State Forester of Maryland, has been appointed State Forester of Virginia, with headquarters at Charlottesville.

William L. Hall, District Forester in charge of District 7, and Assistant Forester in charge of the acquisition of lands in the Appalachian and

White Mountains, spent the latter part of January and first of February in an inspection of the Arkansas Forest. During that time he devoted several days with Francis Kiefer, Supervisor of the Ozark Forest, in conferring with the Governor of Arkansas in Little Rock concerning forestry matters pertaining to the State.

H. O. Stabler, formerly Forest Supervisor in charge of the Columbia National Forest, Portland, Ore., and Assistant District Forester since January 1, 1914, in charge of Operation in District 7, has been Acting Supervisor of the Arkansas National Forest at Hot Springs, Ark., since November 1, 1914, and will remain at that post pending a permanent selection to fill that vacancy.

Robert S. Wallace, Forest Examiner, was temporarily assigned to the Arkansas National Forest, from the Ozark National Forest, where he has been since July, 1912, to make a special scaling study of cut-over Shortleaf pine timber sale areas.

Charles J. Heller, Forest Examiner, was permanently transferred to the Ozark National Forest at Harrison, Ark., from the Arkansas National Forest on October 15, 1914. His time has largely been devoted to problems in the administration of White oak timber sales, with special reference to the determination of a uniform method of scaling hardwood purchased by various classes of tight cooperage manufacturers.

Surveys are now being made by E. L. Merrill, temporarily assigned from surveys in acquisition in the Appalachian and White Mountains and formerly highway engineer with the Washington State Highway Department on the Ozark National Forest. A project that will require several years to complete, under the Forest Service Ten Per Cent Fund, is comtemplated in cooperation with the State and Counties to extend across the Boston Mountains that form the main portion of the Ozark National Forest and now constitute a barrier to improved highway travel between the south and northwest portions of the State.

Douglas Rodman, who until recently has been with the C. A. Smith Timber Company, Marshfield, Ore., is now located in Louisville, Ky.: address, 167 Crescent Avenue.

Louis S. Murphy, who is in the Forest Service, with headquarters at Washington, was recently married to Miss Elizabeth Cox, of that city.

Seward H. Marsh was married on September 23 to Miss Mary D. Woodward, of Harrisonburg, Va., where Marsh is in charge of the Shenandoah area for the Forest Service. Marsh's assistant, W. R. Barbour, was married on June 11, 1914, to Miss Annie M. Johnston, of Chapel Hill, N. C.

Robert J. Noyes was married on October 15 to Miss Mildred L. Blanton, of Marion, N. C.

Another marriage in District 7 of the Forest Service is that of Karl Schmitt, who, on December 24, married Miss Beatrice A. Morrison, of North Conway, N. H. Schmitt is stationed at Elkins, W. Va.

Earle H. Clapp, Forest Inspector in the Branch of Silviculture at Washington, has been promoted to Assistant Forester in charge of the recently created Branch of Research.

John T. Harris is Acting in Charge of Industrial Investigations under the Branch of Products at Washington.

The marriage of Miss Helen Achilles, of New York City, and Georges deS. Canavarro took place on March 8.

3. *Central United States*

Assistant District Forester O. M. Butler, of District 4, is handling the portion of the lumber industry relating to the distribution of lumber, particularly in the Mississippi Valley. His headquarters are, temporarily, at Chicago.

The *Milwaukee Leader* is authority for the news that State Forester E. N. Griffith, of Wisconsin, has tendered his resignation, effective at the end of the present session of the legislature. This news is corroborated by the Madison *State Journal*. Griffith has been with the State for ten years.

Burr M. Prentice, who graduated from the New York State College of Forestry in 1913, is instructor in forestry at Purdue University. The appointment became effective in September.

James A. Howarth, Jr., is Deputy Supervisor on the Fond du Lac Indian Reservation, Minn.

Orrington T. Swan has accepted the position of Secretary of the Northern Hemlock and Hardwood Manufacturers' Association. Swan's headquarters will be at Oshkosh, Wis., instead of Wausau, Wis.

A daughter, Marguerite Dunlap, was born to Mr. and Mrs. Stephen V. Klem in East Lansing, Mich., on March 6.

4. *Northern Rockies*

Forest Examiner E. F. White has succeeded Forest Examiner Farquhar in charge of the Section of Planting in the District office at Missoula, Mont. Farquhar is now at Harvard University, where he intends to study scientific management as applied to sawmills.

Deputy Supervisor Alfred B. Hastings is now stationed on the Deerlodge National Forest with headquarters at Anaconda, Mont. He married, on January 19, Miss Fellows, of Newton Centre, Mass.

A son, Stanley Heiberg, was born to Supervisor and Mrs. Elers Koch in Missoula, Mont., on February 9.

Leon F. Kneipp has succeeded E. A. Sherman as District Forester of District 4, with headquarters at Ogden, Utah.

Upon the resignation of David T. Mason, which becomes effective June 30, J. F. Preston will take his place as Assistant District Forester in charge of Silviculture in District 1 of the Forest Service.

Wallace I. Hutchinson is Supervisor of the San Isabel National Forest, with headquarters at Westcliffe, Colo.

5. *Southwest, Including Mexico*

Theodore S. Woolsey, Jr., Assistant District Forester in charge of Silviculture at Albuquerque, New Mex., resigned from the Forest Service on April 1, and has gone to Santa Barbara, Cal., for the summer. Woolsey has been elected president of the Albuquerque Country Club. He gives his address as: Stonycroft, East Gold and Hill Streets, Albuquerque, New Mex.

Arthus D. Read, Forest Examiner connected with Grazing Studies in District 3, resigned from the Forest Service on April 1, in order to enter the cattle business in northern New Mexico. Read graduated from the Yale Forest School in 1906 and has been continuously in the Forest Service. His future address will be Senorita, N. Mex.

R. E. Marsh has changed his address to Taos, New Mex., the headquarters of the Carson National Forest.

E. N. Kavanagh, formerly Forest Supervisor of the Bighorn Forest, in Wyoming, has been transferred to District 3 and made Assistant District Forester in the office of Grazing. He was formerly an Assistant District Forester in Grazing in District 2.

Murrell W. Talbot, Assistant Ranger on the Coconino, has been transferred to Albuquerque to the District Forester's office and assigned to special grazing studies work on the Datil Forest.

Assistant Ranger G. Harris Collingwood took the Forest Assistant's examination recently held at Tucson, Ariz. Collingwood has been a ranger on the Apache Forest for some time, though on furlough for over a year studying forestry at the University of Munich, returning to the Apache last September.

Assistant District Forester John Kerr attended the recent meeting of the National Livestock Association in San Francisco.

The District Forester in District 3 plans to move his offices by July 1, from the Strickler-Otero Building to a new building in Albuquerque, N. Mex., known as the Gas and Electric Building.

6. *Pacific Coast, Including Western Canada*

A daughter, Mary Elinor, was born to Mr. and Mrs. Donald Bruce on December 1, 1914.

George Stanleigh Arnold, formerly a law officer of the Forest Service, was married in Washington, D. C., on February 26, to Miss Elizabeth Sherman Kent, of that city. They will make their home at 3240 Pacific Avenue, San Francisco, where Arnold is engaged in the practice of law.

The Regents of the University of California early in March made the final appointment for the present faculty of the forest school there. The major fields of the men are as follows: Forest Engineering, D. Bruce; Forest Management, D. F. Mason; Nursery Work and Planting, Mr. Metcalf; Ecology, Natural Reproduction, W. Mulford; Utilization, Wood Technology, M. B. Pratt. Mason and Bruce will join the staff on July 1.

The Biltmore Forest School alumni plan a reunion at San Francisco on Friday, October 15. Harry H. Pooler, Biltmore, 1908, is in charge of the arrangements and may be addressed at 701 Flood Building, San Francisco.

Stuart J. Flintham is city forester of Los Angeles.

A son, Charles Franklin, was born November 27, 1914, to Mr. and Mrs. Walter B. Hadley, at Redlands, Cal., where Hadley is in charge of the propagating department of the city nurseries.

William B. Osborne, Jr., has been transferred to the District office at Portland to specialize on forest fire control.

W. H. Gallaher has succeeded the late Louis Margolin in charge of working plans and reconaissance in the District office at San Francisco.

C. B. Neal has been transferred from John Day, Ore., to the District office of the Forest Service at Portland.

About a dozen employees of the British Columbia Forest Branch have already enlisted for active service abroad. Among these are Deputy District Forester J. B. Mitchell and Forest Assistant F. McVickar.

A son, Edward Burgis, Jr., was born to Mr. and Mrs. Edward B. Starr, on January 8.

C. MacFayden, formerly District Forester at Tête Jaune in British Columbia, is heading a private exploration party in the Peace River country. P. S. Bonney, formerly Forest Assistant at Fort George, is now Acting District Forester at Tête Jaune.

7. *Hawaii, the Philippines and the Orient*

D. Y. Lin, Yale Forest School, 1914, is to be connected with the proposed Forest School at Nanking University.

William F. Sherfesee, on January 1, was promoted to be Director of the Philippine Bureau of Forestry, succeedindg Major Ahern. Sherfesee graduated from the Yale Forest School in 1905. Since 1912 he has been Assistant Director of the Bureau.

Louis F. Stadtmiller has been promoted to the position of Chief of the Division of Forest Management, Philippine Bureau of Forestry.

8. *Europe*

Dr. C. A. Schenck, who was wounded at the battle of Lodz in Poland on December 15, is now fully recovered and has rejoined his regiment, of which he is Lieutenant-Colonel and Adjutant. Dr. Schenck has received the Iron Cross for bravery.

Nils B. Eckbo has recently completed a brief study of the effects of the war on forests and forestry in Germany.

Gustave A. Kuhring, a graduate of the Forestry Department of the University of New Brunswick, has enlisted with the Third Canadian Contingent.

9. *Unclassified*

The thirty-fourth annual meeting of the American Forestry Association, held in New York City during January, elected William B. Greeley as Director for two years and re-elected E. A. Sterling and W. R. Brown as Directors for three years, also re-electing Sterling as Auditor.

Royal S. Kellogg, hitherto Secretary of the Northern Hemlock and Hardwood Manufacturers' Association, is now Secretary of the National Lumber Manufacturers' Association, with headquarters at Chicago.

Barrington Moore has resigned from the Forest Service to devote his entire time to research work in forestry and the allied sciences. Moore graduated from the Yale Forest School in 1908 and has been in the office of Forest Investigations at Washington.

With John Birkinbine, who succumbed to a protracted illness on May 14, there passed away one of the staunchest, sanest, oldest and most faithful friends the forestry movement in the United States has known. His interest antedates the organization of the American Forestry Association, when as publisher and editor of the *Charcoal Iron Workers' Journal* he sounded even in the seventies the note of conservatism on economic grounds. He was active in the organization of the Pennsylvania Forestry Association in 1886, whose secretary he became, then its vice-president, and, in 1862, its permanent president.

From the very start he became the editor of the Association organ, *Forest Leaves,* and its constant contributor. His persistence was admirable. His interest was not of the amateurish kind, but was inspired by sound economic reasoning, for which his profession as consulting engineer and his wide experience and activities over the whole Union specially fitted him. As chairman of the State Water Supply Commission, he was brought into close relation to the importance of forest influences, and as president of the Franklin Institute for ten years, he cultivated the scientific spirit in his practical engineering work, as well as in his forestry propaganda.

Those of us who have worked side by side with him have lost a most valuable friend.

B. E. F.

COMMENT

The past winter has been one of trial and tribulation, of testing and proving of forest policies in several States, and the end is not yet.

The most endangered situation exists perhaps in Wisconsin, whose forest policy has appeared to be most safely and sanely established and efficiently administered for ten years through a non-partisan Forestry Board and a State Forester appointed by the Board. Although a legislative committee after most painstaking investigation had approved the work of the Board and of the State Forester, the legislature proposes to destroy this wise organization and substitute a Commission of three appointees by the Governor. This is done avowedly for the sake of economy the new Commission to consolidate four Boards, namely, the Fish and Game Commission, the State Board of Forestry, the State Park Board, and the Conservation Commission.

While, undoubtedly, the work of these various commissions could be supervised by one commission, it is doubtful whether it could be done more cheaply and efficiently. In our opinion, this tinkering, surely is not a move for efficiency. Mr. Griffith, for ten years State Forester, it seems has resigned or proposes to resign his position. It has been amply demonstrated by now that the organization as constituted in the Wisconsin plan is by all means the safest under our political conditions. Still worse befell the State by the decision of the State Supreme Court to the effect that the forest reserves established by the State, in part by purchase, in part by gifts, cannot, under the Constitution, be maintained, since the State, cannot spend money on internal improvements, hence cannot reforest, and may not incur altogether an indebtedness of over $100,000. Under a constitutional amendment, some $200,000 worth of land was purchased for forestry purposes, but this is now declared unconstitutional. The lands must be added to the School Trust Fund and "can continue to be managed as forest reserve lands, but the primary object of such purchases *must not be for forestry!*" Altogether the opinion of the Supreme Court is expressed in language so involved and contradictory that it would take two Pennsylvania lawyers to construe it. We believe, however, we have got the general sense out of it.

One wise judge, Chief Justice Winslow, dissents and brings forward strong arguments, declaring reforestation not a work of "internal improvement" but a "public work" and hence an essential function of the Government, also contending that the sovereign State has the power to tax itself for whatever purpose it desires. The probability, nevertheless, is that only another constitutional amendment can right the case and save to the State the 375,000 acres reserve, and that will take at least two years.

In Minnesota, on the other hand, due to an unusually active propaganda and campaign of public education, a great victory for the forestry cause was gained, when out of eleven amendments to the Constitution proposed, the only one adopted was on the retention of school and public lands better adapted for timber than agricultural use as State Forests.

Oregon escaped the attacks on its non-political Board unscathed, also through a thorough popular education.

In California, the one of the Western States which started earliest in the forestry movement, its first Board of Forestry being inaugurated in 1885, there seems also no settled condition to have arrived, the State Forester and other interests being at cross-purposes as to what the functions of the State Board of Forestry (political) and the State Forester are to be, and how to be carried out. This organization dates from 1905, but, according to the State Forester, "as a result of the unwise elimination of essential provisions, our forests and ranges have continued to be devastated." A bill to establish a system of fire wardens was defeated in 1911.

In a voluminous report by the Commission of Conservation, rendered in 1912, the Southern Pacific Railroad Company was directly charged as opposing adequate forest fire legislation. In 1913, an attempt was made to restore the eliminated provisions of the original act, but this was met by counter bills and propaganda and especially by the active opposition of the California Forest Protective Association—protecting against interference for the benefit of the public (?)—organized the year before and said to be composed mainly of lumbermen.

Last winter saw the resumption of the fight in the same manner by the introduction of antagonistic bills before the legislature. We are not advised of the outcome.

Quite in opposite direction, locally and in spirit, the legislature of Maine has before it a radical proposition of allowing the State to condemn private lands for forestry purposes the same way that lands for railroad purposes are expropriated. The same bill proposes exemption from taxation for timberland as long as no timber below 12 inches is cut; also a curious provision permitting the sale of tree seedlings from State lands.

The latest entrance into the forestry movement is reported from Texas, where legislation has been passed this winter providing for the appointment of a State Board of Forestry of seven members, the Governor, Commissioner of General Land Office, Commissioner of Agriculture, president of the University of Texas, president of the Agricultural and Mechanical College, and two citizens at large interested in forestry problems. A further outside influence is brought to bear by having the Board of Directors of the Agricultural and Mechanical College appoint the State Forester at a salary of $3,000. There is almost too much of "interest" in this many-headed organization and multiplication of councilors; only as a rule this works at an advantage in leaving the State Forester usually a freer hand. The possibility of State forests to be acquired by gift is also foreseen. A newly formed State Forestry Association did the educational work needed to secure this legislation; an appropriation of only $10,000 starts the organization.

Lastly, we may refer to the turning point which has arrived in New York, when the blunder that was made twenty years ago may be corrected, and the Constitutional Convention has an opportunity to amend the clause preventing the State from practising any kind of forestry on its own lands.

Looking back these thirty years to the time when the writer was called upon to formulate for Senator Lowe the legislation which led to the establishment of the New York State Forest Commission and Forest Preserve, one finds that conditions have greatly changed, and the attitude towards the problem of administering the Preserve may also be changed accordingly.

When the first Forest Commission was organized, a technical forest management with the economic and watershed protecting aspect in the foreground was in contemplation. The non-existence of any technically educated personnel at the time prevented this, and eight years later, in 1893, when the Constitutional Convention formulated its forest policy of inaction, this condition had not changed. For this reason, it was perhaps wise that the Commission was prevented from inaugurating any utilization schemes.

Meanwhile, a crop of foresters has grown up, and it would be possible to organize an efficient service of technically educated men, but meanwhile also there has taken place an unusual development in tourist travel, summer guests and private camp building, which has changed the entire aspect of the Adirondack and Catskill region and their problem. The industrial and manufacturing interests which were, still, in 1896, advanced as reasons for the State's purchase of timberlands, have fallen into the background, and the "park" idea has become prominent; even the watershed protection has become only of secondary importance. The State of New York is rich and can afford a playground of some million acres for its well-to-do population of ten million, or of as many as can afford to use it.

In another generation it may be realized that, as in France and Germany, a real forest management, keeping in mind *all* the forest benefits, is possible, but meanwhile probably only a mere park management will be permitted.

One of the "overtures" before the Convention calls for permission "to cut, remove and sell timber (and "trees" should be added) which are dead, fallen or mature, or which are detrimental to forest growth." This permission is necessary even for a conservative park management, and a clause permitting forest planting should also be added to legalize what the Commission has already done in spite of the Constitution.

There remains always the problem of how the administration of the Forest Preserve is to be organized. The legislature has tinkered and experimented more than enough with this problem. The machinery experienced the following reconstructions: at first a Forest Commission of three, then, in 1892, changed to one of five members, then, in, 1895, it was amalgamated into the Fisheries, Game and Forest Commission of five members, then, changing its title in 1901 to the Forest, Fish and Game Commission, of three members, and in 1904 to a single paid Commissioner. In 1911, a Conservation Commission of three members, with a Division of Lands and Forests, in charge of the Superintendent of Forests, as under all former commissions, was inaugurated. The one plan which has worked elsewhere satisfactorily has not yet been tried, namely, a non-partisan Board with a State Forester.

Two of the overtures before the Convention do away with all commissions, have a State Forester appointed by the Governor, but removable only for cause publicly stated and after public hearing, or else for a tenure of ten years. A third overture makes the University of the State, the so-called Regents, an advisory committee to recommend regulations under which cutting may be done—a most incompetent arrangement.

A hearing before the Committee on Conservation to discuss the various propositions is announced as we are going to press.

What we must realize from the contemplation of this review of conditions is that not only eternal vigilance but most active, continued popular education is necessary to keep what we have and to progress on rational lines in establishing sane State forest policies.

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

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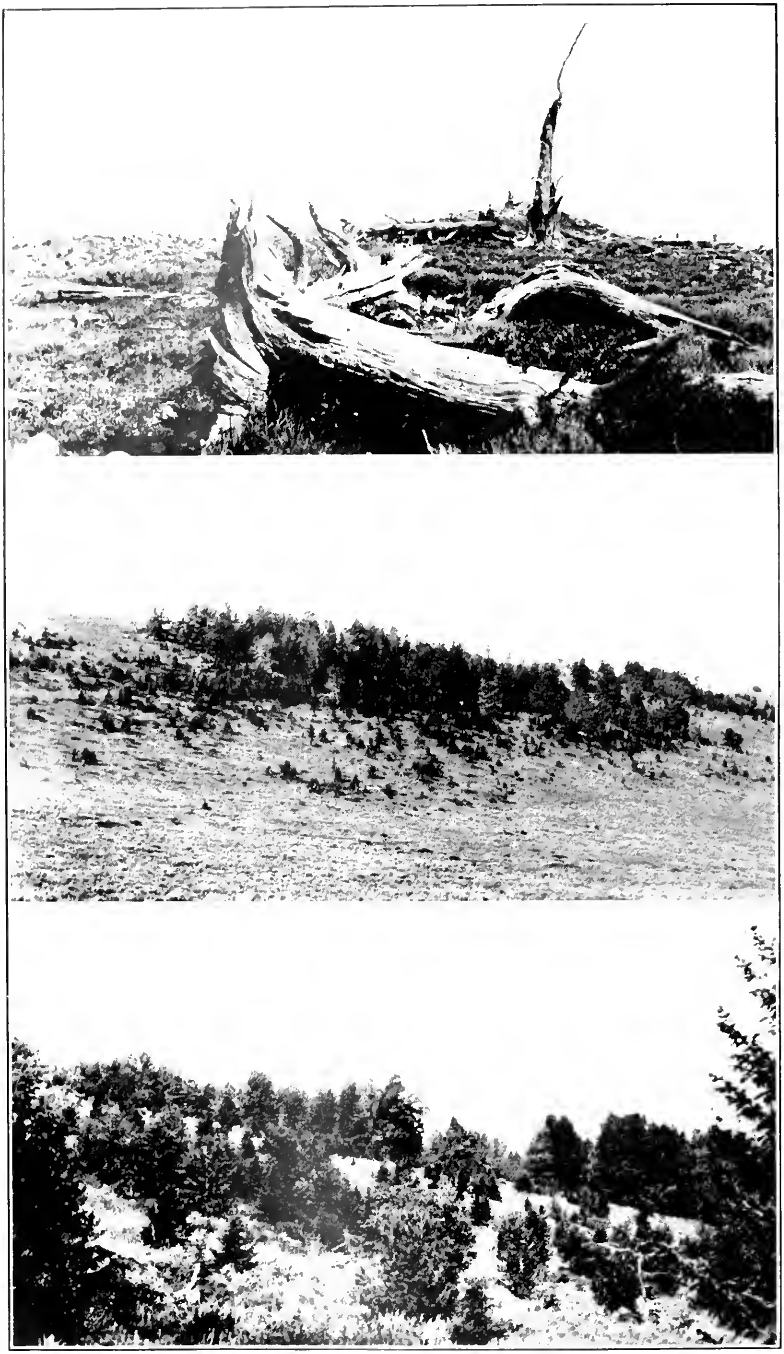


1. One of the higher and more exposed ridges
2. Natural reproduction extending nearly one quarter of a mile from nearest seed trees
3. Nature restocking a portion of old burn

FORESTRY QUARTERLY

VOL. XIII SEPTEMBER, 1915 No. 3

THE REGENERATION OF DENUDED AREAS IN THE BIGHORN MOUNTAINS BY DOUGLAS FIR

BY E. S. PEIRCE

"Lum" Williams' reputation for possessing a cheerful disposition was widespread throughout the Bighorn Basin and it was seldom that he felt so "out of sorts" with himself as on a certain afternoon, late in October in the year '79. That he was returning from a bear hunt the result of which was unsuccessful, in spite of the fact that in those days big game was plentiful in the Bighorns and "Lum" was noted as a good shot, was no doubt partially responsible for his ill humor. The evening before he had heard how a prospector, returning from the Clouds Peak County, "had met up with a monster 'silver tip' right there at the beef trail crossing on Middle Fork," and reckoned, although he was packing his 44 Winchester, he didn't want to tackle him. Now bear didn't grow big enuf to bluff out "Lum" and as he liked bear huntin' second to nothin', he just " 'llowed I'll prowl up that way in the mornin' and see if I can't locate Mr. Bar—that 'ornery pinto needs some ridin' anyhow and a trip up in the hills 'll do him good." Four o'clock the following morning found "Lum" half way up the canyon and soon after sun-up, as he was crossing a soft place near the mouth of South Fork he saw a huge bear track in the mud. He " 'llowed" this was the bear seen the day before by the prospector for it sure was the biggest track he'd ever seen. The bear was headed up South Fork and as riding wasn't good up that way, he picketed the "pinto" in a small park and started off afoot to see if he couldn't get a glimpse of the "Old Boy." About 6 o'clock that evening "Lum," having walked in vain over what he " 'llowed was the whole damn Rocky Mountain range," returned to his starting point to find that his horse had broken the picket rope and "pulled out." "Lum" knew that cayuse too well to entertain any hopes that he would stop short of the ranch, so spotting a log at the edge of the timber he sat down to light his pipe and rest, and incidentally to cuss his double streak of bad luck. The day had been very hot, in spite of the time of year, and "Lum" was feeling pretty tired and disgusted, and was not much relieved by the thought of the 12-mile hike to the valley. While lighting his pipe he noticed at his feet a dead fir branch to which the brown needles were still attached, and he just " 'llowed as how that would make a good blaze," so he reached over and set fire to it. "Lum's" 'llowance was well fulfilled, for the summer having been an unusually dry one, everything was like tinder and the fire started in this way spread and burned for days and days until finally a snowstorm put it out. "Lum" Williams has since passed away, but over 10,000 acres of devastation remain as a tribute to his different " 'llowances" on that day.

Only a small part of the denuded areas in the Bighorn Mountains can be attributed to "Lum" Williams, and his story, which is vouched for by the "Old Timers," is here related partially to show what little concern forest fires gave the pioneer settlers in those days, as well as to explain the origin of thousands of acres of denuded land.

No real effort was made to prevent destruction by forest fires until the creation of the Bighorn National Forest in 1905, whereas, prior to that time, fires had been numerous, dating back, in the main, to the time of the occupation of this region by the Indians.

In the early days the mountains were filled with game and were favorite hunting grounds of the Sioux and Crow Indians and many fires were undoubtedly set by them for the purpose of driving out game. At the time the Indians were on the war-path in Wyoming, they also set fires in order to prevent the soldiers from following them and to otherwise harass the "whites." Since not only fires originating from lightning were allowed to burn until extinguished by storms or lack of inflammable material, but many fires were deliberately set by man, it is not strange that every acre of timberland in the mountains has been burned over at least once and some portions many times in the past.

By far the greater number of these fires occurred in the Lodgepole pine type, and since burned over areas are very favorable for reproduction of that species, practically all such areas are either now covered with satisfactory stands or contain sufficient young growth to serve as seed-trees to restock the remaining portion. Lodgepole pine usually comes in so readily after a fire that even many areas originally Douglas fir are now covered with the former species. With the exception of a few small scattered Yellow pine sites on the east face of the mountains, which are not regenerating, practically all of the present denuded areas are found on the western slope and in the Douglas fir zone. These areas occur within an altitudinal belt ranging from 7,000 to 9,000 feet, located on the watersheds of Brokenback Creek, South, Middle and Main Forks of Paintrock Creek, and their tributaries. The soil is similar in composition over practically the entire region, being a lime or marly soil resulting from a limestone base.

However, the burns may properly be separated into two classes, differing somewhat as regards ground conditions, according to the time they were burned over, namely, "Old Burns" or those dating back more than 100 years, and "Recent Burns" or those originating since 1879.

Old Burns.—These old burns now consist of grassy "parks," containing more or less sagebrush, with here and there old charred stumps, the only remnants of the former forests. In parts of this old burn pieces of well-preserved charred wood have been found buried from 6 to 12 inches in the ground. In all probability, as is indicated by fire scars on one old solitary Douglas fir, which is still living, the absence of forest cover is due to two large fires, occurring 210 and 110 years ago, respectively. The former killed the virgin stand, while the latter destroyed the second growth which followed and consumed most of the dead material remaining from the first fire. What little dead timber was not burned has since decayed, with the exception of the few pieces still to be found, and in the interval a fairly thick cover of sod and sagebrush has become established, leaving the areas in their present treeless condition. On the higher and more exposed ridges the soil is shallow, more or less rocky, and occasionally interrupted by outcrops of limestone.

Owing to the thick ground cover, found generally over the areas, natural reproduction is very slow, but nevertheless it is gradually encroaching on the open parkland wherever small stands of timber or individual trees are within seeding range. These patches of advance growth occur scattered over the burns and, given protection from fire, large portions of these once timbered parks will ultimately be restored to forest growth. This reproduction, quite naturally, is most noticeable on the leeward side of the parent trees, good examples of which are shown in two of the pictures.

However, this is not always the case for on south slopes near the upper limit for Douglas fir, excellent reproduction is advancing down the slope, in a direction at right angles to the prevailing wind. This is due, no doubt, to the seed being carried by water from the melting snow banks above. A good example of this can be seen on the ridges near the head of Brokenback Creek.

It is impossible to tell to what extent Nature will reforest these old burns, but there are thousands of acres so located with respect to seed trees, that it is reasonable to presume they will sometime be naturally restocked. There are, however, other large areas which cannot be regenerated naturally, either because of the absence of favorably located seed trees or because of the presence of surface conditions adverse to seed germination and development. The need, however, for restoring the forest cover to these areas is not urgent at the present time, and it is doubtful if there ever will be occasion for reforesting them. These areas now support a fairly thick vegetative cover, which exerts a beneficial influence in holding back water, and there is therefore little necessity for reforesting them for stream-flow regulation. They now afford excellent pasturage and the need for retaining them for grazing purposes exceeds that of converting them into forests for the production of lumber.

Recent Burns—The areas burned over in 1879 are covered with dead trees, many of which have fallen and lie strewn over the ground. The humus which originally covered the ground was consumed by the fire, and on the steeper slopes practically all the soil has since been washed away, leaving a surface composed of a scanty amount of fine soil mixed in between a mass of small pieces of limestone. These steep slopes support here and there a thin and scattered ground cover of grasses (principally *Festuca* and *Koeleria*) and weeds (chiefly *Chamaenirion, Lupinus, Senecio, Balsamorhiza*, and *Nacrea*) with an occasional patch of sagebrush, Oregon grape, low bush juniper and *Shepherdia canadensis*. From 15 to 25 per cent of the ground surface is broken by outcrops or displaced boulders of limestone.

On the more moderate to gentle slopes there is little or no

1. Reforesting a moderate south slope on "Middle Fork" by the seedspot method
2. Good forest land on gentle north slope into Middle Fork Paintrock Creek. On this area are found dead trees with a D. B. H. of 36 inches and total height of 110 feet
3. Reforesting 70 acres on "Middle Fork" watershed

humus but the soil is deeper with fewer small rocks, while only a very small proportion of the surface consists of outcrops or boulders. The ground cover is much thicker than on the steep slopes, but similar in composition. These recently burned areas are better adapted to tree growth than to any other purpose, and it is especially important that they be regenerated. With the economic development of the Bighorn Basin, will come a great demand for water and timber—even now in fact, the completion of contemplated irrigation projects will create a demand for water exceeding the present supply—and the areas in question are well located to serve this double function. The south slopes and the steep slopes of all aspects were originally covered with only a scrubby stand of timber, the trees growing very slowly and not averaging over 50 feet in height, hence it is to be expected that regeneration would serve primarily for the beneficial influence of forest cover on the regulation of streamflow, and to prevent further erosion.

The moderate to gentle slopes, however, are excellent sites for the production of timber, and restoring them to forests would be chiefly for commercial purposes with streamflow protection a secondary consideration.

To successfully regenerate all these denuded areas Nature will have to be aided by man, for although natural reproduction is gradually coming in wherever it can, nevertheless on over 3,000 acres of it conditions are such that reforestation can only be attained, either wholly or in part, by artificial means. As a rule, the north slopes contain a few scattered live trees, which are serving as seed trees, and as ground conditions are more favorable than on the hotter and drier south slopes, natural reproduction is gradually becoming established. Although the seed trees are few and scattered and the restocking process consequently slow, nevertheless Nature can be expected to ultimately entirely restock these north slopes.

On the gentle slopes natural regeneration of Douglas fir, with the exception of a few isolated specimens of seedlings or small saplings, is entirely lacking, due to the absence of any live trees of this species within seeding range. However, in places, the Lodgepole pine is creeping in and will undoubtedly continue to do so, wherever seed trees of this species are near enough to make this physically possible. The best example of this is found on the Middle Fork of Paintrock Creek, where, for a distance of about one-half mile, the creek is fringed with a young stand of Lodgepole pine. This stand has come in on, and apparently confined itself to, a narrow strip of granite glacial drift covering the limestone and extending for the above distance beyond the terminal moraine. Although many of these trees have been producing seed for probably twenty years, reproduction is encroaching on to the limestone soils very slowly indeed, which is probably in a large part due to the fact that the prevailing winds, coming up the canyon, scatter the seed up the creek rather than on to the limestone soil to the south and southeast. However, observations over the Forest lead me to believe that Lodgepole reproduces much more readily on silicious than on limestone soils, which may partially explain the lack of more seedlings on the latter areas. Seventy acres of this barren strip between the Lodgepole on the north and the steep slope on the south, where natural restocking is coming in, were seeded to Douglas fir, by the "seed-spot" method, in the spring of 1913. Although it is as yet too early to determine whether or not this work is a complete success, nevertheless, there is little doubt that at least a seed tree stand will be obtained, so now the entire area on the south side of "Middle Fork," from the edge of the creek to the top of the slope, can be left for natural restocking.

On the other hand, the moderate to gentle slopes on the north side of "Middle Fork," portions of which are shown in the pictures and an area of about 300 acres on the south side of Battle Creek, contain no living trees of any species, so artificial reforestation will be required. It is possible that forests might ultimately be restored to these areas by planting a few seedlings to the acre, about 20 to 30, to serve as future seed trees to restock the remaining portion. However, with the possible exception of the more favorable parts of the Battle Creek area, I doubt the success of such a plan. Experiments by various methods of direct sowing of tree seed (all of which included some sort of ground preparation, and which therefore would seem to be better than Nature's way of scattering seed on unprepared ground) made on sites more favorable than these, have invariably resulted in failure, due to drought, and to the fact that a large proportion of the seed was eaten by field mice, chipmunks and other rodents, in spite of the fact that the areas were poisoned preliminary to sowing. Abnormal droughts are more than likely to occur every two to three years, and the young seedlings are not sufficiently hardy to withstand them. Therefore, natural regeneration will be more or less of a gamble on climatic conditions and at the very best will be an extremely slow process. However, it is the intention to try out the plan, and in the event of failure planting can then be resorted to.

The restocking of the steep south slopes will have to be entirely accomplished through the planting of seedlings, for there are no living trees on the areas nor anywhere within seeding range, and even if there were any such trees, natural restocking would not occur because of the poor surface conditions. Furthermore, as stated, the surface, consisting of a very meager amount of soil intermingled with a mass of small rocks of limestone, gets extremely dry in summer. These two conditions, so inimical to seed germination and seedling development, preclude any hopes of securing natural reseeding until, through the long establishment of forest conditions, the ground surface undergoes a change in character. Experimental work has demonstrated that, because of drought and rodents, direct seeding methods will not succeed on sites of this kind; therefore, regeneration can only be attained by the planting of nursery stock. Planting is expensive work, and the recovery of these areas for forest growth will require a large investment, but the expenditure, in the end, will be justified, since thousands of acres of present devastated and worthless land will be converted into forests, having a marked influence in conserving for irrigation, the water which now runs to waste in the early spring.

THE ARTIFICIAL PRESERVATION OF MINE TIMBERS

By Dr. Friedrich Moll

Abstracted from the German by F. W. Haasis

According to recent estimates, about a tenth of the timber annually produced in the world is used for mine-timbering. On the one hand, the application of wood in mining is extraordinarily varied, because for many purposes wood forms the only suitable material of construction. On the other hand, the life of wood in the mine is very limited and the yearly demands for the replacing of rotten wood are greater than in any other wood-using industry.

Opinions differ greatly as to what ought to be included under the term *mine timbers* (*Grubenholz*). In the narrower sense, no wood is considered except what is used in the finishing of mines, such as stulls, slabs, caps, points (*Spitzen*), and lagging planks. In a broader sense, however, there may also be considered as mine timbers all wood that is used in the mines from day to day, such as the wood for props at the starting of shafts, for the shaft-timbering, for sheds, etc. In deciding upon a definition of mine timber, one prevalent notion, especially in the case of private owners of forest land, must be debarred, namely, that waste wood is "mine timber," and that all wood which cannot be used for lumber or telegraph poles is "mine timber." The great requirements for safety and economy which are placed on the use of mine timbers permit the employment of only good, sound material. Oak, which formerly was used almost exclusively, today has largely disappeared from mines. This followed the realization that so far as strength and warning of failure are concerned, pine is fully as valuable as oak. Moreover, pine, like coniferous woods in general, is very much lighter and easier to work than oak, and the tree has a smooth, symmetrical bole. These advantages, together with its low cost, far outweigh the chief advantage of oak, namely, its greater natural durability.

The German mining industry used in the year 1912 about 200 million cubic feet of mine timbers (1,024 cubic feet in the average per 1,000 tons of coal, and 440 cubic feet per 1,000 tons of ore).

It seems strange that a branch of an industry which every year uses, and loses through decay, such an enormous quantity of wood has only very recently given attention to the question of artificial preservation. Although in the case of many railroad and telegraph companies no ties or telegraph poles have been used in the natural state for many years, until 1900 practically nothing could be read of a mine timber treatment; and even today the amount of mine timbers treated can scarcely exceed 10 per cent in Germany, and hardly a fraction of one per cent taking the world as a whole.

A few of the historically important facts may be briefly noted here. Bréant, the discoverer of the process of treating wood under pressure in closed cylinders, in 1831 made the first exposition of his new method before a group of mining engineers and made explicit reference to the fact that he had made a discovery which was of the most far-reaching significance, for the entire mining industry. Bréant's discovery was, however, entirely neglected by the mining industry, and altogether reached the great importance enjoyed by it at present only after the year 1840, that is, after the introduction of the railroad. It was not until 60 years after Bréant, in the year 1891, that any serious efforts were made for the preserving of wood in mining practice. In the Falkirk Mine in Scotland, mine timbers were then boiled in napthaline in open vats.

Next follows an era of suggestions of, and experiments with, all possible and impossible methods. It was not until after 1900 that mines concerned themselves seriously with the question of wood preservation. The references about this time are, indeed in most cases, published by interested wood-preserving firms or discoverers, and are therefore lacking, to a considerable extent, in a uniform clear survey of the methods and purposes of treatment. In a publication in the year 1904 Bergassessor Wex mentions 41 mines which have made experiments, in one way or another, in the preservative treatment of wood.

Since 1903 the Schlesische Grubenholzimprägnierung G. M. B. H. (Silesian Mine Timber Impregnating Co., Ltd.) has employed a salt of fluorin, which had been experimented with to the greatest extent by the telegraph companies of Austria. Today some hundred mines either treat wood themselves, or use treated wood, or have made experiments with such wood, making available a series of useful results from the experience with such wood.

Of oils, creosote products are the only ones which are used to any great extent. Since the pure creosote was too high-priced, it was mixed with an aqueous salt solution, chloride of zinc and others. These processes had no important results whatsover. In spite of the mixture the cost was very high. Moreover, the durability was not increased to the extent anticipated. Today we know, what at that time was to a considerable extent overlooked, that in the mixing as at that time practised, one material interfered with the penetration of the other and that the oil formed scarcely more than an outer veneer. Now, if the solutions are very weak, or if salts of slight effectiveness are taken, it is naturally, not to be wondered at if the treated wood does not have any remarkable resistance. An oil treatment can bring economic results only when the mine can produce the oil itself in its own business as a by-product.

Very many mines are satisfied with mere brush treatment of the wood. This, however, is entirely non-effective. Painted wood lasts little longer than unpainted. It has been suggested that the results would be more satisfactory if the wood were left submerged in the oil for a longer time. It is, however, necessary to warm the oil until the salt dissolves, since otherwise it does not penetrate into the wood. A beginning of such dipping in creosote (open tank method) has been made in German mines.

Lastly we must mention the forcing in of oil, in cylinders, under pressure. From the technical standpoint this is the best method, since it alone ensures a true impregnation of the wood and a really permanent protection. The best plant of this type has been operated for many years by the Lothringen Mine in Gehrte in Westphalia. This treatment costs $2.84 per hundred cubic feet of wood. In comparison with this the Plesse management had to pay $6.31 per hundred cubic feet for treatment by the Rütgers works, and the Fuchs Mine as high as $8.52 including freight. Without question, the life of wood is extraordinarily lengthened by the treatment under pressure in cylinders, while painting is entirely worthless and the results of dipping (conducted according to the methods of Giussani and Kruskopf) are at least problematical. The economic value for mine timbers of the creosote treatment is closely connected with the restoration of the oil by a suitable operation.

Similar to creosote is the sodium creosote (*Kreosotnatron*) which has been used for many years in German and English lignite mines. This results from the treatment with sodium hydroxide of the lignite tar for the purpose of working it up into paraffine and lubricating oil. A residue is formed, composed of sodium hydroxide, water, phenol and neutral oils. It has a slight advantage over creosote in that it is less inflammable. It is undesirable for many purposes, and, especially in places where timbering is to remain in use for several years, it is found that the sodium creosote in the course of time makes the wood fibres brittle through the effects of free sodium hydroxide.

If we consider merely the increased life and the resulting economy, creosote products could undoubtedly be looked upon as extraordinarily valuable wood preservatives. Nevertheless, their application in mine construction to-day must be looked upon as on the decline. Most mines have, indeed, abandoned creosote again, and have hurried to salt treatment. Bergassessor Stenz, with the authority of his extensive experience as director of one of the largest mines, gives the following as the most important factors militating against the application of creosote in mining construction. "Creosote has an unpleasant odor. Many people refuse to work where there is wood treated with creosote. Furthermore, creosote causes an appreciable increase in the fire hazard. Where people sweat at their work—and this is always the case in mining—the oil produces very unpleasant skin diseases." The present writer can testify from his own experience, also, that in horizontal workings where the outside weather conditions can never have any very great effects, the creosote evaporated under the influence of the high temperature of the mine attacks the eyes especially in a very perceptible manner. In the Mariemont Mine, which used the creosote treatment for many years, it has been abolished for this reason alone. A further disadvantage is the greatly increased weight of the wood. In the case of pine, for instance, a penetration of 6.3 pounds of oil per cubic foot of wood means an increase of 20 per cent in weight. Furthermore, woods treated with creosote are much harder to work and soil the clothes of the workmen in a very disagreeable manner.

The use of salt solutions for the preservation of wood for mining purposes, also, so far presents very few data. This is somewhat strange, since we know that the preservative influence of solutions of metallic salts has been known from time immemorial. This neglect can be explained by the fact that in olden times the value of wood was very small in comparison with that of the metal. In the renowned Spanish copper mines at Rio Tinto, which were mentioned even by the Greek traveler Diodorus Siculus, there is timbering which has lasted from the time of Caesar. Also, there has been timbering standing in use for centuries in the salt mines of Hungary and Galicia. In the year 1837, Dr. Granville proposed to dip wood for mines in the mother liquor from salt pits. In the years 1825-40 the director of the mines at Dieuze made more extensive tests with wood treated in a similar manner. In the year 1893, Aitken established two vats at the Nidrie Mine in Scotland in which he treated mine timbers in a concentrated solution of common salt and magnesium chloride. This mixture of salts occurs in nature under the name of Carnallite.

Mining practice is broken up into countless independent systems, isolated from one another, which experiment now with this, now with that type of preservative treatment, according to personal inclination and familiarity with inventions and diverse conditions of production in different mines, and naturally, at first those methods were involuntarily given preference which were the most loudly recommended. As a general rule, however, it is not the older methods, known for many years, which praise themselves. For this there are in several cases definite reasons. The disadvantages of creosote treatment have already been indicated in a preceding paragraph. There are objections, also, to the use of the Boucherie treatment for mine timbers. This method of treatment is adapted, as is known, only to freshly felled timber. That presupposes, however, that the purpose for which the wood is intended and the purchaser are known at the time of cutting, because practically no timber dealer will give timbers, especially mine timbers, a preservative treatment in advance when he does not know definitely that the same will find a purchaser. Treatment with zinc chloride has been tried in a few instances, but because of insufficient protective value has been again abandoned. Kyanised wood, that is, wood treated with corrosive sublimate, has been used only to a limited extent in mine construction in Germany and Austria. The reason for this must be looked for in economic conditions. It has been very conveniently asserted that treatment with corrosive sublimate brought with it fears for the mining industry, since the handling of timbers treated with poison is dangerous; the salt evaporates into the air, and by precipitation the salt would appear in the ground water and animals and men drinking it would be poisoned. Now as far as handling is concerned it will be readily agreed that a process, by which since the year 1830 almost a million poles have been treated in Germany without any cases of poisoning whatsoever affords proof which does not admit of discussion by sane people. The evaporating belongs in the realm of fable—chemists have no knowledge of it. The last point also can be passed over in a few words. In general, mine waters are not drinking waters, and, even if they were drunk, the minute traces of corrosive sublimate which could reach them would be entirely negligible.

Heretofore wood has been treated with corrosive sublimate by soaking it for a few days in a .066 per cent solution in open tanks, but a better and more effective treatment is that in closed cylinders under pressure. But under the influence of the corrosive sublimate, as in the case of copper sulphate, the iron cylinders suffer severely and are soon destroyed. To avoid this, coatings of asphalt, tar, white lead, etc., have been tried extensively, but so far have always resulted in failure. The only solution is offered by the use of our newest building material, reinforced concrete (*Eisenbeton*). Cylinders for the treatment with corrosive sublimate under a pressure of up to as much as 8 atmospheres are now made by concrete firms.

The following may be enumerated as the most important factors in a preservative treatment: 1. Economy. 2. Effectiveness. 3. Permanence. 4. Undesirable accompaniments.

The effectiveness can be looked upon as the keynote for every system of preservative treatment. In forming an estimate of the effectiveness (for which it was first necessary to conduct for many years experiments in practice and in the laboratory), only the work of independent, non-partisan investigators can have any systematic value. Among the best, as far as effectiveness is concerned, are, of the older methods, the treatments with zinc chloride and with corrosive sublimate, and of the newer methods that with sodium fluoride, which forms the chief ingredient of the Wohlmann salt mixture.

From the standpoint of economy, the cost of treatment is the deciding factor, next to the effectiveness. It is, of course, impossible to give in an order which will prove true for all cases the economic value of the several methods of treatment. Of the methods involving the use of salt solutions it can at least be said that in the United States on the basis of one cubic foot of wood and one year's duration (annual charge?) the treatment with copper sulphate comes highest and zinc chloride somewhat cheaper, the treatment with corrosive sublimate and with sodium fluoride being, in comparison, the most advantageous. It has, indeed, been said that the conditions seem to vary in individual mines and that it is not at all necessary, therefore, to use the most effective agent everywhere. But it must be remembered that there never occurs one species only of wood-destroying fungus in a mine. We always find a great number of the most diverse kinds together; wherefore we must always direct our efforts against those which require the most powerful combative measures. The materials introduced into the wood must retain their effectiveness for a long time. They must therefore be neither too quickly changed into less effective substances nor too readily evaporated from the wood nor washed out by seepage waters. There must also be taken into consideration a chemical change by the action of materials contained in the seepage waters. As far as the salts used in mining are concerned, only the last two points need be seriously considered. As a matter of fact, the danger of washing out has always been greatly exaggerated, and it is therefore especially gratifying to find Dr. Thomann, chief chemist for Guido Rütgers in Vienna, on page 33 of his pamphlet *Leitungsmaste* (Poles for Electric Wires), writing with reference to zinc chloride, in the case of which, as is known, washing out is most feared: "Zinc chloride can, because of its solubility be dissolved out, but in spite of this fact, it exhibits results which are well worthy of consideration before the fear of washing out be too greatly over-emphasized. Its low price maintains for it even up to the present time a moderately extensive application in Austria as a material in which to dip railroad ties."

A changing of a salt into a less effective substance has frequently been observed in the case of copper sulphate. So far, it has not been shown for corrosive sublimate and sodium fluoride. Too rapid a washing out of the salt from the wood (we can never absolutely prevent washing out because an entirely insoluble salt would also be entirely useless) can best be avoided by using as deeply penetrating a treatment as possible, such as is given by the employment of vacuum and pressure in closed cylinders. Painting of the wood or mere dipping for a few minutes are therefore under all circumstances to be discarded.

The Austrian Telegraph Company, years ago, made voluminous comparisons of treated and untreated wood. Trials made upon about 1,000 telegraph poles showed irrefutably that painting had not had the slightest influence upon the life of the wood.

The harmful effects of creosote have already been considered. It may be added that for coal mines, moreover, the increased inflammability of the wood due to the use of creosote is not inconsiderable. From the methods of treatment with salts, which come into consideration in mine timbers (Kyanising and Wohlmann's mixture), there are no especially harmful effects upon the health of the workers to be feared. During the process of treating, such precautions as are required with the material used must, of course, be taken. The only objection to either salt is that the skin of the hands becomes brittle and cracked. It has been established in practice as fully sufficient a protection, if the hands of the men engaged in the treating are well greased with vaseline.

That the wood shall not suffer from the treatment is so self-evident that it does not require any further discussion. As a matter of fact, however, not a few of the materials used for treating wood attack the wood fibres very seriously and thereby greatly reduce the strength of the wood. In the case of sodium creosote, which was formerly much used in lignite mining, the timbers became in the course of five or six years so brittle from the excess of free sodium hydroxide that they broke under a load. Famous in this respect is the Hasselmann method. Under the influence of the high temperatures at the time of treatment the salts used by Hasselmann dissolved the lignified portions of the wood and changed the wood into a horny mass. This is, however, nothing but cellulose. Hence in the fungus cellar, timbers treated by Hasselmann's process have retained their form to a notable extent, for cellulose is attacked by fungi only with great difficulty. In practice, on the other hand, they have fallen to the ground sooner than even untreated timbers, the natural coherence of the wood being destroyed.

Very recently there has been conducted an extensive propaganda for certain secret processes under the names of "Acrol," "Viczsal," and "Kulba." Referring to pretended certificates from the laboratory for testing materials it is asserted that the strength of timbers treated with these materials is "about 5 to 7 per cent greater," or even 100 per cent greater than that of untreated wood. The chief ingredient of the first mentioned material is an ammoniacal solution of copper sulphate in sodium hydroxide. This, however, attacks the wood fibres rather seriously since it is a solvent of cellulose. The testing laboratory at Berlin, Lichterfelde, to which timbers were submitted for examination, also states that the strength was reduced at least 10 to 15 per cent.

As for the rest, Acrol, Viczsal, and Kulba have absolutely no greater preservative powers than plain copper sulphate, and copper salts have, as tests extended over about 80 years have shown, very insufficient effectiveness. Ammoniacal solutions of copper salts, especially, were tried out without success as early as the years about 1860 by LeRottier.

Of all the hundreds of methods of preservative treatment which have been proposed since the year 1800 (the author has a list of patents for wood preservation methods of almost 2500) there are only two which, judged from the standpoint of mining needs, are suitable for use in mining. The one is the treatment, known since 1870, with corrosive sublimate, called after the chemist Kyan who introduced it as a technical process, Kyanising; the other is the treatment with fluorin salts, especially with the Wohlmann salt mixture, originated by the engineer Wohlmann, which has found a continually widening application since the year 1905.

A WINDFALL PROBLEM

By G. T. Baker

The following study had for its object to ascertain, if possible, the cause of the considerable windfall occuring in the virgin woods on the Snow Creek watershed of the Olympic National Forest. An area of 3480 acres was under investigation.

In general the country is not mountainous, but rather rolling. The slopes are broken by flats and low knolls, and cut by the sharp ravines of the main creeks. There is very little rock outcrop. The soil in general is a sandy loam with gravel admixtures in some situations and on the steeper slopes becoming a partly gravelly soil. It is of medium depth and good moisture content. The humus, except on some of the steeper slopes and certain burned-over areas which total about 100 acres in extent, is of good depth. On no part of the tract, nor on any locality adjacent near enough to have any effect on the windfall, has there been any cutting. There are no deforested areas.

There are three forest types not at all times very distinct, as the associated species in each are essentially the same, and in certain localities the amount by volume of each may run the same, namely approximately 33 per cent each of Douglas fir, Red cedar, and Western hemlock. By area the cedar type covers 46.5 per cent—the hemlock type 37.8 per cent, and the Douglas fir 15.7 per cent of the tract.

The cedar type consists of a mature stand of cedar associated with Douglas fir, hemlock, and Amabilis fir with a scattering of White pine occurs. By volume, 46 per cent of the stand is cedar, and following the streams. It is on the higher elevations, on knolls where the soil is drier and more stony, that most of the White pine occurs. By volume, 46 per cent of the stand is cedar, 26 hemlock, 23 Douglas fir, and 4 per cent Amabilis fir. White pine and Sitka spruce together form but 0.5 per cent of the stand in volume. On the lower flats, along the streams confined to the Salmon Creek drainage, Sitka spruce *(Picea sitchensis)* occurs. The condition of the timber throughout this type is on the whole better than in the other types. The cedar rises clear and straight with very little butt swell. The average d. b. h. is between 40″ and 50″, with occasional trees 100″ or more. The soil generally throughout this type, is deeper, more loamy, and contains more moisture than that found in the other types.

The hemlock type is found largely on the thinner and more stony soils, and drier situations. The same species are found in association, wth the exception of Sitka spruce, which is absent, and a few scattered White pine. This type occurs more commonly on steeper slopes and higher up on the ridges, but in general topography it is much the same as the cedar type. Hemlock constitutes 46 per cent, Douglas fir 24, cedar 21, and Amabilis fir 9 per cent of the stand by volume. Over much of this type surface fires have run through the mature timber, especially on the Trapper Creek drainage. Only about 77 per cent by area is mature, 15 per cent being under 100 years old, and 8 per cent from one to 20 years. This youngest growth is on old burned-over areas, now reproducing to hemlock, fir and cedar, with hemlock in predominance. The condition of the timber for all species is poorer in this type than in the other two types, with the exception of the cedar, which is good. The hemlock is in poor condition and shows evidence of unsoundness, though the trees have clear boles and generally well formed crowns.

In the Douglas fir type, which occurs on the drier slopes and tops of ridges and knolls, associated with hemlock, cedar and scattered Amabilis fir, the soil is much the same as in the hemlock type, though it tends to be somewhat deeper and more loamy. There is practically no immature timber in this type. The Douglas fir occurs as two stands, much of it being over-mature and decadent, averaging from 90″ to 100″ d. b. h. with occasional trees 120″ d. b. h., and mingling with the over-mature timber is a thrifty mature stand of fir averaging about 40″ d. b. h. Of the whole stand, 47 per cent is Douglas fir, 29 is hemlock, 22 is cedar, and 2 per cent Amabilis fir by volume. There is some evidence of butt rot, but very little of fungus attack. The cedar and Amabilis fir are in good condition, whereas the hemlock, as in the other types, has a considerable amount of defect. Much of the Amabilis fir is still immature, and is fairly good as to quality and is clear boled with well defined crowns.

Over the greater part of the area there is only a very scattered reproduction of hemlock and cedar, with practically no fir. There are certain portions, however, in limited areas in the upper slopes of the hemlock type where there is a dense reproduction of hemlock and cedar. Over most of the burned-over areas there is a good reproduction of hemlock, cedar, and fir, though on one of these areas, 61 acres in extent, there is a fair but not dense reproduction of hemlock and cedar with but little fir.

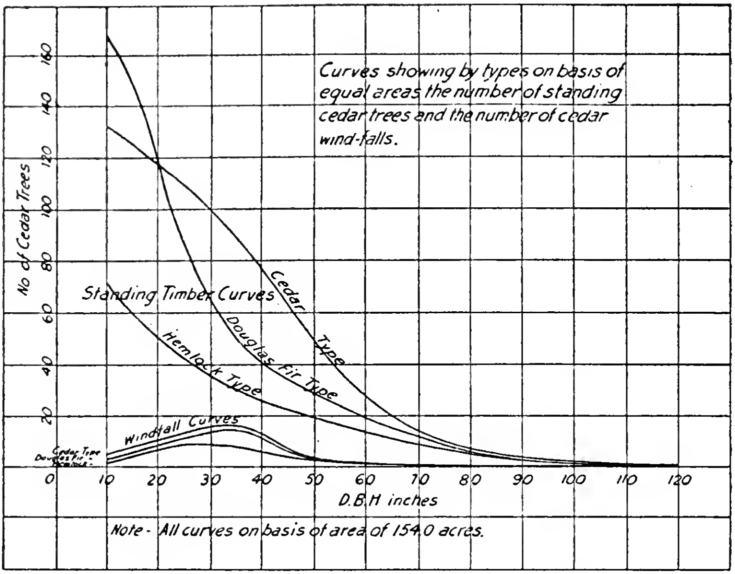
The underbrush is in no place dense, save for a few patches of thick rhododendron occuring on about 80 acres in the cedar type. It consists principally of salmon berry, devil's club, huckleberry, rhododendron, and blackberry. The ground cover consists of salal, Oregon grape, and herbaceous growth, being scattered pretty heavily over the greater part of the watershed.

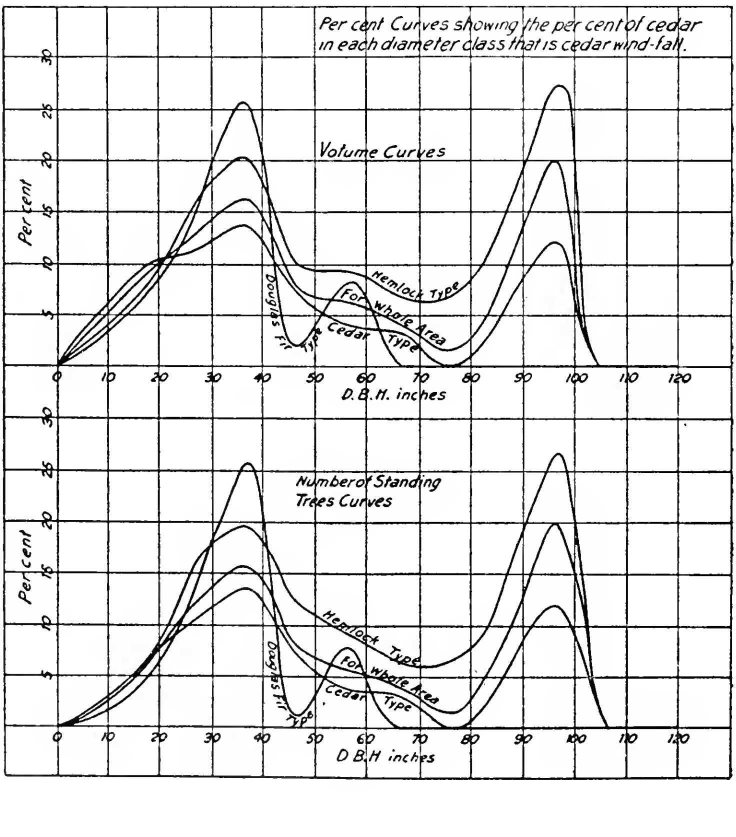
Tabulations were made for each type, showing number of trees and per cent of each species, noting especially the down timber of cedar, average diameters and contents of average tree, and total volume.

Curves were drawn to bring out the relationships of fallen to standing timber and of diameters to fallen timber, of which the two given on page 320 are samples.

Throughout the area there is considerable windfall, in the hemlock type especially, more than in the cedar or fir types. There is a good deal of windfall in hemlock, fir, and cedar, with some Amabilis fir,—much of this has been quite recent. On certain places in this type on the Trapper Creek drainage, there are patches of windfall, where several trees have been wind thrown and have carried down with them all the trees on a strip of from five to six chains in length, and two or three chains wide. The trees thus recently thrown have in general well developed crowns, and except for some which have been carried down by the others, have been taller than those surrounding them. Most of these have been located on the flats, but windfall occurs scattered throughout the type on different situations and topography. By volume, and also by number of trees the cedar alone shows 12 per cent in windfall.

In the fir and cedar types there is not proportionally as great an amount of hemlock windfall. The conditions regarding windfall are much similar in these two types. Especially in the larger diameters of the fir, trees with tall straight boles and good-sized crowns have been wind thrown. Usually several trees in a group will go down, apparently the one opening up the crown cover and at the same time weakening the hold of the adjoining root system on the soil of neighboring trees. In some places, large trees


Curves showing by types on basis of equal areas the number of standing cedar trees and the number of cedar wind-falls.
No of Cedar Trees
160
140
120
100
80
60
40
20
Standing Timber Curves
Cedar Type
Douglas Fir Type
Hemlock Type
Windfall Curves
Cedar Type
Douglas Fir
Hemlock
0
10
20
30
40
50
60
70
80
90
100
110
120
D.B.H inches
Note - All curves on basis of area of 154.0 acres.


Per cent Curves showing the per cent of cedar in each diameter class that is cedar wind-fall.
Volume Curves
Per cent
30
25
20
15
10
5
Hemlock Type
For Whole Area
Cedar Type
Douglas Fir Type
0
10
20
30
40
50
60
70
80
90
100
110
120
D.B.H. inches
Number of Standing Trees Curves
Per cent
30
25
20
15
10
5
Hemlock Type
For whole Area
Cedar Type
Douglas Fir Type
0
10
20
30
40
50
60
70
80
90
100
110
120
D B.H inches

have carried down smaller ones which were growing close enough to have interlacing root systems. By volume in both of these types, 8 per cent of the total merchantable cedar is windfall, and 9 per cent by the number of trees. The amount of cedar windfall on the whole tract is approximately 10 per cent of the merchantable cedar. This amounts to 3 per cent of the total volume of all species on the area.

Tables were also constructed to give by types and for the whole area the conditions of standing cedar and cedar windfall, showing for each diameter class the number of trees and the volume, and also the per cents of each by diameter classes, and the per cent in each class that is windfall. For the whole area and by types the cedar is in much the same condition as to defect, so that the general average for cedar for all diameter classes is about 8 per cent.

From these tabulations the following relations appear.

In the Douglas fir type, by number of standing cedar trees, over 40 per cent is between 12″ and 20″, and the per cent decreases in the larger diameter classes, being a little over 10 per cent from 32″ to 50″, and for trees between 92″ and 100″ but 0.2 per cent, whereas in the windfall approximately 40 per cent occurs in trees 32″ and 40″, after which point the per cent drops to less than 2 per cent in the next diameter class and rises to about 7 per cent for trees from 52″ to 60″ in diameter. No windfall occurred in cedar above 60″ d. b. h. in this type. For all cedar by total number of standing trees and windfall, the per cents for each diameter class are practically the same, as only 9 per cent of the total cedar is in windfall. The greatest per cent of cedar windfall in any one class is 25 per cent for trees 32″ to 40″, after which there is a marked decrease followed by a slight rise for trees 52″ to 60″ in diameter. On the other hand, 23 per cent or nearly one quarter of the standing cedar by volume is in the diameter class 52″ to 60″, and about the same amount, 23 per cent, for the diameters 22″ to 40″ and in the classes 62″ to 80″. In windfall, slightly over 50 per cent occurs in trees 32″ to 40″, and 25 per cent in trees between 52″ and 60″. Over 25 per cent of the total volume in the trees from 32″ to 40″ is in windfall.

In the cedar type, over 25 per cent by number of standing trees is in diameter class 12″ to 20″—and over 70 per cent between 12″ and 40″. There is a decrease in per cent in the succeeding diameter classes, except for 72″ to 80″ which has a little over 3.5 per cent, while the class from 62″ to 70″ has only 2.3 per cent. Over 35 per cent of the cedar windfall is between 32″ and 40″. It is this diameter class that has the greatest amount, 14 per cent, of the windful in any one diameter class, although between 92″ and 100″ there is nearly 13 per cent. There is no windfall in trees 72″ to 80″, nor any in trees from 100″ to 120″ in diameter.

In the hemlock type, over 30 per cent by number of standing trees are in the diameter class 12″ to 20″. From 12″ to 30″ over 52 per cent of the trees by number occur—there is a gradual decrease to 0.6 per cent in 112″ to 120″, except for the diameter class 102″ to 110″, where there were no trees tallied for this type. Although nearly 30 per cent by windfall is for trees between 22″ and 30″, while 32″ to 40″ has but 25 per cent, the greatest per cent of windfall in any one diameter class is 20 per cent and occurs in the class 32″ to 40″. By volume the greatest per cent for standing cedar, 20 per cent, occurs for diameters 52″ to 60″; 27 per cent of volume in trees 92″ to 100″ is windfall, while for 32″ to 40″ it is over 20 per cent, from which point the per cent decreases until the 82″ to 90″ class, when it again rises.

For the whole area taken as a unit, the conditions as to cedar windfall show that in number of trees, 30 per cent is in 12″ to 20″ and over 80 per cent from 12″ to 50″. The per cent decreases, except for the slight increase from 72″ to 80″ over that in 62″ to 70″, as was found in the cedar type. The greatest per cent, 34 per cent, in windfall occurs for trees 32″ to 40″; over 80 per cent of the windfall by number of trees is from 12″ to 40″. As only 9 per cent of the cedar on the whole area is windfall, the per cents for the total number of trees, both standing and windfall, is practically the same as for the standing timber. By volume, the greatest per cent, approximately 20 per cent, is in 52″ to 60″ for standing timber, and for windfall is 34 per cent in the class 32″ to 40″. In this class the cedar windfall amounts to 16 per cent, from which point it decreases, being only 1.5 per cent for trees from 72″ to 80″ in diameter, for trees above this size there is an increase to 20 per cent for trees 92″ to 100″ in diameter. On the whole area there is no windfall above 100″.

The greatest amount of standing cedar by volume in any class comprises about 20 per cent of the total volume, and occurs between 50″ and 60″—except for the cedar type, where the greatest is between 40″ and 50″. In windfall on the other hand, for the area and for each type, both by volume and by number of trees, the greatest amount is from 30″ to 40.″ The amount of windfall both by standing trees and by volume, for trees between 32″ and 40″ varies, approximate figures for standing trees being, in the fir type 40 per cent, in the hemlock type 25 per cent, and in the cedar type and also for the whole area 35 per cent; and by volume, 15 per cent for the fir type, 20 for the hemlock type, 40 for the cedar type, and 35 per cent for the area.

All the figures for the per cent of the total volume that is in windfall, with the exception of those for the fir type, show essentially the same thing, as is brought in graphic form by the accompanying curves, No. 2. There is a rise up to 32″ to 40″ and then a rather rapid descent continuing from 70″ to 80″, after which there is a rapid ascent. On the total 331.6 acres on which the data were obtained, there was no windfall in the trees above 100″ in d. b. h. This indicates that after this diameter is reached, the trees are so firmly established that the danger from windfall is at a minimum. In the fir type, cedar above 60″ appears immune from windfall; the same conditions appear in this type as in the whole area, except that the lowest per cent before the second rise is for from 42″ to 50″ instead of from 72″ to 80″. Although above 60″ d. b. h. no windfall in cedar occurred, 26 per cent of the stand by volume, and over 5 per cent by number of trees, is between 60″ and 100″. The greatest amount of windfall both by volume and by number of trees occurs in trees from 30″ to 40″ d. b. h. and after that the danger of windfall is much less until the trees are from 80″ to 100″, when it is again considerable.

As a result of the study, it appears that the greatest amount of windfall occurred in the hemlock type, where the soil was poorer, and where surface fires had run through the stand. In the cedar windfall the amount by volume was 12 per cent, whereas in other types it was only 8 per cent. For areas where the conditions are very similar to those on this watershed in regard to general forest conditions, and approximately the same relative amounts of the associated species, about 10 per cent of the merchantable cedar will be windfall. The greater per cent of it will be in trees from 30″ to 40″ in diameter. In general, trees over

100″ in diameter appear immune from windfall, in the fir type this immunity holds for trees over 60″ in diameter. The greatest amount by volume occurs throughout the area and by types, in trees between 32″ and 40″. This diameter class and that from 92″ to 100″ are the most critical periods in respect to windfall, as shown by the greatest per cents of windfall in the standing timber occurring in these classes, except in the fir type, where it is for 32″ to 40″ and for 52″ to 60″ that the most cedar windfall occurred. This difference in the fir type is due to the greater protection afforded the cedar by the presence of a greater number of firs about them. The danger of windfall seems little affected by exposure or topography, except in the case of very steep exposed localities where there was windfall in fir; but tall, dominant trees with well formed crowns are more liable to be windthrown than others; much of the windfall in these other shorter trees and in the trees of smaller diameter classes, occurred where the larger ones have carried them down either by opening up the stand and weakening their hold on the soil, or because of interlacing root systems.

THE PROGRESS OF WOOD IDENTIFICATION IN THE PHILIPPINE ISLANDS

By E. E. Schneider *

[This very interesting article was submitted nearly two years ago, but was delayed on account of the pressure on space by material of closer home interest. The article has lost nothing of its interest by the delay.—Ed.]

The relative complexity and difficulty of the study of wood structure is primarily, of course, a mere matter of number of species. There are probably few countries in the world where in an equally small area there can be found a more complex and varied forest flora than in the Philippine Islands and where, consequently, there is presented a wider and more interesting field for the study of woods.

The Philippines extend over about 1100 miles, from the latitude of the middle of Borneo to near the southern end of Formosa. Geologically, as well as by population, they constitute the northernmost spur of the Indo-Malayan region. Their topography is very rugged, ranging from coastal swamps to mountain tops of 10,000 feet in height. Besides coral and limestone soils, they possess almost every possible type of soil of volcanic origin. The flora of the Archipelago is, in the main, of Malaysian origin, but numerous Formosan, Japanese and Chinese species are also found.

More than 10,000 species of woody plants have so far been recorded. Of these, about 2500 are trees, in the botanist's wide acception of the word. The species that, by size and quality of product, can be called timber trees number over 500, while those that reach the dignity of being "commercial woods" will probably reach 200 or more. These figures, vague as they are, are very conservative estimates, and will undoubtedly be largely increased as further explorations and collections enable us to make them more accurate.

A single concrete example will illustrate these conditions. At Lamao, Province of Bataan, only twenty miles or so from Manila, there is a forest reserve containing 17 square miles. It extends from the shore of Manila Bay to one of the peaks of Mount Mariveles, 4600 feet in height, and contains at least four types: a bit of beach, a small area of mangrove swamp, a fairly heavy

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dipterocarp forest on the slopes, and mossy forest on the ridges and summit. Up to 1909 there had been listed from this reserve 548 tree species; since then, others have been collected and determined, still others remain undetermined, and it is very probable that some still remain to be discovered. When we consider that this small area has probably been used as a collecting area more than any other place in the Islands, it becomes plain that it is impossible to make more than vague estimates of what may yet be found in the great, half-explored forests of other regions.

A word here would not be out of place regarding the methods of collection used by the Bureau of Forestry. For more than ten years, forest officers have collected wood specimens with botanical material. The botanical material is registered in a separate series in the Botanical Section of the Bureau of Science, and each wood specimen is stamped with the number of its corresponding botanical material from the same tree. In this way it is possible not only to label each wood specimen correctly according to the botanical report furnished by the Bureau of Science in the first place, but also to make future corrections, so that the nomenclature of the wood specimens can keep even pace with progress of botanical knowledge. When, for instance, the Botanical Section of the Bureau of Science publishes a complete review of a given family, all the wood specimens of that family in the Bureau of Forestry collections are taken from the shelves, the numbers checked with those cited in the publication and the labels completed or corrected. The entire collections of the Bureau of Forestry now comprise the following material: hand specimens (pieces 1 cm. x 10 cm. x 15 cm.) and shelf specimens (small sections of logs showing bark and sapwood), all with botanical material, about 6,000 numbers, representing every province in the Archipelago; hand specimens of trade samples, that is commercial lumber without botanical material, about 2,000; museum logs with botanical material, over 400; and museum planks (almost all commercial), from six inches to four feet wide, over 300. The total number of species represented by this material is over 1500, belonging to more than 100 families.

As an extreme instance illustrating the magnitude of the task of making a collection of Philippine woods may be cited the case of the genus Eugenia, of the family Myrtaceae. Of this genus the collections of the Bureau of Forestry contain botanically identified specimens of no less than forty-two species, yet this is less than half the number of species of the genus that have so far been enumerated in the Islands. On all this material, but primarily, of course, on the botanically authenticated specimens, are based all the studies in wood technology of the Bureau.

The first publication under the American regime having to do with timber was *Important Philippine Woods,* by Captain (now Major) George P. Ahern (Manila, 1901). This was a compilation of notes, somewhat in the nature of a "check-list," giving the distribution, habit and habitat, and common and scientific names of a limited number of trees, with remarks about the mechanical properties, general appearance and uses of the woods, the data being taken from all sources then available.

As early as 1903, some beginnings were made of the study of the structure of Philippine woods with the object of identifying positively commercial material. Mr. J. J. Eaton, of the Bureau of Education, in co-operation with the Bureau of Science, prepared transverse, radial and tangential sections of a number of species, which were photographed, the photographs being accompanied by very careful and detailed descriptions. For various reasons, this work was not completed and published. Though these descriptions would undoubtedly be of service to any one undertaking a minute and detailed study of the subject, the methods employed were too complex and laborious to be available for practical application in the identification of commercial material in quantities.

Somewhat later, Mr. J. R. Hillsman, formerly of the Bureau of Forestry and later of the Forest Products Section of the Bureau of Internal Revenue, compiled a very complete and in the main very accurate set of descriptions of the gross characteristics of all the woods named in the lists of the first, second, third and fourth groups in the *Forest Manual.* These descriptions included also, in many cases, notes on the minute structure as revealed by a hand lens in a smooth cross section. This work, too, was never published, but was of considerable use to succeeding writers.

The meaning of the "groups" above referred to should be explained. For administrative purposes, the common and well known timber trees were classified during the Spanish regime into several groups, the forest charges or stumpage varying on each timber according to the group in which it was legally listed.

With various modifications, this system has been retained. The present classification, which has been in force for about ten years, recognizes four groups, the stumpage being highest in the first, which includes some of the finest cabinet woods and some of the most valuable construction timbers, and becoming progressively less in the other three groups. All species not named in the *Manual* as belonging to the first three groups fall into the fourth. Now this list has two great defects; it includes, in the first place, various species now known to be, on account of their small size or limited distribution, of relatively little commercial importance, and, on the other hand, fails to mention many large and abundant species. The earliest work in the line of descriptions of Philippine woods was naturally based on these lists in the main; it was only just beginning to be realized how small a portion of the field they covered, and even had the writers of that time attempted to go beyond the limits of the official lists, the exploration of the forests and the collection of authentic material had not progressed far enough to furnish means for describing other species.

The second publication on wood technology was Bulletin 4, Bureau of Forestry, 1906, by Rolland Gardner, entitled *Mechanical Tests of Thirty Philippine Woods,* followed in 1907 by a second edition containing tests of four additional species. This work, as its title indicates, contained little material that would aid in identification.

In 1907 also, there was published in the Philippine Journal of Science, the first work devoted entirely to the subject of minute structure and identification, namely, *Philippine Woods,* by F. W. Foxworthy. This work, based on the same list as Hillsman's notes, contains a key arranged according to the minute structural features, very detailed descriptions, and fifty-five microscopic photographs of cross sections with a magnification of about five diameters. It was written with the purpose of assisting the average wood-user to identify commercial woods with no apparatus more elaborate than a sharp knife and a good pocket-lens and it undoubtedly contributed a great deal to a better knowledge of the subject on the part of trade school teachers and others engaged both in the production and consumption of lumber. It was this work that first brought to the attention of the public interested in wood the fact that the prime means of identification is the structure as shown in the cross section. The Chinese, Filipino and Spanish lumbermen had no notion of any means of identification other than examining the texture, color, odor, taste, hardness, etc., with the aid, in occasional species, of some special feature, such as colored deposits in the pores, peculiar oils or resins, etc. Most Americans, new to the country and ignorant of even the existence of a science of wood technology, had no recourse but to follow their example.

Philippine Woods was followed, in 1909, by *Indo-Malayan Woods*, by the same author. This work gives a bird's-eye view of the woods of the whole Indo-Malayan region, with special reference to the Philippines, and is illustrated with over one hundred photographs like those of the former work, about ninety of the illustrations being of Philippine species. The most interesting and valuable single feature of the book is probably the very comprehensive treatment of the family Dipterocarpaceae. This family, by far the most important in the Indo-Malayan region, had been sadly neglected in the Philippines under the Spanish regime and in fact it was only at about the middle of the past decade that its importance began to be fully realized.

Since the above, no important works have been published bearing directly on wood identification. Bulletin 10, Bureau of Forestry, *The Forests of the Philippines,* by H. N. Whitford, contains short descriptions of the gross characteristics of the species described in Part II, Bulletin 11, Bureau of Forestry. *Uses of Philippine Woods* describes only the gross structure of the hundred and forty-odd woods mentioned in it, as do also the Descriptive Leaflets issued with hand specimens distributed by the Bureau. *The Philippine Craftsman,* December, 1912, published an article by the present writer, entitled *Methods of Identification of Philippine Woods*, which described some eighty odd woods, but little of the material was new, the article having been written principally to make easily accessible to laymen the knowledge scattered through various more or less technical works.

To an audience of foresters, wood-technologists and others interested in related subjects, it is not necessary to say that all this extensive collecting and study of wood specimens is not a mere academic matter, but has many and extremely practical applications. But some one may ask just what some of these applications are in a country where conditions are so different from those of North America.

In the first place, it must be understood that the Bureau of Forestry under the American regime began with almost a clean slate. The Spaniards had done very little in exploring or developing the immense dipterocarp forests, confining their attention principally to the scattered trees of the finest cabinet and most durable construction woods; their literature on the subject was scanty and, for the most part, extremely unscientific; the botany of the Islands was in a condition only to be described as chaotic; and finally, practically nothing existed in the way of collections of either herbarium material or wood specimens. If any such had existed (and it is to be supposed that the Spanish Forestry Bureau must have had something in the way of a working collection of herbarium and wood specimens), they were probably lost in the fire which totally destroyed their offices in Manila, just a year previous to the American occupation. From all this it will be seen that the task of the Bureau of Forestry was almost like that of exploring an entirely new country. Only by actual exploration and collecting could any knowledge be acquired at all.

Now for the application of the knowledge so gained. First, there was the very pertinent and practical matter of collecting the forest revenue. Once the system of classifying the woods into various groups was adopted, it was necessary to learn to know the trees and their products, in order to carry out properly the law regarding the collection of the forest charges. And here, at the very beginning, entered a difficulty not mentioned before. It is well known how many different popular names a given species may have in different parts of the United States. If this is the case where all the people speak one language, imagine the condition in a country where they speak a different dialect or language in every province, or even in adjacent towns! A complete dictionary of Philippine plant names (if it is ever written!) will be about the size of Webster's Unabridged. Is it necessary to explain the need of being able to recognize the timber in order to tell to what group it belongs?

Probably half the inquiries that come to the Bureau of Forestry regarding classification, qualities, uses, etc., of timber, originate in this matter of the variety of local names and in a majority of cases they can only be answered positively if the inquirer sends a sample of the wood in question. Such inquiries come from every Bureau of the Government that makes use of wood in any way, from railway and naval construction companies, public and private contractors and a host of others. Very frequently they merely want the specimen identified, the inquirer being already satisfied that if the wood is such and such a species, known to him by name, it is fitted for his purposes.

Frequently, also, samples are submitted without any name, the inquirer desiring all possible information about them. In such cases (if the specimens can be identified) the Bureau of Forestry gives the inquirer the name, qualities, uses, distribution and supply, in short, all information of which data are on record.

Finally, numerous inquiries come from other countries, often accompanied also by samples. These are of two kinds, inquiries regarding Philippine woods that have been exported and are not well or not at all known at their point of arrival, and others accompanying samples of foreign woods and wishing to know if similar ones can be obtained from the Philippines.

Hardly any two such inquiries involve all the same points, but it is plain that the answer to all of them depends primarily on the identification of the sample in question.

The most important work in the dissemination of the knowledge of wood structure, at least as regards the future, is that being done at the Forest School. Each class is given instruction extending over the entire senior year in wood-technology, the material used being, besides literature, hand specimens of about one hundred kinds of wood. Details of the methods of instruction would require too much space here, but an example of the results obtained may be of interest. The present school year (1913) began June 9. On July 3 Dr. Foxworthy gave the senior class a test on one hundred small wood specimens, comprising twenty-four species. The thirty-six students in the class identified on the average, 76 per cent of the specimens. Two weeks later, the second test was given, again on one hundred specimens, but consisting of thirty-one species. The class identified 86 per cent. One week later, July 24, the test was on thirty-eight species and the class made an average of 87 per cent.

Formerly, forest officers acquired their knowledge of timber in a haphazard, empirical fashion, much as did lumbermen and others. In the future, every native ranger (for no permanent rangers are now appointed except from the graduates of the school) will start out equipped with a good working knowledge of a hundred or more species. Besides, he is expected to carry to his station with him, for ready reference, the set of samples furnished him at the school. It is evident how much it will serve to simplify questions of nomenclature and classification when scores of rangers thus equipped are scattered through the provinces. Especially will it contribute to familiarizing the inhabitants of all provinces with the official names of the commoner woods. In every region there are people who recognize positively certain trees or timbers, but know them only by their local names. If one of these "local experts" is told by a ranger, backed up by a sample bearing a printed label, that the woods he knows, say, by the Bikol or Bisaya name Baráyung is officially and in commerce called Tíndalo, he will remember it and so much is gained for the standardization of species names. And this alone, when one remembers that Molave, for instance, has about forty recorded local names, is no small matter.

An almost equally valuable result, though an indirect one, of the preparation of specimens for study has been the opportunity for furnishing authentic specimens of a very large number of species to inquirers of all kinds. The distribution of specimens, which was begun, so to speak, merely incidentally, has grown to such an extent that during the last few years an average of three or four thousand hand specimens per year have been sold and otherwise distributed. And these have gone out not only within the Islands, but a great many to other countries, especially the United States, England and Germany.

RULES OF THUMB FOR VOLUME DETERMINATION

By F. R. Mason

For a long time the writer felt the need of a rough rule of thumb that would give approximately the volume of standing trees based on a simple mathematical computation. It is a well-known fact that it is an endless task to try to memorize volume tables when a number of species are being dealt with constantly. Many of the existing and generally published tables have been tried out by checking them against tree measurements and they are usually found to be inadequate, varying anywhere up to 100 per cent in

D.B.H. Inches	Number of 16-foot Logs														Basis No. of Trees
	1		2		3		4		5		6		7		
7	1.8	2	...	...	...	...	...	...	...	...	...	...	...	...	2
8	2	2	3.6	5	...	...	...	...	...	...	...	...	...	...	34
9	2	2	4	5	6	6	...	...	...	...	...	...	...	...	20
10	2	2	5	5	7	7.5	...	...	...	...	...	...	...	...	18
11	3.5	3	6	5	8	9	13	11	...	...	...	...	...	...	50
12	...	...	7	5	9	9	12	14	...	...	...	...	...	...	71
13	...	...	8	7	11	10.5	15	16	...	...	...	...	...	...	74
14	...	...	8	9	12.5	13.5	16.5	18	21	22.5	...	...	...	...	118
15	...	...	...	...	14	15	19	20	26	25	...	...	...	...	102
16	...	...	...	...	14.5	15	20	20	26	25	35	36	...	...	74
17	...	...	...	...	16	16.5	21	20	28	30	...	...	...	...	66
18	...	...	...	...	20	19.5	25	24	30	30	41	43	...	...	47
19	...	...	...	...	18	16.5	26	25	34.5	32.5	45	48	...	...	47
20	...	...	...	...	20	19.5	29	28	38	40	52	54	...	...	33
21	...	...	...	...	36	36	32	34	41	40	58	60	...	...	25
22	...	...	...	...	...	...	32	32	45	45	...	...	...	...	16
23	...	...	...	...	...	...	38	36	55	52	64	57	75	70	10
24	...	...	...	...	...	...	41	40	54	52	54	54	92	79	14
25	...	...	...	...	...	...	38	36	59	57	69	69	124	112	8
26	...	...	...	...	...	...	...	...	65	65	87	93	104	122	5
27	...	...	...	...	...	...	...	...	...	...	78	78	...	...	3
28	...	...	...	...	...	...	...	...	77	77	...	...	...	...	4
29	...	...	...	...	...	...	...	...	82	81	...	...	...	...	1
30	...	...	...	...	...	...	...	...	...	...	96	99	120	122	5
31	...	...	...	...	...	...	...	...	93	82	109	100	...	...	2
32	...	...	...	...	...	...	...	...	...	...	...	...	122	137	1
33	...	...	...	...	...	...	...	...	...	...	...	...	162	157	1
34	...	...	...	...	...	...	...	...	...	...	...	...	140	140	1
35	...	...	...	...	...	...	...	...	...	...	...	...	211	213	2
36	...	...	...	...	...	...	...	...	...	...	149	140	...	...	1
37	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
No. of Trees	30		71		298		301		124		22		9		855

error for individual trees and often up to 30 per cent for groups of trees when applied to the timber in Idaho and Montana, using the Scribner Decimal C rule.

The writer had occasion to make up a volume table for Douglas fir and at the time the scaled volume of individual trees was noted there was also noted the scale of the butt log of each tree, together with several other figures upon which several rules of thumb are based. When the computations were completed it was found that the volume in each size class checked very closely with the volume as obtained by averaging the scale of the butt and top logs and multiplying by the number of logs, using 16 feet as a standard log length. This rule is reported as being considerably used by a number of Minnesota pine cruisers. In the preceding table each left-hand column shows the average volume of a group of trees; the right-hand column shows the rule of thumb result for the same group.

These results indicate an average difference of about one per cent in timber of this size, with a maximum difference of about 13 per cent in individual trees.

The following is a comparison of 59 Douglas fir trees ranging in diameter from 31 to 52″:

Volume by Scale	*Volume by Rule*	*Volume by Scale*	*Volume by Rule*
1140	1100	2400	2130
1420	1420	2000	1890
1690	1680	1710	1690
1660	1500	2580	2450
1210	1260	1290	1500
1090	990	2320	2380
1690	1590	2990	2870
1500	1440	3050	2800
1280	1260	1910	1710
1620	1560	1930	1960
1320	1260	2120	2000
1170	1110	2760	2380
1700	1590	2600	2590
1420	1560	2390	2590
1770	1920	2620	2590
1640	1740	3860	3750
1450	1560	3020	2730
1760	1740	1990	1920
2470	2160	2650	2520
1560	1680	2600	2520
1810	1820	2940	2520
1650	1680	3080	3280
1340	1400	3150	3130
1680	1820	3170	3040
1760	1610	4510	4400
1510	1470	5360	5160
1420	1290	3570	3420
2070	2130	3200	2960
2110	1850	5050	5130
2390	2380		
		131,120	127,580

The result by rule is 3 per cent low. Greatest difference 16 per cent.

The close coincidence in this species led to the belief that if similar results could be obtained with other species a general volume table might be made based on a formula that would be applicable to several or all species. A number of comparisons have been made using from 20 to 100 or more trees of each of the following species, with results as indicated. For cedar, results are very close for trees up to 24" in diameter but are too high by 10 to 15 per cent for trees over this size. For White pine, spruce, Yellow pine, larch, Lodgepole pine and White fir, average results are within 5 or 6 per cent of actual volume for trees of all sizes, individuals varying in extreme cases up to 15 per cent, but seldom over 6 or 7 per cent.

Such results for individual trees are closer than can usually be found in using volume tables owing to the variation of individual trees from the average volume for its size usually caused by different degrees of taper in the lower logs of the tree which contain the greatest volume. For example, two trees having the same D. H. B. and same number of logs may vary two or three inches from having the same taper in the lower logs where the volume is greatest and hence may vary considerably from one another in volume. By basing the rule on the *scale* of the butt log rather than on D. B. H. this variation is largely eliminated.

Another advantage possessed by this method is that it makes little difference what diameter is used for the top log as long as the number of logs to this point is correctly used.

The following examples of Yellow pine trees will illustrate this point:

Yellow pine 22 inches D.B.H., 5 logs to 6-inch top

$$\frac{\text{Scale butt log} + \text{scale top log}}{2} \times \text{number logs} = \text{total scale}$$

D.I.B.	*Inches*	*Scale*
First log	18.6	24
Second log	16.4	16
Third log	14.5	14
Fourth log	11.4	7
Fifth log	6.0	2
		63

		Rule	*Actual*
	$\frac{24+2}{2} \times 5$	= 65	63
If only 4 logs are cut	$\frac{24+7}{2} \times 4$	= 62	61
If 3 logs are cut	$\frac{24+14}{2} \times 3$	= 57	54
Conversely if the butt log is discarded	$\frac{16+2}{2} \times 4$	= 36	39

Yellow pine 23-inch D. B. H.—6 logs

D.I.B.	*Inches*	*Scale*			
First log	19.1	24	$\frac{24+2}{2} \times 6 =$	78	80
Second log	17.8	21	$\frac{24+6}{2} \times 5 =$	75	78
Third log	16.1	16	$\frac{24+11}{2} \times 4 =$	70	72
Fourth log	13.7	11	$\frac{21+2}{2} \times 5 =$	57.5	56
Fifth log	10.0	6			
Sixth log	6.0	2			
		80			

or

Yellow pine 27-inch D. B. H.—6 logs

D.I.B.	*Inches*	*Scale*			
First log	20.9	30	$\frac{30+2}{2} \times 6 =$	96	98
Second log	19.2	24	$\frac{30+7}{2} \times 5 =$	92.5	96
Third log	17.9	21	$\frac{30+14}{2} \times 4 =$	88	89
Fourth log	15.1	14			
Fifth log	11.2	7			
Sixth log	6.0	2			
		98			
and conversely			$\frac{24+2}{2} \times 5 =$	65	68

These are not selected trees, but were chosen at random from measured trees that contained an even number of 16′ logs.

The feature of dropping an entire or part of a butt log is particularly adaptable to trees having defective butts which would not be utilized, the D. I. B. measurement being estimated at 16 feet above where the tree would be butted off. For example, if the butt of a tree is worthless for a distance of, say, 4 feet, the D. I. B. would be taken at 20 feet instead of at 16 feet, the first four feet being disregarded. Such species as Yellow pine to which a fixed top diameter can not be strictly applied may be estimated to the top diameter which would be taken and this diameter used in getting the scale of the top log.

From the formula a volume table may be made up which will be applicable to practically all trees cut to the same diameter in the top. For example, if trees are cut to 6″ tops

		Number of Logs			
D.I.B.	*Av. log*	2	3	4	5
10	40	80	120	160	...
12	50	100	150	200	250
14	65	130	200	260	330
16	90	180	270	360	450

A simpler application is to list the average log for each size of D. I. B. and multiply this result by the total number of logs tallied in trees of each D. I. B.

The simplest application of the rule to individual trees is to memorize this figure for each D.I.B. or to memorize the scale rule and compute the scale of a tree whose volume is desired. In this connection, it will be found that three times the radius squared will give approximate results for 16′ logs over 24″ in diameter.

Another rule of thumb has been devised by Lumberman Girard which is also dependent on the scale. It has the advantage of being obtained from the breast height measurement of trees outside the bark rather than an estimated diameter inside the bark at a point which can not be reached from the ground. It has been carefully checked over and seldom varies over 4 or 5 per cent from actual measurements of groups of trees, usually less than 2 or 3 per cent. It is subject, however, to variations in individual trees above or below the average.

This rule is to add 6 inches to the D.B.H., divide by 2 and use this result for the diameter of the average log. The scale corresponding to this diameter multiplied by the number of logs gives the volume of the tree. Thus a tree 24″ D.B.H. with 5 logs will be computed as follows:

$$\frac{24+6}{2} = 15'', \text{ scaling } 140;$$

$$5 \times 140 = 700 \text{ feet B.M.}$$

This rule will hold for White pine and spruce cutting to a 6″ top and for larch cutting to an 8″ top. For Douglas fir cutting to an 8″ top add 4″ instead of 6″; for Lodgepole pine cutting to a 6″ top add 5″; for Yellow pine under 20″ add 6″; 20 to 25″ add 8″; 26″ and over add 10″, or for all sized Yellow pine add 8″ straight.

A volume table or table of average logs may be made up from this rule similarly to that described above. Neither of these rules makes any allowance for breakage or defects.

THE ABNEY HAND LEVEL AND THE CHAIN ON INTENSIVE FOREST SURVEYS

By C. R. Anderson

The articles which have appeared within the last two years on control in forest surveys indicate general dissatisfaction with the aneroid barometer for obtaining vertical control in mapping on intensive surveys. The Abney hand level, where substituted for the barometer, has proved its value. The topographers of reconnaissance parties and land classification crews of the United States Forest Service now condemn the use of the barometer for any work except the making of very rough maps.

It is impossible to say to what extent the aneroid barometer itself is to blame for some of the poor maps made. There is no doubt that poor results have been attributed to its use when frequently they were due to the carelessness or inefficiency of the man using the instrument; there is, however, also no doubt that foresters have expected too great a degree of accuracy from its use. Experience shows that in a country of long, moderately steep slopes, the aneroid barometer will give fair results. Almost any other condition demands the use of some other method.

A serious objection to the aneroid barometer is that its use tends to make the mapper careless of detail in the field. The correcting of the map invariably means the loss of some detail. This loss of detail, however little it may be, has the effect of really encouraging the man to take less detail in the field. Whether the man works carefully or carelessly, the tendency in the use of the barometer is in the direction of encouraging him to ignore that which gives the map real value for most purposes. The use of the Abney hand level, on the other hand, encourages the good mapper to be a better mapper, for he can get and hold detail by its use.

The Abney hand level does, however, demand greater skill on the part of the mapper than does the aneroid barometer. The average member of a reconnaissance party or land classification crew can show uniformly fair results with an aneroid barometer after a few days' practice; it will take him considerably longer to become thoroughly familiar with the Abney hand level, and skilled in its use.

For intensive work the method of using the Abney hand level with pacing of the distance lays itself open to the criticism that the resulting map cannot be more nearly accurate than is the pacing. Therefore, under conditions where it is extremely difficult to pace, owing to steepness of slope, presence of brush or windfall, or other disturbing factors, the horizontal distance must be obtained in some other way than by pacing. This has led to the trial, along with the Abney hand level, of the tape or the chain.

The tape will generally be found more acceptable than the chain. The use of either renders necessary a table giving the correction for the slope, which figure must be added each time to the distance on the slope to give the desired horizontal distance.

The following table shows the distance that must be added on slopes of different per cents, to get the desired horizontal distance. The corrections for the intervening per cents can be got by interpolation.

TABLE OF SLOPE CORRECTIONS

Slope *Per Cent*	100-*Foot Tape* *Feet*	2-*Chain Tape* *Feet*	300-*Foot Tape* *Feet*
5	.1	.2	.4
10	.5	.7	1.5
15	1.1	1.5	3.4
20	2.0	2.6	6.0
22	2.4	3.2	7.2
24	2.8	3.7	8.5
26	3.3	4.4	10.0
28	3.8	5.1	11.5
30	4.4	5.8	13.2
32	5.0	6.6	15.0
34	5.6	7.4	16.9
36	6.3	8.3	18.8
38	7.0	9.2	21.0
40	7.7	10.2	23.1
42	8.5	11.2	25.4
44	9.3	12.2	27.8
46	10.1	13.3	30.2
48	10.9	14.4	32.8
50	11.8	15.6	35.4
52	12.7	16.8	38.1
54	13.6	18.0	40.9
56	14.6	19.3	43.8
58	15.6	20.6	46.8
60	16.6	21.9	49.9
62	17.7	23.3	53.0
64	18.7	24.7	56.2
66	19.8	26.2	59.4
68	20.9	27.7	62.8
70	22.1	29.2	66.2
72	23.2	30.7	69.7
74	24.4	32.2	73.3
75	25.0	33.0	75.0

There is now obtainable a 2½-chain tape having the last ½ chain graduated for the per cent slope. The person watching the tape lets the 2-chain point run by, "snubbing" the tape at the figure corresponding to the per cent slope. The distance is then just 2 chains on the horizontal. Obviously the use of this tape renders the table of slope corrections unnecessary. The per cent graduations are the more desirable. The scale should run to at least 125 per cent for very steep country.

The forest survey crew can be run as a two-man crew, or as a three-man crew. On the two-man crew the compassman and mapper pulls the tape while the other man watches the rear end of it. On the three-man crew the division of work is quite different. Generally the best arrangement is for one man to run compass, one to map, and one to estimate the timber or do the other special work of the crew. The compassman pulls the tape, as on the two-man crew. The mapper stays at the rear end of the tape, thus permitting the third man to go ahead at his pleasure.

The mapper in using the hand level sights ahead on compass line parallel to the slope or picks out a definite object above the ground on or near compass line and allows for its height above it when he gets up to it, or sights on the man at one end of the tape, he himself being at the other end. The last is the more nearly accurate.

The following illustration indicates the procedure, with a two-man crew, estimating timber. Let us suppose that the elevation of the control point at which the crew is to begin work is 3250 feet. The compassman takes a hasty sight on line and finds that the slope is about 35 per cent. He calls out "35" to the estimator, and goes ahead. The latter stops him at 2 chains plus the distance additional for a 35 per cent slope. The compassman must now determine accurately the elevation of his present position. He turns around, takes a careful sight on the estimator, signals the latter to come ahead, then reads the Abney. It reads +34 per cent. The compassman then refers to his table of difference of elevation, finds that 34 per cent for 2 chains is 45 feet, adds that to 3250 feet, and has 3295 feet as the elevation of the new point. He plots the point and maps up to that point using actual contours. The estimator comes ahead while the compassman is figuring and mapping.

The notes can be kept in several forms. Probably the simplest form is that shown below, in which the first column gives the chains or feet, the second the per cent, and the third the actual elevation.

2+34—3295
4+20—3321
6—22—3292

The putting down of the per cent will enable one to locate more easily later any mistakes in figuring the elevation. The notes should be put on the margin or on the back of the map sheet.

The following table gives the difference of two points, on slopes of different per cents, the points being 2 chains apart horizontally.

TABLE OF DIFFERENCE OF ELEVATIONS FOR 2-CHAIN DISTANCE

Slope Per Cent	*Difference of Elevation Feet*	*Slope Per Cent*	*Difference of Elevation Feet*	*Slope Per Cent*	*Difference of Elevation Feet*
1	1.3	26	34.3	51	67.3
2	2.6	27	35.6	52	68.6
3	4.0	28	37.0	53	70.0
4	5.3	29	38.3	54	71.3
5	6.6	30	39.6	55	72.6
6	7.9	31	40.9	56	73.9
7	9.2	32	42.2	57	75.2
8	10.6	33	43.6	58	76.6
9	11.9	34	44.9	59	77.9
10	13.2	35	46.2	60	79.2
11	14.5	36	47.5	61	80.5
12	15.8	37	48.8	62	81.8
13	17.2	38	50.2	63	83.2
14	18.5	39	51.5	64	84.5
15	19.8	40	52.8	65	85.8
16	21.1	41	54.1	66	87.1
17	22.4	42	55.4	67	88.4
18	23.8	43	56.8	68	89.8
19	25.1	44	58.1	69	91.1
20	26.4	45	59.4	70	92.4
21	27.7	46	60.7	71	93.7
22	29.0	47	62.0	72	95.0
23	30.4	48	63.4	73	96.4
24	31.7	49	64.7	74	97.7
25	33.0	50	66.0	75	99.0

No table is needed where a 100-foot tape is used, the per cent slope giving the difference of elevation at once. When the 300-foot tape is used, the per cent slope must be multiplied by 3 to give the difference of elevation.

All forest surveys offer difficulties which must be overcome, and chances for errors which must be guarded against. The new method is no exception to the rule. The Abney hand level must be kept in perfect adjustment. The man who fails to test the instrument every morning has no place on a forest-survey crew. The mapper must be exceedingly careful to see that he is not sighting uniformly too high or too low.

Abrupt changes of slope frequently give trouble. Perhaps the mapper will not be able to see the man at the other end of the tape at all when he reaches the new point, due to a sharp ridge, or to a sudden drop or rise in the ground. He must then "break chain," as it were, and figure the shorter distance. The tape length may carry the compassman across a gully or draw, with an abrupt descent and rise. Shall he "break chain?" Or shall he proceed to the end of the chain, pull it taut, then get the proper correction?

The members of a crew must always work together so as to lose the least amount of time. Oftentimes the compassman is through mapping at a particular point before the estimator reaches him. Shall he wait, then go ahead his tape length, and again wait for the estimator to come up? Or shall he mark the point prominently and go ahead, being careful not to pull the end of the tape past the mark before the estimator reaches it? Where there is very little underbrush, a deep mark made with the heel can usually be picked up easily. Where there is much brush, the estimator may have trouble finding the mark, if the compassman starts ahead too soon. It will often be found helpful in brush country for the compassman to carry some waste paper with him, and impale a small piece on the brush, over the mark on the ground. In brush that breaks easily, two or three pieces of brush broken will answer equally well.

The most serious drawback to the use of the hand level and the tape in mapping on forest surveys is brush. In heavy, stiff brush, the tape may catch and hold tightly until released by one or the other of the crew. Under such conditions it must be pulled with great caution to prevent its breaking. It must not be overlooked, however, that the estimator can follow his compassman's line easily in brush when he has the tape as a guide. The great drawback lies in the inability of the compassman to see in sighting the hand level. This difficulty may at first appear insurmountable, but the fact of the matter is that the sound of the estimator's voice may be substituted for actually seeing him. The latter must face the compassman squarely, open the mouth well, and project the sound directly from the mouth rather than from the throat. A throaty sound cannot be picked up easily. The estimator will, as a rule, fail to appreciate the importance of this point until he himself has tried mapping in brushy country.

The mapper who is trying the hand level for the first time in mapping will wonder how he can possibly run 2 miles of line per day. If the 2½-chain tape, described earlier in this article, is used, there are 80 sights involved in merely carrying the control aside from perhaps numerous side shots. Every movement made by the mapper must count. No advocate of the use of the Abney hand level and chain will maintain that the line can be run as quickly as with the aneroid barometer and pacing. In my experience, the method will take 10 per cent more time. This conclusion is based on a comparison of 24 days' work, using the aneroid barometer, with the same number of days' work with the Abney hand level in the same type of country in the Coeur d' Alene Mountains, on a two-man crew. But when the amount of time necessary to correct the map made with the aneroid barometer is taken into account, it is seen that there is very little difference. It takes from thirty minutes to one hour to correct a map made with the aneroid barometer, where the curve must be plotted, the day's readings then corrected, and the map adjusted. This offsets almost exactly the 10 per cent additional time needed in the field when the Abney hand level is used.

The question will arise as to closeness of "checking out." In country in which a 100-foot or a 50-foot contour interval shows the country well, the average error in distance can be made less than one-half chain, the average vertical error less than 25 feet. Time and again the error will be less than 10 feet.

The results generally obtained with the use of the Abney hand level and the tape are usually satisfactory. A high percentage of the maps made as herein described are among the very best maps made on intensive forest surveys in the United States. Timber appraisers, lumbermen, and logging engineers, who are, as a rule, exacting in map requirements, have found them to stand the test.

HARDWOOD PLANTING IN OWENS VALLEY, CALIFORNIA

By L. T. Larsen

Much interest has been shown in the hardwood planting of the middle west. Probably few people, however, are aware that the Timber Culture Act of March 3, 1873, which prompted much of the hardwood planting in Nebraska and Kansas, was responsible for similar work in the arid regions of Southern California.

Considerable planting was done 22 to 30 years ago in Owens Valley in compliance with this act, and the plantations which have received proper care have done remarkably well. Only a few species were planted at that time, however, and in the spring of 1911 the Forest Service experimented with a large number of eastern hardwoods to determine which species are best adapted to that region.

Very little natural tree growth occurs in Owens Valley and the increasing demand for fuel and fence post material has resulted in the cutting of most of the accessible timber in the surrounding region. In consequence, there is a marked shortage of such material in the valley and prices are very high.

Owens Valley lies in east-central California. It is long and narrow and has a northwest-southeast trend. The Sierra Nevada Mountains form the west wall of the valley and the Inyo and White Mountains the east wall. The floor of the valley ranges from 2 to 8 miles in width and its length, from the Mono Divide to the south end of Owens Lake, is 120 miles. The elevation of the valley floor ranges from about 8,000 feet above sea level at the north to 3600 feet at Owens Lake, the lowest point of the valley.

The Sierra Nevada Range is of granitic formation, and the soil resulting from the disintegration of the rocks varies in texture from a silt to a gravel. The White Mountain range is built up of a thick series of sedimentary rocks and the soil along the western slope of this mountain range is a gravel, sand or fine silt. By far the greater part of the soil consists of a coarse sand at the surface with an admixture of silt at a depth of 3 to 4 feet. Occasionally, at a depth varying between a few inches and several feet, there is encountered a hardpan composed of fine silt. The soil of the bottomlands along the river contains considerable admixture of loam, the result of lake and river deposits, and in places there is much alkali and soda in this soil.

In general, most of the soil of the valley is of sufficient quality to support most species of hardwoods. However, only poor growth can be expected on alkali or soda soils or wherever the hardpan occurs close to the surface.

Owens Valley has a semi-arid climate with an average of less than 5 inches of rainfall. Most of the rain comes in winter and only occasional showers occur during the summer. The monthly mean temperature at Independence for a period of 15 years varied from 40.2° *F.* to 78.6° *F.* with a mean annual temperature of 58.1° *F.*

The plantations established in the valley to meet the requirements of the Timber Culture Act were well cared for at the start but most of them have since been neglected. The species planted were Black locust, Lombardy poplar and cottonwood. A large amount of planting has also been done for ornamental and windbreak purposes and practically all of this work has been a decided success. Generally, fast-growing, short-lived species have been used, such as willow, poplar, and cottonwood. Black locusts, Soft maples, Black walnuts, and Horse chestnuts have also been planted for ornamental purposes and are doing excellently.

A few measurements were taken in several Lombardy poplar and Black locust groves, but because of the differences in the character of the site and the degree of care given the trees, these figures should only be regarded as approximate and suggestive rather than as accurately indicating what may be expected in any given case. Cottonwood has been planted to some extent in rows, but no measurements were taken of this species. In every case, however, the growth has been unusually rapid and diameters of 20 to 30 inches have been attained within 30 years.

The following table summarizes the data secured on the more important groves in the valley:

Grove	*Species*	*Spacing in Feet*	*Age Years*	*Average D. B. H. in Inches*	*Average Height in Feet*	*Value per Acre as Post Material*
Scott........	L. Poplar	5 x 5	22	5.2	48	$207.00
McNally....	L. Poplar	5 x 5	27	6.8	60	313.00
Eaton.......	B. Locust	8 x 8	30	4.4	26	442.50
Eight-Mile...	B. Locust	8 x 8	22	6.6	48	1,000.00
Collins......	B. Locust	5 x 5	5	1.8	20	....
Clark.......	B. Locust	4 x 4	5	2.1	22	....

Both of the poplar groves are on the east side of Owens River on very poor sites and they have received no care for many years.

The Eaton locust grove has been neglected for over 20 years, and there is a hardpan within two feet of the surface at this place. No very good results can be expected on such sites.

The trees in the Collins and Clark groves were cut five years ago and the sprouts are very thrifty. The Collins grove comprises six acres and was established in 1886. Seven years ago every other row was cut out and over $1200 worth of posts obtained. Three years later the remaining rows were cut and still larger returns secured. No record was kept of the number of posts secured from the Clark grove.

The Baker grove, which is on a particularly good site, produced $470 worth of fence posts and telegraph poles per acre in 20 years.

The Eight-Mile locust grove comprises 10 acres, being the largest grove in Owens Valley. This grove has been well cared for and shows what can be expected from well managed Black locust groves in Owens Valley. It is 22 years old and the trees average 6.6 inches D. B. H. and 48 feet in height. Several years ago the city of Los Angeles offered $10,000.00 for the trees in this grove but the owner would not accept this price. It is evident that the establishments of such groves on favorable sites is a profitable investment.

Forest Service Planting.— The four plantations established by the Forest Service in the spring of 1911 are located in the eastern foothills of the Sierra Nevadas at elevations of from 4700 feet to 6400 feet. These plantations were established at ranger stations so that they could be given the necessary care. The subsequent abandonment of one of the stations and the lack of water for irrigation at another, caused the failure of two of the plantations. At the present time the only successful plantation is the one at Wells Meadows. At this place 44 per cent of the trees are alive and many of them are over 6 feet in height. Similar results were obtained at McMurry Meadows, but last fall cattle broke down the fences and damaged practically every tree. The trees at that time were 4 to 7 feet in height. About 15 per cent of these trees are alive and it is probable that most of them will sprout.

In this experiment 4360 seedlings of various species and 2,000 cuttings of poplar and willow were planted. The species planted were as follows: Cuttings of Russian Golden willow; Norway poplar. Seedlings of White ash; Box elder; Silver maple; White elm; Hardy catalpa; Osage orange; Russian mulberry; Norway maple; hackberry; beech; basswood; Black walnut; White birch; Horse-chestnut; butternut; sycamore; alder; larch.

Box elder, White ash, White elm and Silver maple showed up remarkably well at the time of the examination in the spring of 1914. These species averaged 4 to 6 feet in height, while Box elder in some cases were over 10 feet high. Hackberry and Norway maple did fairly well, but most of the other species were a failure. Black walnut, Hardy catalpa, Osage orange, Horse chestnut and butternut suffered from frost, in most cases being killed outright, while in a few instances the terminal was killed and new shoots came out the following spring. The damage from frost is specially great at the elevations at which these trees were planted and it is probable that they would sustain no injury from this source at lower elevations in the valley.

The willow cuttings did poorly and grew in the form of shrubs, but the Norway poplar cuttings made exceptional growth and many of the trees are over 10 feet in height.

While planting timber for commercial purposes will probably here not be conducted on a large scale, still it is certain that many groves will be established for the combined purpose of protection against wind and the production of fuel, fence posts and repair material.

The species recommended for planting in this region for different uses are as follows: *Fuel:* White willow; cottonwood; Black locust. *Fence Posts:* Black locust; Russian mulberry; Green ash; Honey locust. *Farm Repairs:* Green ash; Black locust; Honey locust. *Lumber:* Black walnut; cottonwood.

Black locust is undoubtedly the most suitable for woodlot purposes in Owens Valley and will probably bring the largest returns. Honey locust is also a desirable woodlot tree, but the main objection to it is the clusters of large thorns. This tree, however, is more drought and frost resistant than Black locust.

Green ash is not a very rapid grower but it is a very hardy tree and is well adapted to drp situations and is only slightly inferior to White ash.

Russian mulberry is fairly drought resistant and it makes a vigorous and rapid growth.

Black walnut will probably succeed in the valley, but should first be experimented with on a small scale. It does not grow as rapidly as some of the other species but makes excellent lumber.

The rapid growth of both White willow and cottonwood make them commercially profitable when planted in wet situations. The growth of both species is very rapid but the yield of cottonwood is greater than that of willow.

It is probable that catalpa can be grown successfully in the valley, but there is danger that it may be killed by frosts. Because of its rapid growth and the durability of the wood, Hardy catalpa is an exceedingly valuable tree, and it should be tried out on some of the better soils in the valley at lower elevations.

Windstorms are quite severe in the spring and a shelter of some kind is very essential. Windbreaks serve as a great protection to both orchards and fields and they add greatly to the comforts of the farm.

The species recommended for protection purposes in this locality are: Cottonwood; Lombardy poplar; Silver maple; White willow; Russian mulberry; Box elder; Honey locust; Blue spruce; Scotch pine; Austrian pine. For ornamental purposes the following species are recommended: White elm; White ash; American linden; Norway maple; Sugar maple; Hackberry; Black locust; Honey locust; Blue spruce; European larch.

Establishment and Care of Plantation.—Certain species, like cottonwood and willow, can be successfully propagated by cuttings, but the majority of hardwoods must be established by seeds or seedlings. Ordinarily, one-year-old seedlings are most suitable.

The best time to plant in this region is in early spring. To get the best results the ground should be put into a state of thorough cultivation before planting. Ground with sod should be plowed and disked the year before the planting is done and then disked and harrowed in the spring.

Ordinarily, the best results are obtained when trees are planted in pure stands, and whenever mixtures are advisable they should consist of only a few species. Mixtures are to be recommended when dealing with intolerant species. When such trees are set out in pure stands they must be spaced so closely that they interfere with each others' growth or otherwise grasses and weeds come in and a great deal of cultivation is necessary. By mixing a light-demanding and a shade-enduring species better results are secured and the soil is utilized to a fuller extent.

The width of spacing will depend on the purpose of the planting and the species used. In woodlots in this region a spacing of 5 by 5, 4 by 8, or 6 by 6 feet is recommended.

The cost of establishing a plantation is not great. In most cases it will be necessary to plow and harrow the ground, but the expense of this operation should not exceed $4 an acre. This will then materially decrease the cost of planting and the planting proper will not be more than $2.50 to $4 an acre. The price of broadleaf seedlings runs from $1.50 to $6 a thousand, so the total cost at most should not exceed $12 an acre.

The limited amount of rainfall necessitates irrigation for the first few years at least, and while artificial watering throughout the life of the plantation is not absolutely essential, it is very desirable and the growth will be greatly increased thereby. The trees should be watered as soon as they are set out and for the first few months they should be irrigated at least once a week, after which once a month is usually sufficient. Irrigation should be withheld after late summer to allow the trees to harden off before winter. It is often a good plan to turn in the water early in the winter when no further growth is possible in order to keep the soil from drying out too much during the winter.

When the plantation is not irrigated frequently at the start, cultivation is essential until the trees are large enough to shade the ground. Its object is to conserve the moisture of the soil and to prevent the growth of weeds and grasses. Cultivation should not be undertaken too late in the summer, since it tends to stimulate growth out of season and to render the tree susceptible to early fall frosts. In well managed groves cultivation should not be necessary after a period of from three to five years.

As soon as the trees begin to struggle for light a thinning in which the smaller and less promising trees are removed is advisable. Frequent light thinnings are most desirable and in no case should they be so heavy that they make the growth of weeds and grasses possible. Repeated thinnings from time to time, leaving the better trees to form the final stand, will in the end produce a very valuable plantation. The thinnings will usually more than pay the cost of necessary labor.

With close planting, pruning is seldom necessary for the side branches are shaded out and the trees prune themselves naturally. Light-demanding species seldom require pruning, but shade-enduring trees often do. The best time to prune is late in winter or early spring just before growth starts.

When a young tree is not developing properly, a good method is to cut it back to the ground two or three years after planting, provided, of course, that it is a species that will sprout.

Utilization.—About fifty per cent of the posts used in the valley are juniper and locust. The balance of the material is pine, cottonwood, poplar and willow. In a few cases the wire is strung on live trees, either willow, poplar or cottonwood, but such a fence is very unsatisfactory. Much of the soil in the valley is a sandy, gravelly soil and the decay of the portion of the post which is in the ground is very rapid. Because of the dryness of the atmosphere the top of the post is very long-lived. When cut green, peeling and seasoning gives the best results, in some cases quadrupling the life of the post. Charring the butt of the post, if properly done, gives very good results, but by far the best results in prolonging the life of fence posts have been secured by impregnation with creosote.

Black locust (*Robinia pseudacacia*) is not a native species of Owens Valley but it has been widely planted as a windbreak tree and there are also several small groves of this species in the valley. Posts of this species, 2 to 5 inches at the top, bring 25 to 40 cents apiece and those 5 to 7 inches 45 to 50 cents. Posts of larger diameters which can be used for corner posts sell as high as $1 apiece. The life of locust posts depends chiefly upon the amount of sapwood and the seasoning. The sapwood begins to decay within 3 or 4 years, and within 7 or 8 years it has entirely disappeared. Thus small posts of this species usually rot out in 7 or 8 years due to the large proportion of sapwood, while large posts composed almost entirely of heartwood are practically entirely sound after 20 years.

Two species of juniper (*Juniperus occidentalis* and *utahensis*) occur quite plentifully in the foothills. There seems to be little choice between the species. The Utah juniper of the White Mountains is the most accessible, and for this reason most of the posts of the valley are of this species. Juniper usually occurs as a clump of slender stems and seldom yields more than one post to a stem. Juniper posts sell for 40 cents apiece in the valley, and even then there is little profit for the post-maker because of the high cost of exploitation. A juniper post which has very little sapwood will last 20 to 35 years under ordinary conditions, but in moist, sandy soils it will rot within 12 to 15 years.

Dead material of Lodgepole pine (*Pinus contorta*), Foxtail pine (*P. balfouriana*) and Pinon (*P. monophylla*) is used to a considerable extent for posts. The value of any of this material for this purpose depends on the resin content. As a rule, the Foxtail pine is more apt to show this deposit of resin and for this reason is preferred by the ranchers. These posts delivered cost the ranchers 15 to 20 cents apiece. The average life of a non-resinous post is 4 to 5 years; of a very resinous post, 12 to 15 years.

Cottonwood (*Populus fremontii*), aspen (*P. tremuloides*) and willow are used somewhat for posts, but these species are utilized mostly as cordwood. Posts of these species sell for 3 to 5 cents apiece delivered. Ordinarily, in moist soils the life of these posts does not exceed 2 or 3 years. Under the most favorable conditions—that is, in very fine dry soil or in saturated soil—the life may extend to 8 or 10 years.

A few posts are secured from birch (*Betula fontinalis*), which occurs quite plentifully along most of the streams. These posts are not durable and seldom can more than one post be secured from a stem since this species generally grows in shrub form.

Lombardy poplar (*Populus nigra* var. *italica*) is not a native species but it has been planted extensively for windbreak purposes. It grows tall and yields a large number of posts per tree but is very short-lived as post material. The price for Lombardy poplar posts and birch posts is about the same as for cottonwood.

Wood is already so scarce that people are beginning to use coal, which is very expensive. Pinon wood costs $10 a cord delivered and this is what is known as the short cord. Several carloads of cedar posts have been shipped in from Oregon, such posts costing the ranchers about 30 cents apiece. These posts are of good quality and are probably superior to the posts obtained in the valley, but it is certain that they will continue to rise in price, and it would be more profitable for the ranchers to raise their own posts.

A BLIGHTED CHESTNUT OPERATION IN NEW JERSEY[1]

By E. C. M. Richards

The continued advance of the chestnut blight in the Eastern States has led a large number of owners to log their chestnut timber. Having had charge of several of these chestnut utilization jobs, I offer this article as descriptive of the conditions found, methods used, and results obtained, on one such operation.

The tract was located near Bernardsville, New Jersey, on top of a range of hills called Mine Mount. Bernardsville stands about 300 feet above sea level, and the tract (distant about two miles to the northwest) reaches 800 feet. The country is covered with rolling hills with steep sides but no cliffs or out-crops of rock. There are plenty of small rock fragments in the well drained soil, but the "bottom" is hard and animal logging is easy.

On this operation, all the chestnut that could be sold was cut, and with it an occasional tree of other species, which had been injured by the felling of the former. The fact that the forest of the region was made up almost entirely of chestnut, made the logging a clear cutting, with one or two small groups of Rock oak on the hilltops as the only remnant of the former woodland. Along two small brooks where the wet soil kept the chestnut out and favored Yellow birch, tulip, etc., no cutting of any kind was done. These areas, however, were so small that they do not enter into the problem.

The best stands of chestnut ran up to 15,000 feet B.M. per acre, but since the timber was only 45 years old, the trees were too small to make good poles. If the stands had been thinned, better results might have been obtained, but, as it was, only a few of the trees were of pole dimensions and the whole stand went under the class of "pile timber." As chestnut piling is difficult to dispose of, a sawmill was installed and the greater part of the timber was cut into lumber and railroad ties. The average stand per acre for the entire tract, based upon the actual cut

[1]In F. Q., vol. XII, pp. 204–210, will be found an article entitled "Reforesting Cut-over Chestnut Lands," which deals with the same district as the present article.

of the mill, was 6250 feet B.M. Less than 1 per cent of the timber had been killed, but all of it had been attacked by the blight. The result was, therefore, identical with what would have been secured in uninfected stands.

The felling was done by a crew of two men and two boys, all of whom were Americans and excellent workers. This crew was able to fell, trim and buck up from 10 to 12 M feet B.M. per day. The men did most of the sawing, while the boys notched the trees, trimmed off the branches and cut off the tops. The stumps were cut as low as the slightly rotten-butted timber permitted. This crew was paid $1.50 per M feet mill cut and kept about 25 M feet of logs cut in advance of the skidding teams.

The skidding crew, which consisted of two teamsters and their teams and one swamper, was under the direction of the barn boss, who helped the crew when the work was very hard. An ordinary chain choker was used in skidding telegraph poles, piling and for long logs. Logs for the mill, however, were loaded on a log boat and dragged to the landing or the mill by one team. These log boats were skeleton sleds with two bunks about a foot and a half off the ground, and running on wooden runners which had to be renewed every few days. The crew's output varied a great deal, depending upon the length of the haul, the size of the timber, the condition of the weather, etc., but on an average they were able to stock a mill which cut about 8 M feet per day. The longest skidding distance was not more than a quarter of a mile and the operation with the log boats very simple. This work of skidding was done under contract, the price being $2.00 per M feet as cut by the mill.

The sawmill used was a Curtiss, with an inserted-tooth circular saw. It was driven by a belt from 25-H.P. engine, mounted on top of the boiler, and the carriage was operated by a rack and pinion feed of the usual type. The operation was most conveniently located and carried on systematically.

In piling an effort was made to get all the lumber of the same thickness and width together, paying little attention to the length, and throwing out only the very poorest grades and the miscuts. In the case of inch stock, however, no attention was paid to the widths, a satisfactory arrangement, since inch material was largely sold "all widths."

The crew of the sawmill was as follows: 1 log roller on the log deck; 1 sawyer; 1 marker on the platform; 1 slab man; 2 pilers in the dump; 1 engineer and fireman; total, 7 men.

The output of the mill averaged 6400 board feet per day, including the days when it was shut down on account of rain or for other reasons. On the days the mill actually ran, the cut was about 8 M feet and the largest day's run totaled about 14 M feet. The sawing was done by contract, the millman receiving the logs from the skidding crew and delivering the lumber and ties to the men in the dump for $3.50 per M feet for lumber and $1.90 per M feet for ties. Altogether the mill cut totaled about 1,225,000 board feet, using five set-ups for the work. Each set-up was located so that as large an area of woodland as possible could be logged to it. The slope of the ground and the position of roads determined the exact position, after the stand of timber to be cut had been taken into account.

The lumber was hauled with horses, and, except for a couple of weeks in early March, entirely on wagons. The roads to Bernardsville were practically all down hill and good hard macadam, and a team was able to haul from 1500 to 1800 feet per load, or two cords of 4-foot wood. The distances varied from one and one-fourth to two and one-half miles and the teams were able to haul daily three loads of 1,000 feet each. Generally, they preferred to make two trips with 1500 feet.

The hauling crew consisted of two teamsters, using their own horses, wagons, chains, axes, pickaroons and canthooks. They were paid at the rate of 60 cents per hour per team. On rush work, or work requiring great strength in loading the freight cars, an extra man was put on to help. Ordinarilly, however, the teamsters did their own loading at the station, under the supervision of the woods foreman, who had charge of the entire operation and also took care of the shipping. The crew worked ten hours per day when weather permitted. During the heavy storm of early March, wagons were useless and log-boats were fitted with poles and used as hauling sleds. Four horses were used to each sled and the load was also increased to about 2 M feet, so that the cost of hauling did not vary. This cost in terms of M feet hauled averaged about $2.00.

The available markets were of two classes: 1, local sales to carpenters, farmers, builders and townspeople; 2, sales to concerns located at some distance and generally requiring shipment by rail.

The bulk of the sales fell under the second class, which contained all of the largest customers, who also proved to be more prompt in paying. During a period of six months the amount of business done with out-of-town concerns made up 83 per cent of the total business transacted, leaving only 17 per cent for the local market. The out-of-town market took all the poles, piles, railroad ties, and also took all the various kinds of products manufactured except sawdust.

The local market was principally taken up with small orders of inch boards, some planking and dimension stock, occasionally a barn or house frame and tapered fence posts, slabs, cordwood and sawdust. All these orders were small and were either delivered by team or called for by the buyer. For the most part local orders were unsolicited and sometimes the buyers gave the order before the timber had been cut, so that the sawing could be done "to bill," which saved waste in the cutting. It is a good practice to have the customer personally inspect the stock, since it gives the manufacturer an opportunity to show what he has to sell. All things considered, it would have been better to have sold entirely to the local markets, had not the time limit placed upon the work prevented this from being done.

The key to the choice of selling policy, in local versus out-of-town, resolves itself into a matter of freight rates and the wishes of the owner. The price of chestnut lumber and timber of ordinary dimensions ranges close to $25 per M feet anywhere within shipping distance of the blight-infected section of the country. Local sales, therefore, costing nothing for freight, will bring the best return where such sales can be made, and, since a certain amount of lumber is used in every community, there is usually an opportunity to dispose of some chestnut in this way, especially if the stock is well manufactured and promptly delivered. But in the case of the utilization of blighted chestnut, there is often a desire on the part of the owner to dispose of his material as rapidly as possible, even if the stock has to be forced on the market at a reduced price. This is an economic mistake and in handling an operation of this kind the forester should be careful to point out the situation to the owner, and then let him decide whether he wishes rapid disposal of the material or the best financial return. Where the condition of the timber and the wishes of the owner are such as to warrant it, a small operation, just large enough to take care of the local trade, will not only return larger profits, but also give less opportunity for labor troubles and permit of more careful and thorough work.

In disposing of the various products manufactured, serious trouble was experienced in getting rid of material less than 6 inches in diameter. This difficulty appears to be general in blighted chestnut utilization. There are many different products into which this stock may be manufactured, such as cordwood, mine props, collar timbers, mine ties, puddling sticks, fence rails, holed, round, tapered and flatted fence posts, extract wood, slack cooperage, kindling wood and charcoal. The profit on all these products is so very small, however, that if it were not for the necessity of getting rid of all the material in some form in many localities this size of wood would be left in the slash. As far as the operation discussed in this article is concerned, the only forms in which this small material could be disposed of at any profit at all, locally, were round and tapered fence posts. Cordwood, flatted and round posts were sold at a small profit to out-of-town concerns. All other uses were impractical from the financial point of view, since no mines, smelters, extract plants, cooperage factories, or other users of such products were located nearby, and the freight rates exceeded the profit over and above the actual cost of production.

In order to furnish some concise idea of actual prices received for the various products sold, the figures of the first eleven months of the operation have been arranged and are given below:

Lumber: per M feet delivered;[2] 1-inch stock, $22.18; 2-inch stock, $22.75. *Timbers:* per M feet delivered, $22.48. *Railroad ties:* Each f.o.b.; Small, 32½c; 6 x 8 inches, 53c; 7 x 9 inches, 55c; switch, $23.67 per M feet. *Poles:* 30-foot, Class B, $2.75 each. *Cordwood:* 4-foot, per cord, when called for by purchaser, $3.00; when delivered by wagon, $4.00; when shipped out of town, $4.52, f.o.b. *Slabs:* Cut into 4-foot lengths, shipped out of town, $3.66 per cord, f.o.b.; odd lengths, $1.00 per load at mill; $4.00 local delivery. *Tapered fence posts:* 5 x 5 inches to 3 x 5 inches, 22½c each, local delivery. *Round peeled fence posts:* 5-inch top, 20c each, local delivery; unpeeled, 5-inch top, 7 feet long, 10c each, f.o.b. *Sawdust:* 25c per load at the mill.

[2]Delivered prices include freight charge.

The figures of cost and the prices given in this article are, of course, of direct value only to the specific operation under consideration, but give a general idea of possibilities.

The financial results can be stated as follows:

Assortment	*Cost of Production*		*Average Price*	*Net Profit Local*	*Average Freight*	*Net Profit Out-town*
Lumber	Felling.......	$1.50				
per M feet	Skidding.....	2.00				
	Sawing.......	3.50				
	Piling........	.50				
	Hauling......	2.00				
	Overhead.....	1.00				
		$10.50	$22.47	$11.97	$6.00	$5.97
Railroad Ties	Cutting......	$ .06				
per piece	Drawing.....	.08				
f.o.b.	Sawing [3]......	.076				
	Peeling.......	.0125				
	Hauling......	.08				
	Loading......	.01				
	Overhead.....	.04				
		$ .36	.55	.20	...	.19
Telegraph Poles	Felling and peeling......	$ .30				
Class A, 30-foot	Snaking and Hauling.....	.60				
f.o.b.	Loading......	.50				
	Overhead.....	.10				
		$1.50	2.75	1.25	...	...
Cordwood per cord	Cutting and Stacking....	$ .90				
	Hauling and Loading.....	1.50				
	Overhead.....	.05				
		$2.45	4.52	2.07	.88	1.19
Slabwood 4-foot per cord	Cutting and Stacking....	$ .55				
	Hauling and Loading.....	1.50				
	Overhead.....	.05				
		$2.10	3.66	1.56	.55	1.01
Posts	Cutting......	$ .02				
Round, unpeeled, per piece	Snaking and Hauling.....	.05				
	Loading......	.01				
		$ .08	.10	.02	...	...

[3] Hewing instead of cutting and sawing, 10c.

If overhead charges are made in the last item, the figures would show that it hardly pays to manufacture this product.

From the above, since owner and contractor divided the profits equally, the owner's net profit, which may be called stumpage value, would be $2.985 for lumber per M feet; 10 cents per tie; 62½ cents per telegraph pole; 57½ cents per cord; 50½ cents per cord slabwood; 1 cent for posts. As a matter of actual record, the net profit on the entire operation involving 1,223,631 feet of manufactured product (not counting in cordwood, slabs and small fence posts) was $2830.50, or $2.31 per M; the cordwood, slabs and posts just about paid expenses.

This apparently small return may be accounted for by the fact that the operation was a "park forestry job" in many ways and that great care was taken in logging; also the chestnut market was flooded and a time limit was forcing the sale throughout.

According to the specifications included in the contract, all the material down to a 3-inch diameter was to be utilized. The timber down to about a 7-inch diameter was either cut by the mill or manufactured into hewn railroad ties or round posts. The crooked stock and the material below a 7-inch top went into cordwood. Cordwood choppers were paid by the cord, so that it was to their interest to cut as small material as would be accepted in order to increase the total amount of cordwood that they had to cut on the tract. On account of the above conditions the material too small for cordwood consisted for the most part of very small brush. The contract called for the scattering of this brush over most of the area in such a manner that it would not exceed two feet in height above the ground. This was to facilitate its decay, and in a year or two the greater part of it will have disappeared. Along certain roads the brush was burned by men who were not in the employ of the contractor.

In so far as the brush might interfere quite seriously with the reforesting of the cut-over areas for a year or so after the logging, the following suggestions are offered as to its disposal.

On areas where the removal of the chestnut amounts to a clear cutting, fire the brush as it lies and burn over the entire area broadcast (of course, with suitable burned boundary lines and fire-fighting force present to keep the fire under control).

Then, early the following spring the area may be reforested artificially. This method assumes that no adequate reproduction of good species exists on the cut-over area, and no seed-producing trees of desirable species stand within seeding distance (which is often the case).

The work as performed on the operation described in this article was let out under contract, the terms of which called for the completion of the work by the contractor—he could not assign it without the owner's permission,—who advanced all money, kept all books, supplied all tools, men, horses, etc, the work being done under the supervision of the forester. Monthly account sheets were submitted to the forester, showing the gross and net profit and loss on the whole operation, and the final settlement called for an equal division of the total net profits between the owner and the contractor.

On the face of it, this type of contract called for absolute reliability on the part of the contractor, and only when such reliability is present should such a contract be made. But aside from the element of reliability of the contractor, the system of dividing the net profits is exceedingly dangerous to the owner. This is due to the fact that such an agreement might be very readily twisted around by a sharp lawyer so as to appear to a court of law as constituting the owner and the contractor as partners in the work. The failure of the contractor to meet some obligation which he had incurred might then involve the owner in a troublesome and perhaps expensive lawsuit.

Another feature to be considered in connection with this type of contract is, that, if there is no profit—perhaps the contractor is lazy and does not sell the lumber at a good price,—the owner receives nothing at all for his stumpage, and if there is a deficit, he may have to pay out money to cover his portion of the loss. Altogether the profit-sharing contract has too many bad points in it to make its use advisable.

In making out a contract for an operation similar in character to the one described above, the essential points are, that the contractor should pledge himself to take all the timber, large and small, that is merchantable; that he will agree to complete the work within a given time; that he will perform the work according to certain specifications which are a part of the contract; that he will protect the owner against possible trouble by carrying accident liability insurance covering his crew; and that he will pay a certain specified sum for each unit of each of the various products which he manufactures. Such a contract is difficult to make with most lumbermen, but it is safe and will give full justice to the owner when properly drawn up and executed.

SEED DATA ON SOME SECONDARY TREE SPECIES

By E. A. Ziegler

Several seed experiments carried on in the Pennsylvania State Forest Academy nursery in 1910 and 1911 are worthy of cataloguing, partly because they deal with the less common forest trees on which there is little recorded data; partly because they add information on several species in respect to their hardiness under southern Pennsylvania climatic conditions.

The nursery is located about 10 miles north of the Maryland line in Franklin County, at the west foot of the Blue Ridge (here known as the South Mountains) at an altitude of 1,000 feet.

The experiments were conducted by Mr. Arthur B. Wells under an Instructor's observation. These notes are summarized from Mr. Wells' report filed at the Academy.

Platanus occidentalis. The most elaborate and detailed experiment was made with the seed of the American sycamore.

Seed balls were gathered locally from three trees in different situations. The balls had hung on the trees all winter. Five balls from the first tree *A* showed the following detailed results:

Ball	*Dry Weight Gram*	*Separated Seed No.*	*Separated Seed Weight Gram*	*Separated Seed Weight P. ct.*	*Core Weight Gram*	*Core Weight P. ct.*	*Chaff Weight Gram*	*Chaff Weight P. ct.*
1	7.85	1872	5.15	66	.55	7	2.15	27
2	6.05	1667	4.10	68	.35	6	1.60	26
3	7.15	1815	4.85	68	.45	6	1.85	26
4	6.95	1844	4.65	67	.55	8	1.75	25
5	6.75	1778	4.55	67	.55	8	1.65	25
Total...	34.75	8976	23.30	67	2.45	7	9.00	26

The following summary may be made of the number of seeds per pound of cleaned seeds and per pound of dry balls for the three trees:

Tree	*Balls Number*	*Balls Weight, Grams*	*Cleaned Seed Number*	*Cleaned Seed Weight, Grams*
A	5	34.75	8976	23.30
B	..	.....	1998	5.00
B*	1	2.58	1028	1.60
C	1	6.05	1850	4.23
C	9	53.78	....	38.50

* Double ball.

From this summary, it is seen that 97.2 grams of seed balls contained 67.3 grams of cleaned seed or 69.6 per cent. This compares closely with the 67 per cent cleaned seed in the 5 balls of tree *A* detailed above.

The 34.1 grams of cleaned seed averaged 406 seeds per gram and the seed balls average 280 seeds per gram. Reduced to the pound basis (1 Kilogram=2.20 lbs.) 1 pound of cleaned seed contains approximately 185,000 seeds while 1 pound of seed balls contains 127,000 seeds.

The germination experiment may be summarized as in table on page 363.

The points in this summary are as follows:

1. The germination per cent of sycamore seed is very low, varying from .04 to 2.70 per cent in this experiment. This would indicate the sowing of about 1 to 2 pounds of uncleaned seed per each 200 square feet of nursery bed (4′ × 50′). Full planting or stratifying seed might increase this low germination rate.
2. Wetting the seed appears to shorten the time and increases the percentage of germination.

Magnolia acuminata. Seed collected in 1909 and stratified in sand over winter. Eight hundred seeds weighed 126 grams or 2880 seeds per pound. Seeds to the number of 1830 planted dry on May 13 germinated June 29 to August 5. One-half of one per cent germinated.

Another 800 seeds were soaked May 13 to 21. Of these 110 floating seeds were planted by themselves to verify the propriety of their rejection. None germinated. Of the remaining 690 sunken seeds 28 germinated or 4⅛ per cent.

EXPERIMENTS WITH OLD SEED

Fraxinus pennsylvanica (2-year-old seed). Seed collected 1908. Stored dry. The weight of 1150 seeds (with wings) was 42 grams or 12,400 seeds per pound. Planted May 10, 1910. June 3 first seedlings up. Germination practically complete June 20. A few appeared until July 9. Forty-five per cent germinated.

Cupressus macrocarpa (2-year-old seed). Seed collected 1908 (August) by the Monterey, California, tree growing club. The weight of 1094 seeds was 8 grams or 62,000 seeds per pound. There were 94 dry seeds planted dry on May 6, 1910, of which 6 per cent germinated; 1094 seeds were soaked for four days, of which 125 floated and were rejected. Of 969 seeds planted, 11

Seed from Tree	Weight of Seed Grams	Number of Seeds	When Planted	Time for Germination	Number Germinated	Per cent Germinated	Remarks
A	...	1,200[a]	May 13	12 days	1	.08	Seed planted moist; beds covered with paper until germination
A	...	31,500[b]	May 13	12 days	852	2.70	
A	...	42,000[b]	May 13	12 days	620	1.48	
A	...	8,976[a]	May 26	26 days	42	.47	Seed planted dry; bed paper covered
B	35	14,210	May 20	10 days	13	.09	Soaked before planting
B	70	28,420	May 20	10 days	24	.08	Soaked before planting
B	90	36,540	May 20	......	14	.04	Planted dry
B	...	13,251[b]	May 22	......	19	.14	Planted dry, but watered at once
B	33	13,398	May 25	......	5	.04	
B	33	13,398	May 25	......	12	.09	
C	94	38,164	May 30	......	16	.04	
Total.....		241,057	....	....	1618	.67	

[a] = actual count.
[b] = estimated by weight—406 cleaned seeds per gram.

per cent germinated. The germination period for dry seed was 27 days, for soaked seed 21 days. Note the higher germination and shortened period for soaked seed.

Seedlings froze during the following winter. This species is not hardy in Southern Pennsylvania.

Pinus radiata (2-year-old seed). Seed was collected in the same way as Cupressus, and was stored dry. The weight of 236 seeds was 5 grams or 21,000 per pound. Seed was soaked for four days, and 4 per cent floated and was rejected. There were 225 soaked seeds planted May 10, 1910, and germination began in 26 days. Of these 50 per cent germinated. However, 86 per cent damped off during the summer, and the surviving seedlings were all killed by frost during the following winter. This species is not hardy in Pennsylvania.

AN ADDITION

An article entitled "Results of an Experiment on the Effect of Drying of the Roots of Seedlings of Red and White Pine" appeared in FORESTRY QUARTERLY, Volume XII, pp. 311 ff. The author has sent further information on the condition of these seedlings, which were planted on April 19, 1914. Readers whose interest or work deals with this subject will find the following table of results interesting:

Exposure	*Plants Living, April* 1, 1915 *Red Pine*	*White Pine*
Shade 10 minutes	1	2
Sun	2	2
Shade 20 minutes	1	2
Sun	2	2
Shade 30 minutes	2	1
Sun	1	2
Shade 40 minutes	2	2
Sun	1*	2
Shade 50 minutes	1*	2
Sun	1	2
Shade 60 minutes	2	1
Sun	2	1
Shade 1 hour	2	2
Sun	2	1
Shade 2 hours	1	2
Sun	1	1*
Shade 3 hours	1	2
Sun	1	1
Shade 4 hours	1	1
Sun	1	1
Shade 5 hours	0	0
Sun	0	0
Shade 6 hours	2	1
Sun	0	1
Shade 7 hours	0	2
Sun	0	0
More than 7 hours	1†	5†

* One dead also present.
†Total, more than 7 hours exposure.

The Deterioration of Lumber. By M. B. Pratt. Bulletin 252, Agricultural Experiment Station. Berkeley, Cal. 1915. Pp. 20.

This bulletin gives the results of a study carried on in the yards of a lumber company in the northern Sierra Nevadas of California to determine the amount and causes of deterioration between sawing and shipping. The species concerned were Sugar pine, Western Yellow pine, and Douglas fir. The loss due to depreciation in grade was found to be greater than generally imagined, and was especially high in the case of Sugar pine.

The depreciation in the case of air-seasoned stock was due to blue stain, brown stain, check and warp, pitch, and the mechanical defects resulting from the handling. Blue stain was found to be the most serious cause of depreciation, being especially prevalent in the case of piles put up in the fall. Brown stain, due to a chemical reaction in the green wood and not to fungi, appeared generally as a band between heartwood and sapwood, and often was not discernible until the lumber was surfaced. It, however, does not occur with Western Yellow pine. Both stains developed most widely in the case of green sap lumber piled during hot, humid weather.

In the case of air-seasoned Sugar pine, there were tallied 40,000, 50,000, and 225,000 feet of fall, spring and summer piling, respectively. The deterioration of the upper grades averaged 70, 38, and 16 per cent, respectively, and the monetary loss $12, $5, and $2.50 per thousand feet.

As regards kiln-drying, the study showed that in this vicinity it paid to follow this procedure for all of the upper grades of Western Yellow pine and Douglas fir, both checking badly in this vicinity with air-seasoning. In the case of Sugar pine, however, there is so much "kiln-burn" that many operators do not attempt it; in surfaced lumber this cannot be told from brown stain. The system of kiln-drying Sugar pine has usually been that of keeping a low, steady temperature during the entire drying period. An experiment by the author with 14,000 feet of Sugar pine, treating it like Western Yellow pine, starting at 130° and raising it to 180°, showed much less "kiln-burn" than under the low-heat system; the depreciation was less than air-drying with spring or fall piling, and about the same as air-dried summer-piled stock.

Of 80,000 feet of Western Yellow pine kiln-dried 10 days about 80 per cent retained its original grade; the average loss was $1.55 per thousand board feet. In the case of a tally of 53,000 feet of Douglas fir, about 90 per cent was successfully kiln-dried (5 days) with an average loss of 53 cents for 1-inch and $2.90 for 2-inch lumber, per thousand feet.

While the above data are insufficient in amount, range of conditions, and length of time to warrant a final statement as regards the amount of loss or the best means of reducing it, yet this local study draws attention to an important problem for investigation.

J. H. W.

Wood-Using Industries of the Prairie Provinces. By R. G. Lewis and W. G. H. Boyce. Bulletin 50, Forestry Branch. Ottawa, Canada. 1915. Pp. 75.

This is a statistical treatment of reports received from over 300 manufacturers in the provinces of Manitoba, Saskatchewan and Alberta, using wood as a raw material.

The wood-using industries are developed to a much smaller degree in the Prairie Provinces than is the case in eastern Canada. Only some 68 million feet of raw material was used, costing about 2.3 million dollars. Douglas fir formed 22 per cent, pine 20, spruce 18, and cedar 15 per cent of the total quantity. The average cost of the raw material was: Douglas fir, $35.26, pine $29.21, spruce $15.68, and cedar $32.34, per M feet B.M.

Eighty-four per cent of the raw material was purchased outside the three provinces. Almost one-half of this, or 33 million feet, came from British Columbia, principally Douglas fir and cedar; United States supplied over one-fifth of it, mostly oak and other hardwoods; while Ontario and Quebec supplied an equal amount, largely pine and, oddly enough, poplar. The raw material of local source was, of course, spruce and poplar.

Of the total consumption of raw material, the sash and door industries used nearly two-thirds, box manufacture 16.2 per cent, vehicles 5.4 per cent, and furniture 3.1 per cent.

Tables are also given showing the percentage of species used in the manufacture of different articles, together with the source of supply and prices.

The bulletin closes with a discussion of the possible uses of native woods, and the usual list of commodities manufactured from each kind of wood and a classified directory of manufacturers.

J. H. W.

Philippine Dipterocarp Forests. By W. H. Brown and D. M. Matthews. Reprinted from the Philippine Journal of Science, Vol. IX, Nos. 5 and 6, Sec. A, Chemical and Geological Sciences and the Industries, September and November, 1914. Pp. 413–561.

This publication is of particular interest to those who are interested in tropical forestry, and calls attention anew to certain features that are contrary to ideas generally held on this subject. These are, first, that tropical forests do not contain only heavy hardwoods, but can be counted on for soft and medium hard construction timber; second, that the growth of tropical forests is not extremely rapid; and third, that the reproduction of valuable species is not as simple a problem as in many cases in temperate regions.

The article takes up a general description of Dipterocarp forests for the whole Islands (growth, volume, plant associations, environmental considerations, effect of cultivation, planting and general considerations of management), followed by the result of detailed studies upon specially selected areas, in different parts of the Archipelago. It contains many valuable tables and instructive illustrations.

The conclusions arrived at are very clearly set forth in the summary as follows:

1. The dipterocarp forest is the most extensive and important lowland forest of the Indo-Malayan region.

2. In the Philippines it would naturally occupy all of the best sites, but owing to the combined influence of man and climate it has been removed from considerable areas. This is especially the case in regions in which the dry season is pronounced.

3. Due to the fact that the forest occurs in dense stands of a few species which may be logged at a low cost, it is capable of furnishing large amounts of construction and finishing lumber.

4. The chief difference between the dipterocarp forest and a hardwood forest of the temperate zone lies in the several-storied arrangement of the dipterocarp forest, with an accompanying greater density of foliage, and in the presence of a much larger number of minor tree species.

5. Dipterocarp forests vary from dense stands in which the main story is composed entirely of mature and overmature dipterocarps to more open stands in which the main canopy may contain more individuals of other species than dipterocarps.

6. The volume of a dipterocarp forest may be greater than that of an all-aged managed stand in Europe, but is usually less. When the volume is great its distribution is usually unsatisfactory from a management standpoint, as the bulk of it is contained in large mature and overmature individuals, the removal of which causes the destruction of the forest.

7. If the dipterocarp forest is removed and the land is not cultivated, the forest is replaced by a non-commercial one of a totally different type in which the trees are of small, softwooded, rapidly growing species. If, after the removal of the forest, the land is cultivated and later abandoned, it usually grows up in grass which maintains itself as long as it is burned over at more or less frequent intervals.

8. Dipterocarps growing in virgin forests in the Philippines undergo an extremely long suppression period. After this suppression period *Parashorea plicata,* the most rapidly growing dipterocarp measured, appears to grow about twice as fast as Yellow poplar in virgin stands. The average of the dipterocarps measured shows rates of growth, after the suppression period, about equal to those of hardwoods in virgin forests in the central hardwood region of the United States. *Parashorea plicata,* on Mount Maquiling, shows distinct seasonal rates of growth, there being two periods of slow and two of rapid growth. One period of slow growth coincides with the dry season, the other with the height of the rainy season when the sky is overcast for a large portion of the time.

9. The temperature in the dipterocarp forest of Mount Maquiling is very uniform and not particularly high. The daily range is much greater in the dominant story than in the undergrowth. The humidity and soil moisture under the forest are always high and the rate of evaporation is low. The environment of the dominant story is much dryer than that of the undergrowth. The rate of evaporation, even in the top of the dominant story during the dry reason, is not high when compared with evaporation rates in deciduous forest regions in the United States. Environmental conditions in the forest are apparently favorable for growth throughout the year. The result is that such a dense vegetation is produced that the rate of growth of the individuals is greatly lowered.

10. The total growth of whole forests in the Philippines will in many instances be greater than that in a temperate hardwood forest, but the volume production of commercial timber will usually be lower.

11. Clear cutting over large areas will, in most instances, eliminate dipterocarp species from any forest. Clear cutting on small areas will, in many instances, result in a satisfactory stand of dipterocarp reproduction. Selective cutting and culling, if not severe, will merely lower the volume production without seriously changing the species composition, but if continued over long periods will result in the elimination of all dipterocarp species which are cut. A partial cutting followed by a long period of closure seems to be the most satisfactory method of cutting over a dipterocarp forest.

12. Present experience seems to indicate that planting of dipterocarps will not be successful in open lands and probably only moderately successful in second-growth forests or in openings in the high forest. If planting is to be attempted in the Philippines at the present time, species which are easier to handle than dipterocarps and more valuable at maturity should be chosen.

13. Heavy stands of dipterocarp forest which are largely overmature will have to be managed under some modification of the clear-cutting system. Those which contain distinct second and third stories composed partially of dipterocarps and partially of miscellaneous species can be most successfully managed under the shelterwood system. Those in which there is a satisfactory distribution of dipterocarps throughout all size classes can be satisfactorily handled under either the shelterwood system or the selection system with a diameter limit. Those which have been very heavily cut over should be withheld from all cutting until the small dipterocarps in the lower stories become large enough to bear seed.

A use of the term "rate of growth," indiscrimately, whether current annual, mean annual or periodic annual rate of growth is meant, leads to some confusion in the section on growth, as does also the interchangeable use of the terms management system, method of regulation and silvicultural system under "General Considerations of Management" and under "Effect of Cutting in Dipterocarp Forests." Under the latter section the use of the diameter limit in the northern Laguna Forest is spoken of as a satisfactory method of regulation, although this opinion is not held by all Philippine foresters, and it is nothing but an opinion, as this tract has never been logged as severely as it will be when it is placed under intensive utilization and the full possible cut of the area taken. It is questionable whether under such conditions the diameter limit will prove to be satisfactory. Under

"Planting," although the publication deals only with dipterocarp forests, one is left with the impression that forest planting in general is impracticable in the tropics, while experience in other tropical countries, especially in India and Java, has shown that with certain species, notably teak (*Tectona grandis*), it is eminently practicable. On page 437, in table VII, the heading states that the volume is given in cubic centimeters, where obviously cubic meters is meant.

These are in a way minor matters and do not detract greatly from the extreme value and interest of the publication to all Philippine foresters and others who are interested in tropical forests.

M. D. R.

Report of the Division of Forestry for the Biennial Period Ending December 31, 1914. Board of Agriculture and Forestry. Honolulu, Hawaii. 1915. Pp. 84.

Besides the usual account of the current activities of the Division as given in the reports of the various officials, there is a general summary of the work accomplished during the past decade. Below we give a brief synopsis of this.

The Division of Forestry was organized in 1903 under the Board of Agriculture and Forestry. Since its establishment Mr. Ralph S. Hosmer has been in charge, resigning last year to become head of the Department of Forestry at Cornell.

During the past ten years the forestry policy has been based on the protection of native forests on the important watersheds, and secondly, the encouragement of tree planting.

The first of these objects has been sought through the creation of forest reserves. Today thirty-seven reserves have been created. These are largely protection forests, totaling around 800,000 acres, of which 68 per cent is State-owned. The boundaries of the reserves have been mostly marked on the ground, and much fencing has been done to reduce trespass.

Forest extension work has been the second main line of endeavor. Tree seedlings are supplied free or at cost price for planting, and technical advice is furnished to all who desire it. A certain amount of government planting has been done. These plantations have been largely for experimental purposes, using both native and introduced species, and the U. S. Federal Forest Service has furnished assistance in the form of small yearly grants for the last six years.

A forest fire law was enacted in 1905, providing for a district fire warden system. Since that time a volunteer skeleton organization has looked after fires and enforced the fire law.

The immediate need for further progress is the establishment of a regular ranger service. There is still much necessity for further planting, and scope for educational and investigative work.

J. H. W.

OTHER CURRENT LITERATURE

The Eastern Hemlock. By E. H. Frothingham. Bulletin 152, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1915. Pp. 43.

Injury by Disinfectants to Seeds and Roots in Sandy Soils. By C. Hartley. Bulletin 169, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1915. Pp. 35.

Mushrooms and Other Common Fungi. By Flora W. Patterson and Vera K. Charles. Bulletin 175, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 64.

Soil Erosion in the South. By R. A. E. Davis. Bulletin 180, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 23.

The Huisache Girdler. By M. M. High. Bulletin 184, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 9.

Report on the Gypsy Moth Work in New England. By A. F. Burgess. Bulletin 204, U. S. Department of Agriculture. Contribution from the Bureau of Entomology. Washington, D. C. 1915. Pp. 32.

Shows the different lines of work which are being taken up and the results that have been secured.

The Cypress and Juniper Trees of the Rocky Mountain Region. By G. B. Sudworth. Bulletin 207, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1915. Pp. 36; maps, 11.

Observations on the Pathology of the Jack Pine. By J. R. Weir. Bulletin 212, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 10.

The most important fungous disease of the Jack pine (*Pinus divaricata*) is caused by *Peridermium cerebrum* Peck, which attacks trees of all ages, killing or suppressing the youngest and seriously retarding the older trees. Jack pine is, however, comparatively free from certain diseases which are common to other conifers, and is also resistant to drought, winter injury, and frost, but is sensitive to heat.

The Naval Stores Industry. By A. W. Schorger and H. S. Betts. Bulletin 229, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1915. Pp. 58.

The Production of Lumber, 1913. By the Office of Industrial Investigations. Bulletin 232, U. S. Department of Agriculture. Contribution from the Forest Service in cooperation with the Bureau of Crop Estimates. Washington, D. C. 1915. Pp. 32.

Utilization and Management of Lodgepole Pine in the Rocky Mountains. By D. T. Mason. Bulletin 234, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1915. Pp. 54.

Life History of Shortleaf Pine. By W. R. Mattoon. Bulletin 244, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1915. Pp. 46.

A Disease of Pines Caused by Cronartium pyriforme. By G. H. Hedgcock and W. H. Long. Bulletin 247, U. S. Department of Agriculture. Contribution from Bureau of Plant Industry. Washington, D. C. 1915. Pp. 20.

The National Forests and the Farmer. By H. S. Graves. Reprint from the Yearbook of the Department of Agriculture for 1914. Washington, D. C. Pp. 65–88.

Observations on Rhizina Inflata. By J. R. Weir. Reprint from Journal of Agricultural Research, U. S. Department of Agriculture. Washington, D. C. April 15, 1915. Pp. 4 Pl. I. This peculiar fungus occurs quite abundantly as a saprophyte on the ground in the forest fire areas of the Northwest. There is reason to believe that as a parasite it attacks the roots and causes the death of coniferous seedlings.

Proceedings of the Society of American Foresters. Volume X, Number 3. Washington, D. C. July, 1915. Pp. 217–339.

Contains: Working Plans: Past history, President Situation, and Future Development, by B. Moore; Development of Silvicultural Working Plans on National Forests in the Southwest, by J. C. Kircher; Windfall Damage in Selection Cuttings in Oregon, by K. Smith and R. H. Weitknecht; Some Uses of Meteorological Studies in Silvicultural and Management Problems, by W. H. Kenety; Forest Ranger Education, by D. Skeels; Discussion, by P. T. Coolidge and W. D. Sterrett; The Reforestation of Brush Fields in Northern California, by R. H. Boerker; A Silvicultural System for Western Yellow Pine in the Black Hills, by P. T. Smith; The Use of Frustum Form Factors in Constructing Volume Tables for Western Yellow Pine in the Southwest, by C. P. Korstian; Further Notes on Frustum Form Factor Volume Tables, by D. Bruce; Reviews.

Fourth Annual Report of the New Hampshire State Tax Commission. Concord, N. H. 1914. Pp. 146.

How Vermont Maple Sugar Is Made. By W. H. Crockett. Bulletin 21, Vermont Department of Agriculture. St. Albans. 1915. Pp. 48.

Report of the Massachusetts State Forest Commissioner, 1914. Public Document 108. Boston. 1915. Pp. 10.

The New Massachusetts Forest Taxation Law. Published by Massachusetts State Forester. Boston. 1915. Pp. 35.

Annual Report of the Park Commissioners, and Annual Report of the Forest Warden of the City of Fitchburg, Mass., 1914. Fitchburg. 1915. Pp. 49.

The Older Forest Plantations in Massachusetts: Conifers. By J. R. Simmons, under direction of F. W. Rane, State Forester. Boston. 1915. Pp. 38.

Fourth Annual Report of the Conservation Commission, 1914. Albany, N. Y. 1915. Pp. 367.

Manual of Instruction for the Forest Fire Protective Force, 1915. New York Conservation Commission, Division of Lands and Forests. Albany. 1915. Pp. 30.

Forest Survey of a Parcel of State Land. By A. B. Recknagel. Bulletin 11, Conservation Commission of the State of New York. Albany. 1915. Pp. 17.

Resources of the Forest Preserve. By C. R. Pettis. Bulletin 12, New York Conservation Commission. Albany. 1915. Pp. 41.

Systematic Street Tree Planting for Towns and Cities of New York. By H. R. Frances. Bulletin New York State College of Forestry, at Syracuse University. Vol. XV, No. 4. Syracuse. 1915. Pp. 56.

The Planting of Forest Trees by the Public Schools of the State. Bulletin of the New York State College of Forestry at Syracuse University. Vol. XV, No. 2. Syracuse. 1915. Pp. 14.

Slope Exposure as a Factor in the Distribution of Pseudotsuga taxifolia in Eastern Washington. By G. Turesson. Bulletin Torrey Botanical Club. 1914. Pp. 337–345.

The author has observed, and quotes instances from literature to corroborate his observation, that this tree, in the Spokane region in Eastern Washington, is confined to the north-facing slopes, "these being the only localities that offer the needed humidity in soil and atmosphere."

The National Forests and Wild Life. By H. S. Graves. Reprint from Recreation, May, 1915. New York. Pp. 4.

Emphasizes the need for the protection and development of wild life, and suggests means for utilizing the National Forests to the best advantage for this purpose.

Laws of New Jersey Relating to Forestry. Department of Conservation and Development. Union Hill. 1915. Pp. 44.

Report of the Department of Forestry of the State of Pennsylvania for the Year 1912-13. Harrisburg. 1915. Pp. 493.

Proceedings of the Eleventh Annual Meeting of the American Wood Preservers' Association held at Chicago, January 19–21, 1915. Baltimore, Md. 1915. Pp. 527.

Quantity of Wood Preservatives Consumed and Amount of Wood Treated in the United States in 1914. By C. W. Gould. American Wood Preservers' Association in cooperation with the U. S. Forest Service. Baltimore, Md. 1915. Pp. 18.

Forestry Laws of Virginia. Forestry Leaflet No. 1, Virginia Geological Commission. Charlottesville. 1915. Pp. 12.

Forest Fire Laws of Virginia. Forestry Leaflet No. 2, Virginia Geological Commission. Charlottesville. 1915. Pp. 8.

The Wooden Hoop Silo. By W. D. Zinn. Circular 8, West Virginia University. 1914. Pp. 4.

Timber Resources of Franklin, Wake, Chatham and Lee Counties. Press Bulletins 143, 144, 145, 146, respectively, of the North Carolina Geological and Economic Survey. Chapel Hill. 1915. Pp. 4 each.

Forestry Laws of North Carolina. Press Bulletin 147, North Carolina Geological and Economic Survey. Chapel Hill. 1915. Pp. 17.

Lumber Problems and Their Solution. Reports and addresses presented at the Lumbermen's Mass Meeeting under the auspices of the Forest Products Federation, Chicago, Ill., February 24-25, 1915. Pp. 155.

Luther Burbank, His Methods and Discoveries and Their Practical Application. Luther Burbank Press. Chicago, Ill. 1915. Vols. 12. Pp. 3696, ills. 1260.

Volume XI: Methods Applied to Nut, Lumber and Shade Trees.

Experiments with Wood Paving Blocks. By C. H. Teesdale. Reprint from Municipal Journal, May 6, 1915. Pp. 4.

Gives results of the fourth inspection made June 15, 1914, of the experimental wood block pavement laid in 1906 by the City of Minneapolis in cooperation with the U. S. Forest Service, and a comparison of results of all inspections.

Some Lumber Problems. Minutes of the Sixth Annual Meeting of the Northern Hemlock and Hardwood Manufacturers' Association at Milwaukee, Wis., January 26-27, 1915. Published by the Secretary's Office. Wausau, Wis. Pp. 107.

Contains, besides the yearly reports of the Association, election of officers and new business, the following addresses: Inter-Insurance, by C. F. Simonson; Insurance of Compensation, by C. H. Crownhart; Classification of Lumber Rates, by B. G. Dahlberg; Timberland Taxation, by W. A. Holt; Troubles of Lumber Industry, by R. S. Kellogg; Cost of Manufacture—Discussion; Camp Missionary Work, by M. Daly; Lumber for Factory Trade, by W. W. Brown; Bureau of Business Methods, by E. Hines; Birch for Interior Finish, by E. Colburn; Timber Utilization, by O. T. Swan; Cost of Carrying Timber, by C. H. Worcester.

Feeding Men in Logging Camps. By R. S. Kellogg. Northern Hemlock and Hardwood Manufacturers' Association. Wausau, Wis. 1915. Pp. 8.

The Forest Club Annual. Volume VI. University of Nebraska. Lincoln. 1915. Pp. 137.

This number of the Club Annual is dedicated to the memory of Dr. Charles Edwin Bessey, the originator and promoter of the Forestry Department of the University of Nebraska.

It contains the Forest Club Program for 1914-15, and the following articles: The Quadrat Method as Applied to Investigations in Forestry; A New Industry in Middle Park; The Collection of Lodgepole Pine Cones; The Importance of Phenological Observations; Pathogenicity of the Chestnut Bark Disease; Grazing and Forestry; Some Methods in the Germination Tests of Coniferous Tree Seeds; Outline for Preliminary Report on Mineral Claims; Some Developments in Reforestation on the National Forests; Forest Types of the Coeur d'Alene Mountains and Their Determining Factors; With a Dry Kiln in the Northwest; Forest Planting in Sweden; Charles Edwin Bessey.

Flora of New Mexico. By E. O. Wooton and P. C. Standley. Contribution from the U. S. National Museum, Volume 19. Washington, D. C. 1915. Pp. 794.

The University of Washington Forest Club Annual. Volume III. Seattle, Wash. 1915. Pp. 73.

In addition to a review of the year's club meetings, an account of a forestry exhibit planned and conducted by the College of Forestry, letters from the field and a roster of students, this publication contains the following articles: The Cost of Growing Timber in the Pacific Northwest, as Related to the Interest Rates Available to Various Forest Owners; Changes in the College of Forestry During the Year; The Logging Spur; The Value of Ammonium Polysulfide as a Wood Preservative; A Preliminary Growth and Volume Study of Noble Fir; The Logging Engineer.

Fire Prevention and Control on National Forests. By S. C. Bartrum. Oregon. Pp. 20.

Third Biennial Report of the State Forester of Montana, 1913–1914. By J. C. Van Hook. Helena. 1914. Pp. 35.

Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ended December 31, 1914. By W. F. Sherfesee. Manila. 1915. Pp. 78.

Treated Wood-Block Paving. By. W. G. Mitchell. Bulletin 49, Dominion Forestry Branch. Contribution from the Forest Products Laboratories. Ottawa, Canada. 1915. Pp. 40.

The Relation of Forestry to the Development of the Country. By R. H. Campbell. Circular 11, Dominion Forestry Branch. Ottawa, Canada. 1915. Pp. 7.

The National Domain in Canada and Its Proper Conservation. (Forest Products, pp. 14–22.) By F. D. Adams. Commission of Conservation. Ottawa, Canada. 1915. Pp. 48.

The Planting and Care of Shade Trees. By F. E. Buck. Bulletin 19 (second series), Department of Agriculture. Ottawa, Canada. 1914. Pp. 24.

A Preliminary Survey of Forest Insect Conditions in British Columbia. By J. M. Swaine. Bulletin 7, Division of Entomology, Department of Agriculture. Ottawa, Canada. 1914. Pp. 41.

Agricultural Land in British Columbia and Its Relation to Forest Policy and Forest Administration. By H. N. Whitford. Paper given before British Columbia Forest Club at Victoria, January 5, 1915. Pp. 4.

Reports to the Board of Trade Upon the Supply of Imported Pit-Timber With Special Reference to the Resources of Newfoundland and the Maritime Provinces of Eastern Canada. By C. F. Rey. London. 1914. Pp. 20.

Woods and Trees of Ireland. By A. Henry. Reprint from the County Louth Archaeological Journal. 1914.

Annual Administration Report of the Forest Department of the Madras Presidency for the Twelve Months Ending 30th June, 1914. Government Press. Madras. 1915. Pp. 247.

A Critical Revision of the Genus Eucalyptus. Volume III, Part 2 (Part XXII of the complete work). By J. H. Maiden. Sydney, N. S. W. 1914. Pp. 23–44. Pls. 93–96.

Forest Tree Growing in the South Island. By R. G. Robinson. Department of Lands and Survey. Wellington, New Zealand. 1914. Pp. 30.

This bulletin gives a brief account of tree-raising methods with special reference to the three South Island State nurseries, and some insight into the afforestation work.

Ausgerichtete Bundesbeiträge an ausgeführte Aufforstungs— und Verbauungsarbeiten im Jahre 1914. Dept. des Innern, Inspektion für Forstwesen (Schweiz). Pp. 7.

Verzeichnis der wissenschaftlich gebildeten Forstbeamten der Schweiz. Aufgenommen durch die Schweiz. Inspektion für Forstwesen, Jagd und Fischerei, nach amtlichen Angaben der Kantone, auf den 1 Januar, 1915. Berne. 1915. Pp. 21.

Rapport du Département Suisse De l'Intérieur sur sa Gestion en 1914. VIII. Inspection des Forêts, Chasse et Pêche. Pp. 17.

Tree-Growth and Meteorological Factors. By J. C. Kapteyn. Recueil des Travaux Botaniques Néerlandais, Vol. XI, L. 1. Groningue. 1914. Pp. 70-93.

PERIODICAL LITERATURE

BOTANY AND ZOOLOGY

Rest Period in Trees

In a volume of 166 pages Klebs on the basis of painstaking investigations, especially on beech, demolishes the theory that a rest period is a necessity for all trees, and that the variable period is a matter of predisposition and adaptation to climatic conditions, which by outside influences can be somewhat varied but not entirely overcome. By means of electric light of from 200 to 1,000 candle power, Klebs could force beech plants and twigs to either sprout or remain quiescent at will. The shoots so forced either grew continuously from November till spring with more leaves than were originally found in Anlage, or grew more or less intermittently. From these and other experiments, the author has reached the conclusion that above all the relation between supply of carbohydrates and nutritive salts to the vegetation points decides whether rest or growth results. This explains also the influence of light. Under illumination respiration is always more intensive than carbonic acid assimilation, so that the nutritive salts, which otherwise would be utilized in the latter process, could go to the buds and stimulate them into activity.

In nature the budding out in spring, with beech at least, is due to increasing light together with satisfactory supply of salts. The quiescent state of buds in summer arrives through the competition of leaves and cambium for the salts: the accumulation of assimilated food impedes the growth energy of vegetative points. The August shoot is a victory of strong light available to specially favorably located buds.

Since in the experimental plants spring wood and summer wood was formed alternately, the author inclines to Hartig's and Wieler's theory of this variation as being due to variations in the nutrition of cambium cells, and proposes a change of terms to wide and narrow wood (Weit- und Engholz). He recognizes, however, an inherited structure of wood of different species.

Über das Treiben der einheimischen Bäume, speziell der Buche. Review. Zeitschrift für Forst- und Jagdwesen, March, 1915, pp. 211-212.

Large Trees

An unusual specimen of *Carpinus betulus* is found near Liestal in Switzerland, standing in a pine forest, lately severely culled or cut. The height is nearly 60 feet, with a clear bole of only 10 feet, where three stout branches start, the diameter breast high about 3 feet (3 *m* circumference). The tree is sound and fully crowned. An illustration is given.

Schweizerische Zeitschrift für Forstwesen, March to April, 1915, p. 69.

SOIL, WATER AND CLIMATE

Utilization of Chemical Soil Factors

As a result of an extensive study Bauer discusses at great length the varying ability and the method of using the chemical constituents of the soil by different individuals and species. The literature on the subject and its historical development is fully utilized.

Referring to Mitscherlich's showing that since a certain amount of energy is spent in root development, the larger the root system the less volume above ground is formed, he furnishes examples of two-year-old beech, in which by weight the roots represent from 52 to 74 per cent of the total.

A table is given, which demonstrates the correctness of the corollary that *ceteris paribus* that species must be the more frugal which has the ability to absorb the largest amount of nutrients per grain of root volume. The series: pine, larch, spruce, elm, beech, oak, corresponds to the generally accepted one in practice.

The plant on the poorer site reacts by a relatively increased root development. The well-known frugality of pine resolves itself to the capacity to exploit a large body of ground for water and nutrients, where spruce and fir die from thirst and hunger.

The utilization of the chemical constituents of the soil is conditioned by at least three moments, namely, differently graduated osmotic processes, different root development, and different root activity. The time element or periodicity in providing and absorbing nutrients was made a particular study, the results of which show that with young forest trees at least—and probably it is typical for older plants—requirements vary in time. "If in addition the great variation in root formation and the very variable root activity is considered, these findings may be a contribution to the scientific justification of the mixed forest." The long period of vegetation for our forest trees, middle of May to middle of September, is a principal reason for their frugality.

The method of analysis is described and the detail results on alder and elm laid down in many tables.

Here, as in other plants, four more or less definitely distinguishable periods may be observed, namely:

1. The period from rest in the spring until the partial formation of new organs, during which reserve materials are extensively withdrawn from root, stem and needles. Respiration also causes loss of organic substance;

2. The period of lengthening and development of new organs under increasing assimilation and absorption of nutrients;

3. The principal period of vegetation, when absorption and assimilation culminate;

4. The time until the end of vegetation with a gradual decrease of the two processes, the broadleaf trees and larch, contrary to evergreens, showing a tendency to store nitrogen and phosphoric acid.

A distinction between nutrient requirement and fertilizer requirement, made by Wagner, namely, the requirement on the condition from the soil and the amounts of nutrients found by analysis in the plant, is as yet not possible.

Zur Ausnutzung des chemischen Standsortfaktors durch Waldpflanzen. Forstwissenschaftliches Centralblatt, November, December, 1914, pp. 549–578, 610–621.

Forest Influence on Snow

As a result of measurements at 12 double stations for 20 years, the data of which are tabulated, Dr. Schubert states that in the early winter the snow cover in the forest is lighter than in the open or of the same depth, while in the spring the forest preserves usually a deeper cover. In coniferous woods the snow cover is even in midwinter lighter than in the open, but in the spring it somewhat impedes the melting and evaporation, and is relatively deeper. In spruce forest the decrease of the snow from February to April was 15 *cm* less than in the open. On beech stations a decidedly greater depth is found in the stands, which increase steadily until March, when in both field and forest a rapid diminution sets in.

Die Höhe der Schneedecke im Walde und im Freien. Zeitschrift für Forst- und Jagdwesen, October, 1914, pp. 567–572.

SILVICULTURE, PROTECTION AND EXTENSION

Troubles in Waste Land Planting

The question of the reforestation of waste lands and poor agricultural soil is discussed by Forstmeister Krause from another than the usual point of view by quoting language of the director of the geological survey of Hesse expressing a doubt whether deforestation of agriculturally valuable land should not be the prior consideration for Germany.

The author recalls that clearing land was the main concern in Frederic the Great's time, but that in the eagerness to settle and colonize the country, instead of happy communities, devastation, impoverished and degenerated settlers were the result, due to settling unsuitable lands. *Tout come chez nous!*

The same careless, wasteful treatment which our farmers accorded to their woodlot, was in the early part of the nineteenth century accorded to the peasant holdings of forest, and started the waste lands of today, especially in the eastern provinces of Prussia.

The uncultivated waste area of Germany is estimated at 12.8 million acres, of which nearly three quarters are moors, hence only around 3 million acres are uplands. But this is considered greatly under-estimated partly because, as with us, distinction between forest and waste land is difficult to draw, and that as agricultural it will also be noted land that produces a crop only every four to six years. Abandoned farms are growing in number not because of industrial development but because of deterioration of the soil; woods or waste can be the only choice and the Prussian government has chosen the former.

Waste land planting has been carried on with enthusiasm on a grand scale and at first with rosy expectation and apparent success, but when the polewood stage is reached, the young stand of pines begins to open up, single poles and groups die, the openings increase, flow together, and finally a new plantation becomes necessary. The reason is still hidden; insects, fungi, composition and layering of soil under the plow, lowering of ground water due to deforestation have been adduced as causes without proof.

The customary split planting has also been charged as cause, the effect claimed being the formation of a shallow, fan-like root system instead of taproot, but the author could not in many hundred investigated poles find such a root formation, and altogether hundreds of thousands of acres have been planted by that method in other locations with entire success.

The possibility of an inimical effect of animal manure exists at least on old pastures.

The author believes that a combination of causes may explain the phenomenon, but especially a change of water conditions of the soil. He cites the experience in the province of Posen, where within a forested sand area there are found sinks or depressions, which are fit and are used for farm purposes. In one of these districts, after an extensive forest fire in 1883, when suddenly several thousand acres were entirely deforested, these sinks became swamps so that their cultivation had to be given up. On a neighboring revir not burned, such small sinks gradually became drier so that their former use for cabbage growing had to be abandoned, and pine regeneration crept in. When the timber surrounding these sinks was cut, the sinks became wet again, so that alder was planted. But when the surrounding pine plantations grew on, the water conditions changed again and the deteriorating alder had to be replaced by birch. This latter was lately crowded out again by pine volunteer growth, the soil having become as dry as it had been ten years before.

The author cites a number of similar experiences, showing the drying effect of the old stands. When these are removed the new young plantation finds enough water, indeed the water contents of the soil increase and the soil bears grasses and herbs which usually can hardly thrive in forest soil and which use up accumulated humus deposits. Our method of reforestation is a jump from one extreme to the other: the open area is suddenly changed into a fully stocked forest, while nature conquers the ground only gradually from the outer boundaries; first softwoods are the pioneers in whose protection oak and beech gradually establish themselves. For this procedure we have no time!

The author reaches the conclusion that the first planting on waste places is only a preparation which in a few decades must be followed by the second step of recovery. Hence the cost of first plantations should be reduced as much as possible; sowing even on unprepared ground the author thinks more successful than is usually admitted; and no great anxiety is necessary to plant up failplaces. He recommends a superficial soil preparation with a mere harrow, sowing broadcast and following with the harrow at right angles to the first operation. After trials, he has reduced the seed quantity (pine) to about 2½ pounds per acre. Lately he ties two harrows together and leaves a strip of five feet unworked between two worked ones, except on the second harrowing, when the unworked area is disregarded. While the apparent first result is not a show plantation, patience will be rewarded in two or three years. Especially on old fields which were not too grassy or weedy this method has furnished good enough results. An addition of lupine seed is found advantageous. The soil must, of course, be fit for this kind of cultivation. Any existing volunter growth is, of course, preserved.

An example of a pine forest started in 1776 to 1784 by sowing pine cones, now 115 to 123 years old, cut over 5,000 cubic feet per acre with 76 per cent workwood, or an average of 45 cubic feet per annum. When the first plantation has done its work to fit the soil, the real economic planting comes.

Aufforstung von Oedländereien. Zeitschrift für Forst- und Jagdwesen, January, 1915, pp. 29-46.

Spacing of Spruce

Under the title "Forestal Questions of the Day," Dr. Borgman continues to discuss various problems and publications on these. He reports the interesting results of the experiments at Wermdorf, Saxony, with various methods of cultivating spruce, and especially with regard to the influence of different spacing, which were begun 50 years ago. It is rare that trials on a large scale of so long standing are available as basis for discussion. The area, not less than

12 acres, compactly located, was planted in 1862 in 19 comparative parts, namely, by broadcasting, by sowing in furrows and in plats, 5 areas by planting single plants with the spacing of .85—1.13—1.42—1.70—1.98 *m* in the square, and a parallel series with bunch planting (3 plants in the bunch); 4 areas in rows, single and in bunches, 2.27 × .85 and 3.40 × 1.13*m*, and two areas by mound planting. The soil was of questionable quality for spruce, rather a pine soil, and this fact enhances the value of the experiment, for the less climate and soil suits a species, the more come all further moments which influence growth to expression.

Leaving out the bunch planting which furnished in all respects decidedly inferior results, the comparison at the age of 50 years may be tabulated as follows, the figures being in meter measure.

	Sowing			*Planting*			
	Broad	*Furrows*	*Plats*	*.85*	*1.13*	*1.42*	*1.70*
Number of stems	102,306	37,302	23,252	10,097	5,558	4,159	2,841
Basal area	48.25	44.74	46.13	47.52	42.66	37.81	37.33*
Diameter	2.5	3.9	5.0	7.7	9.9	10.8	12.1
Volume	225.4	228.6	260.2	324.5	306.7	274.8	235.1
Stout wood	102.8	132.1	181.7	251.3	266.7	247.8	217.5
Value product	527	515	909	1935	2640	2676	2632

* A somewhat better site.

The showing is persuasive. With the decrease of numbers, wider spacing, results improve up to, say, 4 feet spacing. The larger basal area in broadcast seeding shows that by itself this factor is meaningless. The total wood volume reaches its culmination at 2¾ feet, but the timberwood production at the wider spacing of $3^1/_3$ feet. The value product, however, found by multiplying diameter with stoutwood production culminates at 4½ feet, and is two to five times as large in the plantings as in the sowings. Who can doubt the superiority of planting over natural regeneration? (!) Up to the fiftieth year at least, on poor soil, a stand of 1700 to 2,000 trees to the acre produces best results.

All stands had been "moderately" thinned in the fortieth and forty-fifth years. In the product of these thinnings the same items as above tabulated show the same tendency as the remaining stands: the broadcast sowing furnished the largest number and basal area; the widest spacing furnished the largest diameters, the largest volume of boles resulted from the spacing of 2¾ feet, of stoutwood and value from 4½ feet spacing. In the fiftieth year, when the effect of the method of culture may be said to have been fully demonstrated, a severe thinning was made according to the prescription of the Association of Experiment Stations which avoids all subjective determinations of stem number, basal area, etc. The unforeseen result was that the differences in all spacings are already more or less evened out as far as basal area, volumes and also numbers are concerned, hence from this time grow under similar conditions. These are given in the following table, from which also the *height growth appears, contrary to generally accepted belief, to be favorably influenced by open position.*

	Full	*Strip*	*Plats*	*.85*	*1.13*	*1.42*	*1.70**
Stem number	2963	2060	1688	1507	1521	1128	1327
Height	9.6	11.0	12.2	14.0	14.2	14.7	13.9
Basal area	19.64	19.71	21.53	24.05	25.86	22.96	25.19
Diameter	9.2	11.0	12.8	14.3	14.7	16.1	15.6
Volume, total	117.7	124.8	150.1	190.1	204.9	181.2	189.5
Volume, stoutwood	89.4	108.7	140.0	181.4	196.6	175.5	183.0
Form factor	.624	.576	.571	.565	.558	.537	.541
Value product	822	1196	1792	2594	2890	2826	2854

* Area suffered from frost in juvenile stage.

If the height had been adduced in making up the value factor, the difference would have been still more favorable for the plantings. At another place the author shows that shaft form also is not best developed in a close but in a more or less open position, as the form factors above indicate.

On normal spruce sites and with early and severe thinnings the superiority of wide spacing may perhaps not be so decided.

One scientific fact of note results also from this experiment, namely, the unreliability of the basal area as basis of a judgment of production.

Forstliche Tagesfragen. Tharandter Forstliches Jahrbuch, 1915, volume 66, pp. 129–154.

Thinning Results

In a discussion on "Forestal Questions of the Day," by Dr. Borgman, in which the value of mensuration and especially studies of increment is pointed out and a plea is made for greater interest of practitioners in the progress of experimentation and for saner interpretation of its results, the author makes some interesting generalizations from the existing yield tables used on thinned stands. In a footnote he gives the full text of the instructions for thinnings issued by the Association of German Experiment Stations.

He points out how rapidly stem numbers are reduced by the prescribed thinnings—accentuating the findings of the above brief on spacing! On good soil the stem number per acre for spruce is around 2400 in the thirtieth year, and 240 in the eightieth year, hence in the intervening 50 years 90 per cent are removed in thinnings, only 10 per cent are left for final harvest. In volume the product in 80 years will have been 14,000 cubic feet, of which 40 per cent, or 5600 cubic feet, will have been removed in thinnings and 60 per cent, or 8400 cubic feet, are final harvest.

From decade to decade, beginning in the thirtieth year the thinnings reduce the number on the average each time by one-third, or more precisely by 40, 35, 30, 30, 30, and 25 per cent, if the final harvest takes place in the eighty-fifth year. Similarly with pine on good sites, the number is reduced from 2,000 in the thirtieth to 160 in the hundredth year and to 120 in the 120th year; that is 92, or 94 per cent, goes into thinnings, only 8, or 6 per cent respectively, remain for final harvest. For oak, the reduction is even greater, namely from 1600 to 100 and 80, or 6.25 and 5 per cent remain in the hundredth and 120th years respectively. Nevertheless, the volumes in both species at the two rotations, are nearly alike, namely 5,000 or 5700 cubic feet for the two rotations.

In beech, which starts with a specially large number of stems, 97 per cent may go into thinnings.

Management under severe thinnings in the subdominant brings out interesting relationships between number, basal area and volume: when 30 per cent of the number is removed, $^7/_{10}$ of that per cent, or 21 per cent, is removed of the basal area, and $^6/_{10}$, or 18 per cent, of the volume. This holds in a general way for spruce, pine, beech and oak.

If managed under a moderate thinning, the percentages are lower, namely $^6/_{10}$ and $^5/_{10}$ respectively for basal area and volume, so that if 20 per cent of numbers were removed this would involve 12 per cent of area and 10 per cent of volume. Generally speaking, the severer the thinning, the more the stouter stem classes are involved in it, the nearer to each other stand the per cents of number, area and volume.

Thinning in the dominant and leaving the subdominant undisturbed produces opposite relations, namely higher area and volume per cents. Thus to a 15.4 per cent removal of numbers in a

55-year beech stand there would be involved 18.3 per cent of area and 18.6 per cent of volume.

Under severe thinnings in the subdominant, the beneficial effect of which lies in an early beginning, in the middle age the number removal naturally declines, while in the moderate thinnings it remains more or less even, so that eventually the two come to the same numbers, but the yield from the severe thinnings in volume and value is always larger, since better sizes are involved: the severe thinning does not, as has been asserted, swamp the market with inferior material, but on the contrary it furnishes better class material; only during the transition time from poor practice into the better may a temporary excess of small assortments be involved.

In further discussion of the attitude of practitioners to experimental areas, the author cautions against the mistake of looking at these areas as models: such areas are to find out effects in all gradations in order to find the optimum which is expressed by the sustained value production on a wood capital in most favorable condition as to density of stand and time of production.

Forstliche Tagesfragen. Tharandter Forstliches Jahrbuch, 1914, volume 65, pp. 351–376.

Experimentation in Silviculture

At this time, when the establishment of experiment stations has come into vogue in this country, it is worth while to recall a publication, although nearly three years old, by Dr. Vater, the well-known soil chemist at Tharandt, in which he analyzes the factors of success in silvicultural experimentation and the causes for the poor success the experimenters have so far had. (This in Germany!)

The first trouble is that experimenters in silviculture, however careful in trying to secure a high degree of reliability, fail mostly to subject their results to a mathematical determination of the average error of their experiments, for which it is necessary to determine those errors which occur even when in a repetition apparently all conditions of the experiment are the same. The errors resulting from the unwilled variations of our actions are found by repeated measurement when an average and the deviations from it can be ascertained. For certain large groups of investigations, as for instance chemical analyses, a generally determinable percentage of error may be ascertained, and then a single analysis may suffice, but in less developed and less well-known fields, and where great accuracy is to be attained, repetition alone brings safety.

In silvicultural experiments the results of certain treatment is not only dependent on this treatment, but also on the site. On another site the same treatment produces a more or less different result, which may even be entirely opposite. Hence an application of silvicultural experiences can only be made if the site is recognized as the same or different from that on which the experience was secured.

The fundamental start for a scientific silvicultural experimentation is the question, what variations show the sites believed by us as alike, when the same species in the same manner is grown on it.

The answer to this question of the variation of sites must in the first place be given for the different parts of the same experimental area, and then by parallel or control experiments. Such parallel or check areas are usually lacking in forest experiments, and as a rule a mere belief in equality of sites exists. Such experiments cannot furnish scientifically correct data.

It is customary to use yield tables, divided into five site classes, for determining soil quality, yet they contain nothing of the detail of soil, climate, topography, elevation and other influential factors of production. Such are good enough for cameralistic use in regulating utilization, which is revised every decade, but they are not fit to serve as basis for scientific, natural history conclusions. They characterize the site by the stand that happens to be on it, but how the site would fit stands of other character they cannot tell. For the classification of farm lands in Saxony not less than 43 field classes, each with 21 grades are used; and for meadows not less than 19.

It is entirely erroneous to assume, as is often done, that the progress of development of the stands on these as equally good recognized sites in the forest really developed in the same manner. From the equality in height of two stands in the same age, it does not follow that the heights have been attained in the same manner or that they will grow alike in future; the same with volumes.

Again, stands, which treated by thinnings in the subdominant furnish equal yields, may behave quite differently under thinnings in the dominant. Not yield classes, but real forest site classes are needed; such a site class to comprise all the places which under all silvicultural operations approximately behave alike. The limits of the classes will have to be agreed to by practical considerations and the classes are to be determined by the best available soil knowledge. When such classification is attained the observing forest manager will relate his experience to such site classes and recommend only for such his operations.

The general rule that there is no general rule is applicable in forest organization where subjective considerations must enter. But in silviculture this is different; for silviculture is a doctrine of the consequences of human interference with nature; the same kind of interference under the same conditions must have the same result. It must, therefore, be possible, as with other natural history-technical sciences, for silviculture to bring together all its experiences into a whole less and less contradictory. To attain this, the author insists, the finer distinction and description of sites is necessary.

To be sure, the author admits, that the knowledge to do this efficiently, is but poorly developed and hence difficulties arise. These the experiment stations themselves must first overcome as one of the primary most important undertakings. "The present status of experimentation forces the open acknowledgment that the art of inaugurating silvicultural experiments is much more difficult than had been assumed when the experiment stations were founded and the desire by the experiments to solve directly qustions arising in practice has led to neglect in furnishing the fundamentals for a successful experimentation (except in mensuration)." To develop this neglected art, to further for its own sake the art of experimentation and description of experiments will most certainly further the solution of problems for the practice much more rapidly.

A hint as to how to proceed with site description is given by referring to Liebig's law of the minimum which the author phrases happily into: "the fertility of a site is limited by its most unfavorable factor." Hence for an exhaustive site description the ascertainment of that factor which prevents a better development than the existing is indicated. Such a determination will make appear as well founded much that has appeared irregular. It may, for instance, be expected that different sites, which under a given silvicultural method furnish equal yields, would behave differently under other treatment according to whether lack of water, of nitrogen, of certain mineral constituents, or some deficiency in physical condition limits its productive power.

The objection that while the art of experimentation is being developed, the practice is not furthered, the author brushes aside by pointing out that everywhere else in serious nature study incidentally much of practical utility is found indirectly. Ascertaining in every range the detail site conditions will alone discover many things that had remained unexplained.

Über die Anstellung waldbaulicher Versuche und über die Klassen der forstlichen Ertragstafeln. Tharandter forstliches Jahrbuch, 1912, pp. 252–264.

Boys as Forest Scouts

The old saying, "Many hands make the burden light," is well illustrated in connection with fire prevention work in the State of Michigan, where for the past three summers this work has been carried on by schoolboys from the ages of 7 to 19 years, totalling in all at the present 5,000 boys.

These patriotic children are called forest scouts and fire fighters. They are organized into companies of five or more by the field supervisors. To become a member a boy must be of the required age; he must promise to obey all reasonable orders; to be considerate of others and clean in sport and habits. To be a charter member he must know the scout rules and regulations. An honor medal is given to a scout who puts out a fire or reports one to the fire warden; a hero's medal to one who has been brave or shown good judgment in the saving of life or property. The education department, cooperating with the forestry department, awards honor medals to school children, both boys and girls, for stories about forest scouts and their work. Honorary membership is conferred upon winners of story awards or others deemed worthy.

The scouts are supplied with a textbook, giving methods of fighting forest fires, first aid to the injured, etc. They are given instruction in surveying and timber estimating. Upon reporting a fire they are expected to tell: The kind of material in combustion; the approximate area of destruction; the probable area of destruction; the establishment of fighting lines; the means for fighting: water, sand or earth, flails, brush or water-soaked sacks or blankets, fire-lanes, etc.

Lectures upon forestry subjects, given by members of the forestry department to school children in all parts of the State, are part of the system which is working so well in Michigan.

A summary of the results accomplished by these boy scouts is interesting and is evidence of the enthusiasm which is put into the work. Over 900 small fires were reported to the fire wardens in 36 months, and 206 fires, at least two of which were large enough to have been handled by experienced adult fire-fighters, were extinguished, with little loss to property. These figures do not include incipient fires. One watchful lad alone put out 100 such fires in one summer. Another, a scout captain, ran 7 miles at 4 o'clock in the morning to report a fire, and thus was the means of saving a town from destruction.

Before the inauguration of the scout movement, the State had approximated $1,000,000 as the annual fire loss. In 1911 the property damage from forest fires amounted to $3,746,000; in 1912 to $67,000; in 1913 to $23,000; and in 1914, when dry conditions presupposed many fires and made necessary greater watchfulness and care, the loss did not reach over $154,000.

North Woods, May, 1915, pp. 10–14.

MENSURATION, FINANCE AND MANAGEMENT

Volume Determination and Dendrometer

Guttenberg considers with Kubelka the formquotient method of Schiffel as the most satisfactory method of determining tree volumes, avoiding the necessity of felling sample trees. But it presupposes the use of an instrument, with which to measure indirectly the diameters high up the tree with sufficient accuracy and simplicity. In regard to the latter requirement the existing dendrometers are deficient; moreover, they are expensive. Kubelka recommends a new construction, which Guttenberg claims to have been suggested in 1896 by his assistant Raschke. It consists of a simple transit in the diaphragm of which a fixed and a movable vertical hair or else two horizontal movable metal points are inserted to enclose the diameter to be measured at any height, while the vertical hair contains besides the usual gradation in degrees a tangent gradation, which latter permits the finding of the height. To measure the diameter, the apparent diameter between the two metal points or hairs is sighted and read off from a scale set up at the same distance.

[In this connection we call attention to Burton's Biltmore Pachymeter (see F. Q. IV, p. 8), which is the simplest device for measuring diameters at different heights, and needs no staff or tripod, but a hypsometer.]

Whether the new dendrometer will permit widespread use in practice may depend on the cheapness of its construction.

Guttenberg shows that he antedated Schiffel's development of the formquotient.

Die Stammkubierung und Holzmassenermittlung mit Hilfe des Formquotienten. Österreichische Vierteljahrsschrift für Forstwesen, 1915, pp. 38–44.

New Finance Rotation Formula

Hönlinger has developed new and simpler concepts, methods and formula for the determination of the financial rotation. He points out that the soil rent theory starts out with two false dogmas, namely that the net soil value can be determined only from the naked area and that a management class is the sum of so many independent single management units. Neither of these dogmas is an essential part of net yield calculations.

He starts out with the value of a whole management class and considers that when the net yield pays the best interest rate on the forest value the most profitable rotation is used.

There are two ways of calculating: either figuring the variable rent value of soil and stands with a constant demanded business interest rate, or else figuring what variable interest rate the forest rent represents related to the constant forest value.

There is no difference in principle in these two calculations, and there should be no difference of results by either method. The latter is, however, simpler.

The fundamental formulae are

$$F_r . ox = f_r$$

$$F_{r+1} . ox = f_{r+1}$$

when $F =$ forest value, $f =$ forest rent, from which, subtracting the one from the other, the per cent is developed $x = 100 \frac{f_{r+1} - f_r}{F_{r+1} - F_r}$; an index per cent to be used similar to Pressler's. But, since in this case the ideal forest of stands of equal areas and equal quality is posited, in the expression $F_{r+1} - F_r$ all stand values from the age class o to $r-1$ with their soil values may be excluded as of no consequence in the difference, and hence merely the value of the last age class, the r year stand, and the last member of the forest value F_{r+1}, is needed—an easily ascertained tangible sale value.

The author then critically reviews the formulae of Pressler, Schiffel, Riebel and others and shows that their error lies in the fact (inherent in the soil rent theory) that the soil alone is charged with all expenses, the stock of the management class being unconsidered in this theory.

The argument in developing his own formula is as follows: The value of an ideal management class under a rotation (r) shows r parts, the combined effect of which produces the annual forest rent f_r. Hence the forest value $\frac{f_r}{.op}$ should be distributable over r parts. If we write this forest value $\frac{f_r}{1.op^r - 1}, \times \frac{1.op^r - 1}{.op}$, the last factor represents the sum of the r parts: $1.op^0 + 1.op^1 + 1.op^2 + \ldots + 1.op^{r-2} + 1.op^{r-1}$, and if the r times repeated value $\frac{f_r}{1.op^r - 1}$ is called K, then

$$F_r = \frac{f_r}{1.op^r - 1} \times \frac{1.op^r - 1}{.op} = K 1.op^0 + K 1.op^1 + 1.op^2 + \ldots + 1.op^{r-2}$$

$+ 1.op^{r-1}$, the forest value in r parts.

These values set in the fundamental formulae stated above and subtracted, reduce the equation to:

$$K1.op^r \times .ox = f_{r+1} - f_r;$$
$$.ox = \frac{f_{r+1} - f_r}{K1.opr}$$

and setting in for K the original form the final formula becomes

$$x = 100 \frac{f_{r+1} - f_r}{f_r + \frac{f_r}{1.op^r - 1}}$$

That is to say, the net yield increment $f_{r+1} - f_r$ appears as rent of the net yield f_r that could have been drawn in the year before.

With this end result the concepts of stand value and soil value become unnecessary; it is only necessary to know the net yields to develop this index per cent.

The author adds that rotations figured with this per cent are up to thirty years longer than those calculated with the gross yields of the soil rent theory, the low rotations of which have always been a stumbling block.

Zur Umtriebsbestimnung der Wälder. Zeitschrift für Forst- und Jagdwesen, September, 1914, pp. 538-549.

Forest Valuation

In a discussion at the Austrian Forestry Congress, June, 1914, Dr. Hufnagel pointed out the necessity of formulating procedure in valuing both farm and forest property, especially for public purposes. Such valuations are either for purely fiscal purposes, like taxes, or cases in which the interest of third persons is involved, like bankrupt proceedings, executive sales, inheritances, etc. Valuation by sale value presupposes a division of the property into parts; valuation by yield value presupposes management of the whole; valuation by productive value represents the lowest price at which an owner may give up a property without loss. Since forests as a rule are to be considered as a unit [a managed forest is supposedly meant.—Ed.], they should be valued by their yield value with a difference according to whether taxatory or other considerations are to enter. In the first case only that yield is to be used which under ordinary management results, capitalizing it with the general current interest rate. In the second case the financially most profitable management must be posited. The question at what rate in the latter case the yield is to be capitalized is not answered.

Österreichische Vierteljahrsschrift für Forstwesen, 1914, pp. 288–290.

Financial Result of Small Forest

An interesting insight into the financial management of a small cantonal forest property in Switzerland, that of Aargan, shows the profitableness of the management. The total area is not more than 7556 acres, with the exception of 26 acres coppice and 115 acres open, all in timber forest. The year 1914 has brought a slightly increased utilization in final harvest in thinnings, the cut per acre being 86 cubic feet, of which 35.8 per cent is workwood, 36.7 per cent stout fuelwood, 27.5 per cent brushwood. The total gross income from wood was around $73,000, the expenditure $31,000, leaving a net result of $42,000, or little less than $6 per acre. The price per cubic foot of the main crop was a little over 10 cents, the highest, but for one exception, since 1860. The small material from thinnings reduced this price to 6.4 cents.

In the expenditures, the administration figures with 9 cents, cultures 4.6 cents, roads 6.3, logging 2.7 cents per acre.

Since an overcut had taken place, the equivalent sum of $4,130 was placed by the administration in the reserve fund.

Schweizerische Zeitschrift für Forstwesen, March to April, 1915, pp. 68–69.

Estimating for Yield Regulation

Schubert reports on the results of a ten year revision of the yield determination on a more than 100,000 acre district in Saxe-Meiningen. In the original organization the form factor method was employed in stock-taking, calipering all stands which were to be utilized in the decade.

Only in uniform close stands, which were probably to be utilized in the second decade, the sample area method was used. Comparing now, after 10 years, actual cut with estimated budget, comprising total estimated stock and increment, an excess of only 6 per cent in the cut is found over the estimated—a very satisfactory estimating. This is the error in the average on a cut of about 18 million cubic feet. For single stands, to be sure, the differences may be much greater, but from the standpoint of yield regulation for the whole district this does not matter. Since the estimator does not know the sequence of fellings and progress of regeneration, which the manager directs, he cannot for each stand make a prognostication with any tangible amount of accuracy.

Comparing estimates for different species, the estimates in spruce are most closely covered by the cut, namely only 4.2 per cent over the estimate, with very small deficiencies in three revirs, but in single revirs the excess may go up to 14.6 per cent.

For pine, the total cut showed an excess of 8.5 per cent; in one revir the excess reached 28.5 per cent, which is, however, supposed to be some error.

In beech, the accuracy of estimate is very much lower than in the conifers, with an excess in the cut of 14 per cent; and in oak with 14.9 per cent, which in composite forest was still further increased to 15.6 per cent. In the small oak timberwood area, the error was only 6.1 per cent.

These greater errors in the broadleaf species is to be referred to unsatisfactory form factor and increment determinations.

Altogether the form factor method has shown itself satisfactory as regards degree of accuracy, which, comparing it in cost, is possessed by no other method.

Über Holzmassenschätzung für Zwecke der Waldertragsregelung. Forstwissenschaftliches Centralblatt, April, 1915, pp. 171-176.

Revolutionary Yield Regulation

Neuhaus inveighs against the use of so many unknown terms in yield calculations, such as normal stock, normal increment, equalization period, rotation. The only really tangible, known factor is the actual stock.

As to rotation, he cites Stötzer, that "no rotation can, with assurance, be declared the irrefutably correct one," and Frey, that practically a predetermined rotation is not, cannot, and should not be followed. The distinction between intermediary and final yield also is declared undesirable.

He then points out that Mantel's formula corresponds to his requirements, but only if for extensive districts one and the same *r* is arbitrarily and unalterably fixed, when the expression becomes a real constant with which out of the stock on hand budget, and with time actual, increment may be determined.

For practical purposes this is all that is necessary, whatever statistics may be gathered for scientific purposes by Experiment Stations.

For the determination of the stock on hand, however, he advocates the use of yield tables, provided many height measurements are being made to test their applicability. It the latter is in doubt, let the experiment station decide the proper per cent of addition or subtraction, which is then also to be considered a constant. Finally, the stock of the older age-classes should only be used for the yield regulation, which permit of direct measurement. He objects to ocular taxation.

Einiges über Forsteinrichtung. Schweizerische Zeitschrift für Forstwesen, March to April, 1915, pp. 41–44.

Determination of the Rotation

We have regretted all along that lack of space has prevented us from briefing fully the critical discussions by Dr. Martin, which have for some time been running in the Tharandter Jahrbuch under the title "The Economic Problems of Forest Management, with Special Reference to the Prussian State Forests." While they do not bring anything especially new, they are classical in exposé, replete with information, logical in their philosophy and unusually simple and clear in style—a rarity among German writers on forestry—so that a close study of them may be set down as an excellent course on forest management. In the last two (sixth and seventh) chapters, running through three numbers on 95 pages, the author continues the discussion of the problem of determining the rotation and the organization of a working plan's bureau, the author being an advocate of such in preference to leaving the work to the supervisors.

Only a translation would do justice to the expositions of Martin. We can therefore only call attention to these most valuable contributions to the literature.

Die ökonomischen Aufgaben der Forstwirtschaft mit besonderer Berücksichtigung der preussischen Staatsforsten. Tharandter Forstliches Jahrbuch, volumes 65 and 66, 1914 and 1915.

UTILIZATION, MARKET AND TECHNOLOGY

Wood and Iron

In green wood the conditions for rusting iron are given, namely moisture and salts, chlorides, phosphates, and acids which accelerate the rusting. Electric reactions are also influential. There are, however, certain Australian woods which are not liable to rust iron in contact with them. Among these are *Afzelia byuga, Flindersia australis* (Moa), *Eucalyptus microcorus* (Tallow wood), *Eucalyptus marginata* (Jarrah), and *Eucalyptus pilularis* (Blackbutt), which Dr. Rohland has investigated. The first two were the most rust resisting. Such woods are specially valuable in industries which need vessels that must resist attacks by acids, such as the color vats in spinning mills, the fermenting vats in breweries, the vats for aniline color and other color manufacture, in underground use, etc.

Probably the same cause which prevents the rusting of iron in re-enforced concrete explains the behavior of these woods. In the concrete a calciumhydroxid is formed when the iron is being imbedded, which protects the iron against rusting. In wood, possibly potash or other organic compounds which contain hydroxylions and hence react alkaline may be the protecting agent, the close structure of the wood being also favorable.

Das Verhalten des Holzes gegen Eisen. Forstwissenschaftliches Centralblatt, March, 1915, pp. 109–112.

STATISTICS AND HISTORY

Russian Forest Resources and Policy

The Russian Government published early in 1914 a full statement in French of its forest resources, its main purpose being, according to the Germans, to present evidence of its assets in order to induce the French to loan money for war preparations. Be that as it may, the statement furnishes complete information in regard to the forest resources of the Russian Empire.

The forested areas in the different parts of the empire and the percentages of the total land surfaces in Europe are as follows:

European Prussia	451,000,000 acres	—34%
Finland	38,000,000	45
Caucasus	20,000,000	22
Asiatic Russia	862,000,000	
Total	1,371,000,000 acres	

The total area is 10 times that of the whole of Germany and 39 times its forested area, and, as will be seen, the forests of Russia are for the most part concentrated in the northern part of the Empire.

Russia is one of the great wood-exporting countries, and the following table, giving the percentages of sawtimber supplied by the various countries, shows how its relative importance has imcreased in the period between 1902 and 1911:

	1902	1911
Russia	29.4%	35.7%
United States of America and Canada	30.1	31.1
Sweden and Norway	28.9	20.7
Austria-Hungary	11.6	12.5

While the wood exported represents only 14 per cent of the total amount cut, it makes up 10.7 per cent (1912) of the total annual export trade, its composition by volume and value being as follows:

	By Volume	*By Value*
Sawtimber	52%	70%
Logs	28	20
Pulpwood	14	6
Mine timbers	4	4
Firewood	2	..

The importing countries and the percentages which they take are as follows:

England	39.8%
Germany	33.1
Holland	12.1
France	4.15
Belgium	3.8
Austria-Hungary	2.7
Sweden and Norway	2.0
Turkey and the Balkans	.65
Miscellaneous	1.7

The Government is the dominant factor in the control of the Russian forests because it owns or controls the following percentages in the different parts of the Empire:

European Russia	65%	or 232,000,000 acres
Caucasus	65	8,000,000
Asiatic Russia	75	253,000,000
Total		493,000,000 arces

The administration is centered in a Bureau of the Department of Agriculture. There are 1490 forests, varying in size from 250,000 acres in northern Russia and Siberia to 27,000 acres in the semi-arid regions in the southern part of the Empire. In addition to the technical force of over 4,000 foresters, there is a protective force of 32,000 men, so that the unit area per man is 38,000 acres, as compared with 40,000 acres in the United States. Yet the Russians feel that in many cases their forests are undermanned.

Working plans have only been prepared for those forests where close utilization is possible. Twenty-three per cent of the forests now have extensive plans which cost from 1 to 1.6 cents per acre, while intensive plans have only been prepared for 5 per cent. The cost of these more detailed plans averaged 8.8 cents per acre.

Timber sales are handled much as in the United States. The Government does not do its own logging, but sells the stumpage to the highest bidder after advertising. As yet, sales are limited to four years, but an attempt is being made to secure legislation which will allow longer periods.

Higher technical schools are maintained at Petrograd and Novo Alexandria, which turn out 90 to 110 graduates annually. In addition, there are 43 ranger schools, for the most part in European Russia, which give a two-year course to lads over 16 years of age.

K. W. W.

Die russische Forstwirtschaft. Forstwissenschaftliches Centralblatt, January, 1915, pp. 10–19.

Bavarian Budget for 1915

The State legislature had the forest budget for 1915 under consideration for seven days during May last year. In order to show how important the income from the forests has become the gross receipts for several recent years are given below:

1890	$7,000,000
1900	9,000,000
1908	10,000,000
1910	14,000,000
1914	16,000,000

The expenses are now only 49½ per cent of the gross income, in spite of the fact that the cost of administration increased 3 per cent the last year on account of pensions and insurance. Similar increases in the neighboring States of Prussia, Hesse, and Württemburg have been offset in part by their more favorable market conditions. In Bavaria, one of the large costs is the administration by the forest service of the communal and private forests. In addition, servitudes, the high cost of mountain logging, and the general increase in wages have increased costs greatly in the last few years.

On account of the large percentage of mountain land, the forest units are larger than in Württemburg, Saxony, or Hesse. The size of the average State forest is 5500 acres, while the communal forests do not average more than 2900 acres.

The average rotations are as follows:

Spruce	105 years
Fir and pine	110
Beech	118

The value of the Bavarian State forests is estimated to be as follows:

Timber	$400,000,000
Soil	75,000,000
Total	$475,000,000

On this capital value there is an annual interest return of 1.65 per cent.

Much discussion of the question of servitudes took place in the legislature. Two-thirds of the State forests are encumbered in this way. The forest service, of course, is trying to get rid of them as fast as possible, and it was this process of elimination to which the members of the legislature representing rural communities objected. The whole administration of the servitude question leads to constant petty annoyance, but only ten cases were taken into court in 1912. One of the rights which has led to much abuse is the right to cut wood in the log for firewood. The custom grew up because it was cheaper to drag in a log than to cut it up first. It has, however, been difficult to restrict this privilege to timber only suitable for firewood. It is generally conceded that the demand for litter is detrimental to the forests and should be done away with. The Government also took a decided stand against permitting more grazing in the mountains.

Another mooted point was the handling of hunting privileges. Naturally, the Government was inclined to let the present practice stand because one of the prized perquisites of the forest officer is the hunting privilege, and, moreover, any great increase in the game, such as would come about if hunting were placed on a commercial basis, would be detrimental to the forests. The legislature was, however, inclined to take the stand that the Government should get as much revenue as possible out of the hunting rights.

The final approved budget provides for a net yield of $4.00 per acre on the productive area.

K. W. W.

Der bayorische Foreststat für die XXXI Finanzperiode 1914–1915. Forstwissenschaftliches Centralblatt, October, 1914, pp. 512–520.

Saxon Financial Results

A tabulation of the results of the administration of Saxon State forests for each revir, giving area, felling budget, felling results and wood sales, incomes, expenditures, net proceeds and a calculation of the forest capital and the interest per cent it has earned, all this for the forest soil alone, is of main interest to us in the exhibition of the wide limits within which all items and especially the rate moves at which the forest management of different revirs pays on the capital.

Within the ten districts into which the forest is divided, the rate varies between 1.63 and 3.18 per cent, the average being 2.67 per cent; but within the 109 revirs of which the districts are formed, the variation is 0.03 to 4.39 per cent. In other words, there are still revirs that do not pay. There are only 7 revirs that pay 4 or more per cent; 24 that pay between 3 and 4; 47 between 2 and 3; 21 between 1 and 2; 10 remaining below one per cent. The total forest capital for the 426,400 acres is figured at around 103 million dollars or $240 for the average acre, paying $6.40 per annum.

A table, showing the cost of planting (including repair) per acre and per thousand plants also shows great variations, there having been planted in 1912 around 700 acres by seed and 8350 acres by plants.

The average cost, including planting tool account and plant material cost, was $16.50 per acre; but from district to district the variation was from $13 to $22 and from revir to revir $5.30 to $18.70. Per thousand plants the cost varied from 54 cents to $3.48.

Die Reinertragsübersichten der Königl. Sächs. Forsten, 1912. Tharandter Forstliches Jahrbuch, 1914, volume 65, pp. 196–210.

Japan Forestry

In a well illustrated article Eckbo gives the following data regarding Japanese forest conditions and administration. The forest area of around 56 million acres represents 59 per cent of the land area. Of the 800 species of trees, only 20 are of importance, six conifers and as many broadleaf trees being the principal ones. More than one half the area is privately owned, State and Crown own slightly over one fifth, and public forests constitute the remainder. Besides, the forests of Hokkaido and Formosa are not included in this figure and are managed by local authorities. Some two million acres are managed as "Reserve forests" for their public utility, watershed protection, etc. The 10,850,000 acres of State Forest are managed under law of 1899 by a forestry bureau, under the Department of Agriculture and Commerce. The personnel consists of 20 secretaries, 23 assistant secretaries, 82 higher experts, 1426 clerks and assistant experts, and 1321 forest inspectors and rangers, some 2872 altogether.

The State forests are divided into ten districts and 211 Forests, the ranger districts numbering 1314. Some three million acres are still unexploited, being inaccessible, and 1,150,000 acres are still open for sale, the proceeds averaging over $11 million, which is set aside as a forestry fund.

A division of work is made into ordinary and extraordinary affairs carried on by two distinct departments. For 1909, the expenditure was 12 cents per acre and the net revenue 15 cents, the cut being in the neighborhood of 50 million feet B.M. Other interesting details are given.

Forests of Japan. American Forestry, June, 1915, pp. 693–711.

Swiss History

In connection with the exposition at Bern in 1914 the report on the forestry section contains a brief reference to the development of forestry in Switzerland.

According to Tacitus, 100 years after Christ, the country was still densely wooded, and clearing was a necessity. The nearer fields and woods became family property, the more distant woods became communal property and some have remained so for more than a thousand years. At Charlemagne's time, in the early part of the ninth century, it became necessary to prevent clearing; but in the fourteenth century, due to depopulation through pest and disease, the forest area increased. Soon, however, clearing, forest-destruction and forest-devastation proceeded again. The movement for a better treatment of the woods began feebly some hundred years ago, but two catastrophes by floods in 1834 and in 1868 were needed to rouse the people to action.

In 1843, the Swiss Forestry Association was formed; in 1855, a forest school was inaugurated; in the years 1858 to 1862, a reconnaissance of the Alpine forest conditions was made; and at last, in 1874, the constitution was amended to give to the federal government supervision over water and forest police in the high Alps, which led, in 1876, to the federal law for carrying out this provision. In 1897, the supervision was extended by popular vote to the plains and all Switzerland. In 1902, new legislation was formulated, including supervision over pastures. The object of the law is to maintain the present forest area, especially in endangered places, promote the creation of new protective forest, correction of torrents, and dangerous avalanche districts, encourage mapping and organizing of public forests, assisting in a good technical administration by paying part of the salaries of foresters of the cantons, communes and corporations, and giving money aid for protection works, reforestation, roads, etc.

A forest experiment station was organized by the federal government in 1885.

In 1912, a last step forward was made when the revised civil law paid special attention to forest property, giving the right to cantons and municipalities to subject forest use to limitations, to prevent dismemberment of properties, to enforce cooperative reforestation, and of combining small parcels into manageable units, and other matters.

Rückblick auf die Entwicklung des schweizerischen Forstwesens. Schweizerische Zeitschrift für Forstwesen, March to April, 1915, pp. 50–53.

MISCELLANEOUS

Fertilizer Conditions in Germany

Esslinger discusses the condition in which Germany finds itself with reference to artificial fertilizers during the war. There is a surplus of potash salts, especially Kainit, due to the stoppage of export, the annual production being about three times the usual home consumption.

The conditions are less favorable for the supply of phosphoric acid in the shape of bone meal, superphosphates and Thomas slag. There had been a considerable export of the latter, which has stopped, and as long as the steel works remain in operation there is no fear of scarcity. An increase in price of 14 per cent is due to scarcity of jute bags which used to come from England. Other phosphates are also still sufficient in sight. Nitrogen supplies are, however, a more complicated problem, since the import of Chili saltpetre is stopped and military requirements are said to have drawn stock on hand from the market. Ammonium sulphate, a by-product of gas and coke manufacture, used to be exported, especially to Belgium, and will therefore be sufficient. The question of securing nitrogen from the air occupies the chemists more strenuously, to make up the anticipated deficiency of about 200,000 tons. A special new factory has been established for this purpose near Ludwigshafen, and at the same time the

Government has fixed a maximum price, modified according to quantities ordered; prohibition of exports has also been enacted but appears to be a nugatory provision.

Altogether the outlook on the problem of fertilizers is said not to be discouraging.

Beschaffung der Künstlichen Düngemittelwährend des Krieges. Zeitschrift für Forst- und Jagdwesen, March, 1915, pp. 205-210.

Miscellaneous War Measures

Forstmeister Sieber, an active officer of infantry, speaks of the tasks of German forest administration during the war.

Germany imports about one third of the wood it uses. These imports ceased with the war, but during the first few months of war there was a corresponding lessening in the actual amount of timber used. Now the demand for timber is again rising and may necessitate an overcut: *i. e.*, a cut in excess of the calculated, sustained yield.

Sieber urges an increased use of wood for fuel and mentions that in his experience, heating by wood is no more expensive than by burning coal in the stoves. He further urges the fullest possible use of the grazing areas within the forests and of agriculture in growing crops in areas undergong regeneration.

A. B. R.

Die Aufgabe der Forstverwaltung während des Krieges. Allgemeine Forst- und Jagd—Zeitung, January, 1915, p. 12.

Upper Rhine Forestry Meeting

The most important problem before this association was the devising of ways and means to minimize the damage done by the annual floods from the Rhine river. For three months during 1910 the bottom lands around Baden were flooded. As a result extensive improvements are planned. By straightening the channel, diking, and draining, it is planned to make it possible to use these rich bottom lands every year without fear of floods; 22,500 acres are to be reclaimed by the same methods that have proved so successful in northern Germany and Holland.

The Association excursion at this meeting was through the forests which had been planted on the lowlands unfit for cultivation. Most of these forests are subject to frequent overflow, and it is only on the better drained sites that oak, ash, elm, and walnut can be grown. In 1910 a 60-year-old stand of ash was killed by being flooded for a month. On open, moist, sandy soils several species of poplar have been most successful. The Canadian poplar—probably *Populus tremuloides*—has grown especially rapidly. Trees 17 years old are from 55 to 60 feet high and range in diameter from 9 to 12 inches. On open, gravelly sand maple, linden, and locust have been successful, while the gravels are given over to hornbean and beech. Dry sand has been successfully devoted to birch and Scotch pine, while the wet sands are planted to willow and alder.

A full discussion was had at this meeting also on the question of the administraton of the communal and institutional forests. The raising of such forests was encouraged by the old French laws, and they have now become an integral part of the economic life of the community. They occupy 38.6 per cent of the total area in forests in the upper Rhine Valley. They comprise 46 separate units, ranging from 51 to 300 ha., only 8 of which are over 1000 ha. in extent. In 1912, the annual increment per acre was 35 cubic feet as compared with 78 cubic feet on the State forests. The net yield in 1905 was $2.20 per acre, in addition to a large amount of free use material. The Association came to the conclusion that stricter State supervision should be exercised over the communal and institutional forests, since through lack of technical knowledge the yield was low both in timber and money. Furthermore, protection could be secured much more cheaply if several of the units were consolidated.

K. W. W.

Versammlung der Pfälzer Forstverein für das Jahr 1914. Forstwissenschafliches Centralblatt, October, 1914, pp. 531–539.

OTHER PERIODICAL LITERATURE

American Forestry, XXI, 1915,—

The Pine-shoot Moth. Pp. 637-640.

Bird Enemies of Forest Insects. Pp. 681-691.

New England's Federal Forest Reserve. Pp. 803-812.
A résumé of what has been accomplished in New England in the past five years under the Weeks Law.

Botanical Gazette, LIX, 1915,—

A Study of Delayed Germination in Economic Seeds. Pp. 425-443.

[LX]

The Effects of Illuminating Gas on Root Systems. Pp. 27-44.

Notes on North American Willows. II. Pp. 45-54.

Canadian Forestry Journal, XI, 1915,—

The Work of the Forest Products Laboratories. Pp. 115-117, 135-136.

Pulp and Paper Magazine of Canada, XIII, 1915,—

A Laboratory for Wood Cellulose Research. Pp. 241-247.
Detailed description of the apparatus installed in the laboratory of the Experimental Station at Eberswalde, Germany, where new processes are tested and scientific research work conducted to develop the chemistry of wood and cellulose.

Wood Room Procedure and Its Treatment of Pulpwood in Connection with Newsprint Manufacture. Pp. 370-373.
Compares the different processes in use for barking wood.

Indian Forester, XLI, 1915,—

Twisted Fibes in Chir Pine. Pp. 69-75; 112-116.

Bulletin of Agricultural Intelligence and Plant Diseases, VI, 1915,—

The Trees of the Alföld. Pp. 88-92.
A summary of the tree species growing in the Great Hungarian plain.

The Forests of the Western Caucasus. Pp. 92 93.
These show much more resemblance to those of Central Europe than to those of the Mediterranean.

The Condition of Forestry in Portugal. P. 98.

The Resin Industry in Spain. P. 431.
Statistics of production and exports.

Zeitschrift fur Forst- und Jagdwesen, 1914,—

Beitrag zur Hebung der Holzproduktion und der Erträge der Waldwirtschaft. Pp. 576-595.

Betrachtungen über das Wesen der Waldesschönheit. Pp. 615-620.

Beiträge zur Durchforstungsfrage. Pp. 646-654.

NEWS AND NOTES

An article in a recent issue of the *Peking Gazette* demonstrates China's wide-awake recognition that reforestation is among the first problems the young Republic has to deal with.

During the last centuries practically nothing has been done in this country for the conservation of forests or planting of waste places, of which China has vast stretches. This summer the Minister of Agriculture and Commerce and the United States Consul together planted commemorative trees on the famous Purple Mountain, situated in the vicinity of Nanking city. Addressing the large gathering assembled on this occasion the Minister announced that shortly a law would be passed appointing an Arbor Day for China. A similar ceremony had been performed by the Acting Minister earlier in the spring on the Western Hills, through which a tour was made for the purpose of educating the people to a realization of the importance of forestry. Following these examples, a noted general, with other military officers and soldiers, planted a large number of trees on a hill within the city of Nanking. A feature of this ceremony was the donation by the General of 10 thousand young trees for general distribution and the promise that he himself would be responsible for funds to reforest the whole of this large hill.

Already a large government nursery, controlled by the Ministry of Agriculture and Commerce, has been established in Peking, and experimental tree planting has been started on the Western Hills not far away. Last year nearly half a million trees of different species were set out, and it is expected that the number planted this year will reach over a million. The work of reforestation of these hills is participated in by all the students at the School of Agriculture maintained by the government, and other agricultural schools use the government nurseries and experimental station as a training ground for the practical side of their studies. Over 300 men, students and hired laborers. worked side by side this spring reforesting the slopes of the Western Hills.

The establishment recently of a forest school in the University of Nanking is further evidence of the earnestness with which China is taking up the work. We hope to see large results follow these vigorous efforts.

The week of October 18 will be forestry week at the Panama-Pacific Exposition at San Francisco, fire protection, lumbering and related subjects being brought to the fore. The Society of American Foresters will hold their meeting on Monday October 18, the Western Forestry and Conservation Association on Tuesday, October 19, the American Forestry Association on Wednesday, October 20, and the Pacific Logging Congress on October 21. Visits to lumber camps in the wonderful redwoods will complete the week.

During the last few days in May and the first week to ten days in June, the weather conditions in eastern Canada were very dry, resulting in the spread of many fires, some of which assumed large proportions and did considerable damage. Information secured by both the Dominion Conservation Commission and the Railway Commission indicates that while the damage done by railway fires was small, much property has been destroyed through the spread of fires started by settlers for the clearing of land.

In Ontario, there is practically no restriction upon settlers' brush-burning operations, and the result has been that during every dry season for many years fires started by settlers for this purpose have spread beyond control, causing great loss of property, and, in some cases, loss of life.

The situation in New Brunswick has been very similar in the past, but as a result of serious fires caused by settlers during the early summer, along the International railway, now a part of the Government Railways System, an order-in-council has recently been issued by the Provincial Government providing that in the future, in the settlements of Hazen and Grimmer, no settlers' slashings shall be burned except upon permit issued by a forest officer.

In Quebec, the law endeavors to regulate the setting out of fires, by establishing a closed season, during which no such fires shall be set, unless a permit is issued by an officer of the Forest Protection Branch. However, great difficulty has been met in securing satisfactory observance of this law, and nearly every year great damage is caused on this account.

As a rule, the railways are now doing thoroughly commendable work in fire protection, and have in many cases expended considerable sums in controlling fires unquestionable due to outside sources. The next big step in forest fire protection throughout eastern Canada will no doubt be in the direction of securing better control of settlers' slash-burning operations during dangerous seasons.

The report of the Fire Inspection Department, Board of Railway Commissioners for Canada, shows that a total of 1346 fires are reported as having started within 300 feet of the railway track, throughout the Dominion, during the fire season of 1914. These fires burned over a total area of 191,770 acres, of which 49,326 acres, or 25.72 per cent, was young forest growth and 107,496, or 56.05 per cent merchantable timber, the balance of the area burned over being grass or cultivated land and slashing or old burn not restocking. The total value of property destroyed by the above fires was $433,442 of which $202,987 was for merchantable timber and $59,624 was the estimated value of young forest growth destroyed. Of the above 1346 fires, 904 or 67.16 per cent were reported as having been caused by railway agencies. One hundred and thirty-seven fires are reported as due to tramps, camp fires, etc., 62 fires as due to settlers clearing land and 16 to other known causes. There were 227 fires reported as of unknown origin.

Due to the attitude of the Pennsylvania legislature and ex-Governor Tener, the appropriations of the State Forestry Department were cut down to a point where efficient fire protection became impossible, and severe fire losses this spring have been the consequence. An appropriation of $75,000 per annum is asked for this part of the service.

A bill introduced in the Maine legislature for the preservation, perpetuation and increase of the forests in that State embodies three important provisions, namely: (1) that public lands of the State shall be under the superintendence of the State Land Agent, and that he shall have authority to sell seedlings from these lands at cost; (2) when deemed necessary for the preservation and conservation of the forest interests of Maine, the State may take private lands in the same way that lands are taken for railroad beds, making just compensation therefor; (3) owners of growing timber of certain kinds may cause the timber on certain tracts to be exempted from taxation by filing a plan of the tract, with description, in the files of the State kept for that purpose, no timber under 12 inches in diameter to be cut from these exempted tracts at any time, and taxation to begin only when logging operations are undertaken.

The New York State College of Forestry at Syracuse advocate public control of street tree planting and preservation by municipalities, arguing that this work should be regarded as coming under street improvements. During last year the College made investigations upon the shade trees in New York City, Syracuse, Binghamton, Amsterdam, Mount Vernon, and Olean. An estimate has been recorded that within the cities of the State there are 20,000 miles of streets along which can be planted 5 million shade trees, which would increase the property value $100 million.

A splendid step forward is being taken by the arrangement now being made between the U. S. Forest Service and the British Columbia Forest Branch for cooperation for fire prevention along the international boundary. On the Canadian side of the line will be included the Vancouver, Vernon, Nelson and Cranbrook Forest Districts and in the United States, in District 6, the Washington, Okanagan and Colville Forests, and in District 1, the Kaniksu, Pend d'Oreille, Kootenai and Blackfeet Forests.

The Dominion Board of Railway Commisioners require from the Canadian railway companies monthly reports, during the period from April 1 to November 30, inclusive, on all fires originating within 300 feet of the track and burning over an area of 100 square feet or more outside the right of way in forest sections.

It is announced that the Quebec government has sent to limitholders a notice, stating that the Government wishes to pass an Order in Council making it obligatory on all persons lumbering along the right of way of railways to clear away and burn all tops of trees and debris within 100 feet of the right of way. We only wish they could even now go a step farther and include the burning of *all* debris and slash whether along right of way, in farm woodlots, or elsewhere. The expense annually would be more than reimbursed by the lessening of the danger of forest fires secured by this means.

The British Columbia Forest Branch have continued their educational propaganda among the inhabitants of the Province by addressing to settlers and farmers a letter giving regulations concerning fire permits and rules for guidance when burning slash or brush in clearing land, and also stating what to do in case fire should break out. In this connection it is interesting to note that it has been said that the settlers of British Columbia, as a community, cooperate in the work of fire prevention more than in any other part of Canada or in the United States.

The heliograph, used for communication between high observation points overlooking the surrounding forest, is worked on the principle of the reflection of the sun's rays, as when a small boy uses a mirror to blind a pedestrian by flashing light into his eyes.

Dots and dashes, indicated by breaking the ray of light with a shutter, form signals, read by the sense of sight and at a rate of 10 or 15 words a minute and for a distance of 20 to 30 miles. The only unfavorable condition to the working of this system is cloudy weather. Moonlight answers, but, of course, as can be readily understood, is much less satisfactory than sunlight. But it has been found that messages sent in smoky or hazy weather are more easily read than when sent in bright sunlight.

A lookout man on discovering a fire, using his compass, reads its course in degrees and then signals to a second man, who possibly is able to see the fire, asking him to read also with his compass. By platting these two courses on a map, the location of the fire is found at the point of intersection, when the information is immediately telephoned or heliographed to the nearest ranger and supervisor's headquarters.

A signal lantern of 1900 candle power is used in connection with the heliograph at night or during cloudy weather, but the reflection from this light can be transmitted satisfactorily only for a distance of 10 miles.

During the forest fires around Star and Cranberry Lakes in the Adirondacks this summer, nineteen students from the summer camp of the New York State College of Forestry did work for which they have since been highly praised by Warden Yerden and Ranger Ferris. It is believed that the efforts of these students resulted in the saving of many of the summer homes about Star Lake.

"National Forest Aid" is the title given in California to boy scouts who spend ten days in a National Forest during the fire season, make themselves useful to the forest officer, and later pass an examination in elementary forestry. The symbol of the position is a bronze badge with the Forest Service pine tree in relief encircled by the words "National Forest Aid."

The earnest desire of Mr. T. B. Wyman, Secretary of the Forest Protective Association at Munsing, Michigan, for forest fire prevention, has resulted in an ingenious plan to keep the mind of lumbermen awake to this need. The Association has distributed packs of playing cards on the backs and on the figures on the faces of which are printed brief fire warnings.

The "ceaseless droppings" which now on every hand meet the invader of the forest in whatever capacity should surely soon wear into the "stoniest" mind the wisdom of the old saying, "An ounce of prevention is worth a pound of cure," when our forests are concerned.

At a conference of the U. S. Forest Service officials held at Madison, Wisconsin, April 14 to 17, 1915, and at which the Forest Service Laboratory, the Washington Office of Industrial Investigations, and the seven National Forest Districts were represented by specialists, the following subjects were discussed: Cooperation of the Forest Service with Industries; Lumber Distribution in the United States; Utilization of Low Grade Lumber and Mill Waste; Adaptation of Manufacturing and Grading of Specific Classes of Consumers; Unification and Standardization of Lumber Grades; Study and Development of General Markets for National Forest Timber; Mill Scale Studies, including Technical Methods, Tallying, Etc.; Lumber Depreciation and Collection and Compilation of Lumber Price Data.

Since the inauguration of its Wood Waste Exchange, on April 15 last, the Forest Service has been requested to list 147 mills and factories as having waste material for sale, while during the same time 76 other wood-using concerns have asked to be listed as desiring to purchase waste of a wide range of species in specified dimensions or as mill or factory run. The latter have been included in the list of "Opportunities to Sell Waste," which is sent monthly to concerns which have waste material for sale. This list is growing steadily, but the Forest Service is anxious to accelerate its rate of growth inasmuch as it comprises only about half as many buyers as there are sellers listed under "Opportunities to Buy Waste."

The Forest Service through its Exchange has already brought several concerns together, thus reducing mill waste and at the same time locating cheaper raw material.

There is no charge for the use of the Wood Waste Exchange.

The Government of the United States, endeavoring to put different federal departments in position to be helpful in solving industrial problems of the people of the nation, held a session of the Federal Trade Commission at Chicago on July 19, when representatives of the export lumber industry and of the lumber industry as a whole were given an opportunity to state what they consider are the reasons why this industry is not prospering as it should, and what the means to alleviate the unsatisfactory conditions.

In this connection, we may quote, as evidence of a changing attitude on the part of the lumbermen to foresters, the text of a resolution passed at a meeting of the Directors of the Lumbermen's Association of Chicago:

WHEREAS, The Forest Service of the United States Department of Agriculture is now actively taking up a constructive study of the entire lumber industry; and

WHEREAS, the industry is now passing through a critical period, the proper solution of which will have a tremendous effect on the future permanency of the industry; and

WHEREAS, Many vital questions are involved in this study of conditions such as—

The carrying charges on stumpage;

The freight rates on lumber as compared with other products;

The prohibition of lumber in many municipalities without regard to economic use;

The conditions forcing the production of lumber greatly in excess of demand;

The hostile public attitude toward the industry;

The ignorance of the costs entering into the price of lumber; and

WHEREAS, These questions and many others affect the extent to which the timber supply of the country can be economically and properly utilized; now therefore be it

Resolved, That we urge our members and others interested in the industry to assist the accredited representatives of the Forest Service in its investigations, so that the true conditions of our industry may be better understood, and that our relation to the general public as a problem in national economics may be fully realized.

As a result of war conditions, the United States Forest Service is arranging to send a trial shipment of matchwood to Brazil, a country which formerly was supplied with aspen from Russia.

The U. S. Department of Agriculture announces that it has under consideration the prohibition of the importation of all European pine, owing to the possibility that these pines are the source of the pine-shoot moth. Certain pines of Europe and Asia are already excluded on account of the danger of the introduction of the pine blister rust.

An Order in Council has been passed by the Dominion Government prohibiting the importation into Canada of all "forest plant products, including logs, tan bark, posts, poles, ties, cordwood and lumber, originating from any one of the States of Maine, Massachusetts, New Hampshire, Connecticut, and Rhode Island, unless accompanied by a certificate showing that they have been inspected by the U. S. Department of Agriculture and found free from gypsy moth." The passing of this Order was made necessary because of the discovery of the moth in shipments of forest products, even pulpwood, received from the United States.

The Assistant Superintendent of Forestry of the Canadian Pacific Railway has received from the Chief Engineer of the Chicago and Alton Railroad Company the following information regarding concrete ties:

"There were 60 concrete ties placed in the track in October, 1903. They were ballasted with stone, where they had good drainage and were kept in good surface. In 1906, 12 concrete ties were taken out; in 1911, 32; in 1912, 10, and in 1913, 6.

These ties were taken out on account of crushing and breaking down under the rail, thus being unsafe to remain in the track. Ties were constructed of cement, iron girder and oak block. There were two blocks of concrete 7 inches thick, 9 inches wide and 3 feet long. There was an iron girder that ran through the blocks that was 2 inches thick and 2 inches wide; there was an oak block 3 inches thick and 10 inches wide and 24 inches long set on top of the concrete tie to use for cushioning the rail and to spike rail. There was a wooden plug in the concrete to hold the spike in place.

"These ties weighed about 450 pounds, and when track was surfaced the ballast had to be dug out from between the ties. If this was not done the rail would lift up and ties would stay in ballast on account of their weight.

"When track heaved slightly in the winter it was caused to become slightly uneven. The ties under the heavy part of the track would crush and break, and this left the track unsafe. We were compelled to place oak track ties between the concrete ties to hold track to gauge. After six years' test I have concluded that ties of this make are a failure."—*Canadian Forestry Journal.*

Dr. H. S. Graves, Chief Forester of the U. S. Forest Service, has gone to Alaska to inspect the Alaskan forest reserves.

Mr. H. R. MacMillan, Chief Forester of British Columbia, at present on a world tour as special Trade Commissioner for the Dominion Government, reports in the July 15th issue of the *Canada Lumberman* "England's War-time Requirements" from the timber trade.

According to a report from the Department of Trade and Commerce of Canada, an order has been placed for 800,000 feet of Pacific Coast spruce, or Silver spruce. This is said to be the only satisfactory timber for aeroplane construction, one of the important qualities being its clear straight grain. It is used also in thin stock in building certain types of naval vessels.

A "Traveling" Forest Products Exposition is contemplated by the originator of the Forest Products Exposition held at Chicago and other cities last year. This exposition would consist of a train of both passenger and freight cars of latest model, carrying from town to town, where they would be sidetracked for a few days, an exhibit that would demonstrate the uses of wood. This is an admirable idea, well worth carrying out. The resulting good for the cause of forest conservation from this educational propaganda among the inhabitants of the towns thus favored would be widespread.

The Technical Section of the American Pulp and Paper Association offers a prize of $100 for the best paper on certain subjects embodying problems met with by American manufacturers. The purpose of this competition is, of course, to stimulate research work for advancement in methods and processes in the pulp and paper industry. The July 15th issue of the *Pulp and Paper Magazine of Canada* publishes the list of subjects for papers and the rules under which the competition will be carried out.

A forest map of the Philippine Islands has been prepared on a scale of 1 : 800,000. It has been placed on exhibition in the Philippine section at the Panama-Pacific Exposition.

Announcement has been made that the appointment of a Chief Conservator of Forests for the Bombay Presidency has been sanctioned by the Secretary of State.

The Diana Paper Company of Watertown, New York, has planted 150,000 spruce seedlings on its property in the Adirondacks. The company has established its own nurseries and will continue the planting yearly.

The Laurentide Company of Grand Mère, Quebec, are planning tree planting operations on a very large scale. Last year 150,000 trees were planted. This year, including spring and fall planting, 500,000 trees will be set out, and as soon as possible there will be planted annually a million trees, a number equal to the Company's annual cut.

A planting on 10 acres of cultivated area on Mount Maquiling, P. I., of ipil-ipil has resulted in a splendid crop of young seedlings.

A successful outcome in this case will mean the planting within the next few years of many areas on this mountain. Thus will firewood be available either for local use or for disposal in Manila.

Upon the suggestion of Mr. H. E. Fletcher, of the Fletcher Paper Company, and Chairman of the Executive Committee of the Technical Section of the American Pulp and Paper Association, several manufacturers have contributed to a fund to establish scholarships in paper manufacture at the University of Michigan. The first of these scholarships to be established has been awarded for next year to a graduate student who is to devote the entire year to the study of manufacture of paper and to the investigation of some important problem connected with this industry. These scholarships are preliminary to the establishment of a course in paper manufacture at Michigan University similar to that given at the University of Maine, which is this year sending out graduates.

During the last winter a number of District Foresters of British Columbia gave instruction and practice in cruising, surveying, and scaling to rangers and forest guards. The trial having proved successful and been appreciated, it has been decided to hold these ranger schools, so called, every winter.

The Department of Forestry of the New York State College of Agriculture at Cornell University conducted this year a summer term offering instruction in timber utilization and measurement, silviculture, forest management, and advanced research into various forest problems. The first six weeks of the term were taken up with lectures at Ithaca, and the rest of the time until September 22 will be spent in camp in the Adirondacks.

At the University of Giessen there were thirty students enrolled in forestry, but twenty-one of these are in the army. The other nine are underclassmen and hence not yet ready for lectures in forestry. These lectures have in fact been omitted during the past semester, especially since two members of the forestry faculty, Weber and Baader, are with the army.

Most of the other forest schools are in the same condition.

Only at the Universities of Munich and Tübingen were forestry lectures held, but these on a reduced scale because only the older professors are present, the younger being with the army. Thus Fabricius of Munich and Wagner of Tübingen are with the army.

Courses are announced in the following German forest schools for the summer semester: Universities of Giessen, Munich, Tübingen, Karlsruhe and the Academy at Tharandt. In most cases, it is noted, however, that these courses are subject to change due to the war.

At the Academies of Eberswalde, Münden, and Eisenach no lectures will be given.

Fourteen high schools in the State of New York have this year undertaken the beginning of school forests to the extent of one to five thousand trees. This work is the result of co-operation between the State College of Forestry at Syracuse, the State Education Department at Albany and the high schools of the State. A recent bulletin put out by the College of Forestry is entitled "The Planting of Forest Trees by the Public Schools of the State." The Dendrological department of the College is working on a collection of native woods for distribution to the schools, each set to comprise 35 species and to be accompanied by a pamphlet giving information on the structure and properties of the wood.

The forest wealth of Quebec is placed at $600 million, of which White and Red pine represent $200 million, spruce and balsam $250 million, other pulpwood $100 million, hardwoods $25 million, and cedar $25 million.

The world's supply of camphor is mainly obtained from the mountainous districts of the island of Formosa, where the forests are estimated to contain about 1 million camphor trees, some 10 thousand of which are felled each year. Under present conditions it is impossible to commence reforestation. Wild head-hunting savages inhabit these regions, and knowing the value of the trees, they oppose the Japanese in their endeavors to harvest this crop. Hundreds of camphor gatherers are killed annually. The Japanese are nevertheless gradually advancing into the forests by making wide paths, placing guardhouses every 120 yards, and equipping every fourth or fifth house as a fort with trenches, defended by wire entanglements, machine guns, and telephonic communication.

Hollowed redwood logs, used for water-piping, which were laid at Fort Bragg, California, and which were in use 16 years, until their capacity became too limited, have been relaid after ten years' exposure to the elements. Close examination of the timber after this long period of idleness revealed it to be in such good condition that it is expected the piping will be serviceable for many years to come.

Wood-flour, especially from pine and spruce sawdust, ground in mills similar to those which grind grain, is used as an ingredient of dynamite, linoleum, etc. Wood-flour dynamite, though inferior to that made with infusorial earth as an absorbent for nitroglycerine, the explosive ingredient, because of being cheaper, answers many uses. In making linoleum this wood-flour mixed with linseed oil gives body to floor coverings. It is also useful in the manufacture of xyolite, a kind of artificial floor covering resembling wood in weight and stone in other respects, and said to be impervious to water and fireproof.

Mr. Aubrey White, for 28 years Assistant Commissioner of Crown Lands and Deputy Minister of Lands and Forests of the Province of Ontario, died on July 14, in his seventieth year.

To foresters Mr. White was known mainly as having for the first time organized a fire patrol for the Ontario Crown Lands as long ago as the early eighties, when this idea was as yet undeveloped.

Although Mr. White was found at forestry meetings an active participant and was one of the past presidents of the Canadian Forestry Association, it cannot be said that he was active in the practical application of forestry methods in the administration of the Crown Lands. This was perhaps natural for one who was expected to secure present revenue under the license system, and who, through long continued service in the administration of this system, had become staid and conservative in method.

His place may now perhaps be filled by a more progressive official who may be able to accomplish the difficult task of reforming the administration of the public timber lands in the forestry sense, that is with an eye to the future. Mr. White, who was accustomed to hold in hand and control personally every detail of his office leaves a difficult place to fill.

PERSONALITIES

1. Northeastern United States and Eastern Canada. 2. Southeastern United States. 3. Central United States. 4. Northern Rockies. 5. Southwest, including Mexico. 6. Pacific Coast, including Western Canada. 7. Hawaii, the Philippines and the Orient. 8. Europe. 9. Unclassified.

The above classification is adopted in order to facilitate the identification of important news items. It is only natural that readers will be interested more in the news from one region than from another. Realizing this, the news are arranged accordingly.

1. *Northeastern United States and Eastern Canada*

Robert Landon Rogers died of tuberculosis in Providence, R. I., on May 25. Rogers was born in 1883, went to school in Providence, in 1905 graduated from Yale College, where he was editor of the *Yale Banner* in 1905 and a member of the Elihu Club. In 1908 he graduated from the Yale Forest School and entered the Forest Service where, until December, 1908, was engaged chiefly in planting work. In December, 1908, with the creation of the six western districts, he became a member of the silviculture staff in District 3, later being made Deputy Forest Supervisor of the Coronado National Forest in that District. In December, 1912, he was transferred to Washington for editorial work, where he remained until continued illness brought about his retirement not long before his untimely death.

B. M. Winegar, forester to the Operating Department, Eastern Division of the Canadian Pacific Railway, was married in June to Miss Dohan, of Montreal.

Edward E. Carter resigned from a professorate in the Harvard Forest School on July 1 and re-entered the Forest Service as an inspector in the Branch of Silviculture with headquarters at Washington.

Philip T. Coolidge has been appointed Assistant State Forester of the Forest Park Reservation Commission of New Jersey.

J. J. Levison and Miss Ray B. Haskell were married on June 6. They reside in Brooklyn, N. Y., where Levison is arboriculturist for the Department of Parks.

Dr. B. E. Fernow's youngest son, Karl, a junior at Cornell University, rowed bow in the varsity boat which won the Poughkeepsie Regatta on June 28.

W. N. Millar, Assistant Professor at the Toronto Forest School, visited, during the summer, forest reserves in the western part of Canada with the object of gaining data to assist in perfecting the organization and in developing scientific investigation of timber growth in the prairie provinces.

Mr. J. E. Rothery, of the firm of Vitale and Rothery, of New York, has been elected a fellow of the Royal Geographical Society. Rothery has also been elected a member of the graduate advisory board of the Yale Forest School to succeed T. S. Woolsey, Jr.

S. B. Detwiler's address is 925 Commercial Building, Philadelphia, Pa.

Ralph C. Hawley was re-elected secretary of the Connecticut Forestry Association at the annual meeting on May 8.

Blaine S. Viles was, in March, elected Mayor of Augusta, Me.

John Harold Foster, on July 7, was married to Miss Mary Elliott, of Waterville, N. H. Mr. and Mrs. Foster will reside at Durham, N. H., where Foster is professor of forestry at the New Hampshire Agricultural College.

W. E. Dexter, student assistant, in the head office of the Dominion Forestry Branch, is now Lieutenant with A Company, 38 Battalion, in camp at Barriefield, Ont.

William E. Dunham was married on May 4 to Miss Mabel Reese, of Warren, Pa.

James O. Hazard resigned from the State Service of New Jersey in April to undertake the development of 1100 acres of land which he has purchased near Atlantic City.

George R. Monell has been elected secretary-treasurer and forester of the Vermont Timberland Owners' Association. A daughter was born to Mr. and Mrs. Monell on July 9, 1914.

B. K. Ayres was married on May 24 to Miss Irene Warner, of Brooklyn, N. Y. They are now at their home, 155 South Cliff Street, Ansonia, Conn., where Ayres is lumber salesman for the Ansonia Forest Products Company.

W. W. Coykendall is located at Schnectady, N. Y., as local representative and manager for the Fassett Lumber Company of Quebec.

Edward C. M. Richards has been chosen manager of the Empire State Foresters, a consulting firm with headquarters at 156 Fifth Avenue, New York City. During the summer Richards made a trip to the Pacific Coast.

2. *Southeastern United States*

The marriage of Edna Lyall, daughter of Mr. and Mrs. J. Weller Martenis, and Willard Springer, Jr., took place in Wilmington, Del., on April 15.

W. Hoyt Weber has been re-appointed chief fire warden and administrative officer of the West Virginia Cooperative Fire Association for the ensuing year.

Temple H. Tweedy has been in Norfolk, Va., and Jacksonville, Fla., inspecting lumber to be used, after creosoting, for paving blocks, and also inspecting the creosoting of ties, for use by the city of New York.

Fred W. Besley, State Forester of Maryland, has been appointed a collaborator in the office of State Corporation in the Forest Service.

Karl E. Pfeiffer, who received the degree of Master in Forestry from Cornell in June, has joined the staff of the State Forester of Maryland.

J. Girvin Peters' address is Edgewood, Bethesda, Md.

A son, William Johnston, was born on April 6 to Mr. and Mrs. William R. Barbour.

Bruce Johnson Downey was married on May 10, at Nashvile, N. C., to Miss Mabel Davis Coley.

Mr. F. H. Newell, for twenty-six years with the U. S. Reclamation Service, from 1902 to 1907 as Chief Engineer and from that time until 1914 as Director, has accepted the position of head of the Civil Engineering Department of the University of Illinois.

3. *Central United States*

A son, John Miller McMurray, was born on June 4 to Mr. and Mrs. Murray McMurray of Webster City, Iowa.

The forest school at the University of Nebraska has been discontinued.

A daughter, Katherine Aylwin, was born on March 4 to Mr. and Mrs. William Winter, of Indianapolis.

A daughter, Marguerite Dunlap, was born to Mr. and Mrs. Stephen V. Klem, on March 6 at East Lansing, Mich.

4. *Northern Rockies*

Emanuel Fritz has been appointed Forest Assistant in the United States Forest Service with headquarters at Missoula, Mont.

John H. Hatton, formerly in charge of grazing in District 5 (San Francisco) is now in charge of that office in District 2 (Denver). Hatton was in Denver on detail last summer.

Mrs. Leila C. Hutchinson, wife of Supervisor Wallace I. Hutchinson, of the San Isabel National Forest, died on May 30 at Denver.

Clinton G. Smith is now supervisor of the Cache National Forest with headquarters at Logan, Utah.

Wilford B. Willey has been promoted to the position of supervisor of Clearwater National Forest with headquarters at Orofino, Idaho.

Samuel B. Locke has been promoted to the position of supervisor of the La Sal National Forest, with headquarters at Moab, Utah.

A son, Charles Henry, was born on March 18, to Mr. and Mrs. Edgar F. White, of Missoula, Mont.

J. Warrington Stokes has been transferred to the Unita National Forest, with headquarters at Provo, Utah.

Charles F. Evans has been transferred to the Ashley National Forest, with headquarters at Vernal, Utah.

William O. Sauder has been transferred to the Cochetopa National Forest, with headquarters at Saguache, Colo.

5. *Southwest, Including Mexico*

Theodore S. Woolsey, Jr., has been chosen to serve as vice-president of the Yale Alumni Association of New Mexico which was formed on March 27. Woolsey has leased Dr. Seidbotham's house at 1936 Laguna Street, Santa Barbara, Cal., for the four months ending October 1, 1915. He has not as yet recovered from his operation for appendicitis and will probably have to undergo a second operation before the wound heals.

6. *Pacific Coast, Including Western Canada*

Forest Assistant L. C. Tilt has been appointed to the Manitoba Inspection Office at Winnipeg.

C. F. McFayden has been appointed Forest Assistant in the Dominion Service and will probably be assigned to the Athabasca Division of the Rocky Mountain Forest Reserve.

H. R. Christie, Assistant Chief of Operations in the British Columbia Forest Branch, is making an extended trip of inspection in the northern forest districts.

Mr. P. Z. Caverhill, recently District Forester at Kamloops, B. C., is now Deputy District Forester at Vancouver. This change is in the nature of a promotion for Mr. Caverhill, the forest management work in the Vancouver District amounting to about two thirds of that in the entire Province.

Mr. P. S. Bonney, formerly Forest Assistant at Fort George, is now Acting District Forester at Tete Jaune, B. C.

Messrs. L. R. Andrews, C. S. Cowan and E. G. McDougall, members of the B. C. Forest Branch, have enlisted for overseas service.

Mr. G. Melrose has been assigned to the Vernon, B. C., District as Forest Assistant.

George W. Peavy, Forest Examiner in the District Office at Portland, Ore., has resigned from the Forest Service.

William C. Hodge, of the District office in San Francisco, was married on June 10 to Miss Marguerite T. Murphy.

Following the transfer of Assistant District Forester Hatton to Denver, C. E. Rachford, hitherto supervisor of the Santa Barbara National Forest, has been appointed Assistant District Forester in charge of grazing at San Francisco. Rachford has been succeeded by the former Deputy Supervisor of the Klamath National Forest, J. R. Hall.

M. A. Grainger has been appointed Acting Chief Forester of the British Columbia Forest Branch during H. R. MacMillan's absence on a tour of the world in the interests of trade extension as Special Trade Commissioner.

Wyngard C. Gladwin, inspector in the British Columbia Forest Branch, died on April 13. Gladwin had charge of the Provincial fire wardens from the inception of protection work.

K. Vavasour, graduate of the Forest School of the University of New Brunswick, has been appointed Forest Assistant on the Porcupine and Pasquia Forest Reserve with headquarters at Usherville, Sask.

E. C. Manning, who has been in the Canadian Pacific Railway Company's Department of Natural Resources, has been appointed as Forest Assistant for the Dominion Forestry Branch on the Clearwater Forest Reserve with headquarters at Rocky Mountain House, Alta.

J. A. Doucet, Forest Assistant, is in charge of a reconnaissance survey in the Peace River country. His headquarters will be Spirit River Settlement, via Edson, Alta. Doucet will be assisted by R. D. Macdonald.

George S. Smith is Forest Assistant in the Big River and Sturgeon Forest Reserves, Sask., with headquarters at Big River, Sask.

George L. Clothier has resigned from the professorate of forestry at the Washington Agricultural College, Pullman, Wash., to take up farming at Cedar Point, Chase Co., Kan. A daughter, Nellie Elizabeth, was born to Mr. and Mrs. Clothier on March 17.

Frank G. Miller has been appointed to succeed Clothier in the professorate of forestry at Pullman.

David G. Kinney's address is Upland, Cal., where he is sales agent for the Juruh Rancho.

Frank B. Kellogg resumed active work in District 6 of the Forest Service as Forest Assistant, on July 1.

A daughter, Barbara Cope, was born to Mr. and Mrs. Stuart B. Show on April 13, 1915. Show has been in San Francisco on detail.

Harold S. Newins, professor of forestry at Corvallis, Ore., was married on June 23 to Miss Helene Schmidt, of Brooklyn, at Brooklyn, N. Y.

W. J. Paeth has been assigned as Forest Assistant to the Okanogan National Forest with headquarters at Okanogan, Wash.

7. *Hawaii, the Philippines and the Orient*

Mr. R. S. Hosmer, formerly superintendent of forestry for the Territory of Hawaii, is now a member of the department of forestry of the New York State College of Agriculture at Cornel University. Mr. C. S. Judd, who was on the staff of District 6, U. S. Forest Service, is Mr. Hosmer's successor, having assumed his duties last January.

William Crosby has been appointed Assistant District Forester of Mindanao and Sulu in the Philippines, where he may be addressed at the Forest Station at Zamboanga.

On the invitation of Nanking University, W. F. Sherfesee, Director of Forestry in the Philippines, made a trip to China in May to help organize the forestry work there.

8. *Europe*

W. B. Campbell, Assistant Superintendent, and L. L. Brown, Computing Engineer, of the Canadian Forest Products Laboratories, have enlisted for overseas service in the British Army.

E. S. Davison is now in France serving with the ammunition supply department.

Dr. C. A. Schench is in command of a large camp of prisoners of war in Germany.

9. *Unclassified*

Mr. H. M. Curran, Chief Forester of Argentine, is in charge of the lumber exhibit of that country at the Panama-Pacific Exposition in San Francisco. He will probably spend two years in the United States, gathering information of conditions of the lumber business here and the probable effect on the timber supply of South and Central America.

H. S. Betts has been appointed Chief of the office of Industrial Research of the Forest Service and reported in Washington early in May. He takes the place of O. T. Swan, who recently resigned. Betts has been connected with the Forest Service Laboratory at Madison, Wis.

Will C. Barnes, hitherto inspector of grazing in the Washington office of the Forest Service has been promoted to the position of Assistant Forester.

Edward A. Sherman, hitherto Forest Inspector (late District Forester) has been promoted to Assistant Forester in charge of the Branch of Lands of the Forest Service.

COMMENT

On page 298 of this volume a statement was made regarding legislation development in California, to which a correspondent takes exception. We are advised by him that it is not fair to charge the California Forest Protective Association with having opposed improved forest fire legislation, and he presents the situation as follows: "The conservation section of the Commonwealth Club of California called several meetings of the people most directly concerned in the forest fire protection bills which were introduced at the 1915 session of the legislature. After several conferences, a compromise measure was formally endorsed by representatives of the State Conservation Commission, the United States Forest Service, the Division of Forestry of the University of California, the Section on Conservation of the Commonwealth Club of California, the Forestry Section of the California Federation of Women's Clubs, the Sierra Club, the San Francisco Chamber of Commerce, the Tamalpais Fire Association, and the California Forest Protective Association."

We regret to have to correct a statement made in the last issue on page 299, describing the formation of a State Board of Forestry in Texas. We were following in this an account to be found in *American Forestry* for May. It turns out that such a Board was not legislated, the Directors of the Agricultural and Mechanical College of Texas, a non-political body, acting as such Board. Our remarks regarding the superfluity of interests and many-headedness of the Board were therefore uncalled for.

We are now in receipt of a copy of the Act, which excels in simplicity and freedom from limiting conditions. The Board has the right not only to receive by gift but also to purchase State Forests, "using for such purchases any special appropriation or any surplus money not otherwise appropriated which may stand to the credit of the State Forestry Fund; all sales of wood or other products to constitute a special Forestry Fund and this fund to be managed by the Board."

The principles involved in this organization are most promising, and it is only necessary to endow the Board properly for a sufficiently large beginning to place Texas in the front rank of States practising forestry.

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SKIDDERS

CONTENTS

VOLUME XIII NUMBER 4

FORESTRY QUARTERLY

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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.

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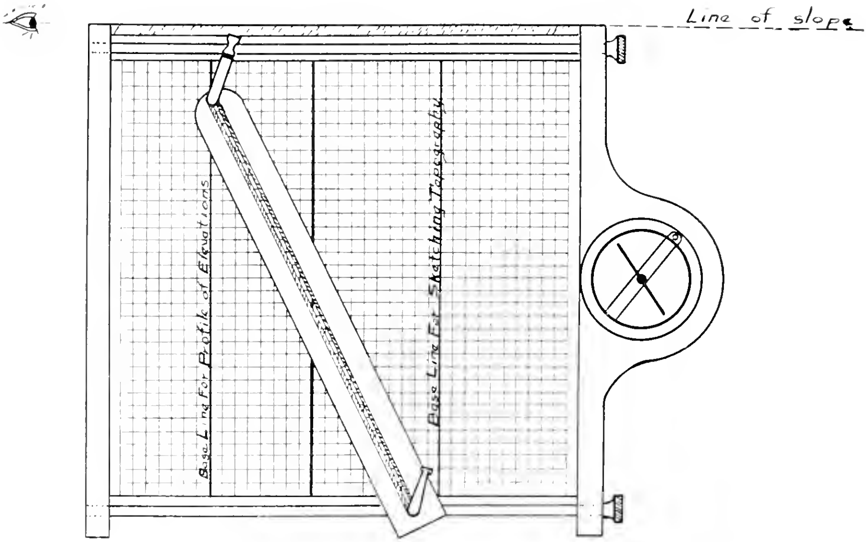
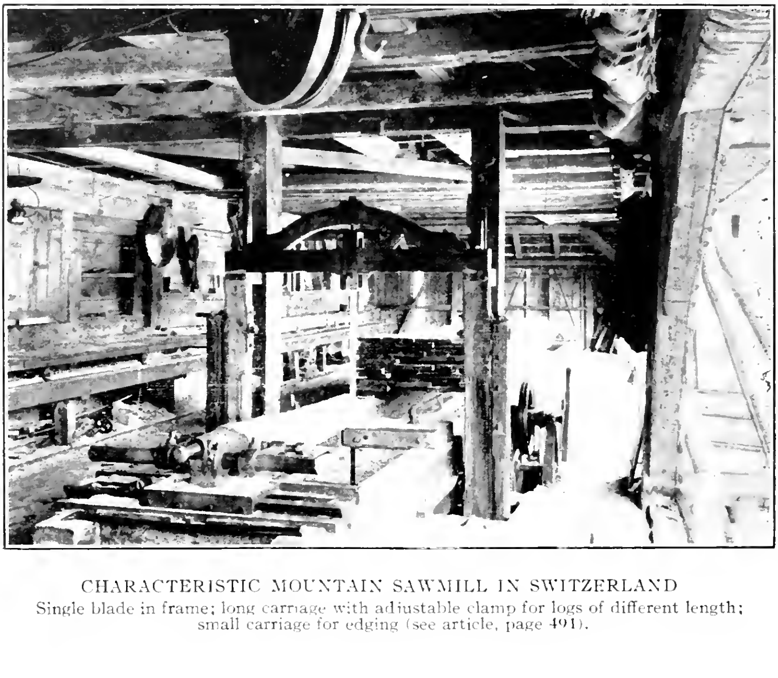


FIGURE 2. ARMY SKETCHING BOARD WITH PROFILE ALIDADE ATTACHED

(See article, page 437)



CHARACTERISTIC MOUNTAIN SAWMILL IN SWITZERLAND

Single blade in frame; long carriage with adjustable clamp for logs of different length; small carriage for edging (see article, page 491).

FORESTRY QUARTERLY

VOL. XIII DECEMBER, 1915 No. 4

THE PROFILE ALIDADE
AN INSTRUMENT THAT MAY PROVE USEFUL IN MAPPING STRIP LINES

BY S. B. DETWILER

The recent discussions in the FORESTRY QUARTERLY of the use of the Abney hand level for obtaining elevations in strip mapping made it plain that the instrument has disadvantages as well as advantages for this purpose. Some of the disadvantages of a hand level are the impossibility of securing a close reading, the time required to secure a proper adjustment of the bubble and to transfer the data to the notes, and the eye strain caused by sighting through a fine aperture which cannot be held absolutely steady. In running about 40 miles of levels with the Abney, of which the writer had charge, it was found that when the instrument was lashed firmly to a camera tripod with a ball and socket head, readings to half a degree could be made when the observer used the instrument for some time and kept in training. By having the instrument held steady much of the eye strain was relieved, and on resurvey the readings checked almost exactly. This method of using the Abney level is fairly convenient in leveling base lines and streams, but, of course, is not suited for use in strip survey mapping.

It is evident that the force of gravity will do the same work as a level. Since a plumb line is at right angles to a horizontal line, if a level bubble is fastened at right angles to the line of gravity in a pivoted pendulum, the bubble should be centered when the pendulum is at rest. Therefore, if a pendulum was fastened to the pivoted arc of the Abney level and the reflection of the degrees on the arc thrown on the mirror instead of the bubble reflection, the operation of the level would be automatic. This idea is applied in the construction of the Forest Service standard hypsometer.

This principle may be applied to topographic mapping by the use of a metal ruler of any convenient size, suspended at one end on a pivot of small diameter. The instrument constructed by the writer (Fig. 1) is of sheet brass, 1/16 inch thick, 1 inch wide and 1 foot long, but a smaller size will be more convenient. The pivot must be centered so that a line drawn lengthwise through the center of the brass strip is a plumb line when the ruler hangs free on its pivot. A pivot specially constructed on the principle of a hub and axle will insure freedom of movement and accuracy. One end of the pivot is tempered and sharpened to a pin point, so that it will hold the instrument when driven into the face of a sketching board. The pivot must permit the ruler to swing freely parallel to the face of the board, but should not allow much movement at right angles to it. The pivot end of the ruler should be rounded or pointed so that the pin point may be inserted exactly at the desired spot. The ruler is divided lengthwise by a narrow slot sawed through the middle from the pivot to within an inch of the opposite end. The edges of the slot are bevelled on the face of the ruler and at the bottom of the slot they are smooth and straight. The slot should be about 1/16 inch wide, so that a well-sharpened pencil point will easily reach to the face of the sketching board beneath the ruler and move freely in drawing a straight line the length of the slot.

The top of the pivot may be a slotted sight on the order of a compass sight, or a brass post with or without a ring sight. In any case, the upper part of the pivot acts as a handle to drive the pin point into the sketching board. The pivot point should have a shoulder of about 1/32 inch to keep the ruler from being jammed too tightly against the board. At the opposite end of the slot another slotted sight or sighting pin is provided, so that the ruler may be used as an alidade, similar to that used with a traverse board, when the sketching board is held horizontally. This feature of the profile alidade will make the use of the army sketching board much more convenient and accurate. A scale should be marked on the edge of the slot of the profile alidade.

To use this instrument for obtaining grades and elevations, the sketching board must have a straight edge for a sighting surface. Cross-section paper is fastened to the board so that the lines are exactly parallel and perpendicular to the sighting edge. A line is then drawn perpendicular to the sighting edge for

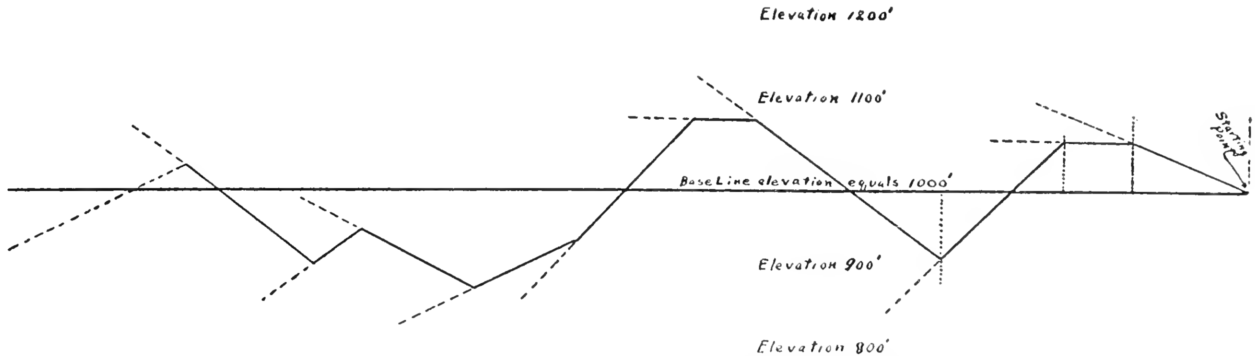


FIGURE 3.—PROFILE OF ELEVATIONS ON A STRIP LINE IN USING PROFILE ALIDADE.

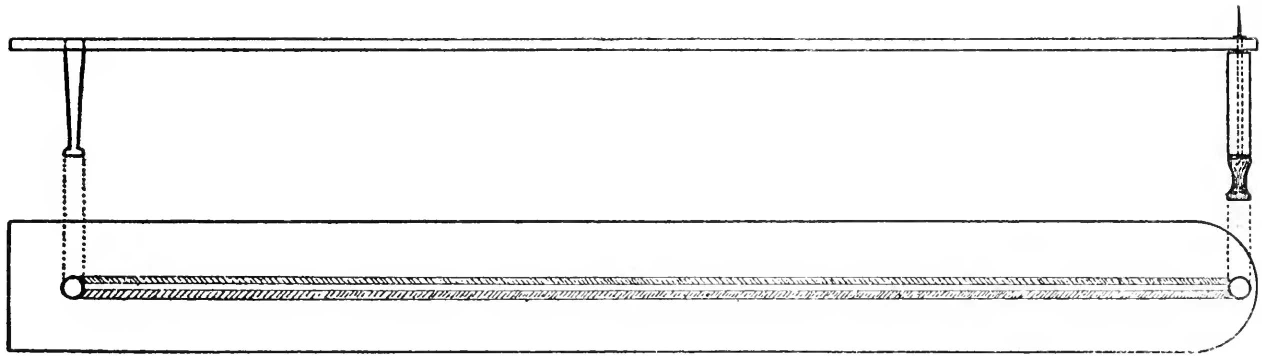


FIGURE 1.—PROJECTION DRAWING OF PROFILE ALIDADE (One-third full size).

a base line for plotting the data from the strip line which is to be mapped. The pivot point of the alidade is inserted at the top of this line as a starting point, the board is held with its face perpendicular to the ground, and sights are taken along the top of the board to the point to which it is desired to obtain the grade (Fig. 2). The same principles govern sighting with this instrument that govern sighting with the Abney or any other hand level. When the suspended ruler has ceased swinging on the pivot, the board is gently turned face upward so as not to disturb the position of the ruler, and a pencil line (which is really the line of slope) is drawn in the slot. The weight of the ruler is sufficient to keep it in place, if the pivot is properly constructed.

The length of a perpendicular line from the base line to the slope line measures the elevation of a point on the base line, on the same scale that is used to tally paces on the base line. If a large scale and finely divided cross-section paper are used, the elevations are plotted and read accurately and quickly. Pacing forward to a new sighting point on the strip line, after drawing in the line of slope from the starting point, the new sighting point is marked on the base line of the profile sheet, according to scale, and the pivot point of the alidade is inserted where a line drawn at right angles to the base line through this new sighting point intersects the slope line. A new sight along the line of slope is then taken. When completed (Fig. 3), the slope lines on the sheet form a profile of the elevations on the strip lines; the elevations to the left of the base line are higher, and those to the right of the base line are lower, than the starting point when the cross-section paper is on the right-hand face of the vertically-held sketching board. This throws the starting point to the right-hand edge of the sheet when the profile is held in its proper position. Using the instrument on the left face of the board will, of course, throw the starting point of the left side of the sheet, when the profile is held so as to show the relative positions of the slope lines to the base line.

The sketching board may be of sufficient length to accommodate sheets large enough for mapping several miles of line, but it is preferable to have the paper mounted on rollers and reduce the size of the board. A board similar to the army sketching case, with a hand grip at the back, is most convenient. The base line on the sheet may be used for entering the sketches of topography made on the strip line, but a better arrangement is to have two parallel base lines, one for topography and one for the profile.

The profile alidade has not been used in field work, but test lines were run around several areas to determine how closely the elevations would check. The results justify the belief that this instrument will be exceedingly useful because it records the data directly on the map sheet, and saves eye strain, and also because it promises greater speed and accuracy than the Abney hand level.

SAVING LABOR IN MEASURING HEIGHTS

A New Principle Applied to the Hypsometer

By S. B. Detwiler

Those who have used the standard hypsometers are aware that severe eye and neck strain accompany their use, especially in the type of instruments with small sighting apertures. There is little inconvenience in sighting a gun because of well-constructed sights and the elimination of annoying unsteadiness caused by weight poorly distributed. If the principle used in sighting a gun is applied to the hypsometer, valuable time and nervous energy will be saved.

The easiest sighting surface for a hypsometer is a straight-edge. The difficulty occasioned by unsteadiness in holding the instrument may be overcome by dividing the sighting surface into a fixed part and a movable or adjustable part. The fixed sight maye be merely a flat brass strip, or it may be the top of a sighting board (Fig. 1) such as an army sketching case or a tally board. The adjustable arm is a strip of light brass, or a rod, which is pivoted to the fixed sighting surface at the end nearest the eye of the operator, and is held parallel to the edge of the fixed surface by a spring which may be released at will. The adjustable arm is counter-balanced back of the pivot, so that the arm balances evenly on the pivot when the spring is released. A heavily weighted pendulum is suspended from the same pivot as the movable arm, and attached to it is an arc of sheet brass which is slotted so as to move freely through a thumb screw fastened to the adjustable arm about 2 inches from the pivot. With the fixed and adjustable sighting surfaces held parallel and the thumb screw free, the instrument is sighted at the base of the tree. After the weighted pendulum has swung forward and is at rest, perpendicularly, the thumb screw is tightened to bind the arc of the pendulum to the adjustable arm, and the spring holding the end of the arm is released (Fig. 2). No matter how much the sighting board may be moved after this operation, so long as the operator remains in the same position, the adjustable arm remains sighted on the base of the tree, being held thus by the action of the weighted pendulum.

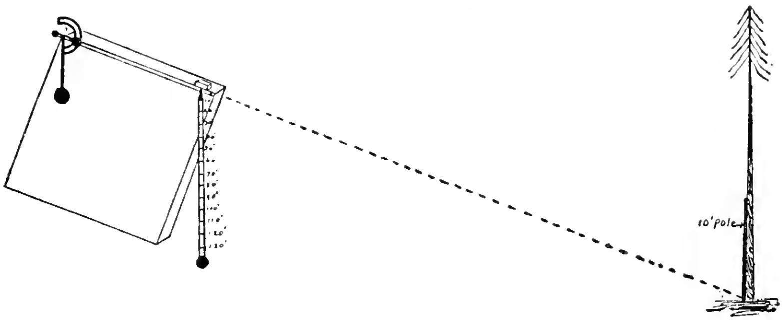


Figure 1

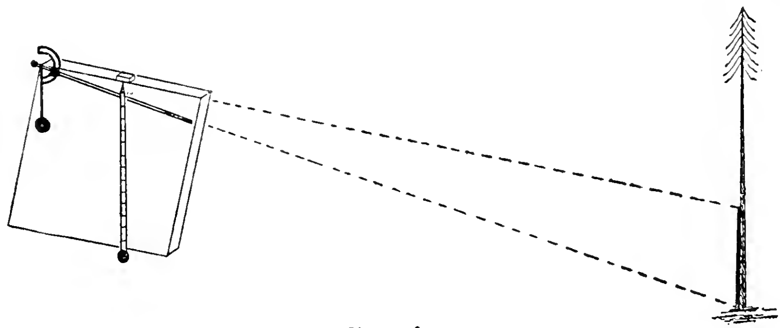


Figure 2

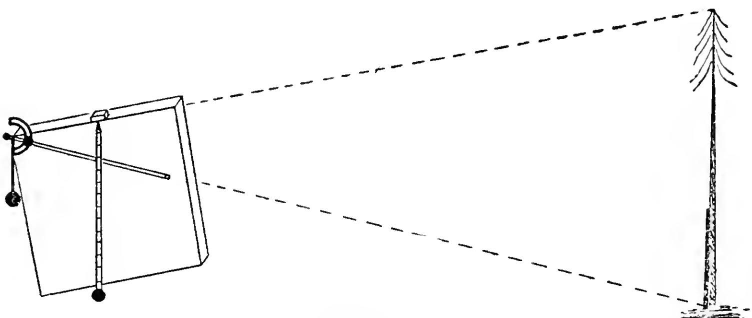


Figure 3

A second pivot and pendulum are attached to a block that is made to slide in a groove along the entire length of the fixed sighting surface, the pivot being even with the edge of the sighting surface. A suitable scale is marked along the edge of the groove, and a similar scale is marked on the pendulum, beginning at the pivot. The pendulum block is then moved along the groove until the pivot stands at the point on the scale corresponding to the number of feet the operator stands from the base of the tree. Instead of measuring this distance with the tape, the adjustment may be made by standing a 10-foot pole against the tree. Both arms of the hypsometer are sighted at the base of the pole, the adjustable arm locked and released, and the fixed arm sighted at the top of the pole. Then, holding the adjustable arm firmly so as to preserve the angle between the fixed and movable arms (*i.e.*, the angle from the eye of the operator to the top and bottom of the 10-foot pole), the pendulum is slid back until the point on the scale corresponding to ten feet crosses the edge of the adjustable arm. Special construction will make this adjustment easy and accurate.

The height of the tree is shown on the pendulum scale when the movable arm is sighted on the base of the tree and the other arm is sighted at the top. If a strip of metal is used for the fixed sighting surface, independent of a board, this may be attached to a stock somewhat like a gun stock, but lighter and more curved, so as to bring the end of the sighting surface close to the eye. A simple trigger and spring arrangement may be attached, so that when the trigger is pulled a rod will grip the scale pendulum and adjustable arm and hold them firmly in place until the reading is made.

The instrument may be made so that the scale arm of the second pendulum swings upward, as in the Klausner hypsometer, but it is preferable to have the pendulum scale read from the pivot downward, since this saves one adjustment over the other form, if the instrument is used with the 10-foot pole. So far as the measurement of height is concerned, this instrument operates on exactly the same plan as the Klausner. The new feature is the adjustable sighting arm which automatically remains fixed on the point to which it is set, and which permits of the free movement of the principal sighting arm without affecting the accuracy of measurement. In a hand instrument, this is a valuable quality; it gives us the accuracy of the Klausner without the necessity of using a tripod or staff. Models which have been made indicate that its use is practical. The idea is presented to the readers of the FORESTRY QUARTERLY in the hope that it may be used to increase efficiency and comfort in height measuring.

THE USE OF THE PLANE TABLE IN MAKING FOREST MAPS

By S. B. Locke

This discussion will be limited to the application of plane table methods of mapping to mountainous country with broken cover, such as is typical on many of the National Forests in central Idaho, where the valleys are generally narrow, the mountains in high ranges with rocky crests, and the secondary drainage basins long and crooked. Only methods of field work which experience has shown valuable and which are not generally found in textbooks are here to be described. About twelve months were spent in actual field work during the years 1910, 1912, and 1913, on the Salmon and Sawtooth National Forests in Idaho. A topographic map was made of about 10 townships showing cover types, and a timber estimate completed for about 4 townships.

The instruments used during this time for primary triangulation were the Johnson plane table, size 24″×31″, telescopic alidade, with a telescope having a focal length of 15 inches, giving an inverted image, and having a power of 20 diameters. The secondary work was done with a brass sight alidade about 7 inches long with 6 inch sights used on a 15″×15″ traverse board. In some cases the telescopic alidade was used on the traverse board. A Forest Service Standard compass was used on a peg, fitted to the traverse board to measure vertical angles for secondary work.

The maps made by these methods are of two classes, the difference being that on one contours having a 100-foot interval were sketched, while on the other no contours were drawn, the elevation of the stations being calculated. The drainage system and ridges are shown in detail, and a cover or type map made for both classes. In rough country with broken cover, the different cover areas are in this way located more accurately than would be done by paced compass lines. The scale on the field sheets in both cases was 2 inches to the mile.

Methods of Planning Control.—It is sometimes possible to locate a triangulation system over the area from bench marks and triangular stations used by the U. S. Geological Survey. The accuracy of location of these points is greater than will be maintained in the plane table triangulation. On account of the distance between these stations, it would generally be necessary to plat their location on a small scale map, which would be changed to the larger field scale as soon as several control points were located on the area to be mapped. The exact latitude and longitude of the U. S. Geological Survey triangulation stations and bench marks may be obtained from the Geological Survey, and by these values platted on the field sheet. These stations are so located that they are especially adapted to triangulation work and also give a basis for tying in the vertical control. It will, in some cases, be preferable to obtain by triangulation with a transit, a few primary control stations over the area. This method would be of greatest desirability where the area to be covered was very large and the control points a considerable distance away. The resulting triangles could be balanced and the control stations more accurately platted on the final plane table sheet than would be possible by plane table triangulation, which, on account of the great length of sights, would have to be done first on a small scale and enlarged for the final sheet.

There are often extending into a forest, valleys containing areas surveyed by the land office. The corners in such a survey can be used in starting triangulation work, if the survey is accurate. The points may be platted generally on the 2-inch-to-the mile scale, and a long base used, so that a location to a sufficiently high degree of accuracy is possible. The table may be oriented by sights at other visible survey corners or those made visible by signals. There is in Forest Service work considerable need to refer to land office subdivisions, and this method of originating the triangulation system allows a very accurate extension of the subdivisions over the map in unsurveyed territory. Sometimes, in old surveys made under contract, the locations in the field will not coincide with the platted location, and if several years old, it is difficult to find the corners. A check as to the accuracy can be made by sights to several corners to check the platting, and if they are found to be much in error a retracement may be necessary.

Where there is no survey system near the area which can be used to start from, or one which it is impractical to use, it will be necessary to measure a special base. In most cases it would be located in the valley bottom, but a flat ridge top can be used to advantage. The latter location may allow many points over the area to be located directly from the base, thereby eliminating any accumulated error in triangulating. The length would depend on the size of the country to be mapped and the accuracy to which the measurement could be carried. For small areas, a stadia traverse might answer, where it would be unnecessary to expand the triangulation beyond the limits of locations from this base. Such a base might be located by stadia traverse for a distance of 10 miles, locating triangulation stations over the entire area in the same operation. In general, a long base located to a good degree of accuracy would be more satisfactory than a short one where the attempt was made to measure to a high degree of accuracy. There are few men familiar with accurate base measurement who would be fit to undertake this work. Another point is that in measuring the short base, nothing else would be accomplished, while by the time the long base was finished, practically all the primary control would be established. In this case the base becomes practically a traverse.

The choice of a system of control would, in the end, depend on local conditions in each case. The U. S. Geological Survey stations are the most accurate, are better located for use as triangulation points, give a basis for horizontal control, and can be platted more accurately. They are generally so far apart that locations must be made on the field sheet on a small scale and later enlarged, unless a transit be used. The land office corners are more often available, a system of legal subdivisions is more adapted to Forest Service needs, the meridian can be located without special calculations, and, if recently established, offers the choice of a great many different stations. The special base would not be used if either of the other two methods were available. The method of locating the special base would also be governed by local conditions.

Platting on Map Sheets.—There is so much detail to be put on forest maps that it is necessary to use large scale field sheets. The scale of 2 inches equal one mile is large enough for abundant detail, and still small enough to allow considerable area being mapped on each sheet. The standard on intensive timber reconnaissance is 4 inches equal one mile, but this is so large that it causes not only too frequent changing of map sheets or joining of sheets, but also shortens the sights materially so the full advantage cannot be had of triangulation points. The platting of U. S. Geological Survey triangulation stations or bench marks should be by means of latitudes and longitudes. The platting of township plats may also be checked by the latitude and longitude. In plane table triangulation, the table is always parallel to its original position, so if at any time after the work is started, a check is made by a solar or star observation, a true meridian must be platted on the paper, making allowance for convergency of meridians. Where any tie with other land office work is made at a distance from where the work began, the layout must be made with full allowance for convergency.

Under any circumstances, and especially if there are U. S. Geological Survey triangulation stations within reach, it is a very good plan to plat the area and the location of known points within sight on a scale of one-half inch to the mile. If this sheet is used while the triangulation progresses, a tie is made to a considerable area outside that actually mapped, and new points located. This small scale map is particularly valuable in assembling the results with relation to the other outside country, a part of which is generally surveyed.

Planning Field Work.—As far as possible, the units on the field sheets should include water basins or other natural units. It is very necessary for accurate work to have a good system of signals distributed over the area. It is possible to set these signals from each camp before the mapping begins from that particular camp, but the better way is to have the signals all set before commencing the triangulation. This is especially true if the instrument man is not very familiar with the country. The preliminary work in setting signals gives him the opportunity to plan the work ahead and know from what points he can accomplish the most, also which points he will locate with the greatest possible accuracy. The signals may be set at the time of making the preliminary examination of the area. Since this work will be used as a basis for grazing and timber reconnaissance, it is desirable to locate as many points as possible which can be used to tie in later work. For this reason, more signals will be set and monuments made than would be necessary for reasons of control alone. In our case, one signal with monument of rocks was made on the average for about every two square miles.

The plan of work should consider whether a considerable area may be covered from one camp, or whether frequent changes of camp will be desirable. A ride of six miles from camp and back is ordinarily as far as can be made and leave time to accomplish work. If there are good trails and not much climbing, rides up to 10 miles may be made for a few stations if necessary to avoid moving camp. Side camps for a few days will often make it unnecessary to move main camp. Small crews are the best for this work, a crew of three men being a very convenient size. One man can work entirely with the large table, one with the traverse board, and the other man set signals, move camp, etc. All three men can work together on stadia traverse work, or the third man may at times accompany the man using the telescopic alidade, acting as recorder. The speed of the work depends so much on the roughness of the country that an exact estimate is difficult. In our case, for a complete map, the time over considerable areas ran from one to three sections per day per man, including both primary and secondary work.

Plane Table Primary Control.—In making a forest map, the plane table and telescopic alidade can safely be used for the primary work. In one case a triangulation system was extended from a land office survey for 25 miles, and the location of the signals checked by a relocation from a new base (corners on a standard parallel). The greatest difference in the six points located in common, on sheets platted to a scale of 2 inches equal one mile, when one set was transposed over the other, was one half chain for one of the signal points, and one and one half chains for a point located by sighting on a sharp peak. In order to carry accuracy to this extent, it is necessary to make very careful location of the primary points and use signal poles entirely. The greater accuracy obtained by the use of a transit and a careful balancing of the angles in the triangles would not justify the extra expense, since sufficient accuracy for all practical uses of the map may be obtained without this. As far as the primary work is concerned, a station to every 5 square miles would give excellent control. Generally, this number allows the use of the quadrilateral system of composition of the triangles giving the greatest possible strength to the locations.

Secondary Control.—There are often points occupied in the primary work which are difficult of access and which control chiefly very rough country. Much more time is taken in going to and coming from such a point than in the work when it is reached. The detail or secondary work was done in such cases in conjunction with the primary control, saving a second trip to such stations. Owing to the roughness of the country, it was unnecessary to locate as many points as where the cover types were of greater importance; more could also be sketched because of the wider view. Such a procedure balanced the work very well, as otherwise the secondary control would have fallen behind the primary. The primary control points for the country not completed in this manner were transferred to sheets 15 inches square, on which the details were located by use of the traverse board and small alidade.

One great advantage of having a good number of signals located is that it makes it possible to do all the secondary work without running a traverse. The three-point problem can be used wherever it is necessary to occupy a station not previously located. The secondary points can be so selected that they will serve both to locate contours and to control the sketching of cover types. Where much of this work is to be done, it would be well worth while to try the Baldwin Solar Chart[1] in orienting the table. It is exceptional to find country in the mountains where the magnetic needle can be depended upon for orienting the table. The plane table can be used as a range finder to advantage. (Wilson's "Topographic Surveying," p. 291.)

In mountainous country, and for as long sights as are used in this work, the small boxwood scale alidades are not satisfactory. The brass alidade with 7″ blade and sights 6″ high is fairly satisfactory, but one having a 10″ blade would be much better.

Primary Vertical Control.—The primary vertical control can be carried with very satisfactory accuracy by means of vertical angles. It is impossible to keep the table level enough for the vernier to read on zero, so two readings must be made, one sighting on the signal and the other with the tube level. Before any important angles are read, a test should be made by reading the telescope with the level direct and reversed, the telescope being both upright and turned 180° in the collar. A correction can then be applied to the level reading if necessary. Since

[6] See "Topographic Instruction of the United States Geological Survey, 1913."

- ELEVATION TABLE. ANGLES OF ELEVATION OR DEPRESSION.

- Value in Table Times Distance in Miles Equals Elevation Difference In Feet. -

Vertical Angle	0'	5'	10'	15'	20'	25'	30'	35'	40'	45'	50'	55'	Difference each 1'
0°	0.0	7.7	15.4	23.0	30.7	38.4	46.1	53.8	61.4	69.1	76.8	84.5	1.54
1°	92.2	99.8	107.5	115.2	122.9	130.6	138.3	146.0	153.6	161.3	169.0	176.7	1.54
2°	184.4	192.1	199.8	207.5	215.1	222.8	230.5	238.2	245.9	253.6	261.3	269.0	1.54
3°	276.7	284.4	292.1	299.8	307.5	315.2	322.9	330.6	338.4	346.1	353.8	361.5	1.54
4°	369.2	376.9	384.6	392.4	400.7	407.8	415.5	423.3	431.0	438.7	446.5	454.2	1.545
5°	461.9	469.7	477.4	485.2	492.9	500.7	508.4	516.2	523.9	531.7	539.4	547.2	1.55
6°	555.0	562.7	570.5	578.2	586.0	593.8	601.6	609.3	617.1	624.9	632.7	640.4	1.555
7°	648.3	656.1	663.9	671.7	679.5	687.3	695.1	702.9	710.7	718.6	726.4	734.2	1.56
8°	742.0	749.9	757.7	765.6	773.4	781.3	789.1	797.0	804.8	812.7	820.5	828.4	1.57
9°	836.3	844.1	852.0	859.9	867.8	875.7	883.6	891.5	899.4	907.3	915.2	923.1	1.58
10°	931.0	938.9	946.8	954.7	962.7	970.6	978.6	986.5	994.5	1002.4	1010.4	1018.4	1.59
11°	1026.3	1034.3	1042.3	1050.2	1058.2	1066.2	1074.2	1082.2	1090.2	1098.2	1106.3	1114.3	1.60
12°	1122.3	1130.3	1138.4	1146.4	1154.4	1162.5	1170.6	1178.6	1186.7	1194.7	1202.8	1210.9	1.61
13°	1219.0	1227.1	1235.2	1243.3	1251.4	1259.5	1267.6	1275.7	1283.9	1292.0	1300.2	1308.3	1.625
14°	1316.5	1324.6	1332.8	1340.9	1349.1	1357.3	1365.5	1373.7	1381.9	1390.1	1398.3	1406.5	1.64
15°	1414.8	1423.0	1431.2	1439.5	1447.7	1456.0	1464.3	1472.5	1480.8	1489.1	1497.4	1505.7	1.65

- Correction for Curvature and Refraction. -

Tenths of Miles	Miles. 1	2	3	4	5	6	7	8	9	10	11	12
0	0.6	2.3	5.2	9.2	14.3	20.6	28.1	36.7	46.4	57.3	69.4	82.7
2	0.8	2.8	5.9	10.1	15.5	22.0	29.7	38.6	48.5	59.2	72.0	85.4
4	1.1	3.3	6.6	11.1	16.7	23.5	31.4	40.5	50.7	61.5	74.3	88.0
6	1.5	3.9	7.4	12.1	18.0	25.0	33.1	42.4	52.8	64.5	77.2	91.1
8	1.9	4.5	8.3	13.2	19.3	26.5	34.9	44.4	55.1	65.7	79.8	93.6

Remarks.

Add for Elevation Angles

Subtract for Depression Angles.

S.B.L. '14.

the sights are often several miles in length, it is worth while to make corrections for curvature and refraction which can be read from a simple table. The signals will, in many cases, be used as turning points, the elevation of the point being taken as that of the flag, a reduction to ground level being made when this value is needed. When any station is occupied, the difference between the height of the instrument and height of signal must be determined. The angles which are used should be as large as possible. An error of 1′ in the vertical angle at 2° would give a resulting error in elevation twice what the error for 1′ would be at 6°.

Secondary Vertical Control.—The instruments for obtaining secondary vertical control are: Forest Service Standard Compass, with slot in staff head, Abney level, or the telescopic alidade. The compass is used either on a peg fitting the traverse board tripod head or set directly on the tripod when the new style traverse board which fits the regular tripod head is used. The Abney level when fitted to a staff head is to be preferred to the compass.

Use of Tables.—The attached table (adapted from Wilson's "Topographic Surveying") and chart will save considerably calculations. For the primary work the table would give superior accuracy, but one multiplication being necessary. The accuracy of reading the values from the chart will equal that to which the secondary angles can be read. Mounted on cardboard, it can be carried in the plane table or traverse board case.

For secondary work the following general formula may be of use:

$$h = .02 \times a'd, \text{ less } 4\% \text{ for angles up to } 10°,$$

where h is difference in altitude in feet, a' is the vertical angle expressed in minutes, and d is distance in chains. For angles from 10°-14° reduce the result by 2 per cent and angles over 14° reduce by 1 per cent. In order to do away with the percentage reductions in slide rule computations, the following values may be used:

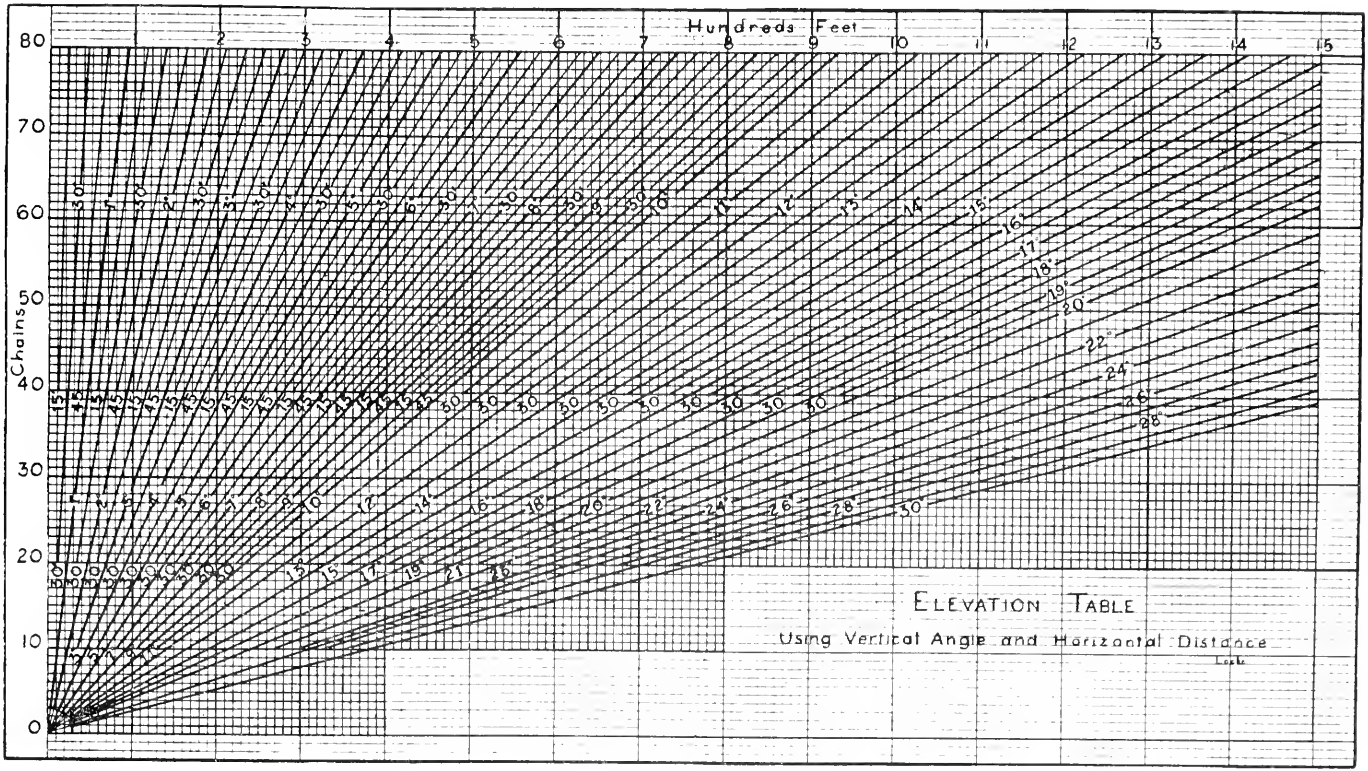
$$h = .0192 \times a'd, \text{ up to } 5°59'$$
$$h = .0193 \times a'd, \text{ from } 6° \text{ to } 8°59'$$
$$h = .0194 \times a'd, \text{ from } 9° \text{ to } 11°59'$$
$$h = .0196 \times a'd, \text{ from } 12° \text{ to } 16°$$

Traverse Lines.—Sometimes it is impossible to locate sufficient control points by triangulation. This most often happens in narrow canyons or canyons which are heavily timbered. In cases of this kind, or where the accurate location is necessary, a traverse line may be run. The telescopic alidade allows the use of the stadia rod. The best rod to use is one which may be made locally as described in "Plane Surveying," by Tracy. Tied to a triangulation point, such a traverse line can be used as a secondary base. Their location is most frequently in the bottom of the canyon unless the chief use is as a secondary base. For secondary locations, a paced traverse line is often practical for points of slight importance and where frequent checks are possible.

Use of Photographs.—A set of good pictures is a valuable supplement to a map. Even with a film kodak, it is possible to get pictures which will join nicely at the edges, and represent a wide range of country in a panorama. Such pictures show the nature of the cover, and to a considerable extent, the topography. Trails, grazing allotment boundaries, etc., can be pointed out to anyone unfamiliar with the country. A careful selection of points from which these are taken will give photographs of practically all the country mapped. A photograph is a great help in a readjustment of contour lines or in filling in when it is impossible to sketch all contours in the field.

Field Experiences and Methods.—Following are some experiences and outline of methods whose value has been proven in the field. Some new methods which might be useful are also mentioned.

If the alidade is in adjustment, there is no need of turning the telescope in the collar to take a check reading, as the slight correction possible could not be platted. Considerable care needs to be taken in drawing the lines and handling the needle points. Errors are much more apt to be accumulated through faulty platting of the lines than through instrument errors. It is found impractical to try to take the sights on this work without using a very fine needle point in the board as a pivot. If the needle is used once, it should be used constantly, one of the smallest size, taking great care to set it in the board the same distance each time and perpendicular to the plane of the paper. The lines may be drawn from the needle center parallel to the blade.


Hundreds Feet
Chains
ELEVATION TABLE
Using Vertical Angle and Horizontal Distance

If a needle of the same size is used each time and set in the same position, the result is the same as though the blade were made wider by an amount equal to the radius of the needle. In orienting the table and using two points, the needles should be of the same size. If a change is made in the needles, the orientation of the board should be checked. For the most important control points at least, the attempt should be made to bring the accuracy of platting as nearly as possible up to that of the instrument. The circular level on the blade is especially handy, as the leveling can be done very quickly, and being always in place, any change from level is quickly detected.

Double mounted paper is desirable for use on the primary work with the large table. The single mounted paper is satisfactory for secondary work, and the use of the double mounted is never justifiable on the traverse board. Celluloid sheets are desirable for secondary work in wet weather. It is very trying for the eyes to work over the white paper in strong sunlight, and for this reason it is very necessary that the plane table sheets be tinted. If tinted sheets cannot be obtained, tinted glasses are necessary, but are not satisfactory, for if the tint is heavy enough to give good protection, it lessens the clearness of vision through the telescope when taking long, difficult sights. A shade is used sometimes for the table, but is impractical for this work, both on account of bulk in packing and the prevailing high winds on the triangulation points.

A satisfactory method of marking the stations in the field has not been devised. There is little time to spend in making chisel marks on the rocks, and these are difficult to find on a mountain top which is a mass of loose rocks or ledges. It is also very impractical to attempt to carry wooden posts and mark them. The points established in the past have been monumented by a substantial pile of rocks with a Forest Service blaze on any trees near. A description of these points is kept as a record and notes made on the easiest way to reach them. A practical method of marking these triangulation stations and bench marks might be to scratch the station number on one of the metal Forest Service cruising posters which would be buried in the monument of rocks. There might be two posters left, to guard against one being lost. Where it was possible to calculate the elevation while the station was occupied, this could also be scratched on the poster.

There are very few points where it is necessary to put up a high signal, nor is it necessary to use large size poles. The best size pole is about 4 inches in diameter and 10 feet long. It is difficult to set high poles solidly enough. If high ones are needed in order to increase the visibility, a slender pole can often be used. On timbered summits or wherever a tree can be used which will increase the visibility, the signals may be tacked to a dry pole which is nailed to the top of a tree. Sometimes the pole can be tied up with rope to hold it in place until it can be nailed. It was almost always necessary to trim off some of the top limbs to make the flags clearly visible.

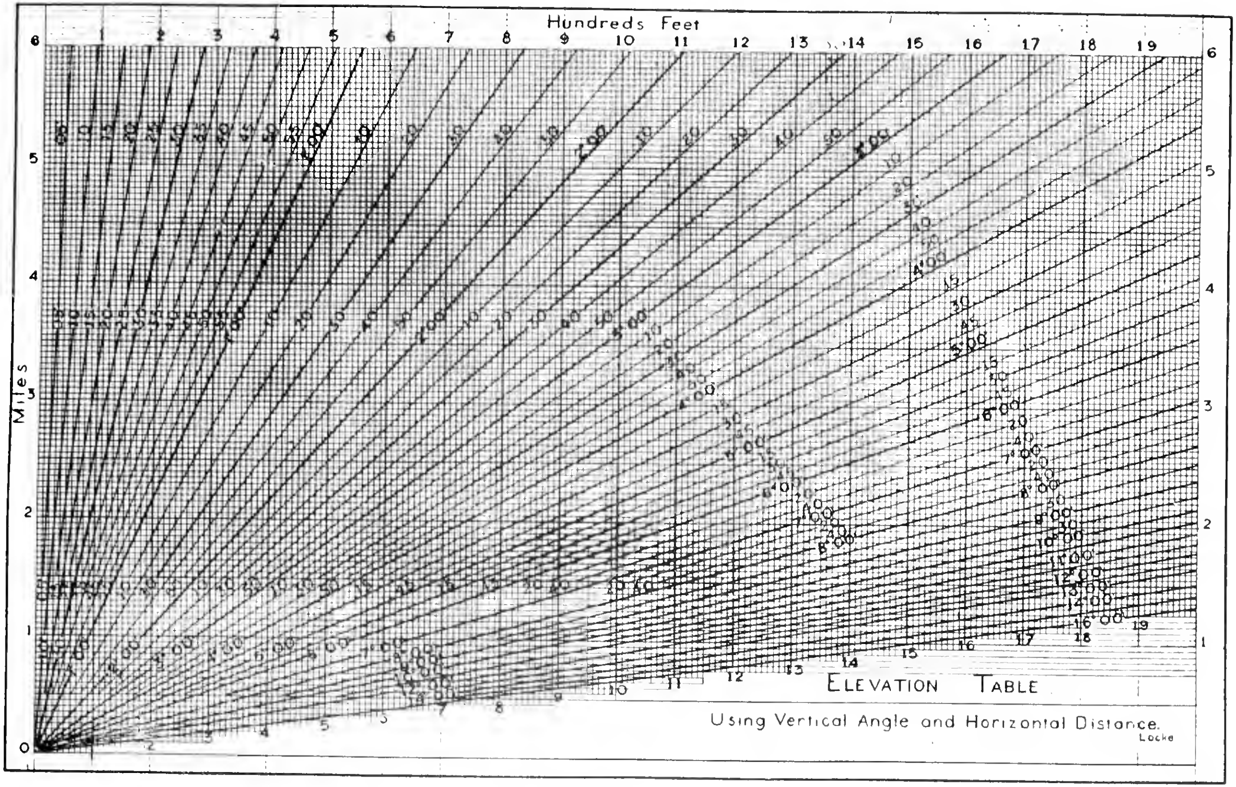
The most satisfactory form of notes was like the sample given below. The book was the standard form 289, which is very handy to carry. Lengthy descriptions were often necessary, and this form made them possible, as well as making a record of all observations and computations for each point in one place convenient for checking. A field glass aids materially in the description of a new point. A careful description is necessary, both as a matter of record and to insure any point being recognized when viewed from other stations.

When two points on the map are close together, the alidade cannot be set accurately for a back sight. If it is known that a point near at hand is to be occupied while the table is in position the line may be extended and this extension used, or two needles set on the extended line. This eliminates the error in platting with a short base.

Often it is possible to get the direction of a part of a stream or ridge before enough points have been located to complete it. That is, from a point, streams or ridges coincide in part with a sight along the edge of the alidade, and their direction may be sketched.

If several extra sheets of paper are carried constantly in the case for the large plane table, they become very thoroughly seasoned and are, therefore, less affected by changing conditions of the atmosphere.

Wilson, in his "Topographic Surveying," recommends setting the needles in sealing wax. If no wax is obtainable, the needle, after the head is broken off, may be set in a block of hard wood,



Hundreds Feet
Miles
ELEVATION TABLE
Using Vertical Angle and Horizontal Distance.
Locke

¼″×¼″×1″, by means of a pair of pincers, *later* the block to be whittled to a convenient size. A very convenient way to carry extra needles (all mounted) is to have a piece of cork fastened inside the instrument case into which they may be stuck. A piece of cork may be fastened in one of the leather pencil holders, in the compartment made for the scale, and several needles carried there. The needles may be stuck in the sealing wax by slightly warming the wax and heating the needle quite hot.

A sandpaper pencil sharpener may be fastened on the under edge of the board by tacks and is always handy. If a flagman is used at a distance, he can easily be located or signaled to if a pocket mirror is carried.

The tracing cloth or graphic method of solving the three-point problem is the most rapid and the most satisfactory for secondary work. The chief objection is the trouble in handling tracing cloth in a wind. This may be overcome by using a sheet of celluloid with a needle hole in it and thumb tack holes in the corners. The lines can be erased easily, and if the needle hole becomes enlarged a new one can be made. The stretching and wrinkling of the tracing cloth is also avoided by the use of celluloid. This method can also be used to find the approximate location in using the more accurate Coast Survey Method.

SAMPLE NOTES

July 20
(From) Sta. II
Set up over section corner on township line between sec. 33 and sec. 34, T. 8 N., R. 14 E. B.M. Called this Station II, oriented on sec. cor. between secs. 34 and 35. Elevation 8450 feet. H.S. 25′ (height of signal) H.I. 4′.

(To) No. 8
Flag on highest peak east of Clarke's.

V = 36° 42′
L = 29° 48′
V.d = +6° 54′
D = 298.5 chs.

Sta. II
Log. Tan. V.d. = 9.08283
Log D. = 2.47494
1.55777

El. d. = 36.122 chs.

1980.	
396.	
6.6	
1.32	
.13	
2384.05	feet
4.	(H.I.)
8450.	(El. of Sta. II)
10838.	El. of No. 8 flag
20.	Ht. of signal
10818.	El. of No. 8 gr.

No. 9
Mountain top N. and beyond S. Fk. of Champion Cr. Timber on south.

No. 9 — Sta. II 8,450

Snow bank near top.

V = 35° 46′
L = 29° 50′
V.d. = +5° 56′
D = 5.63 mi.

```
  548.7    (from table)
    5.63
  -------
   16461
  32922
 27435
 --------
 3089.181
   18.     (Cor. for curvature and
 --------    refraction)
 3107.2    Ft. El. d.
    4.0    H.I.
 8450.0    (El. of Sta. II)
 --------
11561.     Ft. El. of No. 9
```

No. 6 — Sta. II 8,450

V. = 26° 36′
L. = 30° 2′
V.d. = 3° 26′
D. = 2.28 mi.

```
  316.7  (from table)
    8.22 (Abbreviated multiplica-
 ------    tion)
 6334
  633
  253
 ------
 -722.0
    4.0  H.I.
    2.8  (Cor. for curvature and
 ------    refraction)
  715.2  Ft. El. d.
 8450.0
 ------
 7734.8  El.
```

No. 10 — Sta. II 8,450

Big dead tree at lower edge of timber halfway from No. 5 to No. 8.

V = 33° 5′
L = 29° 55′
V.d = +3° 10′
D = 2.60 mi.

```
E.d. = 757 ft. (from chart)
         4 H.I.
      8450
      ----
      9211 El.
```

Note.—Explanation of notes. The first difference of elevation is calculated by logarithms, the second and third from table, and the fourth from chart. Made in note book Form 289.

THE APPLICATION OF RECONNAISSANCE DATA TO THE PROBLEM OF MARKING TIMBER FOR CUTTING

By Richard H. Boerker

The object of this study is to inquire into the number of trees to the acre, the density, the representation of age classes and the contents of trees and stands in our Western Yellow pine forests, with the idea of securing data that might be of use in the management of these stands. About 60 per cent of the merchantable timber on the Lassen Forest is Yellow pine; the largest and most continuous stands are found in the eastern and central parts of the Forest.

This study is confined to pure Yellow pine stands, *i.e.*, stands in which Yellow pine represents 80 per cent or more of the merchantable timber. The data used were taken from the forms made out in the reconnaissance work of the last two years. Owing to the fact that these data include only those trees above 5 inches D.B.H. the study involves only trees above that diameter. Investigations have shown that on the basis of the number of trees per acre the average Yellow pine stands are composed about as follows:

Other species	10%
Yellow pine:	
Under 5 inches	10
Over 5 inches	80
Total	100

The stand on each form, representing two acres—usually a fair average of the entire forty—, was classified into 5 diameter groups, namely: 6–10″, 11–20″, 21–30″, 31–40″, and over 40″. This was done with 350 forties. These were taken by groups of sections and were representative of the pure Yellow pine stand in 17 townships. These data represent 700 acres actually calipered, and if we assume that the ordinary strip taken through the center of a forty is fairly representative of the entire forty, then this study is based on 14,000 acres.

The Average Number of Trees Per Acre

After the stands had been classified into the 5 diameter groups mentioned before, it was found that the 700 acres in question contained from 5 to 80 trees per acre. Upon closer examination, it was noted that 28 trees per acre was the dividing line, so to speak, between the average and the maximum, for only 14 acres out of the total 700 contained more than 28 trees per acre. Below 28 inches the stands were divided as follows and the entire 700 acres classified:

TABLE 1

Class	No. Trees per Acre	No. Acres Measured	Per Cent of Total
I Very open	5– 9	222	32
II Open	10–15	220	31
III Medium	16–20	148	21
IV Dense	21–28	96	14
V Very dense	28–80	14	2
Total		700	100

From this table it will be seen that a large majority, in fact 84 per cent, of our Yellow pine stands contain 20 trees or less per acre. If distributed evenly over an acre, these trees, young and old, would be about 50 feet apart. This condition immediately reflects the conditions of soil exposure, drouth and brush, which, as a matter of fact, are present.

The various density classes were found to conform very closely to various sub-types in the Yellow pine region. It seems only natural that the density of a stand should be closely related to the site which that stand occupies. In general, the lower the altitude and the drier the site, the more open the stand; and the higher the altitude up to a certain limit, the greater the amount of soil and atmospheric moisture available, the greater is the tendency towards a mixture with other species, the denser is the stand and the better the forest conditions. The description of these classes is as follows:

I. *Very open.*—(5–9 trees per acre.) Usually pure, but occasionally mixed with Lodgepole pine of poor quality. Soil: light volcanic ash. Site: poor, open, dry, sage-brush flats. Elevation: 5400 to 5700 feet.

II. *Open.*—(10–15 trees per acre.) Usually pure, but occasionally mixed with White fir; on lava flats with heavy undergrowth of manzanita and snow-brush. Soil: volcanic ash with loam and clay. Elevation: 5400 to 5700 feet.

III. *Medium.*—(16–20 trees per acre.) Sometimes pure, but often mixed with White fir and Lodgepole pine; on lava flats with light to medium cover of snow-brush and manzanita. Soil: volcanic ash, with considerable loam and clay. Elevation: 5400 to 5700 feet.

IV. *Dense.*—(21–28 trees per acre.) Humid slope type mixed with White fir, also cedar, Douglas fir, Sugar pine and Lodgepole pine. Soil: rich, sandy loam with gravel and disintegrated shales and slates in mixture. Elevation 4500 to 5800 feet.

V. *Very dense.*—(Over 28 trees per acre.) Humid slope type like above, usually about 5500 feet.

Having determined these density classes, the next step was to ascertain the relation of these classes to the diameter groups spoken of before. Accordingly, the average number of trees per acre for each class and each diameter group was determined and compiled into the following table:

TABLE 2

Average Number of Trees per Acre

Diameter Groups	*Very Open*	*Open*	*Medium*	*Dense*	*Very Dense*	*Average*[1]	*Maximum Acre*
6–10 inches	0.63	3.0	3.4	5.3	9.2	2.8	48
11–20	0.9	3.8	4.6	8.0	11.2	3.7	15
21–30	1.2	2.7	5.3	8.4	13.5	3.8	15
31–40	2.4	3.1	3.3	3.5	4.7	3.0	1
Over 40	1.7	1.8	1.3	0.9	1.1	1.5	1
Totals	6.8	14.4	17.9	26.1	39.7	14.8	80

Probably the most striking result of this table is that the average number of trees per acre above 5 inches D.B.H. is only 14.8. The maximum acre given above is the acre in Class V that had the greatest number of trees on it. It is interesting to note here how the average compares with the best we have. Another feature of this table is the poor representation of the lower diameter groups and the large percentage of trees over 20 inches in diameter. It is likewise interesting to note that as the density of the stands increases, the lower diameter groups are better, and the upper diameter groups more poorly represented.

Density of Stands

It is by no means an easy matter to obtain figures on the density of all-aged stands. Considerable time was spent in trying to arrive at a method of determining this factor. It was of no avail to try to compare our stands with German stands of Scots pine, principally because of the great difference in sizes and age of the two species and on account of the fact that stand and yield tables are in most cases made for even-aged stands under careful management. It was concluded that all the literature written would not be of as much use as a few hours spent in

[1] Properly weighted on basis of acreage.

the field. Quite a few crown measurements were taken during the last two summers and this fall a new method occurred to me. In riding through these Yellow pine stands after a light snowfall, I noticed that the open spots underneath the trees (that were free from snow) corresponded very nearly to the projected crowns of the individual trees. This observation resulted in a very easy way of measuring crown diameters and the areas of the crowns as projected on the ground. The following table shows the results of these observations:

TABLE 3

Diameter Group	*Average Diameter Breast High Inches*	*Area of Projection of Crown Sq. Ft.*
6–10 inches	8	100[2]
11–20 inches	15	348[3]
21–30	25	1038
31–40	35	1536
Over 40	..	1925

Applying these figures to the various classes of stands based upon number of trees per acre, we get the density of our Yellow pine stands in tenths based upon an ideal acre.

TABLE 4

Density Class	*Total Trees per Acre All Diameters (From Table 2)*	*Total Area Projected Crowns Sq. Ft. per Acre*	*Crown Density in Tenths Based upon Ideal*
I	6.8	8,581	.23
II	14.4	12,652	.36
III	17.9	15,014	.42
IV	26.1	19,141	.55
V	39.7	28,168	.81
Average	14.8	13,107	.38
Maximum	80.0	29,050	.83
Ideal	....	34,848	1.00

The ideal acre is an acre (43,560 sq. ft.) of Yellow pine, in which 10 per cent, or 4356 sq. ft. is allowed for the young stuff below 5 inches D.B.H., and an additional 10 per cent, or 4356 sq. ft., is allowed for "other species," the remaining 80 per cent, or 34,848 sq. ft., being taken up by the Yellow pine over 5 inches D.B.H. considered in this study. This assumes that the trees utilize every square foot of sunlight, there being no overtopping. This is largely true in the case of Yellow pine, on account of its intolerance. The projected crown area of the

[2] Average area per tree, fifty-year Scots pine No. 1, diameter 8 inches, is 94 square feet.

[3] Average area per tree 120-year Scots pine No. 1, diameter 16 inches, is 283 square feet.

ideal acre, therefore, represents the maximum amount of crowns that can be crowded on one acre and still have each tree enjoy the maximum of direct sunlight. There is, undoubtedly, under normal conditions considerable overtopping, and for this reason the ideal acre on the basis of total crown space is conservative, for it does not take this into account. On the basis of the ideal acre 84 per cent of our Yellow pine stands have a crown density of less than 0.42 or are less than half stocked.

Such a basis of comparison as the one above is fairly indicative of the degree of density of the Yellow pine stands. There is a relative comparison between our poorest and best stands, if nothing else. It is safe to say that the ideal is by no means the best that can be grown, for reasons mentioned above. For this reason these densities are probably high.

The Representation of Age Classes

By consulting the latest growth tables on Yellow pine, the following relation appears to exist between the diameter groups mentioned above and the age of the trees:

Diameter Group	*Age*
6–10 inches	40–55 years
11–20	55–100
21–30	100–150
31–40	150–270
Over 40	Over 270

For the purposes of this study only three age classes will be considered, as follows:

TABLE 5

Diameter Group	*Age*
6–20 inches	40–100 years
20–30	100–150
31 inches and over	Over 150

The following table gives for each crown density class the representation of the three age classes in per cent:

TABLE 6

Crown Density Class		*Trees Per Acre All Ages From Table 2*	*Representation by Age Classes Years From Tables 2 and 5* 40–100	100–150	150 *and over*	*Total Per Cent*
Very open	I	6.8	22%	18%	60%	100%
Open	II	14.4	47	19	34	100
Medium	III	17.9	45	30	25	100
Dense	IV	26.1	50	32	18	100
Very dense	V	39.7	51	34	15	100
Average		14.8	44	25	31	100
Maximum Acre		80.0	79	19	2	100

Contents of Stands and Trees

If we apply a Yellow pine volume table to the trees in the various density classes, we get some interesting results:

TABLE 7

Class	*Trees per Acre, All Diameters From Table 2*	*Total Volume All Trees*	*Average Volume per Tree*
Very open I	6.8	12,142 Bd. Ft.	1785 ft.
Open II	14.4	15,385	1070
Medium III	17.9	15,839	885
Dense IV	26.1	17,374[6]	665
Very dense V	39.7	24,595	620
Average	14.8	14,813[4]	1000[5]
Maximum acre	80.0	19,490[6]	....

To show how the volume of the stand is distributed in the various age classes and to give an idea how much of our merchantable timber is in the form of mature and over-mature trees, the following table is offered:

TABLE 8

	Total Stand per Acre	*Stand per Acre by Age Classes Years* 40–100 (6-20 *inches)*	100–150 (20–30 *inches)*	*Over* 150 (*over* 30 *inches)*
Very open I	12,140	100	750	11,290
	100%	1%	7%	92%
Open II	15,385	450	1745	13,190
	100%	2%	11%	87%
Medium III	15,840	500	3230	12,110
	100%	3%	22%	75%
Dense IV	17,375	930	5460	10,985
	100%	4%	32%	64%
Very dense V	24,595	1330	9100	14,165
	100%	5%	35%	60%
Average	14,815	450	2100	12,265
		4%	14%	82%

[4] This corresponds very nearly to the average figures secured in the reconnaissance computations.

[5] This would make the average Yellow pine for the area examined 28 inches D.B.H., with five logs, and from this we can figure that the logs in the Yellow pine type run on the average of 5 per M ft. B.M.
This is based on 10,360 trees calipered.

[6] It is very evident that this table does not show a true condition of affairs. It is based on the number of trees per acre and a large number of trees per acre does not necessarily mean a heavy stand. But here, as elsewhere, it is significant that young growth from 6–20 inches is the most important factor that determines the density of stands.

Results of the Study

Number of Trees per Acre:

1. Average number of trees varies from 5–80 per acre.
2. Average number per acre for 700 acres of 14.8 trees.
3. About 84% of the stands have 20 trees or less per acre.
4. Only 16% of the stands have more than 20 trees per acre.

Density of Stands (based on ideal acre):

1. Crown density varies from 0.23 to 0.81.
2. About 84% of the stands have a density of from 0.23 to 0.42, and are therefore only ¼ to ½ stocked.
3. Only 14% of the stands have a density of 0.55 or about ½.
4. Only 2% of the stands have a density of 0.81.
5. Average crown density of Yellow pine stands is 0.38, and therefore they are less than ½ stocked.

Representation of Age Classes:

1. In our Yellow pine stands from 15–60% of the trees are over 150 years old and over 30″ in diameter. The average percentage of over-mature trees is 31%.
2. The more open the stand the less the representation of young timber below 20″ and the greater the representation of the old trees above 30″.
3. In going from the very open to the very dense stands the percentages increase from 22% to 79% in the case of the young timber and decrease steadily from 60% to 2% in the case of the mature timber.
4. Our stands do not obey the law of the number-of-trees-per-acre-age curve which shows that the representation in the younger age classes should be much greater than that in the older age classes.

Contents of Stands and Trees:

1. The more open the stand the greater the average contents of a tree.
2. Volume per acre increases with the density of the stand.
3. The average Yellow pine tree for large areas contains 1,000 board feet, is about 28″ D.B.H., and contains 5 logs, which would indicate that this timber runs 5 logs per M ft.
4. From 60–92% of the merchantable timber is over 150 years old and over 30″ in diameter.
5. The amount of merchantable timber over 150 years old decreases as the density of the stands increases.
6. Most of cutting will have to be done in the class that is over 150 years old.

7. The very open and the open stands have the greatest amount of mature timber in them and unfortunately are the ones that can stand cutting least of all.

8. A comparison of tables 6 and 8 is valuable in that it shows the relation of the proportionate volume in each age or diameter class to the number of trees in that class. For example, if all the timber above 30″ in diameter is marked for cutting in the average stand this would remove only 31% of the trees, but 82% of the volume.

CLOSE FOREST UTILIZATION WITH A PORTABLE MILL

By E. A. Ziegler[1]

Since it is contended that it is difficult to obtain an accurate account of utilization by a portable mill the following accurate record of income and expense in an operation on the Mont Alto (Pennsylvania) State Forest by Lewis E. Staley, Forester, may be of interest.[2]

A tract of 17 acres of culled overmature and defective hardwoods was cut with a stand of about 10 M board feet per acre (actual mill scale with close cutting), consisting of chestnut, Red and Black oak, with some Rock and White oak. These trees were from 70 to 175 years old (not a high age for oak), but were in a rather poor condition, due to the tract having been worked over here and there for iron ore during past years and many trees injured. There was an excellent reproduction of Rock and White oak seedling trees about 10 years old and the removal of the older trees released this.

Utilization was begun by hewing railroad ties and utilizing tops for cordwood. This was at once seen to be a wasteful process and a portable sawmill operator was hired to work up the timber by contract. A lath mill and shingle mill were included in his outfit.

At the outset it should be stated that the operation was located on the edge of the Cumberland Valley about ⅛ mile from a branch of the Cumberland Valley Railroad, where an active wood market exists. A local market took for fuel all cordwood and slabwood that was not used for lath. The local market also took the shingles, lath, some of the cull lumber, and house lumber. Wagon factories within 50 miles took wagon stock, and car lumber was shipped to Reading, 100 miles away. The entire success of the operation, of course, lies in the market conditions.

The portable mill was set up in the tract and showed costs as follows from stump to car:

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[1] Director, Pennsylvania Department of Forestry, State Forest Academy, Mont Alto, Pa.

[2] Pennsylvania Department of Forestry Report for 1907, pp. 56–60, for a partial report of this cutting.

	Per M Feet	
Felling trees	$0.78	
Trimming and swamping	.30	
Dragging logs to mill	1.60	(contract)
Crosscutting stems into log lengths at mill	.71	
Sawing	4.00	(contract)
Hauling lumber to railroad siding, 1/8 mile	.90	(contract)
Loading on cars	.33	
Total, stump to car	$8.62	

The prices received were:

	Per M Feet
Car lumber	$19–$20
Wagon stock	22
Building lumber	18– 20.50
Blocking (used in shipping heavy machinery)	12– 16
Mill culls	10

White oak ties, 25, 45, and 60 cents each for Nos. 3, 2, and 1, respectively.
Chestnut ties, 25 and 35 cents each for Nos. 2 and 1, respectively.

The average price of the lumber disposed of was $18.35 per M feet and ties $.42 each.

Trees (chestnut) unfit for logs, but with short, sound sections, had these sections removed for shingle bolts. The cost of shingles from tree to pack was as follows:

	Per M Shingles
Cutting trees into shingle length (23 inches) bolts	$0.91
Hauling bolts to mill	.24
Sawing (contract)	1.50
Baling	.25
Bale iron	.07
Tool account (wedges, saws, etc.)	.12
Total cost of shingles from tree to bale	$3.09

The shingles averaged about 1,800 4″×23″ shingles per cord of bolts and sold for $4.21 ($4 to $5) per M. They showed a profit above cost of $1.12 per M or $2.01 per cord of bolts.

Lath (plastering) were cut from the best chestnut slabs in the lumber mill at a sawing and bundling cost of $2.25 per M. Several tests showed an average of 2360 lath cut from 1 cord of slabs. The lath sold for about $4.00 per M, hence the lath showed a profit of $1.75 per M or about $4.13 per cord of slabs used. This was a decided profit over fuel value of chestnut slabs at $1.50 per cord at the mill.

Since lumber cost $7.39 per M as it came from the saw (cost of hauling to railroad and loading on cars deducted from $8.62) and 1 M feet of logs is equivalent to 2 cords, it can be seen that defective logs, going entirely into slabs for lath, would cost 1/2 of $7.39 or $3.70 per cord ready for the lath saw. It has just been shown that each cord of slabs *netted* $4.13 over and above the cost of lath sawing. Hence there was a net profit of $.43 per cord in picking up chestnut logs so defective that they cut no lumber, but were slabbed into lath stock entirely. Defective logs with some lumber in them *increased* this *minimum net profit* of $.43 per cord ($.83 per M ft. of logs). Of course, logs cutting no lumber were as a rule not brought to the mill, since cutting them into cordwood at $0.60 per cord, which sold at $1.40 to $2.00 per cord (varying with the amount of oak) on the ground, was better than cutting such defective logs into slabs and then into lath with the greater expense, even though the latter showed some profit.

The woods waste was cut into fuel at a cost of 60 cents per cord and sold for $1.40 to $2.00 per cord (average $1.78).

The mill waste not fit for lath was cut into stove-wood lengths of 12 inches at a cost of $.20 per cord and sold for $1.86 (average price) per cord at the mill.

The following statement shows a summary of the operation which includes bark from 38 Rock oak trees, a few telephone poles and miscellaneous products:

Seventeen Acres of Cull Hardwoods, Running about 10 M Feet to Acre; Chestnut, Red and Black Oaks, with Some White and Rock Oak—75 to 170 Years Old

	Sale Value	*Cost of Mfg.*
198 cords fuel from tops and culls..........	$352.21	$118.80
55 cords shingle bolts cutting 98 M shingles	413.05	302.82
178[1] M feet of logs (mill cut)...............	3,266.12	1,444.57[3]
47 M car stock		
36 M wagon stock		
22 M blocking—machinery		
62 M boards and rough building lumber		
11 M mill culls		
6 cords of slabs cutting 14 M lath..........	55.29	31.50
58 cords of slabs sawed short for fuel........	107.68	11.60
318 railroad ties..........................	132.55	115.13
17 telephone poles........................	31.50	17.00
11,730 pounds Rock oak bark.................	43.78	15.00
Miscellaneous (posts, etc.)...................	29.82	......
Total..............................	$4,432.00	$2,056.42

While the lumber item shows a stumpage return of—

$$\$18.35 - \$8.12 \text{ (average cost)} = \$10.23 \text{ per M feet—}$$

the income from fuelwood, shingles, lath and other products increased this to $14.47 per M feet of lumber cut.

[3] Of the lumber cut, 105 M feet was delivered f.o.b. local railroad siding at a cost of $8.62 per M; 73 M feet was piled and sold at the mill at a cost of $7.39 per M.

A SYSTEM OF COST ACCOUNTS FOR A FOREST TREE NURSERY

By B. A. Chandler[1]

The method of figuring the cost of raising nursery stock which we have used until recently, and which I believe is in more or less common use, has seemed very weak to the writer. All purchases were charged on one ledger account against the nursery, and labor was charged to seed beds, transplants, etc., on each man's weekly labor voucher. From these data an estimate was made of total cost of seed beds, transplants and packing. The cost per thousand for each different aged stock was based on an inventory made once each year. The two weak places in this system are: first, that no interest was charged; and second, that the inventory of one- and two-year stock was little more than a guess.

The matter of interest amounts to considerable in any one year, where large expenses come at the beginning of the year, and with expenses which hold over for three years the interest certainly cannot be ignored.

The policy of basing our figures on an inventory of nursery stock is no less vital. It is impossible to make a reasonably accurate estimate. Even if an accurate estimate could be made it would not give the figure desired. We want to know how much it costs to raise enough one-year stock to produce one thousand trees when they are three years old. Our old method gave us the cost of a thousand trees one year old.

Prof. Warren of Cornell gives in his book on *Farm Management* a system of cost accounts for farm crops which, with a very few changes, overcomes most of the weak points in our system. We have been using a modification of this system for a year now and feel that we have something worth while. It is not perfect as yet and will require some changes, but is a great improvement on previous methods. The actual method of keeping the data will have to be worked out for each situation.

In most ways the system does not differ from any system of cost accounts. It is based on an inventory made at the beginning of each year, a set of ledger accounts for each crop on which separate cost figures are distinct, and a set of work

[1] Assistant State Forester, Vermont.

reports. The work reports, which are the key to the distribution of the cost of man labor, horse labor, and equipment, are perhaps the distinctive characteristic of the system.

The cost of all man labor, regardless of what crop it is put on, is charged on one ledger account. In addition, daily work reports are kept for each crop on which separate cost figures are desired. Thus at the end of each day the foreman charges up on the work report for one year seed beds the total number of hours of labor which have been spent on them for that day by the whole crew.

WORK REPORT

First Year Seed Beds (*Seed Planted* 1914)

Date	*Kind of Work*	*Man Hours*	*Horse Hours*
May 16	Making seed beds	4	8
May 23	Making seed beds	27	..
May 25	Making seed beds	16	..
June 1	Treating with formalin	12	..
June 2	Drawing sand	10	10
June 16	Sowing seed	12	..

The same is done for second-year seed beds, transplants, and shipping. At the end of the year each work report will show the total number of hours of labor which have been spent for the year on that particular crop, and the sum of all these totals will show how many hours labor have been spent on the whole nursery. The total cost of man labor, as shown on the ledger account for man labor, divided by this total hours of man labor, gives the average cost of man labor per hour for the year.

For example, the total cost of man labor on our Burlington nursery last year was $1,999.69. The sum of all our work reports showed a total of 9,323 hours man labor.

$$\$1,999.69 \div 9,323 = \$.215$$

cost of man labor per hour. This average cost per hour multiplied by the number of hours of labor spent on a given crop gives the total cost of labor for that crop. In the Burlington nursery there were 6,529 hours of man labor spent on transplants.

$6,529 \times \$2.215 = \$1,403.73$ cost of man labor on transplants.

The special equipment which is used only for one crop, such as the screens for one-year seed beds, is charged direct on the ledger account for that crop. A separate ledger account is kept for the general equipment and the total cost of this is distributed in proportion to the number of hours of man labor.

Thus the cost of man equipment at the Burlington nursery amounted to $240.55. The total number of man hour labor as given above was 9,323; hence $240.55 ÷ 9,323 = $.026 is the cost of man equipment per hour. The number of hours of man labor spent on transplants (6,529) multiplied by this rate per hour ($.026) gives the total cost of man equipment chargeable to transplants—6,529 × $.026 = $169.75.

Where horses and horse equipment are owned by the nursery, ledger accounts will have to be kept and the cost distributed in proportion to the number of hours of horse labor spent on the different crops as shown by the work reports. On our Burlington nursery the horse labor is all hired and is charged direct on the ledger accounts and no work reports for horse labor are kept. At Sharon there is other farm land connected with the nursery and horses are kept on the farm, hence horse work account must be kept.

The ledger accounts differ little from any cost-ledger accounts. On the one-year seed bed account the value of the special seed bed equipment, the cost of all seed and other things purchased, the cost of man labor, horse labor, and equipment, and interest on average value of equipment, seed planted, and other expenses involved at beginning of the year are charged. Warren also adds interest for half a year on the expense incurred during the year, but we have not done this. On the credit side of the account is the value of the equipment at the end of the year. This amount subtracted from the total of the debit side of the account gives the total cost of raising the stock on hand to one year of age.

SAMPLE LEDGER ACCOUNT

Burlington Ledger First Year Seed Beds

Date, 1914	*Item*	*Dr.*
January 1	Inventory of equipment (only such equipment as is used exclusively for first-year seed beds)	$925.00
January 1	Inventory of seed on hand	251.91
April 21	Seed purchased for planting, spring 1914	135.64
December 31	Summary of other items on ledger	51.02
November 1	Seed purchased for planting, spring 1915	100.00
December 31	Cost of man labor 759 hours, at $0.215	163.18
December 31	Cost of man equipment 759 hours, at $0.026	19.73
December 31	Interest on average value of equipment $880 at 5 per cent	44.00
December 31	Interest on seed planted— $251.91÷135.64=$387.55 at 5 per cent	19.38
		$1,509.86

		Cr.
December 31	Inventory of equipment	$835.00
	Inventory of seed for 1915 planting	100.00
		$935.00
December 31	Cost of one-year stock to date	574.86
		$1,509.86

Note.—The amount ($574.86) is carried to the debit side of the two-year seed bed account for 1915, and on December 31, 1915, interest will be charged on it as interest was charged on seed planted this year on this account. The other two items ($835 and $100) will be carried to the debit side of the 1915 account for First-Year Seed Beds.

This item is charged on the debit side of the account for two-year seed beds for the following year, and will have interest charged on it for the whole of the next year. In a similar way, the total cost of two-year stock at the end of one year is charged to the transplants for the following year and the total cost of transplant to the shipping account.

The value of the system grows on one as he uses it. The different parts of the system are so inter-related that any dishonest or careless charging of items is sure to show itself. If the foreman at the nursery charges up more hours labor than is actually spent in order to decrease the cost of labor per hour, it will make no difference in the total cost of labor charged to a given crop. If he tries to decrease the cost of stock during any one year by increasing the value of his inventory, it simply reacts on the next year's account, for compound interest will be figured on this excess value. When these accounts have been kept for three years, it will be possible to determine how much the final crop costs per thousand at any stage in its growth. Furthermore, the final cost figure is the real cost of that particular stock and not simply a rough estimate. If the kind of work is carefully kept on the work reports, there is no end to the amount of data regarding the cost of different operations which may be figured out.

TABLE FOR DETERMINING PROFITS IN HOLDING SECOND GROWTH

By W. D. Sterrett

An interesting business proposition which often confronts the forester is the possible profits in purchasing and holding immature second growth which has promise of becoming merchantable in 5, 10, 15, 20, or 25 years. At present such stands can often be purchased at sufficiently low valuation to pay good profits on becoming merchantable, and much higher than can be expected from establishing plantations which will not mature for 30 to 60 years.[1] The attached table should prove useful in calculations of possible profits in holding second growth which can be purchased at given prices per acre.

In the table, under the column of total cost to date, is indicated how much the stumpage would have to be worth per acre in 5, 10, 15, 20, or 25 years in order to earn 6 per cent on all money invested. If it is estimated, in a given case, that the stumpage will be worth more than these amounts in a given number of years, the investment would be a good one, as more than 6 per cent would be secured from it.

It is thought that the annual recurring expenses are liberally provided for by allowing for taxes and administration (including protection) one per cent annually on the initial investment in land and trees plus 5 cents per acre annually, both compounded at 6 per cent. As the total initial cost is subtracted, the future value of the land after the timber is removed constitutes an additional profit and can be reckoned upon accordingly. The entire amount of initial investment is subtracted because it is not possible to separate the value of the land from the value of the growing stock of trees at time of purchase.

This table is also applicable to holding of mature timber which is increasing in yield or value per acre by allowing it to stand for a given number of years.

[1] See "Table for Determining Profits in Forestry," F. Q. vol. XIII, p. 12.

COST OF HOLDING SECOND GROWTH

Initial Cost per Acre	*Number of Years before Cutting*	*Costs per Acre to Date* *Initial Cost at 6%*	*Annual Expenses*[2] *at 6%*	*Total Cost*
$5	5	$6.69	$.56	$7.25
	10	8.95	1.32	10.27
	15	11.98	2.33	14.31
	20	16.04	3.68	19.72
	25	21.46	5.49	26.95
$10	5	13.38	.85	14.23
	10	17.91	1.98	19.89
	15	23.97	3.49	27.46
	20	32.07	5.52	37.59
	25	42.92	8.23	51.15
$20	5	26.76	1.41	28.17
	10	35.82	3.30	39.12
	15	47.93	5.82	53.75
	20	64.14	9.20	73.34
	25	85.84	13.72	99.56
$30	5	40.15	1.97	42.12
	10	53.72	4.61	58.33
	15	71.90	8.15	80.05
	20	96.21	12.87	109.08
	25	128.76	19.20	147.96
$40	5	53.53	2.54	56.07
	10	71.63	5.93	77.56
	15	95.86	10.47	106.33
	20	128.28	16.55	144.83
	25	171.68	24.69	196.37
$50	5	66.91	3.10	70.01
	10	89.54	7.25	96.79
	15	119.83	12.80	132.63
	20	160.36	20.23	180.59
	25	214.60	30.18	244.78
$75	5	100.36	4.51	104.87
	10	134.31	10.54	144.85
	15	179.74	18.62	198.36
	20	240.53	29.43	269.96
	25	321.89	43.89	365.78
$100	5	133.82	5.92	139.74
	10	179.08	13.84	192.92
	15	239.66	24.44	264.10
	20	320.71	38.62	359.33
	25	429.19	57.61	486.80

[2] Annual expenses: 5 cents per acre for administration, plus 1 per cent of initial cost for taxes.

THE PRESENT FOREST TAX SITUATION IN NEW HAMPSHIRE

By J. H. Foster[1]

In 1908 a study of the effect of the general property tax on woodlots and timber tracts in New Hampshire was made by the writer for the U. S. Forest Service cooperating with the New Hampshire Forestry Commission. The findings and recommendations were published in the biennial report of the Forestry Commission for 1907-8. The facts upon which the conclusions were largely drawn were based upon the personal examination of some 200 individual timber lots, both large and small, widely scattered over the State. Since 1908 the writer has continued his interest in the forest taxation problem and has gathered additional information from time to time.

During the last year, in cooperation with the Forestry Commission and the Tax Commission, an effort has been made to bring up to date the information previously obtained, particularly that which related to the lots personally examined in 1908. From the Boards of Assessors in the different towns it has been possible to secure the 1914 assessments and some facts regarding the present condition of 126 of the lots previously studied.

By comparing the assessments and the timber conditions of these lots in 1908 with the assessments and conditions as they have been found to exist in 1914, some very interesting and significant results have been obtained. It is the belief that this information is of much concern to the people of New Hampshire. The writer has studied this subject with entire impartiality and presents the facts as they exist and the conclusions to be drawn from them.

These 126 distinct and widely scattered timber lots form the basis for the figures and conclusions which follow. The lots were mostly of second growth White pine, and separately listed in the assessors' books in the different towns. For the most part they were of average value and the majority of them would not have come on the market in the natural course of events for 10 to 20 years or more.

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[1] Professor of Forestry, New Hampshire State College, now State Forester of Texas.

Of these 126 lots, 65, or 51.7 per cent, have been entirely cut off since they were personally examined by the writer in 1908. The other 61 lots, or 48.3 per cent, may be classified as follows: Two were cut before the 1908 study; the owners of four are negotiating for the sale of their lots at this time; on several lots the owners have cut some timber from time to time; and on the balance the timber is still standing and it is not known whether sales are contemplated or not. A number of these remaining lots are owned by persons of means who have no particular desire or intention of removing the timber.

A comparison of the 1908 and 1914 assessments and the relation between assessed and actual values on the 61 lots not cut over since 1908 shows the following:

Twenty-four lots have increased up to 100 per cent in assessed value with an average of 66.5 per cent, and represent an average per cent of assessed values compared to actual values of 74.6 per cent.

Thirteen lots have increased 100 to 200 per cent in assessed value with an average of 145.3 per cent, and have an average per cent of assessed values compared to actual values of 76.2 per cent.

Eleven lots have increased 200 to 300 per cent in assessed value with an average of 246 per cent and have an average per cent of assessed values compared to actual values of 65 per cent.

Two lots have increased 300 to 400 per cent in assessed value with an average of 323 per cent increase and an average per cent of assessed values compared to actual values of 65 per cent.

One lot has increased 500 per cent in assessed value and the assessed value is 75 per cent of the actual value.

Two lots have increased over 600 per cent in assessed value with an average of 616.5 per cent and have an average per cent of assessed values compared to actual values of 70 per cent.

Three lots have decreased slightly in valuation.

Two lots are assessed the same as in 1908.

Three lots do not furnish all the data necessary to make comparisons.

The average per cent of increase in assessed value of all the 53 lots which have been advanced since 1908 is 161.7 per cent.

The average per cent of assessed values compared with the actual values of all these lots is 74.6 per cent.

On the 65 lots cut off between 1908 and 1914, or 51.7 per cent of the total, the assessed values of the year preceding the cutting are not known except on 15 lots, 10 of which were cut after April 1, 1914. These 15 lots, therefore, furnish the most complete information, but should not necessarily be considered an average of all the 65 lots cut off.

The comparisons of assessments in 1908 and the year before the cutting and the relative assessed and actual values on the 15 lots are shown as follows:

Eight lots increased up to 100 per cent in assessed value with an average of 33.2 per cent and have an average per cent of assessed values compared to actual values of 72.8 per cent.

Four lots increased 100 to 200 per cent in assessed value with an average of 123.5 per cent and have an average per cent of assessed values compared to actual values of 53.2 per cent.

Two lots increased 200 to 300 per cent in assessed value with an average of 278.5 per cent and have an average per cent of assessed values compared to actual values of 75 per cent.

One lot increased 542 per cent in assessed value and the assessed value was 50 per cent of the actual value.

The average per cent of increase in assessed value on the 15 lots is 123.2 per cent. The average per cent of assessed values compared with the actual values of these 15 lots is 66.4 per cent.

If it were consistent to compare the 15 lots cut off after 1908 with the 53 lots not classed as cut off, the figures would fail to show that the tendency to cut off lots is in proportion to the increase in assessment or to the per cent of the actual value assessed. Such a comparison actually shows that the lots not cut off have a somewhat higher per cent of increase in assessment and are assessed at more nearly their actual values than the lots which were cut. This comparison, however, cannot be made because the assessments on the lots not cut have continued to increase, while the reverse takes place on most of the lots as soon as they are cut over.

That there is an astonishing tendency to cut off woodlots cannot be denied when it is seen that 65 out of 126 average woodlots standing in 1908 have now disappeared. Also there must be some relation between the tax assessment and the tendency to cut, when it is seen that the average increase in assessment since 1908 of all lots up to the time of cutting or to the present time (where the lots are still standing) is 153.2 per cent. Furthermore, the question of how high the assessments may go without damaging results becomes of grave importance, when it is realized that the average assessed value of all the lots is 72.7 per cent of the actual values.

The assessors from their personal knowledge have admitted that 9 of the 65 cut-over lots, or 13.8 per cent, were cut directly because of high assessed values. It is probable that the per cent cut for this reason is much higher, since it is inconceivable that an owner will continue to hold a lot when the assessed value has been raised 200 up to 600 per cent, unless he is a person of means and is actuated by sentimental reasons.

The real conclusion is that the majority of lots are cut, not because the assessed values approach the actual values, but because the owners are unwilling to pay taxes on rapidly increased assessments when it can easily be avoided by removing the timber. It often happens that an owner is unable to pay the increase of tax without borrowing the money or selling some of the timber, which might not be possible without disposing of it all. Many of the lots unfortunately forced on the market should have been allowed to grow 10 or 15 years longer. Nevertheless, most of them are marketable and can be turned into cash at any time and the cash invested at from 4 to 5 per cent.

We cannot get away from the economic fact that White pine timber lots reach their financial maturity when 50 to 60 years of age. One does not have to study very deeply into the growth of our dense, unthinned stands of pine which are within 10 years of the economic age for cutting without discovering that the value of the annual growth does not greatly overbalance the interest on the lumber value of the standing trees. If the owners could thin out their pine stands and secure some returns from time to time, in order to increase the amount of annual growth and help pay the taxes, the desirability of letting the timber stand in spite of taxes, would be much greater. Between 35 and 40 years of age the yearly rate of growth in a dense, unthinned pine lot drops from 10 to 6.4 per cent of its volume. Between 40 and 45 years the drop is from 6.4 per cent to 4.6 per cent. At this age and under the present administration of the tax laws, the owner begins to feel the pressure of taxes. His tax bill may double or more than double in one year, and whether or not he realizes that the profits from holding the timber regardless of taxes are at the same time being reduced yearly, he looks about for the best chance to sell. When the timber is sold it is found perhaps that the assessed value was not 75 per cent of the actual value.

Nevertheless, the increasing tax was the one thing which put the lot on the market.

Who is the loser when the lot is sold and the timber cut off? The owner is if the cutting is done before the lot is financially mature and the taxes have not been excessive. The town is in any case, because the assessed value must be reduced after cutting. On only 13 of the 65 cut-over lots above mentioned is the present assessed value as high as the very low valuations that prevailed in 1908. The total assessed value on the 65 lots has dropped from $212,590 in 1908 to $104,000 in 1914. The town has, therefore, lost the increased revenue which it sought to gain.

In order to make it still more clear what the town loses when its timber lots are cut off, an example may be cited of the 5 out of 15 lots where the cutting was done before April 1, 1914, and on which the assessments after cutting are known. The following tabulation concerning these 5 lots may be of interest:

	Assessed Value 1908	*Assessed Value in Year Preceding Cutting*	*Actual Value at Time of Cutting*	*Assessed Value 1914*
	$7,500	$10,000	$10,000	$3,700
	700	4,500	9,000	900
	590	1,500	5,000	414
	4,000	7,000	14,000	800
	1,200	3,000	9,000	450
Totals...	$13,990	$26,000	$47,000	$6,264
Averages	$2,798	$5,200	$9,400	$1,252.80

Using the averages of these 5 lots for computation purposes and a tax rate of 1½ per cent, the town obtains in taxes for a 10-year period the following:

$5,200.00×1½% for one year	$78.00
1,252.80×1½% for 9 years	169.12
Total for 10 years	$247.12

Supposing the 1908 assessment had been continued for 10 years and the lots had not been cut off. The town would then have obtained in taxes $2,798×1½% for 10 years, which is $419.70 or $172.58 per lot more than where the increased assessment was maintained for only one year and the assessments were reduced, as indicated, following the cutting. It should be remembered that these are actual figures taken from tax records in New Hampshire.

Assuming that $172.58 represents the loss to the town in 10 years on an average lot, and that one-half of the 65 cut-over lots could have been saved for another 10 years by maintaining the 1908 assessments, the towns would have gained $5,608.85 in consideration of their leniency in assessment, without regarding what the owners themselves might have saved by increased growth.

It may be of interest to consider another lot which an owner was forced to cut 10 years before the timber was financially mature. The lot contained 35 acres of unusually thrifty growing pine. Its increase in growth in 10 years would easily have been 100 per cent. The assessed value in 1911 was $1,200. In 1912 this was increased to $3,000. The owner was a farmer without sufficient income to permit him to bear the increased tax burden. The timber was sold and removed before the following April. The assessed value in 1913 and each year following has been $450. The town obtains the following in taxes on the lot for a 10-year period at 1½ per cent.

3,000 × 1½% for one year	$45.00
450 × 1½% for 9 years	60.75
Total for 10 years	$105.75

If the assessment had remained at $1,200 for the following 10 years, then the town would have received in taxes at 1½ per cent the sum of $180.00, or $74.25 more than it actually did receive.

What does the owner lose in this instance by premature cutting? The timber sold for $9,000. If the owner had kept this value in growing timber for 10 years, the interest accumulation at 5 per cent together with the principal would amount to $14,670. The taxes paid annually at 1½ per cent on a valuation of $1,200 at 5 per cent compound interest would amount to $237.67, making a total cost of holding the timber to the end of the 10-year period $14,907.67. In 10 years the timber would have sold for $18,000. The owner, therefore, lost $3,092.33.

From the point of view of town finances the only justification for increasing the valuation on growing timber lots rests on the assumption that the lots will not be cut as a result. When it is shown in actual operation that over 50 per cent of the lots under observation since 1908 have been cut following increased valuation, then it appears that the town is not justified from this point of view.

From the point of view of the owner the justification for paying a tax on a valuation of over 50 per cent of actual value depends upon the character and growing condition of the timber. He may suffer a distinct loss even when the assessed value is less than 50 per cent of the actual value if the growing condition is poor. On the other hand, he may profit by holding the timber in many instances when the assessed value is as high as 75 per cent of the actual value if the timber is in good growing condition. It is inconceivable for an owner not to lose when the assessed value exceeds 75 per cent.

The most damaging effect of assessments is caused by increasing them abruptly. If they are found to be very low, it is only fair to raise them, but the increase should not exceed 10 per cent a year. Even this may be too much. Certainly 50 or 100 up to 600 per cent is justifiable. It is short-sighted policy, because the owner can turn the timber into money at a loss perhaps to himself, but certainly to the town.

Increases in assessment should be made slowly until they reach perhaps 50 to 75 per cent of the real values on lots that are growing rapidly and should go no higher. On lots that are not growing rapidly assessments of over 50 per cent of the real values should cause the owners to cut off immediately in order to avoid loss. If the owner then prefers to sell his timber, the town may feel that it has not been responsible.

This paper shows in conclusion:

(1) That 51.7 per cent of the woodlots under consideration have been cut off since 1908.

(2) That the average increase in assessed valuation of all the lots is 153.2 per cent.

(3) That the average of present assessed values compared to actual values of all the lots is 72.7 per cent.

(4) That an assessed valuation in excess of 50 per cent of the actual values on poorly growing lots or in excess of 75 per cent on good growing lots will generally cause a loss to the owner unless he cuts the timber at once and will always cause a loss to the town if he does cut.

(5) That abrupt increases should not be made. They cause the owner to cut his timber regardless of his financial advantage.

SOME FACTORS GOVERNING THE TREND AND PRACTICE OF FOREST SANITATION

By J. R. Weir[1]

One of the most important phases of scientific forestry, and in many respects the most important if the largest possible amount of merchantable material is to be obtained, is the protection of forests from their numerous natural enemies. This work falls into three main divisions—protection against fire, against insects, and against diseases caused by fungi. It is my purpose here to discuss some of the factors governing the trend and practice of forest protection with special reference to fungous diseases.

Although forest protection has only recently been directed into the proper channel for profitable returns, still the prevention of injury to the forest is the oldest branch of forestry and was the first to receive attention. We are reminded of the great royal forests established by the early English kings and the scrupulous care with which they were tended. True, the earliest protection of forests was almost wholly in the interests of the chase, still a way was opened which led to a more rational view of the benefits to be derived from a protective forest policy and later laws were devised regulating planting and the utilization of forest products. The control and prevention of fungous diseases in plants as a practical branch of Botany has only come into prominence in recent years. The old writers before the Christian era knew some of the more virulent plant diseases, especially those which assumed the nature of an epidemic. But this knowledge was so permeated by the philosophy of the time, and as such visitations were looked upon as emanating from the deities, nothing definite could possibly come from it. Not until a true knowledge of the significance of parasitism in plant life became general was any advance possible. This was necessarily dependent on the miscroscope by means of which the presence of the parasites could be detected.

Reviewing the trend and development through which many of the working hypotheses of the present day were first conceived, it is interesting to note the varying view points as to the nature and relationship between living things and the inanimate world,

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by a comparison of which error was eliminated and plant protection established on a sure basis. It was a fortunate trend of the scientific mind which led the old chemists to look into the nature of natural objects and thus lay down the beginning of our knowledge of the composition of common things. It would be difficult indeed to explain the phenomena of plant growth if the great discovery of the transfer and metabolism of food substances between the living plant and the earth and air had not been made. However, with this great discovery, the chemical factors governing plant growth were not fully understood for many years afterwards. Meanwhile, many false positions were necessarily taken by the investigators of the time. Strange as it may seem with our present-day familiarity with the cause of many plant diseases, and the old investigators were not ignorant of parasitism, deterioration in plant growth was in no wise attributed to parasitic fungi. In fact the more conspicuous forms commonly met with in the forest were only associated with folk lore and were despised objects from a scientific standpoint. With an imperfect knowledge of parasitism and nutrition, disease was explained by soil exhaustion, congestion of water in the soil, or excessive fertility. Such a diagnosis was correct in many cases, and we now recognize numerous pathological conditions induced in part or wholly by factors other than plants or animals. But every diseased condition could not be so explained. Numerous forms of fungi were recognized in field and forest, but the opinion held regarding them was similar to that so often expressed in the timber regions of today. They were not associated with any kind of decay. It was impossible to believe that a tree could become infected by a germinating spore coming from without, and it was believed that the disease originated within the tree itself in a kind of spontaneous generation from deteriorating materials. It is evident that much had to be done in the study of the minute structure of things before the rotting of wounds, the formation of cankers, etc., could be understood.

The discovery of plant physiologists that it is possible to determine the chemical composition of plants by the synthetic method of artificial cultures was destined to lend a new impetus to the investigations of plant physiology. A knowledge of the substances selected from the air and earth by plants in order to attain their optimum development has been of far-reaching significance in the proper care of field and garden crops and has been of great service in the management of forest growth as well. It hastened a correct understanding of the biological and chemical relations of the humus covering of the forest floor to tree growth.

In the course of its progress the investigations in purely chemical processes in plant life led to some error in understanding the significance of plant protection. When it was possible to bring a plant to its best development in an artificially prepared medium containing known quantities of the substances required in growth, it was easy to make the mistake of assuming that the natural vigor of the plant depends entirely on the presence of any required element in suitable quantity. While it is true that plants are weakened and suffer a loss in vigor when the proper amount of food substances are withheld, as every tiller of the soil well knows, every indication of disease cannot be referred to this cause alone. Often soils become "tired," not through lack of the necessary elements of growth, but through the presence of parasitic organisms which exert an influence on continued development.

The knowledge of the activities of parasitic plants and animals and the great results made possible through research in chemistry are incomplete and would not explain all phenomena of plant growth if other natural factors were not recognized as playing an important rôle in the problems of growth. It is not necessary to think alone of the meteorological conditions as exercising in relation to the chemical composition of the soil great influences, since a number of other physical forces are at work, and have a great bearing on the state of health and development of the plant. Physiological research alone is not sufficient to explain why it is a plant responds so differently to different kinds of soil or why a plant in a particular soil, notwithstanding an ample supply of the necessary food substances, refuses to develop favorably. Since moisture conditions, temperature and air content of the soil vary according to its physical nature, it seems likely that physical factors may be in many cases responsible for fluctuations in plant growth. To make, then, a correct diagnosis of symptoms in diseased plants is often very difficult. A study of the causes inducing disease often leads even the experienced observer into a tangle from which he is unable to extricate himself or to give any adequate reason for the plant's deterioration. This is in part due to the less organized structure of plants as compared to animals. The plant (tree) is not dependent on any particular organ or parts for the maintenance of its organization. Consequently, it is often difficult to distinguish, owing to the poorly defined line between health and disease, whether a given tree is producing the best possible growth under favorable conditions or is laboring against internal disorders or unbalanced external factors. The leaves of a tree turn yellow, a very common indication of a diseased condition. In order to correctly interpret the cause of the yellow appearance it is evident all accompanying circumstances must be taken into consideration, and it is often necessary to render the verdict, as does the physician in human ills, "death from a complication of diseases." In regard to physical forces as influencing plant growth, it is not possible to assign chief place to any one of them, partly because experimental proof in actual plant life is difficult to obtain. These circumstances indicate a field in which much is to be done and expected from the science of chemistry, soil study, and plant physiology.

It is impossible to expect a complete solution of the problems when the varied influences of living nature are held in mind. By means of the microscope more and more is known of the world of micro-organisms and their great influence on plant development. The study of parasitic life bids fair to lend an entirely different trend to research in plant propagation. In consideration of the earlier view that numerous natural processes in plant life, both normal and otherwise, hinged completely on chemical characters, we now know them to be directly referable to the influence of specific organisms. In this connection, some epoch-making discoveries have been made. Probably the greatest of these is the work of Pasteur and Koch in discovering the causes of fermentation and of contagious diseases. Oxidation and deorganization induced by bacteria resulting in the formation of nitrogen in the soil are other important advances. Numerous lower animals and plants, fungi in particular, owing to the early predominating idea that they were in nowise connected with plant disease, through the researches of De Bary, were shown to have a true parasitic nature and were the cause of many epidemic diseases among plants. The recognition of these facts initiated a very active study along the line of plant diseases with very important results. The symbiotic relation between plants and certain species of fungi in which the green plant was found to be greatly benefited in return for the protection afforded the lower organism has thrown much light on the vexing problem of the inter-relationship of plant life.

So it is that the study of plant growth has received much attention of late years and no one can tell into what direction future investigation will lead. New questions are continually arising concerning the action of bacteria in soil and in plant tissue, and the old idea that bacteria had nothing whatever to do with plant disease is disproved. It is interesting to remember the skepticism with which the statement that bacteria are of importance in plant disease was first received. Not until it was definitely proven that pear blight and a number of other fruit and vegetable diseases were found to be induced by bacteria was the study of plant bacteriology established. The importance of the higher parasitic fungi in deteriorating the forest crop is now generally recognized and has developed into a highly specialized branch of scientific forestry, the object and aim of which is to determine the cause of the disease and introduce practical methods of control. It is evident that little can be done in combating a disease unless the complete life history of the organism producing it is known, and often the nature of the disease together with other poorly understood conditions are such as to preclude any definite step being taken in its control or eradication. This state of affairs may result from a too wide distribution of the disease or exhaustion and failure of all known methods, or it too frequently happens through lack of interest in the matter by the persons most concerned.

Fortunately, however, there are a number of plant diseases that come within the power of man to control or to completely eradicate. As in animal pathology, the most successful treatment of plant diseases, especially those of the forest, must, out of necessity, be conducted along prophylactic lines. The forester, in planning his silvicultural projects, selects those positions where the slope, soil and general climatic conditions are favorable for the development of a particularly desired species. This species successfully withstands the climatic environment. Some parasitic disease associated with it in other situations may not find the factors suitable for its best development and it does not appear to a serious extent. For instance, the foresters of central Europe successfully cultivated the larch only in the highlands at first. Later it was found that the tree would reach a greater and quicker development in the lower levels and was accordingly planted in pure forests in damp localities. A fungous parasite closely associated with the larch in its mountain home and only producing reproductive organs in damp situations followed the tree into the new habitat with the result that great damage was done and special methods were necessary to counteract the ravages of the disease.

A method successfully practised in many forest regions of the Old World is the introduction of other tree species possessed of different qualities from those occupying the original stand. The old forest composed of species to which numerous parasitic fungi had become adapted, not merely because the tree had in any way become decadent, but because a favorable environment was afforded a particular disease through the evenly balanced condition of a pure forest. Pure forests, with few exceptions, always afford favorable conditions for parasitic tree fungi, and the trouble is intensified if the forest is even-aged. It is easy to understand this. Uniform crowns, similar branching and natural pruning, causing wounds at same level, equal depth and extent of root system, equal annual increment with same amount of sap wood; constant temperature, moisture and light relations produce a condition, by increasing or maintaining a funguous activity with no unfavorable influences, unequaled in mixed forests. The constancy of such factors in the life history of the principal attacking fungus introduces a regularity in its growth and the amount of wood decayed, so that it would enable definite pathological units to be established in estimating the amount of merchantable timber to be had. The rotation of fruits, vegetables and field crops in general has brought good results in combating plant disease. The principle involved is the destruction of the spore of the fungus by a long exposure to the soil before the newly introduced host has made its appearance. Moreover, the alternating crop is chosen because of its resistance to the diseases of the preceding ones. To what extent the idea of the immunity of forest trees, other than hardiness under certain climatic conditions, is to be entertained is an important problem. In proof of this the sole salvation of retaining chestnut forests in the United States seems to hinge upon the resistance of certain foreign varieties of chestnut to the ravages of the chestnut bark fungus now destroying the native chestnut in the East.

We have shown that the external environment affects the well being of the plant and the difficulty in making a correct diagnosis of a diseased condition. More and more is the doctrine of the "predisposition" to disease advanced. This doctrine holds that the infection of the host plant by a fungus is in more cases possible only when the plant is susceptible to it. Considering the multifold conditions under which most plants exist, the selection of the weakening factor by which the organization may be strengthened against a disease is difficult. However, this prophylactic procedure of increasing the resistance of the species or race is of some practical importance, and where climatic conditions are concerned the silvicultural practice may be so varied as to bring good results.

The control of heteroecious forest tree fungi in most cases hinges on the elimination of the alternate host and this brings us to the most important part of a prophylactic treatment of plant disease, viz., obtaining a knowledge of the complete life history of the fungus itself. One noted plant pathologist has stated that every fungus has in its development "an Achilles tendon." This means, of course, knowing in what period of development to strike the fungus in order to obtain the most good. To illustrate the nature of heteroecious forest tree fungi, there are in our northwestern forests some half dozen diseases which produce abnormal swellings of trunk and branches. Occasionally a dense matted branching effect is produced known as "witches brooms." The result of these is to stunt and eventually kill the host. A number of these fungi have an alternate stage on some other plant and without it are unable to infect anew other forest trees. The value of knowing the alternate host, and as yet we know but few of them, is evident. It is like the fruit grower who cut down a fine stand of pear trees for the purpose, as he thought, of eradicating a heteroecious leaf disease, and allowed the solitary juniper tree, the alternate host of the fungus and the cause of the trouble, to remain.

In the care of the forest nursery it is important to successfully bring young seedlings through certain growth periods because these are periods of greatest susceptibility to certain virulent nursery diseases. In order to do this, chemical treatment of the seed beds is necessary and a judicial application of water. Here there is a close analogy to horticultural methods or as we might say in human medicine, therapeutical, the application of remedies. A method of this kind can no more be generally applied in the treatment of forest tree diseases than in combating epidemics of human disease. The forest must be considered as a whole. Seldom can attention at the present time be directed to individual trees. Much can be accomplished, however, in small holdings and eventually, after a more thorough organization, in larger forests by the destruction or removal of diseased trees. My observations in the forest lands of Europe illustrate this point. It is the custom of the authorities in many of the large woodlands and parks near the cities, for economic purposes, to scrape up the leaves and fallen branches in the fall of the year and remove the material from the forest. Numerous leaf diseases which pass the winter on fallen leaves are common in these forests. The regular destruction of this débris has practically removed all parasitic leaf diseases from the parks where this is practised. On the other hand, in the woodlands in the same region in question where the removal of débris was not practised, parasitic leaf diseases are prevalent and cause much injury to the forest growth. Whatever might be said against the method of robbing the forest of this much needed humus material, it is not to be compared with the destructive effect of some leaf blights when they assume, as they often do, the nature of an epidemic.

Unfortunately in the northwestern United States, a region now being carefully surveyed for serious tree diseases, a great many virulent needle diseases are present. These may become serious or unimportant in forest and nursery according to the conditions under which they appear or the length of time they may continue. There is usually a far greater assimilatory surface when large trees are in full leaf than is really necessary, consequently if the ravages of a leaf disease are confined to one year, the injury to the tree is slight, but if repeated year after year the food stored in the roots and the trunk is exhausted and the tree dies. Likewise the northwestern forests are filled with all sorts of wood-destroying fungi, rotting the wood of the living tree and continuing its destruction after the tree has succumbed to the disease. In some of the forests of Idaho and Montana the number of infected trees run as high as fifty to eighty per cent of the stand for the more valuable species, and occasionally the more undesirable species show a much higher figure. It is hoped that the disposal of all this infectious material may be brought about by some modification of the silvicultural practice and that some commercial use may be found for it. Considering the close utilization of forest materials now being practised, the outlook is encouraging, but the end is not yet. The removal of diseased material will be a great step toward freeing the forest from disease. How it is to be successfully accomplished with little outlay, and there is no question of the benefits to be derived from it in the future, is the problem confronting the conservationist. That it can be done, the history of scientific forestry shows over and over again. I have often searched diligently in some of the more important forests of Austria and Germany without being able to locate a single diseased tree, and the results were in part realized in some instances by the simple method of destroying the sporophores of the fungus. Such a procedure in the great American forests is impossible, and forest management must be handled on broader lines. Local conditions and questions of economy prohibit any great step being taken in many forest regions, although the plan looks easy in theory. Even a cursory examination of the problems with which the forest pathologist has to deal shows a situation fraught with much difficulty. If the best results are to be obtained there needs to be, in the words of one of our foremost plant pathologists, a little of the spirit of Bunker Hill instilled into the work of forest protection and conservation, as well as in more warlike affairs.

THE SAWMILL OF CENTRAL EUROPE

By J. B. Berry*

In a comparison of American and European methods of manufacture one must consider the economic development of the countries studied; one individualistic, the other communistic; one extensive, the other intensive. European development has been along communistic lines; not as a whole, but as isolated communities, each with its dialect, its distinctive costume, and its own peculiar methods of manufacture. American development, on the other hand, has been along broad, general lines; decidedly individualistic, yet with a certain unity of purpose, based on a deeply grounded sympathy between the various communities, which is almost communistic in nature. This unity of purpose, first liberty, later progress, together with wonderfully improved transportation facilities, has given to each community the experiences of the others, binding them into a homogeneous whole. Transportation may be said to be the great agent of civilization; where the means of transport are many and the cost low, progress is rapid; where the cost is high, progress is slow and the community backward. It is also true that when a community has been backward over a long period of years, progress is slow even in the face of greatly improved transportation facilities. This is true, in general, of Europe. Up to within comparatively recent times the means of transport have been very poor, resulting in many small, isolated communities, each with its peculiar customs, for, under existing circumstances, each had no means of profiting by the experiences of the others. In each of these isolated communities there existed certain demands for the products of the forest and these were supplied from the "common" property, in which each resident of the community had a share. In this communal forest the cattle and sheep of the community were grazed, the trees were manufactured into construction material and firewood, and the cleared areas as far as not reforested furnished additional area for the practice of agriculture. In this way common methods of operation became fixed, each community varying somewhat from every other community.

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Under primitive conditions construction timbers were hewn, just as the meal was ground between two stones. Later came the saw and, with the development of water power, the sawmill. Naturally each community developed sawmills of its own and, in this way, resulted the numerous small mills of Europe, each community having a supply of from one or two to a dozen or more. Even with the introduction of improved methods of transportation, there is a strong tendency to cling to the old type of mill and the large mills are usually nothing more or less than a combination of the equipments of several small mills under one roof. Thus, the equipment of a small mill might be one gangsaw with a capacity of 5,000 feet board measure; while that of a large mill, 10 similar gangsaws with a capacity of 50,000 feet board measure. Naturally, in the larger mill, there is greater efficiency of labor as well as closer utilization. In addition to this, the large mill buys the raw product outright and derives the profit of a commission man, while the small mill, as a rule, manufactures the raw material belonging to another for a certain stipulated amount, bearing the same relation to the farmer as the old-fashioned "grist-mill." This raw material which the farmer brings to the mill to have manufactured is obtained on his right, under what is known as "right of user"—that is, the right of his family to fuel and construction material from the communal forest. (See illustration on frontispiece.)

The first improved saw to be used extensively, and one which is widely used at the present time, is a single blade (approximately 5 feet long by 6 inches wide by 1/16 inch thick) with triangular "ripsaw" teeth. This is fastened in a wooden frame operating between parallel, greased tracks, there being a threaded arrangement of the end of the saw and a burr to preserve tension. In remote mountain districts there are mills of this character to be found in which the saw blade is the only metal used in construction, wooden pins being used in place of nails. Later came the all metal "gangsaw" with its capacity of from 20 to 30 inches, and this now seems to meet every demand for cheapness and efficiency, for it doubles or triples the output without increasing the labor. Its manipulation is simple and it can be quickly and easily adjusted to manufacture boards, planks or timbers, sawing the log completely in one operation. Two sets of toothed rollers, one pair on each side the saw blades, furnish the feed and steady the log, while huge clamps, one on either side, control the alignment. Naturally only straight logs may be fed through such a machine. Another type of saw, which occurs less frequently, is the horizontal "band-saw," with an arrangement for raising and lowering the cutting blade. The gangsaw, however, has the greatest capacity; the single blade varying between one-tenth and one-fifth, and the horizontal band between one-fifth and one-half that of the gang in capacity. The gangsaw requires no carriage, the clamps and rollers holding the log securely in position. The other types of saws, however, require carriages, which are, in general, very similar, being of heavy construction, very long, and operating on small wheels. The log, on the single blade carriage, is clamped on one end and held by a split pin on the other, so as to permit the log being sawn from end to end. Between the two ends of the carriage is a movable section which may be adjusted to the length of the log. After each operation the board is removed and the log readjusted. In the case of the horizontal band-saw the log is clamped from the sides and ends and boards cut from the top, the saw being lowered each time to make the new cut.

As a rule, and especially by the mountain mills, water is depended upon for power; the older forms of utilization being the "over" and "under" shot wheels; the modern form, the steel turbine. The mountain streams, under strict regulation, furnish an abundance of power and it is common to find many small mills with concrete feed pipe and well and with a steel turbine. The advantages of the turbine lie in greater efficiency, higher speed and ease of control.

The daily capacity of the gangsaw is about 5,000 feet board measure, of inch boards, when the logs average 12 inches diameter at the small end and 16 feet in length. Usually the small mill is provided with a 12 to 16 inch circular saw for edging, although but a small per cent of the total cut is edged. Except in the band-saw mill, one man operates saw and edger, starting a log through the saw, then edging a few boards or doing other work until the sound tells him the cut is finished. He then shuts off the power, removes the boards from the clamps, rolls on a new log and starts it through the saw. As a rule the boards and planks from each log are piled together, so that one sees at a glance just what material is sawn from each log. Edgings and slabbing are cut into 24 inch lengths and bound with two wires into 10 inch bundles and sold as "kindling." Merely sawing logs into boards costs from $.75 to $1.00 per 1,000 feet board measure, the owner of the logs often taking also the sawdust coming from his logs when he removes his material. Wages in the small mills vary between $.75 and $1.00 per ten-hour day, although in the larger mills it may run as high as $2.00. The labor unions have had a great influence in Germany on the scale of wages; in a few cases the scale has been doubled during the past five years.

In the small mills there is no attempt at grading and the sawn material is sold as though in the original log form. In the larger mills, however, four grades of spruce, fir and pine are recognized; namely, clear, 1, 2, and 3. Clear permits of pin-knots but they must be sound, and excludes sap, shake, rot, etc. Numbers 1, 2, and 3 are based particularly on sap, shake, character of knots as well as size, rot and stain.

The mill investment in equipment varies from $1,000 to $150,000. One is at once struck by the permanence of the structures; the small mills being of heavy timbers, masonry foundation and tile roof; the larger mills, of brick, concrete, and tile. Many of the small mills have been in operation 50 and more years and the equipment is still good. Uusally the yards are supplied with tracks and transport entirely by push-cars. Drying kilns are of rare occurrence and the supply of logs is kept at least 6 months in advance, while the sawn material is given from one to three months' seasoning in the yard. This necessitates a rather heavy investment in raw material, but the consumer, especially the factory, demands a class of material which necessitates slow seasoning. Occasionally sawn oak is held three years so that it may be thoroughly seasoned, before going into high grade window sashing and furniture.

As to the application of the European sawmill to American conditions, in its entirety it is admittedly out of the question. Perhaps the greatest advantage lies in the substitution of the gangsaw, with its comparatively small waste, for the circular saw, with its unquenchable thirst for "kerf." Perhaps the greatest objection to its adoption lies in its "permanent" character, for it requires secure anchorage and is not adaptable to the "portable mill." The second suggestion, and this applies to those sections where waterpower is available, is the substitution of the turbine for the engine. Both of these suggestions necessitate permanence, yet the reduced cost of operation may more than offset this disadvantage. On the other hand, there are in the Eastern United States many small permanent mills, to which either or both of these suggestions might be profitably applied. Certainly, the efficiency is high and the operating expenses low—two factors which demand consideration.

THE FORESTS OF CENTRAL BRITISH COLUMBIA[1]

By H. R. Christie

The forests of Central and Northern British Columbia, especially in parts of the interior, are so far practically untapped, except for local uses, and their great extent and value are not widely known. This is largely due to the fact that up to the present transportation facilities have been lacking and the timber has been, therefore, commercially inaccessible. For this reason the lumber industry of British Columbia so far has been practically confined to the forests of the Southern coast and Southern interior. Conditions have been changed, however. Some of the best timber areas have been opened up by the completion of the Grand Trunk Pacific. Further large areas will be made accessible on the completion of the Pacific Great Eastern and the Canadian Northern. Undoubtedly in that part of the province a flourishing lumber industry will develop sooner or later—how rapidly depending, of course, on the markets.

Central British Columbia lies approximately between latitudes 51 degrees and 57 degrees, and takes in the whole width of the province. (Latitude 51 degrees is at the north end of Vancouver Island, and passes through Revelstoke or near it. Latitude 57 degrees is north of Fort Graham, on the Finlay River. It includes the forest districts of Kamloops, Lillooet, Prince Rupert, Hazelton, Fort George, and Tete Jaune. In other words, it includes all of British Columbia at present under forest administration except the southern tier of forest districts.)

The total area of Central British Columbia is over 106 million acres, or nearly half the province. This is little less than the total area of Sweden, and all of it lies south of 57 degrees, while nearly all of Sweden lies north of that latitude. The most southerly point of Sweden is about the latitude of Hazelton, or a little north of latitude 55 degrees. (Most of Denmark also lies north of this latitude.) The population of Central British Columbia is now less than 25,000; that of Sweden is over 5,500,000.

(Note: It should be remembered that north of Central British Columbia there is an additional area of 70,000,000 acres. It

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[1] Before the British Columbia Section, Canadian Society of Forest Engineers, 1915.

lies between latitudes 57 degrees and 60 degrees—the northern boundary of the province—and may be called the real Northern British Columbia. It is nearly as large as Norway. Most of Norway lies north of latitude 60 degrees. Little is yet known of the timber resources of that part of British Columbia except that practically all of the country below timberline is wooded, and that there is in the aggregate a very large amount of timber there, especially pulp timber. Like the region to the south of it—Central British Columbia—its development lies in the future, but much farther in the future.)

Forest Regions of Central British Columbia

(From an article entitled "Slash Disposal in B. C.," written by R. E. Benedict, of the B. C. Forest Branch, for the Commission of Conservation.)

Altogether six main forest regions may be distinguished, as follows:

Forest Region	*Acres Forested (Barren Land above Timber Line Excluded)*
1. Northern Coast	20,000,000
2. Plateau and Rocky Mountains	20,000,000
3. Yellow pine, or semi-arid	2,000,000
4. Interior wet belt	9,000,000
5. Upper Fraser basin	14,000,000
6. Northern	15,000,000
Total area forested	80,000,000
Total area	106,000,000

1. *Northern Coast Region.*—This includes the western slope of the Cascade range from Kingcome Inlet to Portland Canal, with adjacent islands. It takes in also the extreme northern part of Vancouver Island and a fringe of its west coast to Clayoquot Sound; all of the Queen Charlotte Islands; and the Skeena watershed east to Hazelton.

The topography is for the most part extremely rugged and rocky. The whole area has been severely glaciated, and while the glaciers are retreating, a considerable proportion of the Cascade Mountains is still covered by ice and snow. The annual precipitation is over 100 inches, the average annual temperature under 45 degrees, the winters fairly cold, with heavy snowfall on the mountains, and the amount of sunshine comparatively small.

The mineral soil is as a rule thin and scanty. The most characteristic feature of the region as a whole is the deep accumulation of partially decomposed vegetable material, consisting of down trees, branches, leaves, moss, roots, etc. This muskeg-like layer, often many feet deep, is saturated with water practically throughout the year.

Western hemlock is a universal constituent of the stand, mixed with Red cedar and Sitka spruce and some Yellow cedar. The forest is dense, but the trees, except on the better soils, are inclined to be short and defective.

The best forests are found on Vancouver Island and the opposite mainland, the Queen Charlotte Islands, and on the watersheds of streams like the Bella Coola, Dean, Skeena and Naas Rivers, which cut through the Cascade Range. The soil and climatic conditions there are more favorable than on the rugged coast mountains. The reappearance of the Douglas fir, or Southern Coast type, on restricted areas inland on the Bella Coola and Dean Channels, and Rivers Inlet, is due to the lesser rainfall and higher summer temperature prevailing there.

While there are some splendid stands of timber on the better sites, the forests as a whole are not of great present merchantable value for saw timber. They are, however, undoubtedly very valuable for pulp, and their utilization for that purpose will be assisted by the splendid waterpowers which are to be found along the Coast.

2. *Plateau and Rocky Mountain Region.*—Included in this is a large part of the uneven plateau lying between the Cascade Range on the west, and the Gold and Cariboo Ranges on the east. It also covers the western slope of the Rockies from the railway belt north to Yellowhead Pass. The general altitude is 3,000 to 4,000 feet, decreasing somewhat toward the northern limits. The precipitation ranges from 10 to 20 inches. The winters are long and cold, the summers warm and dry, with cool nights. The climate on the whole is not very favorable to good forest growth.

The forests are composed chiefly of Lodgepole pine, with spruce, balsam and Douglas fir subordinate. Lodgepole pine is the distinguishing species, forming practically pure forests, especially on the poorer sites. As a rule the stands are dense and the trees small, few of them being of sawlog size. Englemann spruce is common along streams and on moist good soils in general. On good sites, at high elevations, stands of spruce and Alpine fir are common. Douglas fir occurs at elevations below 2,500 feet over all but the northwestern part of the region; in the southern part it ascends as high as 4,000 feet. It is generally mixed with Lodgepole pine, though almost pure stands are found in limited areas, *e.g.*, along the Fraser and North Thompson Rivers.

The whole region has suffered very severely from fire, which has resulted in the present predominance of Lodgepole pine over great areas where once the Douglas fir existed in considerable quantities, but is now marked only by traces. Adequate fire protection should in the course of time allow the proportion of Douglas fir to greatly increase. Poplar is found in nearly all the reproduction following fires.

The forests are not very valuable commercially at present, except for local uses as lumber, railway ties, etc. Lodgepole pine, however, can be utilized as pulpwood, and when markets are available the region is capable of yielding in the aggregate great quantities of this product, as well as of posts, poles and common lumber.

3. *The Yellow Pine or Semi Arid Region.*—This is restricted to the southern parts of the deep valleys of the Fraser and North Thompson Rivers, which cut their way southwards through the great interior plateau. The presence here of the open, park-like Yellow pine forests is due to the long growing season, hot summers and limited annual precipitations of 10 to 20 inches. Douglas fir and Lodgepole pine occur as associates of the Yellow pine. On account of the open stands, the rather short and scrubby timber and the small area of the region, the commercial value of its forests is small, except for local use.

4. *Interior Wet Belt Region.*—This is a region of parallel mountain ranges separated by deep valleys, lying east of the interior plateau. It includes those portions of the Gold, Cariboo, Selkirk and Rocky Mountains extending from the railway belt north to the north fork of the Fraser River. The climate is intermediate between that of the Coast and the interior plateau. The annual precipitation averages 30 to 40 inches. The summers are warm and the growing season comparatively long. The winters are cold, with heavy snowfall. The growing conditions on

the whole are very favorable, and the forests are characterized by great density, rapid growth and large yield.

The chief species are cedar, hemlock, Englemann spruce, Douglas fir, Lodgepole pine, Alpine fir and White pine. Northward on the Clearwater River, Quesnel Lakes and the Upper Fraser River, spruce and Balsam fir form the chief part of the stand, with hemlock, cedar and Douglas fir subordinate.

The whole region has been very severely burned. It is estimated that during the past fifty years 75 per cent of it was burned and over one hundred billion feet board measure of timber destroyed, though good reproduction has appeared on most of the burned areas.

In its commercial possibilities this region is second in importance only to the Southern coast. It is at present practically unexploited, but is capable of an enormous and sustained yield of excellent lumber and pulp, etc., as soon as there are markets for it.

5. *Upper Fraser Basin Region.*—It includes roughly that part of the great interior plateau draining into the Fraser River, from Alexandria north to Nation River. The general elevation is lower than the southern part of the plateau, and the soil and climatic conditions more favorable to forest growth. The average annual precipitation is probably 20 to 30 inches. The winters are long and cold, with heavy snowfall, but the growing season is warm, with long days of sunshine. The resulting forests are very dense and the yield very great, considering the latitude.

The chief species are Englemann spruce, Alpine fir, Lodgepole pine and Douglas fir. Spruce is the most important species, often forming with Alpine fir practically the only constituent of the forest, and stands of 20,000 feet b.m. per acre are not uncommon. Lodgepole pine occurs over the whole region, generally as a result of fire, in pure stands or in mixture. Douglas fir is quite common below 2,500 feet, but on account of fires is much less widespread than formerly. Probably 75 per cent of the area has been burned over in the past fifty years and over twenty billion feet b.m. of timber destroyed.

Commercially the forests of this region are very valuable because of the large quantities of excellent saw timber and pulpwood, and also because they are easily accessible.

6. *The Northern Forest Region.*—All of the remainder of Central British Columbia lies within this region. It covers

roughly the area extending north of the Upper Fraser basin, including the upper watersheds of the Naas and Skeena Rivers, and all the Peace River drainage except the Upper Parsnip. The topography is mountainous, with rather narrow valleys. The annual precipitation is over 20 inches, mostly snow; the winters long and cold, summer frosts frequent, and the climatic conditions in general severe. The resulting forest is rather sub-alpine in character, dense and slow-growing. The species are Engelmann spruce, Alpine fir and Lodgepole pine, the first two nearly always associated, while the pine may be found in pure stands, as well as in mixture.

The region is at present undeveloped and its forest wealth inaccessible and unexploited. When it is opened up, the forests will yield great quantities of fine pulpwood, as well as large amounts of good spruce lumber.

Timber Resource of Central British Columbia

The description of the forests having been dealt with, the questions naturally arise how much timber is there, and what is it worth? Will there be any market for it?

It is conservatively estimated that 80 million acres of the total 106 million acres is forested. Allowing 10 million acres—a liberal estimate—for potential agricultural land, there remains 70,000,000 acres of absolute forest land valuable only for growing timber, and in part for summer grazing. Probably at least 40,000,000 acres of this is capable of growing merchantable timber. The present stand is estimated to be at least 80 billion feet b.m., and is probably nearer 100 billion—or about one quarter the total stand of timber in the province.

The annual growth may be estimated at 100 board feet per year, or four billion feet b.m. per year on the 40,000,000 acres. This is not far short of the total cut of Canada at present. Reckoned as pulpwood, the total quantity is at least 200 million cords, and the annual growth 8 million cords. This latter figure is approximately twice the present yearly consumption of pulpwood in the United States.

While only a very small portion of this annual growth is now being utilized by man, still the total merchantable stand is not being greatly added to by this annual increment, as a large part of it is accounted for by natural destructive agencies, such as wind, insects, old age and fire.

If the 40,000,000 acres were fully stocked with mature timber it would carry at least 200 billion feet b.m. The difference is represented by the large areas which have been burned. Most of this, however, is now bearing valuable young growth.

Value of Resource if Utilized

Complete utilization of the present stand would yield the province forty million dollars in royalty alone. It would distribute in the neighborhood of a billion dollars in logging costs, represented by wages, transportation, supplies, etc.; and 75 to 90 per cent of that would go directly to the community.

Complete utilization of the annual growth would each year yield two million dollars in royalty alone, and distribute around fifty million dollars in logging costs in the province.

Beyond any doubt the forests of Central British Columbia are an exceedingly valuable asset if they can be utilized. Their utilization depends chiefly on the development of markets for their products.

Lumber Markets Needed

Before there can be any permanent and important increased development of the lumber industry as a whole, however, new markets and bigger markets are needed. There is mill capacity in Southern British Columbia now to nearly double the present lumber production if the surplus could be sold, and unless markets are enlarged and a bigger demand created, any increase in lumber production by one section of the province—Central British Columbia, for example—would be made at the expense of other sections.

The development of bigger lumber markets is one of the most important tasks facing the timberholders, the lumbermen and the government of British Columbia today. It is a task which will require and deserves their best efforts, because on its successful accomplishment the commercial future of the province is dependent to a greater degree than is generally understood.

British Columbia's prosperity depends on the profitable utilization of her natural resources, of which timber is one of the most valuable. The province is primarily and pre-eminently a forested country; excluding areas above timberline, nearly all of it is covered with a forest growth of some kind. Great as is the extent and quantity of timber in Central British Columbia, yet it comprises hardly one quarter of the total amount of timber in the province.

If it be wise policy to promote what may be called the indigenous industries, then the natural conditions of this province indicate that the main effort of its people should be to foster and develop the lumbering, mining and fishing industries, just as in the Prairie provinces the natural conditions indicate a primarily agricultural development. It seems evident, also, that any and every effort devoted to the promotion of those chief industries will at the same time constitute the truest and most effective aid to agriculture, the development of which over most of British Columbia is very largely dependent on local markets and on opportunities for remunerative outside employment for the farmer until he has cleared and improved sufficient land to support him.

Of all the main industries, lumbering is and will be the most valuable. It will be conducted over a larger portion of the province than any other industry. It provides a market for the produce of the settler, and gives him employment in his spare time. It attracts and forms a class of men hardy, independent and resourceful. It produces and distributes greater community wealth than any other industry. Seventy-five to 90 per cent of the lumberman's dollar stays in the community in the form of wages, supplies and transportation expenses, and everybody shares it.

According to the census of 1911 the lumber industry, as compared with the other industries of the province, had over half the total capital investment, employed over half the wage earners, paid over half the wages, and produced nearly half the total value of all the products of all the industries.

The present depression and excess mill capacity in the lumber industry is in part due to the general business depression and in part to putting too much dependence on one market. During the recent period of very rapid expansion of settlement and town building the home market in British Columbia and the Prairie provinces absorbed in increasing quantities the bulk of the output of the mills, both interior and coast. To meet this demand new mills were built. The total mill capacity always kept several laps ahead of the demand, even at its best, because most of them were built extra large in anticipation of a still greater business. Meanwhile, the foreign export trade, never very large, was neglected and decreased year by year, while that of the lumber merchants of the United States correspondingly increased. The end of the period, therefore, found this situation: a great mill capacity, and a much curtailed trade both in domestic and foreign markets. The inevitable result was over-production. Prices fell to cost and below it. Mill outputs had to be reduced. Profits vanished. Many operators ceased business until conditions should improve.

The great war, while it has temporarily stimulated some industries, aggravated the situation in regard to lumber because the great demand for war supplies, coupled with the scarcity of shipping, has made it almost impossible for British Columbia lumber exporters to secure ships except at a prohibitive rate. The American exporters, who have always done the bulk of the lumber export business from the Pacific Coast, are also affected by this, but have a certain advantage in that they already had a number of ships chartered when war broke out.

A Turning Point in Lumber History

The whole lumber industry is in a process of readjustment to meet the changed conditions. Greater care than ever before is being taken to practise economy in operation, to avoid waste in utilization and to secure the utmost perfection in mill product. Improved and more aggressive methods of advertising are being adopted and more careful study and attention being given to the needs of the different markets. It is probable that in a few years from now the present period, viewed from its proper perspective, will be recognized as a crisis and a turning point in the history of the lumber industry and the province. Past experience shows that a period of abnormal depression can only be temporary. It is certain that, sooner or later, the business pendulum will swing forward again. There are good grounds for believing that the final result of the whole experience will be beneficial; that the endeavors to increase the demand for British Columbia's forest products will be successful and that they will be sold in wider markets and more intelligently than ever before; that the lumber industry will achieve the prosperity which it deserves and which means so much to the province; and to return again to the original theme, that the forests of Central British Columbia will eventually play their proper part in the economy of the province.

FOREST INVESTIGATIONS IN CANADA
PROPOSAL FOR A NATIONAL ORGANIZATION FOR TECHNICAL INVESTIGATIONS[1]

By W. N. Millar[2]

In attempting to outline the scheme whereby the Dominion Forestry Branch plans to undertake the investigation of the forestry problems of Canada and to co-ordinate the technical work of all Canadian forest organizations, it is first desirable to consider briefly and in a broad way the present status of the forestry profession in Canada.

It would seem that in order to make myself perfectly understood in what I intend to say with regard to foresters and forestry, it might be well for me to begin by offering a definition of both terms. I would define a forester as a man skilled in the practice of forestry. Such a definition leaves entirely out of consideration the question of how such skill is secured, and avoids completely the subject of forest school preparation, which is only one means by which skill in forestry may be acquired. Of course, as in everything else, the final value of a forester's skill depends almost wholly on his own energy, character and ability, in other words, on his value as a man, and in not a few cases the forester who has acquired his training outside of a forest school is the more successful, not at all because of the method of acquiring skill in forestry, but simply because of superior ability and force of character to start with.

This definition does not, however, settle many controversies, because it leaves the term "forestry" itself undefined. Forestry I would define as the art of producing and marketing wood crops on a sustained yield basis. Forestry, it seems to me, is primarily distinguished by the conception of the forest as a crop to be periodically harvested, and not as a mine to be worked out and abandoned. The practice of forestry may then be either extensive or intensive. The more extensive the practice the less of the close detail of forest management is involved, the further away is the forester from the forest itself, and the less, under a given

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set of conditions, is the actual financial return from a given area of forest land.

Technical Practice vs. Present Administrative Demands

Forestry includes two very well marked aspects, the administrative and the technical. Under conditions that exist in America these are very frequently widely separated from each other, so that we have the very common occurrence of men wholly without technical knowledge, actively and successfully engaged in the administration of forest properties. The question, therefore, immediately presents itself, "Why train men to become technical foresters if they are really to be employed as non-technical administrators? Would it not be more logical to train them as administrators with some elementary forestry as a side issue?" Undoubtedly it would if there were not always in the background the idea that ultimately trained foresters would practise forestry, not simply administer timber lands.

Now I take it that you will agree with me that as foresters we are primarily interested in seeing forestry practised to the fullest degree that is economically feasible. We are interested on the one hand as a matter of bread and butter, and on the other because we believe that the handling of the nation's forests on a sustained yield basis is fundamentally the right national policy, and the best all-round procedure to follow in dealing with this important national resource. I personally fail to see how the existence of a body of trained professional foresters in any country can be justified except on the basis of the present or ultimate practice of forestry in a technical sense, any more than you could justify the existence of a body of trained agriculturalists except by the practice of scientific agriculture.

This, of course, brings up the rather hackneyed comment that forestry can only be practised where it is economically practical, and that it will be so practised when and where economic conditions permit. With the former I have no quarrel except to point out that in state forestry, local interests, particularly when extremely vociferous, are very frequently allowed to defeat a national policy that is entirely feasible from a national economic standpoint, although temporarily disadvantageous to the immediate locality.

The assurance, however, that forestry, either state or private, will be practised whenever and wherever economic conditions permit is, I believe, wholly at variance with the facts of experience, and it is very important for foresters to realize that history proves that it requires more than simply lessening or disappearing wood resources to compel the practice of technical forestry. We have a very excellent example of the truth of this in the forest conditions existing in the British Isles, where there are very large areas admirably adapted to forest production and capable of yielding much higher returns from forests than from the uses to which they are now being put, which, nevertheless, are not being used for forest crops in spite of the clear economic gain that would result from such use. It must be clearly apparent that if, under such a combination of favorable economic conditions as exists in England, and more especially in Scotland and Ireland, the practice of technical forestry on an intensive basis has not become established, there must be other forces at work that have a strong influence in determining whether forestry will or will not be practised even where economically profitable. Many other almost equally striking examples suggest themselves. For instance, we find Australia and New Zealand scarcely recognizing the existence of the science of forestry, although importing at great cost a very large part of their wood supplies, while India, with a surplus of wood, has a well-developed forest policy and practice. We find similar contrasts in the United States as between the progressive policy of Minnesota and the standpattism of Michigan. In fact, we need not go outside our own country, for no greater contrast exists anywhere than that between the vigorous and far-sighted policy inaugurated in British Columbia, where there is probably more available forest per capita than anywhere else, and the deplorable condition existing in Ontario under the most favorable natural and economic conditions in Canada.

Retarding Forces to be Reckoned With

The truth of the matter is that economic conditions alone probably never in any place gave rise to the practice of forestry, but that there are equally strong social and political forces that must be reckoned with. It follows, therefore, that foresters, who are the best informed members of the community on these subjects, and who are certainly parties at interest in the case, must align themselves on the side of those social and political movements which are essential for the adoption of forestry as an indigenous practised profession instead of an exotic curiosity, or else must be indifferent to the success of their own profession. Furthermore, a pioneering profession, such as forestry is with us, cannot be content with a slow development, but must have a vigorous aggressive policy and growth, until it becomes an established national fixture. We have had some recent striking illustrations of what happens to an invading army that loses the initiative. The same thing can just as well happen to a new profession that gets into a self-satisfied rut. Possibly in a hundred years or so our professional successors may be able to regard their profession as securely established if we do our part now. Certainly the present generation of foresters, either in Canada or the United States, cannot for a moment lose the initiative without risk to the entire success of the practice and profession of forestry. This statement is based on the premise that professional foresters cannot reasonably continue to exist except under conditions that permit the actual employment of those special qualifications which they possess; that is, their technical training, and that wherever the actual practice of forestry remains as widely divorced from the theory of forestry as it is with us at present, the inevitable result must be the replacement of the technical forester by the non-technical administrator, and, I believe, rightly so.

The plans of the Forestry Branch for undertaking forest investigations are based on the assumption that by forestry we mean more than merely fire protection and the accounting for revenue, but that intensive management of forest properties, both state and private, should be dependent upon economic feasibility only, and that social or political conditions antagonistic to such practice are detrimental to the best interests of the State. The Branch believes that there are portions of Canada where economic conditions warrant a much more technical administration of state-owned timberlands than is now being given them, and in anticipation of future progress in these regions it aims to secure the necessary information upon which such technical management may be based. While to a considerable extent the investigative work must at first be largely in connection with Dominion forest lands, there is no intention to limit the work to such lands. The Branch wishes to make use of its special facilities as a nation-wide organization to secure and assemble all the information possible for the use of all foresters in Canada, believing that the success of forestry as a whole is contingent upon the success of each individual unit, and that anything that contributes to this individual success must inevitably benefit the profession as a whole.

Forestry and National Prosperity

Now, before explaining the details of the plans of the Forestry Branch in this connection, I wish to refer briefly to two closely related subjects of general interest which are vitally important to foresters, and about which there have appeared lately some very loose statements. One of these is the relations which should exist between the individual and the State. There is a tendency, I think, to attribute the present difficulty in Europe to a conflict of two ideas of national organization, the individualistic and the communistic, alleging that Germany's militarism is the result of the idea of the supremacy of the State and that therefore this idea is itself wrong. Undoubtedly militarism, as this term is commonly understood, can scarcely be evolved in a State where the individual is held to be supreme, but neither can any other form of activity that requires national cooperative effort with a long view ahead, and such is the practice of forestry most assuredly. The mistake is made in assuming that militarism inevitably results from the idea of the supremacy of the State. This, I believe, is a false assumption. Whether or not this is a fact, however, these two facts remain, that (1) without a general acceptance in Canada of the idea that in many respects the interests of the State are supreme over those of the individual, forestry will never be practised in this country; and (2) without the practice of forestry, Canada can never realize more than a very small fraction of its national possibilities.

This latter statement deserves some further comment, although Mr. MacMillan, in his recent article on "Forestry in Canada," in the *Proceedings of the Society of American Foresters,* has pointed out in some detail the vital connection existing between our forest resources and our national prosperity. Mr. MacMillan shows that, considering the *entire* land area of the country, only

25 per cent can be considered of agricultural value, while only a very small percentage of this is at present cultivated, and probably several generations will pass before it is largely brought into use. It is not the low percentage of cultivatable land area that is most important, however, for this is still very considerable in actual area, but rather the geographical distribution of the possible agricultural land that constitutes the more important problem, and involves the profession of forestry in a great national question. As you all know, the agricultural portions of the country are roughly seven in number, separated from each other by non-agricultural areas of greater or less extent and strung along 3500 miles of longitude very much like beads on a string. We have, first, Nova Scotia and the lower coast valleys of New Brunswick, highly developed; then the rough forested region lying between eastern New Brunswick and the St. Lawrence; then the second agricultural area in the St. Lawrence and the Ottawa valleys, followed by a narrow belt of forested Laurentian country running northwestward from Kingston toward North Bay. The third and at present most important area of developed land is the Niagara peninsula, but this is separated from the fourth area, the Prairies, by 1000 miles of the most absolute forest soil in America. The agricultural area of the Prairie provinces is, of course, several times greater than all the rest combined. West of it lies the Rockies, 270 miles wide before Sicamous and the Interior plateau is reached; then a possibility for scattered settlement over a hundred-mile width of the Dry Belt, followed by the 150-mile mass of the Cascades, and finally by the limited agricultural areas of the Coast. Except the Prairies, all these agricultural areas are comparatively limited in extent, and some, as those in British Columbia, are badly broken by non-agricultural land, affording room for only a very scattered settlement. All of them are, however, surrounded on all sides except the south by forest areas across which their lines of communication lead. There can be only one result of a geographic situation such as this. Unless these non-agricultural lands are made productive enough through forest growth to support a continuous forest industry, and therefore a permanent population, they will constitute a drag on the development of the entire country by their passive resistance to transportation, communication, local government and all general public activities with,

of course, a consequent enlarged burden of taxation on a limited population. This continuous forest production means sustained annual yield, secured by proper forest management, successful or unsuccessful according to the relationship maintained between demand and productive capacity on the one hand and actual production on the other, and none but foresters, trained and skilled in the practice of forestry, can possibly introduce and maintain such a forest policy.

Annual Destruction and Reproduction

At the present time undoubtedly our forests are producing a large surplus over demand, but for how long can we assume the continuance of this condition? Furthermore, what is the rate of destruction of merchantable-sized material in our forests and what is the rate of replacement? More important still, what destruction is taking place in our unmerchantable forests and reproduction? Studies of past destruction in quite recent times have yielded some startling results. The Forestry Branch has now covered some 100,000 square miles with reconnaissance surveys and found less than 10 per cent bearing timber over 50 years of age. In Ontario so little attention is paid to maintaining a record of fire damage that a single fire covering quite 150,000 acres, and destroying well over 80 million feet of White pine timber, was not even mentioned in the annual report of the Forest Department. Canada spends annually at least $1,300,000 for forest protection alone, and yet there is not a single forester or forest officer in Canada who can give even an intelligent expression of opinion on the results being secured for this vast expenditure. About all that we know is that the money is spent, and if it is a wet season we congratulate ourselves that there have been few disastrous fires, while if it is a dry season we spend a little more money and tell how much worse things would be were it not for the presence of the fire rangers in the woods. When we consider that if the United States spent as much per capita as we do in Canada for forest protection, their annual fire bill would be about $20,000,000, instead of being more nearly $2,500,000, or only about double our own, we can begin to realize the enormous comparative drain that fire protection makes on the resources of the people of the two countries. Furthermore, the area actually covered by fire protective forces is not materially less in the United States than it is in Canada, and yet it is pretty generally agreed in the States that the forest fire problem, except in a few very conservative states of the South, is solved, and all that is now necessary is to see that the feeling of security does not result in a lessening of annual effort and appropriations.

Now, these fire problems are of very considerable importance to foresters because adequate fire protection must necessarily be our first step toward proper forest management and ultimate sustained yield, and unless we can secure such protection at a reasonable cost we might just as well quit the business, because we cannot hope to undertake the more technical branches of forest management until we have a demonstrated basis of efficiency in fire protection upon which to build. Lest anyone think we are a long way from extravagance in forest protection expenditures, I would point out that there is a forest reserve in Ontario where the fire protection costs 7 cents per acre per annum and there is one man to every 9000 acres. This approaches rather closely to European standards as regards expenditure, but not as regards results. It has been necessary for me to give some attention to the question of forest protection expenditures and results in Canada as compared with other regions, and my general conclusion has been that, except in one or two instances, our main problem is not the securing of more funds for fire work, but rather the securing of a rational control over the expenditure of the funds appropriated, and that surprisingly large areas of Canadian timberlands are, from the expenditure standpoint, the most thoroughly protected forest lands in America. As a general problem throughout Canada, it is not more money that we need, but more efficiency in the use of the funds we already have available.

The Mission of the Forest Expert

This brings up the second general question of public policy that is of direct vital importance to foresters, namely, the proper rôle of the expert in government activities. It was long held as an axiom of democracy that the best government was that which governed least. That was the theory which animated a large number of the founders of the American Republic, and for a hundred years or more this theory had full opportunity to demonstrate its worth in the United States. The result has been a realization that governmental systems work well only when thoroughly adjusted to the economic, racial, social and industrial condition of the people, and that no general theory is applicable to even the same people under different conditions. Consequently, with the changes that have taken place in the racial and industrial conditions in the United States there has come a marked tendency to place upon the central government greater and greater responsibility for national undertakings that have an intimate relationship to the daily life of the people. Naturally, if these national enterprises do not pay expenses the difference must be made up in the form of taxes, and as few men are able to escape the tax collector, the question of efficiency in governmental administration becomes one of direct import to every citizen unless we are prepared to admit that the government owes every man a living whether he earns it or not.

This brings up the question as to who is best qualified to perform the functions of executive government. It was long held in the United States that the functions of government were essentially so simple and commonplace that they could be performed by any ordinary citizen. In a simple agricultural community, with no complex internal industrial relationships, no great problems of foreign trade or policy, and abundant room for internal expansion of population, a government of this simple character may work satisfactorily. But the moment the government undertakes to perform tasks of a technical character, tasks which involve the possession of special qualifications in the personnel, then the necessity immediately arises for the establishment of a system for securing government officers who possess these special qualifications; in other words, the expert becomes an indispensable part of the government machinery. The introduction of the expert into governmental activities has met unusual difficulties in America, not because of economic or political conditions so much as because of social conditions. In practically all European states the great mass of the people has always been accustomed to more or less rigidly drawn lines of class distinction, with the commonly accepted idea of a governing class specially endowed with the privilege of exercising the leading part in the national government. Where these governing classes have performed with reasonable honesty and efficiency, results have been satisfactory. Where corrupt and inefficient, revolutions have commonly resulted. In the United States, however, and also in Canada, the whole fabric of rigid class distinction has been rejected and forms no part of the underlying principles of government. Consequently, as soon as the functions of government assume a technical character, or demand qualifications that are not found in every average citizen, there is no intellectual class with a recognized right to fill the deficiency, but a special class of technical government employes must be created. This introduction of the trained expert into executive government seems to meet special difficulties in Canada because a very large element of our population is still strongly influenced by the fear of establishing a governing class, while another large element has not yet realized the consequences resulting from a society without such a class, and there is as yet no large element of our population accustomed to the employment of the technical expert in government activities. Further, the introduction of the forest expert into Canadian government forest administration meets very special difficulties because the forestry expert is almost a pioneer both as a technical expert and as a practitioner of an art that is nowhere else established in the self-governing portions of the British Empire.

Must Shoulder Heavy Responsibility

To sum up, therefore, the Canadian forester has a heavy double responsibility. He must on the one hand convince the nation of the vital connection that exists between national prosperity and the conservation of forest resources, and, on the other, he must demonstrate his fitness for handling the nation's forests in an efficient manner. To do the first he must have ample and accurate information of actual forest conditions throughout the country. This the Forestry Branch plans to furnish him. To accomplish the second he must be given much greater powers over the forest personnel than is the case anywhere in Canada today. It is not so easy to suggest a way to bring this about, but every forester in Canada who has had an opportunity to compare a politically appointed personnel with a non-political personnel realizes that the elimination of politics from the question of staff selection is the greatest of all reforms needed to secure efficiency. At least 80 per cent of the forest protection appropriations go into salaries and wages. This alone would demand that an overwhelming attention be devoted to securing a thoroughly effective type of men. But in no other commodity that we purchase is there a possibility of such an enormous variation in quality as in the case of human labor. Were it a question of paying simply double or triple or quadruple prices, we might consider the case serious, but not absolutely hopeless. But when we deal in human labor we can easily find such divergent efficiencies as one to twenty or thirty or fifty. I have been interested for a number of years in collecting instances of comparative labor efficiencies in different lines of forest work. A recent and not at all unusual case brought to my attention shows what may easily occur in forest administration. A crew of three able-bodied rangers in a certain portion of a Western province was engaged with a team in getting out logs for a house. At the same time a nearby rancher, who was a cripple, assisted by a boy of about 14 and a decrepit team, was getting out similar logs for a building slightly larger, from the same body of timber. The rangers required 15 days to do the work—the rancher 3 days. Considering the difference in the number of men and the wide divergence in physical ability of the men and horses of both outfits, I figure the comparative efficiency in this case as being in the ratio of 1 to 15. Now, we may succeed on an efficiency of 50 per cent or even 30 per cent, but an efficiency of only 2 per cent to 6 per cent hardly looks very promising, and a great many of our politically appointed forest officers, if honestly and intelligently gauged, would have difficulty in showing any higher grade. Personally, I believe that the obviously ridiculous state of affairs that exists in some of our forest protective organizations, notably in Ontario, cannot possibly continue very much longer, and the Forestry Branch takes the optimistic view that whatever changes occur must be in the direction of greater efficiency and, therefore, better forestry. Consequently, the Branch plans to arrange its work so as to build up a corps of trained foresters within its organization which will be available for the work of technical forest management not only on Dominion lands, when that becomes feasible from all standpoints, but which, so far as possible, may furnish material to provincial and private forest administrations that are in a position to do work of this character.

New Efficiency Methods Essential

The way in which the Forestry Branch plans to undertake the securing of the information about Canadian forests which is recognized to be so vitally necessary for future progress in forest organization in many sections of the country is through the organization of a new Branch under the Director of Forestry, to be known as the Office of Forest Investigations, and to be placed under a separate chief who will have direct charge of all work of a technical character except that on the Forest Reserves. The form which it is planned to give this Branch, and its relationship to the rest of the Forestry Branch organization, may be best understood from the report upon which this organization is based. As regards the general scheme of organization the report reads as follows:

"To accomplish the most valuable results in work of this character the administration should consist of (1) a General Staff or Advisory Board consisting of the best available experts in the principal divisions of technical forestry, who shall act as a planning and advisory committee to assist the Director; (2) a chief executive officer, who shall be a technical forester with both administrative and investigative talent responsible directly to the Director; (3) a trained staff, which shall consist of specialists in each of the principal research departments responsible to the Chief of Investigations, and (4) one or more independent inspectors without executive authority, who shall report to both the Director and the Advisory Board.

This administration can best be accomplished by selecting the Advisory Board from outside the Forestry Branch at present; by appointing as Chief of Investigations the best Canadian forester available; by giving him charge over such technical branches as are already established and such additional technical assistants as can be secured, and by appointing temporarily whatever trained collaborators are available to enable an immediate start to be made, and to assist in the training of research officers for the Research staff.

The details of this organization as hereinafter suggested are not necessarily to be considered permanent. I believe that a General Staff, whose function shall be the insuring of proper design in all work undertaken, is an essential part of such an administration. Ultimately this staff may be selected from the Office of Investigations itself, and other considerations may require its members to exercise executive as well as advisory functions. This need not, however, wholly obscure the distinction in function which is the basis of this scheme for administration.

The organization proposed aims to combine under one chief technical executive officer all the technical forestry work of the Forestry Branch except that of the Forest Products Laboratories, which is placed on the same plane of importance as the Office of Investigations. It will be evident that the work of the Forestry Branch falls under two main heads, administrative and scientific. I doubt the possibility of successfully combining these at present, under the conditions which govern the personnel policy of the administrative staff. I feel, therefore, that the two should be entirely separated, and propose herein a scheme for such separation by bringing under the Office of Investigations all the various technical activities of the Forestry Branch, either existing or proposed. These activities may then be assigned to their proper places in the organization, the organization may itself be definitely charted, and all members of the Staff may know both their own position and that of each of the other members. This clear definition of responsibility and line of authority is a fundamental essential for efficiency in executive work, and once established it must be scrupulously respected by the directive officers of the higher ranks.

An Investigative Staff Needed

To provide for successful operation a trained staff is essential. No matter how efficient our design or organization, this work cannot be carried out properly without trained and experienced workers. Here we are confronted with the problem of building up a personnel for which there is at present only limited material. As in the provision made for the Advisory Board, I am suggesting again a temporary expedient by which, through the employment of collaborators, I aim to train up in the Branch an investigative staff capable of carrying out research work on an independent basis. The details of this scheme will be found in the body of the report.

Finally, a system of independent inspection is required for correlating the various activities of the Research offices and insuring the maintenance of uniform efficiency throughout, as well as keeping the directive staff and the Advisory Board fully and immediately informed of the progress of the work on the various projects. This I conceive to be somewhat in the nature of an independent audit, and propose an inspection service responsible only to the Director and Advisory Board without executive function. Such an inspection service will form the bond of unity between the various other units or main divisions of the entire administration, and is absolutely essential to the proper correlation of the work of the entire department.

The ideal of this administration, based upon world-wide experience, should be the establishment of Experiment Stations suitably equipped and distributed, which stations should be developed to cooperate with the administrative staff in the training of administrative officers in technical duties by evolution from experiment stations alone, into staff colleges. This development will insure, (1) the minimum of expense, and (2) the maximum of coordination with the administrative work of the Forestry Branch, which taken together should produce maximum efficiency. This evolution must naturally be extended over a considerable period of years. Its course will depend entirely upon the progress of forestry in general throughout the Canadian forests, and also upon the public support granted the Forestry Branch in the extension of scientific forestry methods to the Forest Reserves, and the building up of a forest personnel on a basis of training and fitness for forest work. It should not be anticipated, however, that any development of training facilities for which the research office may be responsible will compensate for defective machinery or principles in the selection of forest employes. This is not a reasonable supposition, and the elaboration of training facilities through the investigation office should be expected to follow, not precede, reform in methods of appointment in the forest reserve staff."

One of the features of the organization described above, which is somewhat novel in its composition, is the Advisory Board. This may also be briefly explained by quotation from the report commending its establishment as an integral part of the investigative organization. This report reads as follows:

The Function of Design—Advisory Board

"The first consideration is the General Staff or Advisory Board. Without going into details, I would point out that such a central planning committee is a feature of most of the forest research organizations in foreign countries where notable results have been accomplished, besides being one of the most important modern developments in the science of administration throughout all activity. Various forest research organizations differ as to the details of the composition and duties of this General Staff, but few successful ones omit it from their make-up. As I see the situation, I conceive that this staff should fulfill the following fundamental requirements:

1. It should be composed of our best available experts in the principal lines of importance in forestry.
2. It should be intimately associated with the Forestry Branch and know the problems of that Branch in great detail.
3. It should have the widest possible view of the general forestry situation throughout the Dominion.
4. It should be of such a size and composition as to be readily assembled for conferences.
5. It should, if possible, be so composed as to provide for inspection of field operations and the work of the executive staff from among its own members.

Duties of the Advisory Board

1. To suggest projects for investigation and methods for carrying out such projects, if necessary.
2. To pass upon all project plans, elaborated by the executive force either as a result of Staff suggestions or made upon the initiative of the executive; no projects to be carried out unless approved by a majority of the General Staff.
3. To receive, periodically, such progress reports, made in such form and at such times as the Staff may decide upon the various investigations being carried out by the Investigative Office.
4. To review before publication the results of all investigations.

Composition of the Advisory Board

In order to handle this work successfully and expeditiously, and to accomplish the fundamental requirements previously designated, I conceive it to be essential that there be two main divisions of the General Staff or Advisory Board.

To insure a broad view of conditions throughout the country, a rather large membership is essential, but to accomplish any real results the responsibility of the Board must be centralized in as few members as possible. I would, therefore, propose an Advisory Board of from 10 to 15 members, with an Executive Committee of three to five members, both to be appointed by the Director of Forestry. The functions of the Advisory Board shall be those previously mentioned, but any action taken by a majority of the Executive Committee shall be considered the action of the entire Advisory Board. The entire responsibility for the activity of the Advisory Board will therefore lie with the Executive Committee, which must be so constituted as to guarantee the carrying out of these duties."

Work to be Systematized and Standardized

It will, of course, be noted that the scheme as suggested is partly a re-organization of certain existing offices of the Forestry Branch and partly involves the establishment of new offices. Two of the main subdivisions of the proposed office of Forest Investigation are already in existence with both an office and a field staff, and have done considerable work on Dominion lands. It is proposed to bring these offices under the charge of a Chief of Investigations, so that their work throughout the country may be more thoroughly systematized and if possible standardized in cooperation with other Forest Agencies, and also so that their work may be brought in line with the results of such forest research work as will be undertaken by the new office. This research work will of necessity be confined at first to rather elementary forest investigations, such as the preparation of volume tables, the study of silvical characteristics of important trees, the study of forest types in various localities, the establishment of permanent sample plots and the study of forest fire influences, methods of protection and methods of brush disposal. There is also a considerable amount of standardization work that might be undertaken by such an organization as is here proposed, in cooperation with all other forest agencies, so that work being done throughout the country along these lines may, at least, have a uniform value.

The proposal contemplates carrying on cooperative work on a very extensive scale, and the Advisory Board has been selected so that every forestry organization and agency in the country is represented, not only with the idea of securing a general representation throughout the Dominion, but also with the idea of stimulating the cooperative work. A considerable responsibility is, of course, placed on the executive of the Advisory Board, but none of the members of this executive are regularly employed by the Forestry Branch and all have other duties which occupy the greater part of their time, so that it is hoped that the various cooperators, and especially the various members of the Advisory Board who are connected with other large forest organizations, will be active in preparing detailed plans for forest investigations needed in various portions of the country to be submitted for the consideration of the executive.

The Forestry Branch is assured of the funds necessary for carrying out work of this character at least on a scale commensurate with the importance given to such work in the forest organization of other countries, and the success of the work depends, first, upon the ability of the Chief of Investigations, who has not yet been selected, and secondly, upon the spirit of cooperation shown by the various other forest organizations in the country who are directly interested in work of this character. In this connection I might say that the Forestry Branch looks to the Province of British Columbia for very material cooperative assistance, for the reason that it is recognized that British Columbia has already gone farther in work of this nature than any other provincial forest organization in Canada, and although the interest of the Dominion Forestry Branch is perhaps less in British Columbia than it is in some of the other western provinces where there is a great deal more territory under its charge, nevertheless its British Columbia interest is sufficient to make the Branch very desirous of organizing its investigative work in British Columbia in close cooperation with the Provincial Forest Service.

What Is Being Done in Other Lands

As an indication of the importance given to investigative work in foreign countries, I attach hereto a tabular statement of such work in various other countries.

Country	*Research Agency*	*Number*	*Approx. Annual Expenditure*
Sweden	Government Experiment Station	1	$5,000
Russia	Forest Experiment Stations, Imperial Forest Institute	12	150,000
India	Imperial Forest Research Institute	1	52,000[1]
Germany	Forest Experiment Stations at State Forest Academies	7	70,000
Switzerland	Same	1	10,000
Austria	Same	2	......
France	Same	1	......
United States	Forest Experiment Stations	9	215,000
United States	Forest Product Laboratories	3	180,000
United States	Forest Schools (Complete courses)	23	12,500
United States	Forest Schools (partial courses)	52	5,000

[1] Equipment and buildings cost about $70,000.

CURRENT LITERATURE

The Southern Cypress. By W. R. Mattoon. Bulletin 272, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C., 1915. Pp. 74.

Thirty years ago, in the early beginnings of an interest in the subject of forestry, the reviewer, then Chief of the Division of Forestry in the Department of Agriculture, as one of the first undertakings planned a series of monographs on the important timber trees of the United States. Their object was to be to bring to realization the importance and value, and the development and requirements of the species as a basis for devising proper methods of silvicultural management. At that time appropriations were scanty and all that could be done was to interest botanists as voluntary collaborators for a nominal honorarium to produce what they could, the plan of the work being outlined to them.[1]

The White Pine by Spaulding and Fernow, and *The Timber Pines of the Southern States,* by Mohr, were results of this plan, published, to be sure, many years afterwards, when improvement in appropriations had permitted to add the result of more special studies and measurements.

Among the species so farmed out, as it were, was the Bald cypress. Mr. A. H. Curtiss, a botanist of good repute, familiar with the Southern forests, had the assignment and furnished an essay in which he laid down his knowledge; but it was lacking in precise data and hence was not published. Later, it was handed to Dr. Mohr for amplification, and toward the end of the reviewer's administration Dr. Mohr submitted a report, which was not published, but it is quoted by the author of the above Bulletin.

Now, with ample funds to travel, to measure, to study, a man applying himself exclusively to the one task in hand of studying the species in all parts of its field, it should be possible to produce, if not much better, yet much fuller results. The author has used these opportunities to best advantage and certainly has made a

[1]See Annual Report, Division of Forestry, 1886, pp. 177-8.

very full and as complete as possible study, covering all points on which the forester would seek information, and that on only 74 pages, which argues that not much superfluous language is used. All statements are simple and clear, direct to the point. On 18 pages generalities, the customary market statistics, supply and cut, and prices are discussed; 30 pages give the life history of the tree and of stands, including growth tables; 20 pages are given to discussion of forest management; an appendix brings volume and taper tables.

The absence of growth curves and percentic increment calculations is to be regretted, but probably explained by the relative paucity of growth measurements.

Although the painstaking work entitles the author to be believed in every particular, we venture to raise doubts in a few cases.

In the statistical part it is interesting to note that the supply is still supposed to suffice for 40 years with a cut of one million feet. In the biological section we had hoped that a final conclusion as to the function of the cypress knees might have been arrived at. We cannot yet accept the author's conclusion that the mechanical theory is any better supported by the evidence cited on page 29, than the respiration theory. On the contrary, three of his points could be cited as well in support of the latter. The possession of such a respiratory apparatus helps to explain the remarkable hydrophytic character of the species.

This adaptation to wet conditions in which it approaches the mangrove is perhaps the most interesting biological fact. While it may be true, as the author seems to have proved, that cypress "successfully establishes itself only in situations of very abundant moisture," but subsequently shows more rapid growth on better drained situations, we are loath to accept the implied sequence that the cypress exists in the watery environment preferably and not through the inability of other species to stand as much moisture. The author speaks of the alluvial swamps as acid and hence unfavorable to tree growth. Have these waters been actually analyzed for the acid condition?

Regarding shade endurance, the statement that cypress "will endure partial shading for periods of considerable length" and yet "cleans itself readily of branches" would appear contradictory, the latter habit undoubtedly being a result of intolerance.

The very rapid height growth in the juvenile period also is an indication of intolerance, while, to be sure, the remarkable persistency of height growth might lead one to class it with the slower but more persistently growing tolerant. The longevity of thespecies, however, accounts for this persistence, the tree growing for 1,000 to 2,000 years, attaining heights of 150 feet and diameters of over 8 feet. The difference in rate of development of virgin and second growth is shown in various tabulations. Virgin cypress yields are stated to run generally from 8,000 to 14,000 board feet, but occasionally over 20,000 feet per acre on considerable areas, and selected acres may yield 50,000 and even 100,000 feet. What second growth or plantations may produce is, of course, not yet ascertainable.

Since cypress occupies some 42.5 million acres of what is considered permanent swamp, unfit for profitable cultivation except for timber, and since reclamation of reclaimable swamp lands would cost on the average over $80, hence will for a long time not be undertaken, the question of forest management is important. Such management, according to the author, refers to the handling of present supplies rather than to extension of the species and reproduction. It is a question of market changes rather than silviculture which dictates the leaving of certain diameters for later harvest to the lumberman. Conditions where such delay in harvest is profitable vary. The conditions where cutting to a diameter limit is promising policy are discussed. As a rule in a representative stand cutting to an 18-inch diameter limit will leave only 8 to 10 per cent merchantable material. In a given case, cutting to 16-inch, 750 board feet worth $3.75 would be left, a small investment for a second cut, since no fire danger is to be anticipated, and the diameter increase in the trees left may be as much as an inch in little over two years, and 8 to 10 board feet per tree. A table showing board feet and percentic increases for trees of different diameter and various financial calculations are evidently designed to interest the lumberman. Although there is not much hope of the use of cypress in planting operations, the author can report a plantation of some 75,000 trees in Ohio, which excels in rapid growth, making 24 foot trees in 10 years. The planting and nursery practice is detailed. With a set of volume and taper tables this most complete and satisfactory study comes to an end. B. E. F.

Studies in Tolerance of New England Forest Trees. By G. P. Burns and F. P. Hooper. Bulletins 178 and 181. Vermont Agricultural Experiment Station. Burlington. 1914. Pp. 127–144; 235–262.

The investigations described in the above bulletins were made mostly upon the behavior of White pine seedlings under various controlled and instrumentally recorded conditions in the Vermont State Nursery at Burlington. The first bulletin has the sub-title of Development of White pine seedlings in nursery beds, and the second bulletin, Relation of shade to evaporation and transpiration in nursery beds.

The loss of seedlings by the damping off disease has been thoroughly checked by applying to the soil previous to planting 36 gallons of one per cent formaldehyde solution per 32 square feet or 26 gallons of water and 4½ fluid ounces of commercial sulphuric acid for each 24 square feet. The two fungicides seem equally efficacious. Experiments on the influence of depth of planting upon germination showed that germination under one-half inch of sand was almost sixteen times as great as under barely covered condition and more than twice as great as under one-fourth inch cover. The limiting factor seems to be the water content of the soil, for in case of the shallow planting where the surface layer of the soil was given sufficient moisture to prevent drying out, the number germinating was practically the same as in beds with deeper planting. Shading by retarding evaporation had the effect of overcoming the disadvantages of shallow planting.

Beds were prepared under full lath-shade, one-half lath-shade and no shade, and it was found that full shading did not increase the number of seedlings produced, although it gave a somewhat more even stand, but it did delay the germination about two weeks. The light intensity values in the no-shade beds were sometimes thirty times greater than in the full lath-shade beds, and it was only in the no-shade beds that the temperature values reached the optimum for germination. This was in the month of May. The conditions of these two factors explain the delayed germination in the shaded beds. Three months after planting the seedlings without lath-shade were in much more vigorous condition than the shaded seedlings in respect to length and number of roots and condition of foliage. For example the number of lateral root branches was 5, 143, 468 respectively for the full-shade, half-shade, and no-shade conditions.

The average green weight of plants in the no-shade bed was almost twice that of those grown in the half-shade and a little less than four times that of those grown in the full-shade bed. The dry matter grown in the no-shade bed was almost twice as great as that grown in the half-shade bed, and six times more than that grown in the full-shade bed. The average ash content in the plants in the no-shade bed was over five times as much as that in plants of the full-shade bed, but the latter were richer in the percentage of ash.

The second bulletin under notice deals with the problem of the influence of lath covers upon water-loss from the White pine seedlings and of the relation which such water-loss bears to the evaporation from porous cups, atmometers, of the Livingston type. The observations were made during the first two weeks of August in fifteen four-hour periods. Under the no-shade condition the average transpiration from six pine seedlings was compared with the evaporation from the atmometers. During the fifteen periods the average water loss per plant from six seedlings was: no-shade, 8.89 cc.; half-shade 3.42 cc.; full-shade, 0.47 cc. At the same time, the evaporation from a black atmometer was 141.67 cc., 98.83 cc.; and 53.33 cc. respectively for the no-shade, half-shade and full-shade conditions. The ratio of evaporation to transpiration, or the evaporation-transpiration coefficient becomes .063, .035 and .0088 in the three conditions in the order enumerated above. It was found that the effect of cover on the plants was more marked than upon the instruments.

At the close of the experiments the plants were removed from the beds and the average dry weight of the seedlings in each case determined. The relation of water-loss from one gram dry weight of seedlings grown in the different beds to the water-loss from the atmometer from the same bed was found to be: no-shade 1.53, half-shade 1.64, full shade 1.62 in the case of the black atmometer. Comparing this state of affairs in three-month-old seedlings with that of two and three-year-old seedlings, the authors find that per gram of dry weight, the former give off much more water than the latter, and hence they conclude that the younger seedlings in nursery beds need some kind of protection from evaporation.

The reviewer cannot see how the above conclusion of the authors logically follows the data presented, since no evidence is presented that the greater loss of water has any detrimental effect upon the young seedlings. Although it is a common method of procedure among investigators of this subject, the reviewer would question in all cases the value, for comparative purposes, of conclusions based upon transpiration in relation to the dry weight of plants of different ages. As a plant grows older, it has a larger proportion of cells not employed in the conduction of water or in the loss of water vapor. By adding the dry weight of these to the calculation, one naturally reduces the ratio of transpiration to the dry weight of the entire plant. The leaves, of course, in a seedling form a larger percentage of the total dry weight than in a plant a few years older. Suppose a hypothetical case of two plants of different ages and sizes transpiring identical amounts of water, the relation of transpiration to the dry weight of the two plants could not be the same.

C. D. H.

The Testing of Forest Seeds During Twenty-five Years. By Johannes Rafn. Printed for Private Circulation. Pp. 91.

The well-known head of the commercial Scandinavian Forest Seed Establishment gives in this brochure the results of 25 years' experience in testing forest seeds in connection with his business. The actual germination tests were made in the Jacobsen germinating apparatus at the Danish Seed Testing Station, a State institution which carries on about 12,000 tests of agricultural, garden and forest tree seeds in a season. The results of the germinating tests are given under the following headings: weight of 1,000 seeds in grams, number of seeds per kilogram pure seed, per cent purity, per cent germinating capacity (germinated and sound), real value and the course of germination (the per cent germinated in 5, 10, 20, 30, 60, 100, and 100+ days). The real or practical value given in the tables is the per cent purity multiplied by the actual germinating per cent plus the sound but not yet germinated seeds, at the time the test is closed. Such results are given for about 150 species and varieties of conifers and about 100 broad-leaved species from the temperate regions of the earth.

Some remarks of the author upon American conifers may be of interest to American silviculturists. In regard to *Abies concolor* from the Rocky Mountains and from the mountains of the Pacific coast, he believes that they are two different strains of the same species, for according to his experience, seed from high elevations near the Pacific coast produce grayish-blue plants of somewhat weak growth; plants which resemble the Rocky Mountain ones much more than the vigorous green *Abies concolor* from seed from the lowland forests of the Pacific coast. The difference between these two types, however, is not nearly so great as that between the quick growing green Douglas fir from the Pacific coast and the much slower growing glaucous Douglas fir from the Rocky Mountains, or between the very quick growing Shore pine (*Pinus contorta*) of the Pacific coast and the slow growing Lodgepole pine from the Rocky Mountains. He believes it erroneous to consider the latter two as one very variable species.

Abies balsamea is, in the author's experience, the only species of Abies that preserves its germinating capacity till the spring of the second year after harvesting. The seed of *Abies balsamea, A. nobilis, Chamaecyparis lawsoniana*, and *Picea alba* of Danish origin is better, larger sized and of higher germinating capacity than that from their native home. This is probably due to the better site conditions of the ornamental trees. The seed of Sitka spruce from the State of Washington is not easy to bring to germination. It requires higher temperature and even then progresses more slowly than that of the other spruces.

The seed of *Pinus murrayana* from the Rocky Mountains generally almost all germinated (81%) in 10 days; 93 per cent in 20 days, while the seed of the same species from the Sierra Nevada had germinated only 3 per cent in 10 days and 21 per cent in 30 days. Owing to its sluggish germination, the sowing of the latter in the nursery often fails. As with the other more or less slow germinating species, this seed should either be carefully prepared by steeping and germinating before sowing—like *P. jeffreyi* and *P. strobus*—or prepared a year before sowing like *P. coulteri* and *P. lambertiana*. The seed of *P. murrayana* from the Rocky Mountains has an average weight per 1,000 seed of 4.5 grams; that from the Sierra Nevada of 10.7 grams.

It will be noted that the heavier seeds germinate the more poorly. From his 25 years' experience the author concludes that there is no definite relationship between weight and rate of germinating capacity in seeds of the same species. The seed of *P. monticola* from Idaho, near the Canadian border, weighed in 1912, 15 grams, while the Californian seed of the same species in the same year weighed 32 grams per 1,000. The seed weight of *P. jeffreyi*, *P. ponderosa*, and *P. scopulorum* is 125, 46, and 30 grams respectively. The germination of the Rocky Mountain form of the Douglas fir is always better than that of the Pacific coast form. With the former the germination is far advanced after 5 days and is often nearly finished after 10 days, while with the latter germination is hardly commenced after 5 days and is not completed until 30 or more days. The author regards the two forms as distinct species. This is, of course, from the standpoint of a commercial seedsman.

C. D. H.

Injury by Disinfectants to Seeds and Roots in Sandy Soils. By C. Hartley. Bulletin 169, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1915. Pp. 35.

The experiments described in the above-named bulletin were mostly performed in the forest nursery at Halsey, Nebraska; some of them, however, in the nursery of the Pennsylvania Railroad near Morrisville, Pennsylvania. Both soil and subsoil at the former place were fine sand; at the latter place, a light gray sandy loam with a fine reddish sandy subsoil. Most of the bulletin is concerned with discussions of the use of clear, commercial sulphuric acid as a disinfectant, but others such as hydrochloric and nitric acids, formalin, ammonia, lime-sulphur, mercuric chlorid, copper acetate and zinc chlorid were employed in the experiments. The greater part of the disinfectants was applied in aqueous solutions, usually at the rate of two or three pints of water for each square foot of seed bed. The treatments were made chiefly upon Jack pine seedlings and seed beds, although those of Western Yellow pine, Red pine and *Pinus laricio* were also treated.

Some results of the sulphuric acid treatment may be briefly stated. In cases of beds treated before sowing, it was found that if germination takes place at any time during the first month after 0.25 ounce of acid per square foot is applied to the beds, it will be necessary to give more than the usual nursery watering during the germination period in order to insure freedom from injury to seedlings. When the acid was applied at the time of sowing, although in concentrations varying from 0.125 to 0.37 fluid ounce per square foot, there was no indication that the pine seed itself was injured before the germination began, but in case of the Jack pine, at least where the germination was prompt, many seedlings were killed or injured after germination, unless special protective measures were taken, even with the lowest of the concentrations given above. In fact, after the seed begins to germinate any application of sulphuric acid sufficient materially to affect the activity of the damping-off disease will cause the death of the radicles of some of the pine seedlings. As a whole, the disinfectants were most effective when applied at the time of sowing. Even then precautions must be taken to prevent injury to the roots. The best of these is to keep the surface layer of the soil moist by frequent light waterings during the germinating period and until the root tips have penetrated at least ⅝ inch into the soil. This procedure is based upon the fact that the amount of water in the soil bore a direct relation to the amount of injury, and that injury seldom occurred when the root tips had penetrated to the depth mentioned above. Evaporation at the surface of the soil increases the concentration of the poison in the soil water until the injuring or killing point is reached.

Jack pine was most liable and Western Yellow pine least liable to injury by the acid treatment. This was not because the Jack pine roots were more sensitive to the action of the poison, but because the Yellow pine roots grew faster and sooner got below the danger zone in the soil. The beds treated with acids and so watered as entirely to prevent injury to the pines were nevertheless so free from weeds that the cost of weeding the treated beds during the whole season was only one-third that of the untreated beds.

C. D. H.

Indian Forest Insects of Economic Importance; Coleoptera. By E. P. Stebbing. Eyre and Spottiswoode, Ltd. London. 1914. Pp. 648. Price 15s.

It may come to many as a surprise to see a volume of 648 pages on a single order of Indian forest insects, as we are accustomed to think of the vast insect fauna of India as too little known to render possible the preparation of such a work, and while Prof. Stebbing's book, as the author modestly remarks, "has no pretensions to be more than a pioneer endeavoring to indicate in some small degree the lines upon which the further study of the subject should proceed," there is nevertheless a vast amount of information contained within it on the life histories and economic relations of the beetles that are more or less destructive to Indian forests.

Some idea of the vastness of the subject may be gained from the author's statement, quoted from J. S. Gamble (*Manual of Indian Timbers*) that "the Indian forests contain some 5,000 different species of trees, shrubs, climbers and bamboos"; for here, as elsewhere, the number of species of insects corresponds more or less closely with that of the plants on which they feed.

The material for the present work was chiefly gathered by the author since 1898 while acting in the capacity of Imperial Forest Zoologist and Member of the Forest Research Institute, Dehra Dun, India.

The first five chapters deal with the more general phases of the subject, such as the distribution of forest insects in India (Chap. I), the methods by which the presence of insect pests in the forest can be ascertained, the general methods of control and the characteristics of the order Coleoptera. The special part treating of the various families and species of beetles, which are arranged according to Lefroy's *Indian Insect Life,* comprises the remaining 27 chapters. It deals with a very large number of species, about most of which very little is known; but the life histories of not a few of the more destructive species have been worked out by the author, and their economic relations, methods of control, etc., are given in considerable detail.

A good many of the species noticed are of no economic importance, all species showing any definite relation to trees or tree products being included, on account of the necessity, on the part of the forester, of being able to recognize such species and distinguish them from the truly injurious forms.

There are no keys, but descriptions of all the species dealt with are given and a very large proportion are figured. Unfortunately a great many new species are described, an undesirable feature in an economic treatise. This was perhaps difficult to avoid, however, in the present work, as it is possible that the publication of so many new species in the regular journals might have caused serious delay in the issue of the book.

The illustrations include 64 plates, of which 7 are colored, and 401 text figures. They are of very variable quality, being the work of several different artists. The great majority are excellent in every respect, some of the plates, such as Plate XV, on which a group of Buprestids is shown in color, being of great beauty and finish. Some of the colored plates, however, are poor, and among the text figures are a few exceedingly crude sketches, which look like rough field notes that had never been intended for reproduction.

As a pioneer effort in the study of Indian forest insects, the book is deserving of great praise and will undoubtedly be the most useful work on the subject of Indian forest beetles for many years hence. We look forward with pleasure to the appearance of the next volume in this series.

E. M. W.

The Zimmerman Pine Moth. By Josef Brunner. Bulletin 295, U. S. Department of Agriculture. Contribution from Bureau of Entomology. Washington, D. C. 1915. Pp. 12.

For years this insect was known as an enemy of pine in the East. More recently it was found by forest entomologists to be a rather serious enemy of second growth pine, especially Yellow pine, also in the West. While of secondary importance economically, it is largely a primary insect physiologically as regards the trees it attacks. From the standpoint of pure science the life history of any insect is capable of yielding facts that may shed light on hitherto obscure points in one or more phases of general biology. From the economic standpoint we have had repeated occasion to be impressed with the importance of knowing everything possible about the seasonal and life history of all insects having an economic bearing, however small this rôle may be, as the only means of discovering available opportunities for combating them if they are injurious, or utilizing their services if they are beneficial. The paper before us is another illustration pointing to the emphasis to be laid on as nearly complete a knowledge as possible of the habits of an injurious insect. The Zimmerman pine moth, the author demonstrates, is most injurious to second growth, on which we would apparently be utterly helpless in combating it under forest conditions where the use of insecticides is out of the question. But his careful, two-year study of the insect showed that it inhabits dominantly also some old lightning-struck or gnarly branched trees left standing in the midst of old clearings. These trees serve the moth largely as "brood trees," as the author calls them, and thus to stock the area with it. It becomes perfectly patent, therefore, that the removal of such brood trees should practically eliminate the insect as a serious pest. The actual experiment cited shows this conclusion to be operative in practice, and the recommendation is made accordingly.

J. K.

Report of the Sixth Annual Meeting of the Commission of Conservation of Canada. Ottawa. 1915. Pp. 333.

In this report, well-informed discussions are given concerning Canada's resources in forests, fields, mines and streams and important papers are included on technical education, agricultural instruction, providing sanctuaries for birds; and an important place is given to housing and town-planning.

The address of the Chairman, Sir Clifford Sifton, is an excellent summary of the Commission's activities for the last fiscal year.

Although the war has hampered some aspects of the work of the Commission, steady progress has been made in the matter of town-planning. The National City Planning Conference held in Toronto in 1914, and for which the Commission acted as host, gave a marked impetus in Canada to this important economic and social question. The Commission secured the services of

Mr. T. Adams, of London, England, an expert of international repute.

Inventories of Canadian forests are still being compiled for British Columbia and Saskatchewan. Much has been done during the past year to lessen the number of forest fires along railway lines. With but few exceptions, the Commission has had the hearty support of the railways in this work. As a result, great forest areas undoubtedly have been saved from the ravages of fire. These and other phases of Canadian forestry questions are considered in the report by such well-known authorities as Dr. B. E. Fernow, Messrs. R. H. Campbell, H. R. MacMillan, G. C. Piché, and A. D. MacTier.

The agricultural surveys and illustration farms operated for some years by the Commission have proved of such value that the Federal Department of Agriculture has recently taken over the work and is largely extending it.

Canada's mineral resources are considered at length by Dr. F. D. Adams, Dr. E. Haanel and Mr. W. J. Dick. In connection with waterpowers, especially as applying to boundary waters, interesting and valuable papers by Messrs. A. V. White and L. G. Denis, are included in the report.

The report is splendidly illustrated, and a carefully prepared index makes it of unusual value for reference purposes.

J. A. W.

Preservative Treatment of Timber. By H. F. Weiss and C. H. Teesdale. Advance copy of paper presented at meeting of the International Engineering Congress, in San Francisco, Cal., September 20–25, 1915. Pp. 45.

This paper presents a general review of the results obtained in the United States in the artificial preservation of cross-ties, piling, bridge timbers, mine timbers, poles, posts, and paving blocks. The most valuable portion is the long table in which 234 of the most reliable durability records on timber located in the United States have been included. This represents a vast amount of painstaking compilation, and will prove of great practical value.

"The oldest records reported to the authors on the efficiency of preservative treatment are on the full-cell creosote, Burnett, and

Wellhouse processes. For example, it is reported that 150,000 pine ties treated with 10 pounds of creosote per cubic foot gave 19 years average life on the H. and T. C. Railway; 12,000,000 Douglas fir ties treated with 0.27 pound of zinc chloride per cubic foot gave from 10 to 12 years average life on the Southern Pacific Railway; 4,836,668 Douglas fir ties treated with 0.35 to 0.50 pound of zinc chloride per cubic foot gave from 10 to 12 years average life on the C. B. & Q. Railway; 5,631,731 hemlock ties treated with 0.50 pound of zinc chloride, by the Wellhouse process, gave 11 years average life on the C. R. I. & P. Railway. Relatively little data are as yet available on the complete durability of timber treated by the Card, Lowry, or Rueping processes as applied in the United States."

S. J. R.

The Natural Resources of an Area in Central Florida. Geology and Mineral Resources. By E. H. Sellards; Vegetation Types. By R. M. Harper. Separate from Seventh Annual Report of the Florida State Geological Survey. 1915. Pp. 117–188.

The portion of this report most likely to attract the attention of the forester (although it contains much else of interest) is the further elaboration of Dr. Harper's views on the relation of Longleaf pine and fire. He contends that Longleaf pine not only endures fire, but is benefited by it. His reasons are as follows:

"In the first place, in an area which had not been burned for several years most of the pine seeds would probably lodge in the grass and fail to germinate; but those that fall soon after a fire, when the ground is bare or nearly so, take root readily, especially if they fall where the soil has just been loosened up by salamanders (which seem to be most active just after a fire). It can hardly be doubted that fire also tends to keep in check some insects which would otherwise injure the trees, but this point does not seem to have been specially investigated.

"Second, fire returns quickly to the soil the potash and other minerals stored up in pine straw and other dead leaves, and thus allows the pine to do a large business on a small capital, so to speak. For the soil is not very rich in soluble minerals, and these when taken up by plants are concentrated chiefly in the leaves, which in the case of most high pine land plants are tough and decay slowly; so that if many years elapsed between fires most of the mineral plant food near the surface might be locked up in an accumulation of dead leaves, and the trees would be threatened with starvation.

"Finally, if fires should cease entirely, it is reasonably certain that the high pine land vegetation would be gradually replaced by that of the sandy hammocks described below. For although there is little or no original or geological difference in the soil of the two types, the hammock trees seem to require humus and are sensitive to fire, and consequently they cannot invade the pine land very fast as long as fires prevail. The Longleaf pine, on the other hand, cannot stand much shade and crowding, so that it cannot compete successfully with the hammock trees on their own ground. At the edge of a hammock the leaves of the trees must be continually falling a little way out in the pine land, thus giving the humus-loving trees a chance to slowly encroach on the pines."

S. J. R.

Strength Tests of Structural Timbers Treated by Commercial Wood-Preserving Processes. By H. S. Betts and J. A. Newlin. Bulletin 286, U. S. Department of Agriculture. Contribution from Washington, D. C. 1915. Pp. 15.

In this paper are presented the results of tests made by the Forest Service, in cooperation with the Illinois Central Railway and one eastern and two western wood-preserving companies, to determine how the strength of bridge timbers is affected by commercial creosote treatment. The woods used were Loblolly pine, Longleaf pine, and Douglas fir.

The results, while not conclusive in some respects, show that creosote probably has no effect on the wood, but the process by which the preservative is injected may cause very serious weakening of the timber. The effect of a preservative process on the strength of wood varies not only between different species, but also within the species, depending upon the form of timber used, its size, and its condition when treated.

S. J. R.

OTHER CURRENT LITERATURE

The Use Book: A Manual for Users of the National Forests. U. S. Department of Agriculture. Contribution from Forest Service. Washington, D. C. 1915. Pp. 160.

Telephone Construction and Maintenance on the National Forests: Instructions for Forest Officers. U. S. Department of Agriculture. Contribution from Forest Service. Washington, D. C. Pp. 83.

A revision and amplification of an unnumbered circular issued September, 1912. This is a valuable treatise on field telephone systems, which should be in the hands of every forester who is concerned with telephone work.

Handbook for Campers on the National Forests in California. U. S. Department of Agriculture. Contribution from Forest Service. Washington, D. C. 1915. Pp. 48; map.

Cone Beetles: Injury to Sugar Pine and Western Yellow Pine. By J. M. Miller. Bulletin 243, U. S. Department of Agriculture. Contribution from Bureau of Entomology. Washington, D. C. 1915. Pp. 12.

Food Plants of the Gipsy Moth in America. By F. H. Mosher. Bulletin 250, U. S. Department of Agriculture. Contribution from the Bureau of Entomology. Washington, D. C. 1915. Pp. 39.

The Calosoma Beetle (Calosoma sycophanta) in New England. By A. F. Burgess and C. W. Collins. Bulletin 251, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 40.

Douglas Fir Pitch Moth. By J. Brunner. Bulletin 255. U. S. Department of Agriculture. Contribution from Bureau of Entomology. Washington, D. C. 1915. Pp. 23.

Dispersion of Gipsy Moth Larvae by the Wind. By C. W. Collins. Bulletin 273, U. S. Department of Agriculture. Washington, D. C. 1915. Pp. 23.

The results of experiments show that larvae were carried for distances of 13½ miles or more. The conclusion of the author is that wind is almost wholly responsible for the general spread of this insect in New England. The main hope for controlling the disease rests on its natural enemies, which now are playing an important rôle in this respect.

Native Pasture Grasses of the United States. By D. Griffiths, G. L. Bidwell and C. E. Goodrich. Bulletin 201, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1915. Pp. 52.

Factors Affecting Range Management in New Mexico. By E. O. Wooton. Bulletin 211, U. S. Department of Agriculture. Constribution from the Bureau of Plant Industry. Washington, D. C. 1915. Pp. 39.

The Toxicity to Fungi of Various Oils and Salts, Particularly Those Used in Wood Preservation. By C. J. Humphrey and Ruth M. Fleming. Bulletin 227, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1915. Pp. 38.

Game Laws for 1915: A Summary of the Provisions Relating to Seasons, Export, Sale, Limits, and Licenses. By T. S. Palmer, W. F. Bancroft and F. L. Earnshaw. Biological Survey. Washington, D. C. 1915. Pp. 64.

Directory of Officials and Organizations Concernèd with the Protection of Birds and Game. Document 101, Biological Survey. Washington, D. C. 1915. Pp. 16.

Crater Lake, Glacier, Mesa Verde, Mount Ranier, Sequoia, General Grant, Wind Cave and Yellowstone National Parks. Office of the Secretary, Department of the Interior. Washington, D. C. 1915. Pp. 17, 36, 32, 38, 40, 12, 71.
General information.

Paper and Stationery Trade of the World. Compiled from Consular Reports and Supplemented by Grosvenor Dawe, Commission Agent. Special Consular Reports, 73, Department of Commerce. Washington, D. C. 1915. Pp. 458.

Metallurgical Smoke. By C. H. Fulton. Bulletin 84, Department of Interior. Contribution from Bureau of Mines. Washington, D. C. 1915. Pp. 94.

Japanese Markets for American Lumber. By F. H. Smith. Special Agents Series, No. 94, Bureau of Foreign and Domestic Commerce, Department of Commerce. Washington, D. C. 1915. Pp. 16.

The imports of lumber from the United States average less than 20 million feet annually, 80 per cent of which comes from Washington and Oregon.

"Japan uses lumber from the United States for the sole reason that long lengths and large dimensions can be obtained at lower prices than material of equal size from the home forests."

The Japanese lumber merchants buy our lumber only as needed for some specific purpose. Competition with Australian, Philippine and Siberian lumber is constantly growing and bright prospects for an increased future trade are not held out.

The circular contains interesting facts in regard to merchandising lumber in Japan.

Rattan Supply of the Philippines. By J. R. Arnold. Special Agents Service, No. 95, Bureau of Foreign and Domestic Commerce, Department of Commerce. Washington, D. C. 1915. Pp. 40.

A report containing the available data in regard to supply, quality, cost of exploitation, etc.

A rough estimate of the quantity available places it above 5,000 linear meters per hectare, over an area of approximately 60,000 square miles of public forests.

The quality of rattan found in the Islands is claimed to be very superior, but as yet an extensive export trade has not developed, due to inadequate exploitation facilities and to poor marketing facilities.

Dyestuffs for American Textile and Other Industries. By T. H. Norton. Special Agents Service, No. 96, Bureau of Foreign and Domestic Commerce, Department of Commerce. Washington, D. C. 1915. Pp. 57.

A treatise dealing with the dyestuffs situation in the United States especially with products of artificial origin. Of interest to foresters is the discussion of natural organic dyes and the various tree and plant species from which they are obtained.

Philippine Markets for American Lumber. By F. H. Smith. Special Agents Series, No. 100, Bureau of Foreign and Domestic Commerce, Department of Commerce. Washington, D. C. 1915. Pp. 16.

The lumber business in the Islands is in an unorganized condition. Under present circumstances the requirements for lumber from the United States are limited to the imperative construction taking place, since by Executive order the Civil Government is restricted to the use of native lumber, except for concrete construction forms or molds. The government authorities both civil and military have, in the past, consumed the greater part of the lumber imported from the United States.

Increased efficiency in logging methods and the manufacture of native woods is also an important factor in limiting the use of foreign woods.

The report states that it may be logically assumed that the import of lumber from the United States will decrease.

New Hampshire Fire Warden's Manual. Bulletin V (revised). Forestry Commission. 1915. Pp. 86.

Laws relating to forest protection and instruction to forest fire wardens, lookout watchmen, patrolmen and others connected with the Forest Fire Service.

Forest Laws. Circular 7, State Forestry Commission of New Hampshire. 1915. Pp. 31.

Micro-organisms of Maple Sap. Bulletin 167, Vermont Agricultural Experiment Station. Burlington, Vt. 1912. Pp. 602.

Ninth Annual Report of Commissioners of Forestry. Providence, Rhode Island. Pp. 16.

Proceedings at the Opening of the Forestry Building, May 15, 1914. Official Publications of Cornell University, Vol. V, No. 19. Ithaca, N. Y. 1914. Pp. 70.

Recent Results Obtained from the Preservative Treatment of Telephone Poles. By F. L. Rhodes and R. F. Hosford. Reprint from Transactions of the American Institute of Electrical Engineers. New York. 1915. Pp. 2343–2387.

Practical Tree Repair. By E. Peets. McBride, Nast and Co. New York, N. Y. 1915.

Of interest to landscape architects and arboriculturists.

Propagation of Upland Game Birds. By H. K. Job. Bulletin 2, National Association of Audubon Societies. New York. 1915. Pp. 71.

Laws of New Jersey relating to Forestry, 1915. Union Hill, N. J. Pp. 44.

Tenth Annual Report Forest Park Reservation Commission of New Jersey. Camden, N. J. 1914. Pp. 79.

Eleventh Annual Report—The Shade Tree Commission. Newark, N. J. 1914. Pp. 61.

Digest of the Game, Fish and Forestry Laws of Pennsylvania. Edited by J. Kalbfus. Game Commission (Biennial publication). Harrisburg, Pa. 1915. Pp 342.

The Forests of Anne Arundel County. By F. W. Besley. Maryland State Board of Forestry. Baltimore, Md. 1915. Pp. 28.

A report of the forest and forest industries of the county, prepared not only to give detailed information in regard to the forest resources, but also to assist private owners in handling their timberland and woodlot problems.

Loblolly or North Carolina Pine. By W. W. Ashe. Bulletin 24, North Carolina Geological and Economic Survey. Prepared in Cooperation with the U. S. Forest Service. Raleigh. 1915. Pp. 176.

Biennial Report of the State Geologist 1913-1914. North Carolina Geological and Economic Survey. Raleigh. 1915. Pp. 176.

The section of special interest to foresters is the report on forestry, pp. 57–110.

Report of Public Domain Commission for Fiscal Year Ending June 30, 1914. Lansing, Mich. Pp. 181.

Twenty-second Annual Report of the Agricultural Experiment Station, 1913-1914. St. Paul, Minn. 1915.

Forestry Investigations, pp. 55–59.

The Ames Forester. Volume III. The Forestry Club of the Iowa State College. Ames, Iowa. 1915. 141.

Contains: Reforestation on the Black Hills National Forest; Range Reconnaissance on the Wallowa National Forest; A Superior Vacation; A Chapter in the Early History of the United States Forest Policy; Future Forestry in Iowa; Reproduction Studies on the Minnesota National Forest; The Water Relations of the Mesquite; Logging Shortleaf Pine in Arkansas; The Flora of Star Island and Vicinity.

Handbook of Nebraska Grasses. By E. M. Wilcox, G. K. Link, and V. W. Pool. Bulletin 148, Agricultural Experiment Station of Nebraska. Lincoln, Neb. Pp. 120.

Keys for identification, together with a general account of their structure and economic importance.

National Forests of New Mexico. U. S. Department of Agriculture. Contribution from Forest Service District 3. Albuquerque, N. M. 1915. Pp. 20.

A Study of Grazing Conditions in the Wenaha National Forest. By H. T. Darlington. Bulletin 122, State College of Washington. Pullman. 1915. Pp. 18.

The results of a study of grazing areas, forage plants, range deterioration, carrying capacity and range improvement of the above forest. A bibliography concludes the text.

Injurious and Beneficial Insects of California. (2d Ed.) By E. O. Essig. Supplement to The Monthly Bulletin of California State Commission of Horticulture. Sacramento, Cal. 1915. Pp. 541.

A treatise of special value to foresters in that the hosts of the various insects described or cited are arranged alphabetically, and the pests of forest trees and forest products can thus be found at a glance.

Monthly Bulletin of State Commission of Horticulture. Sacramento, Cal. August, 1915. Pp. 351–402.

Among the articles of interest are "The Street Trees and Parks of Pasadena, by A. G. Smith.

Creosoted Wood Block Pavements. By Southern Pine Association. New Orleans, La. 1915. Pp. 24.

The opinions of civil engineers, paving experts, street commissioners and citizen's leagues.

Felling, Sawing and Seasoning Timber. By E. E. Schneider. Reprinted from *Philippine Craftsman.* Vol., .., No. 9. Pp. 18.

Report of the Director of Forestry for the Year 1914. (Part VI, Annual Report, Department of the Interior.) Ottawa, Canada. 1915. Pp. 133.

Forest Products of Canada, 1914: Pulpwood. By R. G. Lewis. Bulletin 54, Dominion Forestry Branch. Ottawa, Canada. 1915. Pp. 18.

In spite of war conditions, an increase in consumption of 10.4 per cent was noted over the preceding year. The greatest increase was in the Province of Ontario, which was 39.4 per cent above the record for 1913.

Forest Products of Canada, 1914: Poles and Cross-Ties. By R. G. Lewis and W. G. H. Boyce. Bulletin 55, Dominion Forestry Branch. Ottawa, Canada. 1915. Pp. 15.

Report of the Commissioner of Dominion Parks for Year Ending March 31, 1914. Department of Interior. Ottawa, Canada. Pp. 127.

How to Finish British Columbia Wood. British Columbia Forest Branch (Department of Lands). Victoria, B. C. Pp. 16.

Annual Progress Report on Forest Administration in the Western, Eastern and Kumaun Circles of the United Provinces for the Forest Year, 1913-1914. Allahabad, India. 1914. Pp. 57+LXXXX+7.

Annual Progress Report on Forest Administration in the Presidency of Bengal for the Year 1913-1914. By C. E. Muriel. Calcutta, India. 1914. Pp. 49-50.

Annual Progress Report on Forest Administration in the Province of Behar and Orissa for the Year 1913-14, with a Summary of Progress During the Five Years 1909–14. By H. Carter. Patna, Bihar and Odessa Government Press. India. 1914. Pp. 63.

Progress Report on Forest Administration in the Northwest Frontier Province for 1913-14. Deshawar, India. 1914. Pp. 15+XXVI.

Progress Report of the Forest College, Dehra Dun, for the Year 1913-14. Calcutta, India. 1914. Pp. 27.

Report on the Forest Administration in Burma for the Year 1913-14. Ragoon, Burma. 1915. Pp. 123.

Annual Report of the Department of Public Lands for the Year 1914. Brisbane, Queensland. 1915. Pp. 98.

Report on State Nurseries and Plantations for the Year 1914-15. By J. Mackenzie. Department of Lands and Survey. Wellington, N. Z. 1915. Pp. 69.

Report of the Botanical and Forestry Department for the Year 1914. Hong Kong, China. Pp. 36.

Handbuch der Moorkulture. Von Prof. Dr. Conrad von Seelhorst. Berlin. 1914. Pp. 336.

PERIODICAL LITERATURE

FOREST GEOGRAPHY AND DESCRIPTION

Vegetation of Connecticut

Descriptions and discussions of the various aspects of the vegetation of the State of Connecticut by Nichols have run serially during the past two years through several numbers of the publications of the Torrey Botanical Club. The four general headings of the work are: phytogeographical aspects, virgin forests, plant societies on uplands, and plant societies in lowlands. The discussions are based upon the conception of vegetation as dynamic, that is, the succession of plants due to changes of erosion on the uplands and of deposition on the lowlands. In regard to the forests, the "sprout hardwood" type, chiefly consisting of chestnut, Red oak, White oak, and Red maple, represents the usual climax formation over fully five-sixths of the State. This type of forest attains its highest development in the central lowland and along the coast. In eastern Connecticut the chestnut is of comparatively subsidiary importance, the oaks being the dominant trees. The forest is less mesophytic than in the lowlands and along the coast. The most mesophytic conditions, however, are evidently in the northwestern portion of the State, where hemlock, beech and Sugar maple are the chief components of the climax forest. Although nearly one-half of the area of the State is wooded, there remain scarcely half a dozen patches of virgin forest, hardly one of which covers an area of over a dozen acres. Owing to forest fires and heavy cuttings bringing about changes in the conditions of exposure, and owing to the sprouting capacity of chestnut and the oaks, it is probable that these trees are much more prevalent now than in the original climax forest. Areas covered by White birch, White pine mixed with the hickories also probably indicate cases of retrogression from the original forest. While in the majority of cases retrogression has apparently taken place, yet in sheltered valleys protected from fire, second growth tracts occur which in composition seem essentially identical with the original forest. The author believes that no matter how far retrogression may have proceeded, there is usually ample evidence afforded by the character of the seedlings that if left undisturbed the forest in most cases would slowly, but surely, change again to approximately the climax type. C. D. H.

Torreya, Vol. 13, Nos. 5 and 9; Vol. 14, No. 10. Bulletin Torrey Botanical Club, Vol. 42.

BOTANY AND ZOOLOGY

Winter Temperature of Pine Leaves

An investigation was carried on during two winter seasons at the University of Michigan by Ehlers to determine the effect of solar radiation upon the internal temperature of persistent leaves and its possible bearing upon photosynthesis and the accumulation of reserve food material under winter conditions. It has been known for some time that apparently the reserve carbohydrates in deciduous trees reached their maximum at leaf-fall, decreased a little in the winter and reached their minimum with the formation of new shoots in the spring. The condition of stored materials is practically reversed in the case of the evergreen trees. Instead of the maximum appearing in the autumn, there is a constant increase of reserve material during the winter and a maximum is reached only at the beginning of spring. If this is true, it would seem that trees with persistent leaves continue to manufacture food during the low temperature "rest period" of the winter months.

Now just what is the internal temperature of the leaves when this winter food manufacturing is taking place? This is the question the present investigator attempted to answer. By means of a slide wire wheatstone bridge, galvanometer, voltmeter thermo-junctions, and necessary accessories, with a lead wire piercing two leaves at an angle of 45 degrees with their long axis, he was able to record the differences between internal and external temperatures of the leaves at various times and under various conditions of atmosphere. The apparatus was placed upon a high platform to bring it up among the leaves of an Austrian pine tree, and it was connected up with the ground floor of the adjacent physics laboratory where the measuring apparatus was kept. The investigator found that the leaves under winter conditions, through the absorption of radiant energy maintained a temperature from 2 degrees to 10 degrees centigrade higher than the surrounding air. The maximum obtained under brilliant illumination with a light breeze was 8.8° C. When the leaves were protected from air currents, a differential temperature of 10.3° C. was obtained. Even diffuse light, according to its brightness, will increase the temperature from 0.5° to 2° C. For February, the coldest month in the year, the average differential temperature between leaf and air—650 readings in all taken between the hours of 8 a. m. and 3 p. m. under all kinds of weather conditions—was 3.06° C. It is to be noted that these differential temperatures are those of the leaf as a whole and not necessarily those of the chloroplasts. It is the chloroplasts that absorb most of the radiant energy; the temperature of the leaf is due to radiation and conduction from the chloroplasts. It is entirely probable, therefore, that the chloroplasts, the seat of the food manufacture, have a temperature considerably higher than that of the leaf as a whole.

In the leaves of the Austrian pine, starch remained abundant throughout October and November, but no conclusive evidence of starch formation was found after December 13th. It does not follow, however, that all photosynthetic activity had ceased. Carbohydrates may have been formed and used or translocated as fast as formed. It merely indicates that photosynthesis was not sufficiently active under the conditions that obtained during January and February to result in production of starch in the leaf. C. D. H.

American Journal of Botany, January, 1915, pp. 32-70.

SILVICULTURE, PROTECTION AND EXTENSION

Silviculture Developed from Yield Tables

Under the title of forestal questions of the day, Dr. Borgmann, in the Tharandter Jahrbuch, discusses the more important developments in science and practice of forestry, as they appear at the beginning of 1915, the object being assistance to the practitioner. In the present number he begins an analysis of what is known as regards yield and the influencing of it in the various species. Having previously discussed the general increment problems (*see* F. Q., XIII, p. 389), he takes up the pine (Scotch) first.

In the introductory remarks the author points out that the whole problem of production consists in finding the optimum number of trees per acre or, what is the same, the most satisfactory standing room per tree, which each individual for its unimpeded development needs and can fully utilize; then, if this refers to all the volume producing factors, diameter, height and form, in the single individual, the stand also will produce its best. It follows that every species, broadleaf or conifer, tolerant or intolerant, must react by increased increment to every measure which improves the growth conditions, such as decrease of competition in crown or root area, securing a proper density, etc.

The influence of thinnings of different degree has so far been most realized with tolerant species, since their dense foliage naturally reacts to an interruption of the crown cover and increased light supply more than the thinly foliaged intolerant species; also, since the tolerant carry larger number per acre, root competition is more fully reduced by removal of individual consumers.

Another characteristic of influence in this regard is what the author calls the *Ausladevermögen* of the species, the ability to invite out, that is, to subdue and crowd out undesirable neighbors in the competition for standing room. This ability lies in the structure of the crown, the disposition to spread or to grow monopodially. The greatest extreme in this respect shows beech and spruce, the first with the greatest ability, the latter with the least ability to get rid of neighbors. Hence, also, the beech is best grown under natural regeneration, the spruce most fit for planting. Due to this ability and its being a broadleaf, shade-enduring species, beech responds to the optimum of density by the most greatly increased increment. Nevertheless, the newest investigations show that pine also responds in the same way and eventually all species, as well as mixed stands, will be shown to react if we only learn what is in each case the optimum density.

Schwappach's yield tables of pine, 1908, brought the following surprises: negative results of three degrees of thinning in the subdominant, and recommendation of a moderate thinning in the dominant of the polewood stage; the fact of a considerable increment increase in younger and middle classes due to severe opening up; most favorable density at time of planting not less than 4,000 plants (for spruce, which lacks in spreading habit, 60 per cent of this number is ample). The pine is a species with especial crowding habit and a rapid grower in its youth, hence a relatively dense position in the first stage is the surest method of securing a sufficient number of satisfactory shafts; but the axe must begin early, in 20 to 25 years, to select the final harvest crop, open up the groups, and free the trees of the future to secure well formed crowns; that is to say, early thinning in the dominant is indicated which with age changes quite naturally into the form of a severe thinning in the subdominant which should begin in the 35th year. The selection of the eventual harvest crop is easy if there is a sufficient number to choose from. In the final harvest stand the pine will then have, say, 120 trees, while the spruce which started with 60 per cent of the number of pines will show 200. While at the beginning the spreading habit was the determinant of numbers, at the end the light requirements of the species rule.

The author doubts the correctness of Schwappach's negative result of the difference in the degree of thinning on the production; the result of the measurements being vitiated by the lack of stands that had been properly treated at the start. If only stands so treated are selected from Schwappach's material a considerable absolute increment in younger and middle classes is noted.

The author then cites at length Kunze's celebrated thinning areas, worked for 50 years (*see* F. Q., XII, p. 273), to support this expectation most convincingly. This stand showed that light, moderate and severe thinning in pine produced timberwood at 70 years of 6,150, 6,265 and 7,000 cubic feet respectively.

Among other interesting results, this example shows also that the length of the crown varies with these three degrees of thinning, the severe thinning producing the longest crowns; nevertheless, since this thinning also produces the greatest height, the clear length is after all longer: the severe thinning does *not* produce shorter or less clear material.

Altogether, the severe thinning produces in pine, increased height, longer clear bole, improvement of form, increased volume and value increment. The author then cites Wimmenauer's yield tables of pine (*see* F. Q., VI, p. 432), which show that severely thinned and underplanted pine stands on I to III site are best managed so that the basal area per acre does not exceed 130 square feet, or is reduced to that amount at each thinning: under such management the annual ring for many decades can be kept at an approximately uniform width. Wimmenauer also succeeded in securing a somewhat larger total wood production than with full crown cover according to Schwappach. Usener's increment per cents (*see* F. Q., V, p. 430) figured for pine in Alsace, are cited, showing again that under the influence of severe thinnings the volume per cent begins to sink, and that only slowly, at around 100 years, when it had reached 1.4 per cent. The quality per cent is then still rising till 120 years, when it had reached .9 per cent, and a price increment culminates the same year, so that the entire value increment in that year reached 3.9 per cent, sinking slowly thereafter. This indicates a rotation of 100 to 120 years. Such a rotation is also indicated by the size requirements in the market, and by the valuable heartwood formation, which under lower rotations remains insufficient.

The performance of three areas near Eberswalde during 16 years is cited, which also were severely thinned, opened up and under-planted, one area opened up to 68 per cent, one to 73 per cent of the basal area, the third experiencing a mere severe thinning. All three areas in 16 years show practically the same area increment, namely about 40 to 43 square feet, or 2.5 to 2.7 square feet per annum, in spite of the removal of 1,530, 2,730, and 3,160 cubic feet on the respective areas. A maximum product, the author suggests, might be looked for by applying an opening between the severe thinning and 73 per cent opening. It is also noteworthy that the diameter increase in the severe thinning was 6.7 *cm* during the 16 years, in the openings 8 *cm* or almost 20 per cent more.

Lastly the increment figures for a 120-year-old mixed stand near Eberswalde of pine and beech, not treated, are given to show the superiority in production of the latter over similar pure stands of the same age, more or less severely thinned. We give the tabulation in the original measure per hectare.

	Height m	No. Trees	Basal Area Qm	Dia. cm	Vol. fm	Annual Increment fm
1. Thinned B degree..	27.9	406	38.8	34.9	493	3.70
2. Thinned C degree..	28	284	32.2	38.1	410	4.50
3. Pine..............	28.5	242	34.6	43	417.7	3.91
Beech.............	23	462	12.2	18.5	135.4	2.60
		704	46.8	....	553.1	6.51

Considering the diameter the indicator of value production, the pine in mixture even at 120 years far outstrips the pure stands; the 242 stems of the mixed stand produce in basal area and volume more than the 284 stems in the severely thinned stand, besides the product of the beech which is an additional bonus. The annual increment in the mixed stand with 6.5 *fm per ha* excels by nearly 50 per cent the considerable increment of the best pure stand with 4.5 *fm*.

Another 100-year-old mixed stand of pine and beech in Saxony leads to the same results, namely, proving the advantage of the mixture. Underplanting with beech should be done early, in 25 to 35 years, and in old stands by natural regeneration with planting of pine; to underplant middle age classes, 40 to 80 years, is not to be recommended, for the beech can then not grow to value by the time the pine is harvested.

Forstliche Tagesfragen. Tharandter Forstliches Jahrbuch, 66 Band, 1 Heft, pp. 60–93.

Yield Tables and Thinnings

The problem of how to secure the highest yield which a sustained yield management permits, is as yet unsolved, but in his yield tables of 1913 Wimmenauer has shown the possibility of absolutely increasing the yield in oak and pine by proper severe thinning and underplanting practices, repeatedly taking away volume without decreasing final total yield. He secured the highest yields on record—the absolutely "normal" yield for the upper three site classes, where underplanting can be practised. Dr. Hemman cites, also, other yield tables for pine, beech, spruce, on sample areas subjected to various degrees of thinning, showing the influence of silvicultural treatment on the yield, approaching the best attainable. He tries to bring out the fact that the relation of the portion of the stock removed in the thinnings every decade to the total stock at the time of thinning is the best measure of a properly managed stand under similar conditions. He advises to use the data of these yield tables for the purpose of control of felling budgets rather than the opinions and estimates of the manager. With this in view, he has from these yield tables figured and tabulated the percentage of removal of the growing stock from decade to decade that is necessary to secure the results of the yield table.

We give a few sample of the calculations on the heavily thinned stands, which are of interest also in other ways.

Volume Per Cent Removal

	Oak After Wimmenauer		*Pine* After Wimmenauer		*Pine* After Schwappach		*Spruce* After Schwappach		
Age	I	III	I	III	I	III	I	III	*Site Class*
30	6	..	21	7	9	7	6	4	
40	23	15	26	13	16	15	10	12	
50	25	22	23	16	15	15	11	12	
60	21	19	23	18	13	14	12	12	
70	18	17	18	16	12	13	13	12	
80	15	16	16	14	11	12	13	11	
90	13	14	15	13	10	12	12	11	
100	12	13	13	12	10	11	12	11	
120	10	10	11	10	9	11	11	11	
140	9	9	10	9	7	9	..	..	

The results of Wimmenauer's management were briefed in FORESTRY QUARTERLY, VI, p. 432.

Über nachhaltige Massenentnahmen ohne Flächenverrechnung. Forstwissenschaftliches Centralblatt, January, 1915, pp. 23–26.

Nurse Tree vs. Selection Method

The issuance of a circular by the Swiss Forest Inspector, advising an increase of selection forest, brought out a considerable amount of discussion by advocates for and against the selection forest. As usual, these discussions, according to Meyer, were somewhat in the air for lack of precise definition of where the limit between selection and nurse-tree or shelterwood (Femelschlag) lies. He cites the language of a working plan, in which natural regeneration and nurse-tree method "in the widest sense of that term" is prescribed. "For the lower elevations this may be a transition to a gradual entire removal and for the higher, steeper locations a lengthening of the regeneration period to a kind of selection forest. Through the choice of a shorter or longer regeneration period it is made possible to take into account all conditions at any one locality without the need of changing to a different form of silvicultural management. All that is necessary to insist upon is the one principle, that in all cases the regeneration period is chosen long enough that after entire removal of the old stand, the young stand answer the protective requirements which the forest is to serve." In addition, the formation of small working circles, and their division in felling series to avoid large felling areas and even-aged stands, helps to bring about the advantages of the selection forest without losing the advantages of the even-aged timber forest. Experience in his own forest satisfies the writer that this procedure answers all purposes, and there is enough variety of management to be found in the canton Graubündten to see what different treatment produces. A description of such results is given, and it is shown that due to a variety of uncontrollable conditions a variety of results is experienced from the same treatment. In the end, the well-educated forester can be left to find the proper silvicultural method in a given case.

Plenterwald und Femelschlagbetrieb. Schweizerische Zeitschrift für Forstwesen, September–October, 1915, pp. 168–173.

Marking Standards

Owing to objections that have been raised against blazing and stamping hardwood standards in a compound coppice forest, it is suggested that in future fellings standards should be reserved by being marked at breast height "with a piece of thin wire (copper preferred) and that the two ends should be joined together by means of a lead seal, as used at present in packing parcels and corking bottles." The writer argues that this would prevent damage to the "seed trees," and after the felling the wire could be removed and used a second time.

The Indian Forester, May, 1915, pp. 153–154.

Selection vs. Uniform System in Burma

Notwithstanding the stand of the Inspector General of Forests in favor of adopting more generally the uniform system (shelterwood), Walker makes an argument in favor of the selection system of the irregular teak forests of Burma. At present the selection fellings occur on a 30-year cutting cycle, removing perhaps 50 trees from 100 acres. Walker's argument summarized is: (1) Granting that in theory the uniform system is simpler, since cutting will be localized, he feels "there will be a great risk of anthrax among the elephants," owing to the heavier fellings; (2) Regeneration must be largely artificial, since with full light "grass, creepers and soft-wooded species spring up." Teak seldom or never forms even-aged stands naturally, although an intolerant species. Artificial forestation will be expensive; (3) Intensive methods in extensive forests are impossible, and to regularize the growing stock would entail an economy of cut which would ruin the local merchants.

T. S. W.

The Indian Forester, April, 1915, pp. 105–112.

Preserving Acorns for Sowing

A method of keeping acorns for seed adopted in the Forestry Domain of the Province of Kasan since 1906 appears to be the best hitherto tried, probably because it approaches most nearly to the natural way. The ground chosen for storing seed acorns is a small clearing of about half an acre, on a north slope surrounded by dense, old broad-leaved trees, so as to be well sheltered from the winds, which in this region are very strong, especially in spring. The spot selected is thoroughly cleaned of all acorns and forest litter (in order that the mice cannot make their nests in it); round it is dug a ditch one foot deep and wide, with inclined sides and embankments on the outer side; to this is connected another ditch excavated on the whole length of the slope of the clearing to carry off the water. This protecting ditch is absolutely necessary to prevent, or at least hinder, the invasion of mice, which are very numerous in the place where the method is applied. After the ground has thus been prepared, it is covered with a layer of dry leaves (preferably oak) about an inch deep, upon this is placed a layer of selected, dry acorns about 2½ inches thick; these are then covered with more leaves and branches to protect them from wind. When the winter has set in for good and the snow no longer melts, if it has not fallen in sufficient quantities, it is piled up to a depth of 2 feet on the place where the acorns are buried; then a layer of straw 7 to 10 inches thick is spread over the snow, and the acorns are left until the spring. From 10 days to a fortnight before the time of sowing, the acorns are uncovered and left either in the clearing or on the place where they are to be sown till they begin to germinate. It is best to make several of these deposits of acorns upon the same area and to uncover them one after the other as required.

This method is the most satisfactory, in the writer's opinion, because it does not entail all the precautions necessary for preventing the acorns heating and rotting and for protecting them from frost; further, by the aid of this system, the largest percentage of well-preserved acorns fit for sowing is obtained with the smallest outlay. R. Z.

Liesnoi Journal, Year XLV, 1915, Part 1–2, pp. 255–259.

MENSURATION, FINANCE AND MANAGEMENT

Yield and Assortments of Beech

A new set of carefully constructed yield tables of the beech is issued by the Badish Experiment Station, compiled by Wimmer. These tables are based in part on the same areas that served for the yield tables of Schuberg compiled 20 years ago. They are therefore of interest in showing changes due to changed management. They also have a special interest on account of the assortment differentiation and money yield tables. Altogether, 39 yield areas from 60 to 160 years old, and 22 thinning experiment plots have been measured six to seven times in intervals of mostly five years. Since 1875, there have been 273 surveys made.

Although the basal areas of the stands have been considerably reduced (from 160 sq. ft. to 120, or from 140 to 104 sq. ft.) below what was considered normal, indicating severe thinning, the total yield, it is stated, has not been influenced by the degree of thinning (in the subdominant). Severe thinning is becoming general practice!

The site classification is based on average height at 100 years, running for the five site classes as 50, 64, 78, 93, 107 feet. The secondary stand shows heights from 10 to 14 feet lower. The remarkable statement is made that after the 100th year the height curve of all sites lies in one and the same line.

The question, what is the basal area which assures the optimum increment, these tables answer differently from Schwappach's, who found that with a basal area of 80 to 100 square feet per acre the best increment occurs for the beech after the 70th year. In the 100th year the I site shows a stem number of 138 trees, with a basal area of 140 square feet and a wood volume of 9170 cubic feet, while the thinning material adds 1144 cubic feet, double what hitherto had been removed in thinnings; the basal area after that is kept slightly increasing.

The reviewer points out that assortment and money tables can have only restricted local value. The method pursued in constructing these tables is the same which Schiffel employed in developing his laws of increment for spruce (*see* F. Q. II, p. 258), since Wimmer found that the same laws applied to beech; the work wood per cent was determined for the whole stand, and then distributed over the six stem classes.

Ertrags- und Sortimentsuntersuchungen im Buchenhochwald. Mitteilungen des forstlichen Versuchwesens Badens, Heft 2, 1914.

Mensuration of Mixed Stands

Dr. Wappes, a prominent Bavarian official, noted as an advocate of systematic procedure, discusses the ways and means of measuring mixed stands. Data on stands of a single species are abundant. With the tendency towards mixed stands, it is high time that equally good data be obtained for these also.

The first part of his article throws light on the character of mixed stands and cites numerous cases in point.

It is interesting to us that his first problem concerned itself with the ascertainment of the mutual influence of White pine with Scotch pine and Norway spruce in mixture. Another problem suggesting the need of devising a technique and for investigating mixed forest was how to convert a pine-beech forest on soil in which oak does not thrive into a mixed timber forest. For instance, how many pines must be introduced into the beech basis, to secure the normal volume growth of a pine stand and what is the reduction in the beech?

The difficulty in this case of finding sufficiently large areas of the mixture of pine and beech in sufficiently similar proportion was overcome by securing data from a number of small areas, too small for generalization (1/16 to 1/8 of an acre), and adding them. Difficulties were also introduced by the thinness of the bark of beech compared with pine (to the disadvantage of the latter in measurements); again the question of age differences, the question of what is to be considered as main and side stand, of site classification raised doubts.

In attacking this last problem, the sample plots were taken as containing a certain number of pines per hectare in number classes, and the data of measurement, averaged for such number classes, comprised besides actual stem number of the two species, their basal area and average diameter, the height for the two species being averaged for the whole stand, aged 62 years for beech, 56 years for pine, remeasured 9 years later. By multiplying basal area with average diameter of the pines, it was thought a value measure could be established for comparative purposes, the pine increasing in value as the diameters.

A table shows the record and a graphic illustration assists in seeing the relationships, the most interesting of which is found in the change of stem numbers as well as basal areas in the different stem number groups. In the groups with a small number, up to 400, the basal areas had increased in spite of some decrease of numbers, but in those above 500 it had decreased, *i.e.*, the loss of stems had not been made up by increment. The value measure products showed that an admixture of about half the normal stem number of the yield table is sufficient to attain the normal yield table figures and with a larger number essentially exceeds the table figures, up to 40 and 50 per cent.

In the beech a very considerable decrease in numbers took place, as well as of basal area. The following silvicultural conclusions are drawn: If a sufficiently large number of pines is assured, the pine-beech mixture is desirable. This is also visible in the effect of the beech admixture in clearing the pine boles. Mixtures, which in their value increment fall below a certain measure, are to be replaced, because they cannot utilize the site sufficiently.

It is evident that the yield tables for pure stands have no application in mixed stands, since the combination works differently from the single components.

Another inquiry had reference to a spruce-fir-beech mixture to answer the questions: How does the mixture influence volume and quality? How much coniferous wood is necessary to obviate the loss of increment and value of the beech?

While interesting, this part is not so pertinent as the second part, in which he gives specific directions how to proceed with the mensuration of mixed stands. This part is full of suggestions for men engaged in forest investigation and, if space allowed, might well be translated in full. Only the salient points, however, can be given here.

Wappes feels that, in order to get real data on mixed stands, everybody must help. It will not do to leave it to the experiment stations, since the task is too large and the need for the data too pressing. He favors the establishment of a great number of permanent sample plots.

Determination of the age of mixed stands is difficult, especially as they are usually uneven-aged as well as mixed. Usually, it is not necessary to determine a formal stand-age, the age of the chief species may suffice, but even this may be difficult. The felling of mean sample trees is not always feasible. It would be desirable to have an increment borer which would reach to the center of trees 30–40 *cm* (12–16 inches) in diameter.

Comparisons of the yield of mixed stands with the yield of pure stands should be based on local measurements of sample plots, not on the yield of pure stands as given in yield tables. The sample plots are to be made permanent. Ordinary calipers are to be used. If possible, the trees are to be numbered; the point of calipering must be marked.

Determination of the increment is especially difficult in uneven-aged, mixed stands. The use of an increment borer and Pressler's formula is suggested. Complete stem analyses are cumbersome for getting the volume now and *X* years ago, and so determining the increment. The best way, Wappes says, is by repeated measurements of the same sample plot (*see* FORESTRY QUARTERLY, Vol. XIII, pp. 60–63).

Finally, Wappes urges the closest cooperation of individual investigators with the experiment station and the unfailing encouragement of the higher administrative officers, if good results are to follow. Such projects as the measurement of mixed stands must be decentralized, since the exact knowledge of local conditions is of paramount importance both in getting the field data and in working them up. A. B. R.

Ueber Technik und Methode der Aufnahme von Mischbeständen. Allgemeine Forst- und Jagd-Zeitung, February, March and April, 1915, pp. 33–39, 57–67, 81–89.

Increment Measurements

On 43 pages Professor Dr. Schüpfer elaborates in great detail and somewhat critically the various methods of ascertaining increment on single trees and stands. There is little or perhaps nothing new in the article, but it is a clear, complete exhibit of this chapter of forest mensuration by an expert, the comparisons of results by various formulae being sometimes in the nature of new material.

A brief historical note to efforts at increment measuring in the eighteenth century introduces the subject. The writer pertinently points out that in all forest measurements only approximations can be secured, yet the degree of accuracy should as far as possible be realized. In the section of increment determination on single trees, the method on felled trees is taken up first, and the difference in results of the precise and the approximation formulae is exhibited.

The author points out that, if on every range even a modest number of measurements were made with precise record of age, site, length of shaft, crown and tree class, whether dominant, etc., in a short time considerable knowledge could be cheaply accumulated, and at the same time young foresters educated.

In the section relating to standing trees, it is shown that the condition of height growth and form change having ceased is probably much rarer than believed. The author found 150-year-old pines still growing at the rate of 2 inches, and 210-year-old ones between 1 and 2 inches, while Hartig found oaks at 240 years still making up to 2-inch height growth, and even these small amounts influence the increment per cents. Tabulations are given of actual measurements comparing area-, volume-, form-and height-growth per cents; also comparisons of increment per cent secured by stem analysis and by Pressler's approximation formula. Schneider's (Koenig) formula comes in for considerable discussion; the practical difficulty of determining the constant which varies between 400 and 800 in that formula is exhibited on examples. Breymann's approximation seems to furnish results close to the precise formula, but the same difficulty as in Schneider's exists when height and form increment must be allowed for, the constants in the measurement of 250 trees varying between 160 and 646. The author found that the relative crown length, which Pressler considered so influential on shaft form, exercises this influence only in younger trees.

The author furnishes a table of constants for use in the formula on pine, based on relation of height and diameter increment.

If in single tree measurements only approximations can be secured, this is still more so the case in measuring stand increments.

The cross-section or basal area is the most accurately ascertainable factor, and should therefore be used wherever possible to gauge conditions or silvicultural management. The selection of sample trees, a number rather than an average stem, must be made with circumspection. The volume of the average stem multiplied by the number of stems gives, to be sure, the total present volume correctly, but a stem analysis of this tree cannot be used for increment determinations of the stand, for it does not represent the average tree at any other age. Only in older stands, deductions from such trees forward (not backward) may be admissible under certain circumstances. Examples show the unreliability of using such average trees.

An alleviation of the difficulty is afforded by forming stem classes (diameter classes) and measuring the average stem of each. For the increment of the stand the increment of the stoutest stem class is determinative; its average stem is to a less extent shifting its position from period to period, for the stoutest trees have at all times been in the upper class. In the lower stem classes the variation of increment in the average stems is much greater. While in a given case, the largest increment of several sample trees of the I class exceeded the smallest 1.43 times and in the II class 1.48 times; in the III class it did 2.6 times; in the IV class, 3.14 times; in the V class, 3.29 times.

In selecting, say, 4 average stems in each of 5 classes, making 20 sample trees, it is of less moment that the diameter be precisely correct, as that in form, height and branchiness they represent the average.

Three trial choices made by three different persons showed that the selection is quite practicable, the increment per cents varying only between 2.64 and 2.77, while a carefully determined per cent was 2.74.

If ascertaining the increment per cent on standing sample trees, the area increment (properly averaged) is found by the formula (Breymann's) $\frac{\Sigma d \Delta d}{\Sigma d^2}$, to which the height increment per cent must be added, or else by the Borggreve averaging of the Schneider formula which is somewhat more circumstantial and less accurate.

Some interesting relationships are brought out. According to Schiffel, in spruce stands, if the trees are placed in five classes of equal number arranged by diameters, then the diameters of the average trees will be found to be possessed, beginning the count with the lowest, at 10, 30, 51, 71, and 91 per cent of the stem number. The author investigated this relation for pine, and found the diameter of the average trees of five classes of equal number at 10, 30, 50, 70, and 92 per cent of the stem number.

If the classes are made with equal cross-section areas then the average diameter lies—

For spruce	at 17, 48, 68, 84, 95	per cent
For pine	at 18, 47, 68, 84, 96	per cent

of the stem number.

The class average diameters may also be calculated from the average diameter of the whole stand, for, according to Schiffel, the diameters of the average trees of the five classes of equal number of stems lie at—

I	II	III	IV	V	
69	84	96	109	136	per cent

of the diameter of the average tree of the stand. (For instance, if 20 inches were the diameter of the stand average tree, the diameters of the class trees would be 13.8, 16.8, 19.2, 21.8, 27 inches.)

For pine and for beech approximately the same relation has been established.

If the stem classes have been arranged with equal cross-section areas, the stem class averages will be for spruce—

I	II	III	IV	V	
75	94	106	122	138	per cent

of the stand average tree's cross-section.

These percentage calculations are especially convenient when the calipering has been done with a registering caliper (Wimmenauer).

Some applications of the increment per cents in determining felling budgets are given.

The process of determining a stand increment is given as follows: Calipering the stand (or a sample area or strip); all trees which during the period for which the increment is to be figured are likely to be felled in thinnings are recorded separately from the main stand. The latter is divided in five diameter classes of equal numbers or equal cross-section areas, and the diameter of the average class trees is calculated. Then three to four specimens of each average diameter of proper height and form are found, and with the use of the increment borer (being careful to measure higher than breast high if root swellings make it desirable) the diameter increment is measured, measuring also the height. The borings should be made at two opposite ends of the diameter, but if four samples are taken this is hardly necessary. The bored core is placed in an envelope properly marked for identification, and all the investigation and calculation is done in the house.

Zuwachsermittlung am Baum und am Bestand. Forstwissenschaftliches Centralblatt, June, July, 1914, pp. 293–315, 349–370.

UTILIZATION, MARKET AND TECHNOLOGY

Wood-waste as Source of Potash

In addition to the potash from hedge clippings and vegetable refuse, etc., the writer draws attention to the value of wood scraps, sawdust and shavings, produced in enormous quantities in sawmills. In localities where this wood-waste is not salable for other purposes, it may with advantage be converted into ash and used as a potash manure. The flue dust from gas-producing plants may contain as much as 10 per cent of potash, thus possessing the same value as kainit.

Other analyses of the ash gave the following figures:

	K_2O *Per Cent*
1. Coarse ash, combustion very complete	7.24
2. Coarse ash, combustion very complete	5.08
3. Flue dust, combustion very complete	9.11
4. Flue dust, combustion very complete	6.35
5. Flue dust, coarser than 3 and 4	5.89
Average	6.73

On the basis of the ordinary price of kainit, ashes with the above composition should be worth from $6 to $8 per ton; and since ash is almost purely a waste product there is good reason to suppose that it could compete with kainit even in normal times.

Journal of the Board of Agriculture, May, 1915, pp. 146–148.

Fibre Lengths and Wood Resistance

As a result of the determination of the length of 100 fibres in each of 66 specimens of *Pinus strobus*, it was found that the length varies according to the situation in the plant. In a disc taken from a trunk 250 years old at about 24 inches from the base, and also in another taken at a height of about 80 feet, the shortest fibres were found near the pith. It appears that the length increases towards the periphery, but in an irregular manner. No constant fibre length was attained.

In 26 samples (bolts) taken at from 2½ to 3 inches from the pith, at 4-foot intervals between the butt and the top of the tree, a tendency towards an increase in average length of fibre was apparent for about two-thirds of the height of the tree.

The relation between the fibre length and the strength values was indeterminate: no direct effect dependent on length alone can be found. The following indications, however, were obtained: (1) from butt to top the specific gravity and strength decreased, but average fibre length increased; (2) in some Loblolly pine (*Pinus taeda*) the late wood was about twice as strong as the early wood, the relative fibre length being as 2.69 is to 3.03 mm.; (3) in Rotholz the fibres are also stronger (in compression) and shorter than those in normal wood. Thus the shortest and at the same time thickest-walled fibres were present in the strongest specimens.

The general range of variation in fibre length was not found to be greater within the species than in the individual tree. From 1700 measurements of 15 specimens of Longleaf pine (*Pinus palustris*), and 900 measurements of Douglas fir (*Pseudotsuga taxifolia*) it was found that the largest fibres occurred in the earliest spring wood; the length then decreased gradually and the shortest fibres were present in the last formed layers of the ring.

The root fibres of Longleaf pine and White pine were found to have a fibre length as long as, or even longer than, that of the trunk fibres. This may enable the pulpmill to utilize stumps obtained where land is being cleared, or the chips from which resin has been extracted, for a strong craft pulp.

In general, the hardwoods or angiosperms have a shorter fibre than the softwoods or gymnosperms. All other things being equal, the strength of a pulp varies with the length of the fibres composing it.

The early or spring-wood fibres are always longer than the late or summer-wood fibres. The data obtained from about 80 specimens indicated that less than one-fourth of the fibres found in every hundred macerated fibres were summer-wood. In two cases the summer-wood fibres made up about one-third of this amount; in both cases this large number of fibres was found in wood from very low down in the tree. The percentage and character of the summer-wood fibres are significant factors in determining the character of a wood to be used for pulp.

R. Z.

Science, Vol. XLI, No. 1043, p. 179.

STATISTICS AND HISTORY

Prussian Forest Budget

From the 7,500,000 acres under forest management in Prussia there is expected for the year 1915 an annual yield of 53 cubic feet per acre. Ninety per cent of the total area is devoted to forest production. The gross income is estimated to be $5.15 per acre and the expenses $2.32, so that the net income will be $2.83 per acre per annum, or 16 per cent over the results of a decade ago.

The estimated expenses are divided as follows:

Salaries	83%
Inspection of communal and private forests	5
Permanent improvements	2
Land purchases	1
Pensions	1
Miscellaneous	8
	100%

The income expected will come from the following sources:

Wood	92%
By-products	4
Miscellaneous including hunting, peat, refunds, and land sales	4
	100%

K. W. W.

Der Etat der preussischen Forst-, Domänen-, und Land wirtschaftlichen Verwaltung für das Etatsjahr 1915. Forstwissenschaftliches Centralblatt, April, 1915, pp. 187–192.

Effects of War

The effects of the war are felt in the Prussian forest administration. In the discussion of the budget in the Prussian diet a speaker pointed out that more of foresters had fallen in battle than of any other profession. The budget of the previous year was calculated as expectancy for the year 1915, but the administration declared its unwillingness to be responsible for its accomplishment. In some districts a considerable reduction of cut had become necessary partly for lack of woods labor, partly for lack of market. Many serious changes in the management have become necessary. To stimulate food production the government had declared itself willing to give land from the forests free of charge, permit the taking of litter, and open them to pasturage. But the Minister of Agriculture did not expect much result from the use of poor grades of soil usual in the forest. He expressed satisfaction at the condition of the cattle, the keeping of which made less difficulty than that of swine.

In East Prussia many foresters' houses have been burned or demolished.

In another place the difficulty in securing tan material is discussed, and that of hides, seriously damaging the leather industry, worth $160 million, which largely relied on importation. The absence of important tan materials, of which $10 million were required in 1913, has revived the price obtainable for oak from the tan bark coppice woods of the Rhine country. While in 1914 the hundredweight of bark brought only 75 cents, in 1915 the price had crept up to $2.50.

A special organization "Kriegs-Leder Aktiengesellschaft" was formed in Berlin in November, 1914, to insure the requirements of leather for the army, the company in which the government is represented working without expectation of financial gain.

The forest administrations are called upon to save all tan barks, especially oak and spruce, the brush of the latter being especially fit for extract. Extract factories, using various woods, have been established. A new process of peeling oak outside the sap season has been devised.

It is calculated that from the regular felling budgets and thinnings in spruce forest alone 7,000,000 hundredweight of bark with an average of 10 per cent tannic acid can be recovered, or 700,000 hundredweight of acid, while the importations amounted to less than one million. It is suggested that this necessity for securing home tan supplies may lead to a new or revived direction of utilization.

Forstwissenschaftliches Centralblatt, May, 1915, pp. 231 ff. and 206 ff.

MISCELLANEOUS

Borggreve in Forestry

Under the title "The Place and Importance of Borggreve in Forestry," Dr. Martin, of Tharandt, the Saxon forest academy, discusses very readably the literary attainments of the late Borggreve. It is not a eulogy, but a critical review of his work along the lines of silviculture and management.

Summing up, Martin says: "In looking back over the manifold mental activities of Borggreve, there is one trait they have in common, namely that in almost all important questions he was in direct contravention to prevailing practice. This will be true in the future, too. The method of natural regeneration which he endorsed (Shelterwood *à la* Hartig) will never become the general rule; selection thinnings will always be exceptions; his formula for the rotation age (r is not reached as long as $5a \trianglerighteq nd$, where a is the age, n the number of years in the last inch of radial growth and d the diameter) will not be used; the soil rent teaching will be more and more widely accepted; and the Prussian Government will continue to plant up waste heathlands. Nevertheless, the spirit of Borggreve will remain alive. His enduring value for the science of forestry lies in the wealth of ideas, the independence of judgment and the keen criticism of existing conditions and views. His was a polemic nature and serves as an example that all important progress and new developments can result only from the conflict of opposing forces."

A. B. R.

Bernhard Borggreves Stellung und Bedeutung in der Forstwissenschaft. Allgemeine Forst- und Jagd-Zeitung, March and April, 1915, pp. 67–71, 89–94.

Forest Bookkeeping

Briefly the objects of forest bookkeeping are the determination of: the value of the stands; the results of management for any given period; the money yields, both present and future, and their sequence; a comparison of the actual total income and the actual gross expenses with the estimates of the budget of the expected income and expenses.

The stand statement may be called an inventory of the forest. In other words, it is a statement of the present capital obtained by taking stock of the present stand. It should show both amounts and values.

The result statement is intended to show the changes in the net value of the property due to management. It cannot, however, be expected to bring out the charges resulting from such extraneous circumstances as the depreciation in the value of gold. It is merely a record of the timber sold and the money paid out. The net yield obtained in this way is not a true forest rent, since it does not take into account the increase in the value of the stand on account of growth in size and quality. Likewise, the soil rent must be figured separately.

The present and future yield statement shows as debits the future income and expenses, and as credits the present income and expenses. The difference between these two, or the excess of debits over credits, is made up of the unfulfilled parts of the budget.

The budget control statement is based on the working plan and is intended to afford easy comparison between the plans of management set forth in the budget and the actual execution of these plans. The results or balances of this statement are similar to the present and future yield statement, but the manner of presentation is different.

Two methods may be used for obtaining these four statements, the double entry system of bookkeeping, or a scheme of cost accounting. The former is an exact science, furnishing results capable of mathematical proof, while cost accounting is based in part on estimates, but gives a more complete picture of the status of the business. The main difficulty with the double entry system is that it does not give directly the figures for the present and future yield statement. This is natural because in each there are estimates of future conditions which cannot be made to enter into a system of formal bookkeeping. On the whole a system of cost accounting, combining the good features of the double entry method with such estimates as are necessary to set forth the future conditions of the business, is most useful.

K. W. W.

Uber die Bedeutung der Kameralistischen und der doppelten Buchführung in der forstlichen Verrechnung. **Forstwissenschaftliches Centralblatt, April, 1914, pp. 176–189.**

Food Value of Wood

The comparative scarcity of feed as a result of the war suggests the possibility of securing feed and even food for men from wood. It is well known that, especially in winter, trees have stored considerable quantities of sugar, starch and fatty oils, especially in the pith rays and parenchymatous tissue—reserve materials which are being used up in the spring for growth of foliage, etc. From 20 to 25 per cent and more of the dry wood substance in volume of the sapwood consists of such materials; the heartwood contains none.

To make these materials available the lignified indigestible tissues would have to be very finely ground and this wood flour mixed with wheat or rye flour. It is questionable whether this can be done to advantage.

The young wood and foliage of trees can without preparation be used to eke out the feed requirements, as is done in snowy winters for game by felling aspen and other softwoods. There is also patented a chemical process for the production of alcohol from wood waste, the residue of which process mixed with molasses may be used for feed. Commercially, this process seems not as yet to be successful.

Der Nährwert des Holzes. Oesterreichische Vierteljahrschrift für Forstwesen, II Heft, 1915, pp. 189–191.

NEWS AND NOTES

It has just come to the knowledge of the Department of Forestry of the New York State College of Agriculture at Cornell University that certain members of the Society of American Foresters failed to receive copies of the pamphlet containing the Proceedings at the Opening of the Forestry Building, May 15, 1914. This publication contains the addresses delivered during the opening exercises and also at the open meeting of the Society of American Foresters held on the following day. Anyone who desires a copy of this pamphlet may obtain it by writing to Professor Ralph S. Hosmer, Department of Forestry, Cornell University, Ithaca, N. Y.

As a result of the present lumber market, it has been necessary in Northern Idaho to modify a number of government timber sale contracts which provided for the cutting of all species. Under present market conditions, fir and larch are not merchantable except in limited quantities. The market for cedar poles has also slumped to such an extent that it is almost impossible to cut cedar for this purpose. As a result, it is necessary to allow operators to cut only White pine on many of the timber sales. Silvicultural investigations of the forest conditions indicate that the removal of White pine and cedar can be allowed without serious results. On many of the areas there is only a limited amount of fir, so that this species is comparatively unimportant. On account of the presence of large quantities of unmerchantable hemlock and White fir, good silviculture requires the slash burning of the areas in order to get rid of these species. The further extensive cut largely depends on the market for cedar. The larch will stand through a slash burn without injury and can be logged at a later date.

The sale of dead timber killed in the forest fires of 1910 in Idaho is about completed. Numerous modifications in the original contracts have been necessary in order to allow for the very rapid depreciation of the timber. It has been found that spruce checks so badly that it is unmerchantable in about one year after the fire. White pine will remain merchantable for a longer period, but the per cent of cull as result of checking is very large.

In one case on the Lolo National Forest, a sale was made prior to the fires which would have netted the Government about $300,000 for stumpage. As result of the sales of fire-killed timber in this area the total receipts will not exceed approximately $50,000.

The Pennsylvania Department of Forestry, in the fall of 1913, adopted the policy of making topographic and stock surveys of her State Forests, plans for which were drawn up by W. G. Conklin. The work has been subsequently carried on under his direction. The Department recognized the fact that systematic procedure of forest management required that an inventory of stock, in the form of existing tree growth, be obtained, and that topographic maps be made available. Only after this data and maps are secured can comprehensive working plans be made, for practically every forestal operation is dependent on growth and topographical conditions.

Pennsylvania now owns 1,004,636 acres of land for forestry purposes which is divided into 55 State Forests, all but four of which are under the direct supervision of graduate foresters. At present there are four foresters classed as topographers in charge of field crews surveying four different Forests. Upon completion of one survey, the topographer is assigned to another Forest. Foresters in charge of the respective Forests attend to the growth inventory, growth notes being taken in the field along with topographic notes.

Upon completion of a survey, subdivision of the Forest into compartments is taken up; age, class and stand maps will be made, and working plans constructed.

All points considered, very favorable progress has been obtained to date, but better progress can be expected from now on, as plans and methods of procedure are adjusted and put into better running order. Following is a synopsis of the work thus far accomplished:

The Barree Forest in Huntingdon County, containing approximately 18,000 acres, was surveyed by Forester T. Roy Morton and the topographic map has been completed. The subdivision of the Forest into compartments is now under way. Provisional compartment lines were sketched on a Topographic Map and are now being run out on the ground. All compartment lines need not be run, as many of them follow open roads and trails surveyed during the course of the topographic work, and corners of the same are either placed at or oriented with a traverse station, still marked on the ground. Most of the ridge lines will, however, have to be run. Concrete posts are being used experimentally for corner markers, although it will be unnecessary at this time to mark every corner. The posts are 4″× 4″× 24″ long and are set 18″ in the ground, allowing 6″ above ground. The cost of making the posts averages less than 15 cents each. They weigh about 30 pounds.

Topographic field work has been completed on two other Forests, namely, the Bear Meadows and the Seven Mountains Forests in Centre County, and maps thereof are now under construction. The Bear Meadows survey was made by Forester W. D. Ludwig, assisted by Topographer Walter Leach. It includes 21,000 acres of State land. The Seven Mountains Forest, containing 14,000 acres, was surveyed by Forester W. E. Montgomery, assisted by Topographer H. W. Siggins.

Topographic field work on three other Forests will, no doubt, be completed by the end of this year. They are the Greenwood Forest in Huntingdon County, the Penn Forest in Centre County, and the Kishacoquillas Forest in Mifflin County, containing respectively 23,000, 15,000 and 34,000 acres.

The six Forests above mentioned are contiguous and comprise an area of approximately 125,000 acres, which is one eighth of the total area of State Forests. The surveys must necessarily include considerable privately owned land made up of scattered tracts entirely or partly surrounded by State land. It is probable that this will amount to 7,000 acres, which would bring the total area surveyed by the end of the present year to 132,000 acres.

In addition to the above, two surveys were begun in late summer and should be completed by the middle of next summer. They are those of the Jacks Mountain Forest in Snyder County, containing 18,000 acres, and the Pennypacker Forest in Perry County, containing 25,000 acres. W. G. C.

On the Pacific slope in the country west of the Rockies the dangerous winds which, during the summer, are likely to cause wide-spread and destructive fires, commonly result from high pressure areas in northern British Columbia, advancing southward towards Washington and Montana. Passing wholly over the Interior, such a wind has but a small moisture content and consequently is very drying. The value to forest protective organizations of being informed about such winds before they arrive is obvious.

Cooperation with the Government Weather Bureau to get forecasts of such winds was initiated in the United States by the Western Forestry and Conservation Association, of which Mr. E. T. Allen, Portland, is Forester.

This cooperation work has been extended until now it includes both the Canadian and United States Weather Bureaus; while the fire wind forecasts are daily received and used through the fire season by the British Columbia Forest Service in Canada, and, in the Pacific States, by the United States Forest Service, the various State Forest Services, and the many private forest fire protection associations of which the Western Forestry and Conservation Association is the central body.

The system has proved of considerable value to the British Columbia Forest Service, but is at present of greater value to the protective organizations in the States, because there the much greater number of weather stations enables the forecasts to be made more definitely and accurately. With the opening of northern British Columbia now taking place by the new railroads, such as the G. T. P., P. E. E., etc., many more weather stations will be established and the value and usefulness of the weather bureau reports will be increased, both to British Columbia and the Pacific States. In British Columbia reports are sent from several of the weather stations by wireless telegraphy. The rapidly increasing use of the wireless telegraph is a most important factor in this work, since it will enable weather reports to be received from a much larger number of stations than would otherwise be the case.

It seems a strange fact that the identity of *Picea engelmanni* as distinguished from *P. canadensis* so far seems to rely entirely on the shape of the bracts of the cone, and often even this distinction becomes doubtful. This is an important matter, since the two species occur together in the foothills and East Slope of the Rocky Mountains in mixture. While it is asserted that the

Engelman spruce is a tree of higher elevations, it occurs freely in the lower elevations. It cannot be, or has not so far been, distinguished by color, form or habitus of the trunk. Whether nurserymen's offerings can be true to name is also doubtful.

A generally interesting article in London *Engineering* on "Refueling Warships at Sea," by Spencer Miller, has a peculiar interest to lumbermen and foresters inasmuch as the system of cable construction for his device of fueling at sea was an outgrowth of the devices designed by Mr. Miller for the Lidgerwood logging systems. With his marine cableway he seems to have satisfactorily solved the intricate problem of coaling at sea from a collier. It is nothing more nor less than an overhead skidder, at the same time providing means to prevent any variation in the strain upon the cables due to the pitching of the two vessels.

Some interesting uses are being made of peat in the United States. It is manufactured into a fertilizer and employed as a fertilizer filler, according to the United States Geological Survey; it is also used for making paper, stock food, and mud baths. In Germany and Austria peat baths are well-established institutions, and during the last few years such baths have been tried in some of the sanitariums of the Middle West and found beneficial in certain cases. As food for live stock, however, peat seems to have found its most curious use, inasmuch as the kind of peat used is thousands of years old, and, although it may still be classed as vegetable in character, it is only a step removed from low-grade coal. As a stock food it is used in a mixture containing molasses. The results are stated to have been very satisfactory in practice, the peat acting as a tonic and corrective. The peat used is the black, well-humified or rotted kind and is prepared in practically the same way as when used for fertilizer. Peat for various purposes was produced in the United States last year to the extent of 57,000 tons, valued at $367,000. The peat deposits of the United States are of enormous extent.

An increasing demand for paper has led to experimental investigations on material not heretofore considered a possible substitute for those materials usually used for paper stock. The U. S. Department of Agriculture has demonstrated that from the tops of zacaton grass—previously waste material—a satisfactory paper-making material may be developed. This grass is commonly known as broom-root grass, wire grass and rice-root grass because its roots are made into brushes of various sorts.

The plant is a perennial one, the growth being almost entirely from self-sown seed. Its range extends from California and Texas southward to the Argentine Andes. It is not uncommon to find many square miles densely covered with the growth, an acre of which is said to yield at least 3 tons of tops.

Laboratory tests show that this grass can be chemically reduced to paper stock by the soda process more easily and with less expense than is necessary to reduce poplar wood. The same processes and methods which are employed for the manufacture of pulp from poplar wood are quite suitable for the treatment of zacaton, but in place of the wood-sawing, chipping, and screening machinery, a grass duster is necessary.

The paper manufactured from the stock has proved as satisfactory in physical tests as a first-grade, machine-finished printing paper. It has, moreover, a very satisfactory appearance and feel but requires more bleaching powder than poplar stock.

The percentage of air-dry fiber obtained from this grass appears to be slightly less than that from poplar wood, but practically equal to that of esparto.

No estimate of the cost of manufacture is mentioned in the government publication dealing with the experiments.

An interesting development brought to light by the exigencies of the European war is that of the manufacture of explosives from woodpulp as a substitute for cotton. The new process is said to differ from that for ordinary woodpulp only in that in the later stages it must be more carefully and thoroughly cleansed until nothing but absolutely pure wood fiber remains. This material is rolled into sheets and nitrified into explosives of tremendous power.

In this connection, we would call attention to FORESTRY QUARTERLY, vol. III (1905), p. 319, to the note that German scientists in Bavaria were then making experiments along this line.

A Swedish paper expert has, by experimentation, confirmed his opinion that *Araucaria imbricata* produces woodpulp for making paper which is even better than that which has usually been employed for this purpose.

According to a statement of Secretary of Agriculture Houston, who made an extended trip through the National Forests, the Forest Service has built nearly 3,000 miles of road and 21,000 miles of trail to make the forests accessible. In a published letter, the highest praise is meted out by the Secretary to the Forest Service for the efficiency, loyalty and devotion of its members and administration.

An aviator has been employed in Wisconsin to detect and report on forest fires. L. A. Vilas, an aviator, is equipped with a powerful machine, which enables him to rise to a height of 1,000 feet in a few minutes. From this height he can survey some 200,000 acres of forest land. Any sign of fire is at once reported to the forest rangers. It is hoped by this means to prevent the outbreak of serious fires. The difficulty, however, of using aeroplanes for such work is the problem of landing places.

A new position has been created in Wisconsin, namely that of State Entomologist, for the purpose of nursery and orchard inspection and administration of laws governing insecticides and fungicides. Professor J. G. Saunders, with Dr. S. B. Fracker as assistant, has been appointed to the office. Both gentlemen were formerly on the staff of the State College of Agriculture.

Six graduate students in the Department of Forestry, Cornell University, have recently completed a detailed working plan for a 3500-acre tract in the Catskill Mountains. This is the second season's work done on the tract, the first season's consisting of a detailed forest survey, the results of which were published by the New York State Conservation Commission as Bulletin 11. The present year's work secured additional facts necessary for the preparation of a detailed plan of forest management.

This tract lies at the headwaters of the well-known Esopus River, the main feeder of New York City's mammoth Ashokan reservoir, and hence is of great value as a protection to this and other streams arising in the vicinity. The tract is divided into steep upper slopes and more gentle lower slopes, about half of the 3500 acres being in each of the two slope types.

The work was done in connection with the training given to its students by the Cornell forest school as a part of the course in the management of large forest tracts.

A special attempt is to be made in Canada this winter to stimulate public interest in matters pertaining to forestry and lumbering by holding various annual meetings at Ottawa during consecutive days. On Tuesday and Wednesday, January 18 and 19, will occur the annual meeting of the Commission of Conservation, at which time all aspects of the situation affecting the natural resources of Canada will be considered. On the first day of the meeting, matters relating to forestry will receive special attention, in order not to conflict with the annual meeting of the Canadian Lumbermen's Association, which will take place on Wednesday, January 19. On Tuesday evening, January 18, will occur the annual meeting of the Canadian Society of Forest Engineers, the membership of which is made up of men engaged in professional forestry work throughout Canada. On Thursday, January 20, will be held the annual meeting of the Canadian Forestry Association, whose publicity campaign has done so much to forward the interests of forestry in all parts of the Dominion. Separate programs will be prepared for each meeting, having particular reference to the problems confronting the respective organizations. A special effort will be made to work along the lines of cooperation, since the fundamental interests of forestry and lumbering are in the long run identical.

It is expected that, as a result of the holding of these meetings conjointly, a much better attendance will be secured, and greater interest manifested, than would be possible under the previous plan of holding the various meetings at different times.

The American Forestry Association has chosen Boston, Mass., as the city in which the next annual meeting will be held. The meeting will take place early in January.

A meeting of the Directors of the American Forestry Association was held at Boston on August 31 and at Profile House, New Hampshire, on September 1. The meeting in New Hampshire was for the purpose of presenting before the Forestry Conference the views and plans of the Association regarding the extension of the Weeks Law. Cooperation of all the forestry organizations interested was urged to bring about their common desire.

"The Philippine Bureau of Forestry exhibit at the Panama-Pacific Exposition has captured the grand prize for the best forestry exhibit in the entire Exposition. This is the highest honor within the power of the Exposition officials to award. Moreover, the officials considered the exhibit of such unusual excellence that in addition they have awarded to the Bureau of Forestry two other grand prizes, three medals of honor, four gold medals, six silver medals, seven bronze medals, and one honorable mention."

Albert Grigg, former M. P. P. for Algoma, has been appointed Deputy Minister of Lands and Forests for the Province of Ontario, in succession to the late Aubrey White.

There has just appeared in Spain the first issue of a new forestry journal to be published in that country. The publication is a monthly entitled "España Forestal," and is edited by Sr. Don R. Cordoniu, who is a member of the Spanish Forestry Association and has been for many years in charge of reboisement work in Spain.

PERSONALITIES

1. *Northeastern United States and Eastern Canada*

A daughter, Elinor Elizabeth, was born to Professor and Mrs. William D. Clark at Amherst, Mass., on June 28.

William R. Brown, of Berlin, N. H., was married on May 27 to Miss Hildreth B. Smith, of Atlanta, Ga.

Professor Nelson C. Brown, of the New York State College of Forestry at Syracuse, N. Y., has completed a three months' trip through the West to gather data on lumbering methods and utilization. In addition to a considerable number of the large western operations, his itinerary included the various District offices of the Forest Service.

Professor Lovejoy, of Michigan, during the summer visited the Cornell Forestry Camp in the Adirondacks, the Yale Forest School Camp at Milford, Pa., and also Ne-ha-sa-ne Park.

Frank B. Moody, hitherto Professor in the Department of Forestry at Cornell University, is now one of the three Conservation Commissioners of Wisconsin, replacing, at the same time, Mr. E. M. Griffiths, who recently resigned from the position of State Forester. Professor Moody left Ithaca for Madison at the end of August.

Married, May 24, 1915, Benjamin K. Ayers, of the Ansonia Forest Products Company, Ansonia, Conn., and Irene Warner, of Brooklyn, N. Y.

Cedric H. Guise, who recently received the degree of Master in Forestry from Cornell University, has been appointed an instructor in the Department of Forestry at that institution.

A son, George the Second, was born to Mr. and Mrs. Guy C. Cleveland in Orange, N. J., on September 6.

Howard B. Waha, hitherto forest examiner in the Southwestern District of the Forest Service, has been appointed Assistant Professor of Forest Engineering at the New York State College of Forestry at Syracuse University.

Prof. R. R. Chaffee, of the Pennsylvania State College, has completed an extensive trip through the Northwest and along the Pacific Coast, visiting lumbering operations. He takes charge of the new optional course in Lumbering offered at Penn State.

A daughter, Louise Chase, was born to Mr. and Mrs. George Hewitt Myers on June 30 at Union, Conn.

Samuel B. Detwiler is in the Philadelphia office of E. A. Sterling.

A son, Charles Peter, was born to Prof. and Mrs. Samuel N. Spring on July 20 at Ithaca, N. Y.

Karl W. Woodward has left the Federal Forest Service to become Professor of Forestry at the New Hampshire State College and Forester of the State Agricultural Experiment Station, the position recently vacated by Mr. Foster.

Mrs. J. A. Ferguson, wife of Professor Ferguson, of Pennsylvania State College, died on July 24, leaving an infant son and daughter, the former born on July 24.

A daughter was born to Mr. and Mrs. J. O. Hazard at Tuckahoe, N. J. on August 13.

Karl Schmitt has resigned from the Forest Service and is now in New York under C. R. Pettis as an Assistant State Forester.

H. J. Kaestner, who graduated from the Pennsylvania State College in 1914, has been appointed State Forester of West Virginia, a newly created office under the Department of the Forest, Game and Fish Warden, with headquarters at Belington, W. Va.

Roy L. Campbell, Toronto, 1914, has resigned the editorship of the *Pulp and Paper Magazine of Canada* to become Secretary of the Canadian Manufacturers' Association. He is also Secretary of the Canadian Pulp and Paper Association.

2. *Southern United States*

Ferdinand W. Haasis is located with the forestry department of the Consolidation Coal Company at Jenkins, Ky., of which M. H. Foerster is forester.

Married, June 27, 1915, R. Brooke Maxwell, City Forester of Baltimore, Vice-President of American Academy of Arborists, and Céleste H. Kleinle, of Roland Park, Md.

Harold L. Russell and Miss Bess Neal Kinzel were married at Abingdon, Va., on October 5.

Samuel T. Dana and Miss Ruth Merrill were married on August 7 at Isle of Springs, Me.

George de S. Canavarro has been appointed Assistant Curator of the National Museum at Washington, D. C., where he will have charge of the arrangement and classification of woods.

A son was born to Mr. and Mrs. Chapin Jones on May 14 at Charlottesville, Va.

A son, John Everett, was born to Mr. and Mrs. J. H. Fahrenbach on July 14, at Beuna Vista, Va.

3. *Central United States*

A daughter, Marie Lincoln, was born to Mr. and Mrs. Lincoln Crowell on August 31 at Neopit, Wisconsin.

Raymond M. Killey and Miss Gertrude H. Parkhurst were married on September 15 at Reed City, Mich., where Killey is Secretary and Treasurer of the Acme Tie Company.

4. *Northern Rockies*

Supervisor T. C. Spaulding, of the Lewis and Clark National Forest, has resigned his position to take up work as Professor in Forestry at the University of Montana. This gives the Montana School of Forestry three professors devoting full time to Forestry in addition to one engineer and one botanist attached directly to the school.

Dr. J. R. Weir, Forest Pathologist for Montana and Idaho, is contemplating what he calls a "Pathological Reconnaissance" in Northern Idaho. The object is to obtain a census of all tree diseases, particularly in relation to the progress of the disease as related to age classes. Small plots will be taken, from which all trees are cut and opened up sufficiently to tell accurately the progress each disease is making with each species.

Another form of reconnaissance is being tried out on the Flathead National Forest, which is known as a "Fire Survey." The object of this is to secure accurate field data in regard to accessibility, relative hazard, inflammability of the forest cover, and the sufficiency of the fire protective force as now organized. Some very interesting results are expected. Forest Examiner J. B. Summers is in charge of the crew.

J. D. Lamont, a member of the Experiment Station staff in District 1 of the Forest Service, was married to Miss Frances T. Carr, of Plainfield, N. J., on August 5 at Missoula, Mont.

W. J. Morrill is now State Forester of Colorado, with headquarters at Fort Collins, Colo.

Clinton G. Smith is now Assistant District Forester in charge of Silviculture at Ogden, Utah, to succeed O. M. Butler, who goes to Albuquerque.

Dwight J. Jeffers has been transferred from the Medicine Bow to the Arapaho National Forest, where he is Deputy Supervisor.

A daughter, Margaret Louise, was born to Mr. and Mrs. A. W. Hayward on August 17 at Dover, Idaho, where Hayward is employed by the Dover Lumber Company.

Carl M. Stevens has been appointed Supervisor of the Cabinet National Forest.

Clarence E. Taylor and Miss Marjorie C. Cooper were married on July 28 at Colorado Springs. The couple will reside at Gramm, Wyo.

A daughter, Margaret Edith, was born to Mr. and Mrs. William O. Sander on August 13 at Saguache, Colo.

5. *Southwest, Including Mexico*

J. Harold Foster, hitherto Professor of Forestry at the New Hampshire Agricultural Experiment Station, Durham, N. H., has been appointed State Forester of Texas, Professor of Forestry and Forester to the Experiment Station at the Agricultural and Mechanical College of Texas. The appointment became effective on the 1st of September.

A daughter, Elizabeth, was born to Mr. and Mrs. Alpheus O. Waha on September 13 at Albuquerque, N. M.

Ovid W. Butler has been appointed Assistant District Forester in charge of Silviculture at Albuquerque, N. M., to succeed T. S. Woolsey, Jr., resigned.

6. *Pacific Coast, Including Western Canada*

Prof. Mason, of the University of California, will be engaged upon the Forest Service's study of the lumber industry which he has been carrying on, until the work is completed, which will probably be about December 1.

J. H. Bridges was married on June 21 to Miss Clara Maude at Tacoma, Wash. Their address is 4116 North 35th Street, Tacoma, Wash.

A daughter, Elizabeth Ann, was born to Prof. and Mrs. Pratt on July 9 at Berkeley, Cal.

A son, E. Treat, was born to Mr. and Mrs. E. T. Clark on May 17 at Seattle, Wash.

Robert Wallace has been transferred from Arkansas to the Cascade National Forest with headquarters at Eugene, Ore.

C. S. Cowan and L. R. Andrews, of the British Columbia Forest Service, have enlisted.

W. J. Boyd, formerly of the staff of the District Inspector of Forest Reserves, Calgary, has enlisted in the Third University Company, Montreal.

Assistant Forester H. K. Robison, of the British Columbia Forest Service, has left for the front as a commissioned officer in the 5th Regiment, Royal Canadian Artillery.

Forest Assistant McVickar, of the B. C. Forest Branch, enlisted with the Royal Canadian Dragoons, who has been in the trenches for several months, is now in England, recovering from illness.

Forest Assistant E. G. McDougall, of the B. C. Forest Branch, is a member of the Second University Company. The University Companies are being used as re-enforcements for the Princess Patricia Regiments.

Deputy District Forester J. B. Mitchell is a member of the Canadian Expeditionary Force now in England.

7. *Hawaii, the Philippines and the Orient*

A son, Arthur Frederick, was born to Mr. and Mrs. Arthur T. Fischer on July 18 at Ada, Ohio.

COMMENT

Once more the unexpected has happened! The new Constitution for the State of New York has failed of adoption by the people, although in many respects it was an unusually carefully prepared document, and progressive in the right direction.

We are naturally most interested in the attempt to improve the section having reference to the Forest Preserve. The improvement on this section did not strike us as a great advance, and especially was a backward step taken in abolishing the single responsible commissioner and constituting a new commission of nine members, one from each judicial district. Whatever small changes of detail in the administration were introduced—such things as should not be incorporated in any constitution, but be left to legislation or administration—the policy of keeping the forest preserve as a game and pleasure resort and without technical forest management was not changed. In view of the crudities apparent in the conception of what a forest management involves and the evident inability of organizing such management, it was perhaps best that things were left as they are, and the Editor had expected nothing else. Indeed, he may be allowed to quote from his communication to the Constitutional Convention the following language, in which he accepted the situation as it was bound to be left:

"There are two problems, closely related to each other, that must be solved by the Convention simultaneously, namely, to declare what rational policy to pursue in the State Forests, with power to carry it out, and to provide a machinery which, removed from political bias, can use this power discreetly.

"When, in 1885, the writer formulated for Senator Lowe the legislation which led to the establishment of the Forest Commission and Forest *Preserve* (*not* Park!), the *economic* and watershed protecting aspect of the Preserve was uppermost. At that time the tourist, private camp, and summer guest development was still in its infancy. The *"Park"* idea was first broached in 1890, but when, in 1896, the policy of buying lands for the State was adopted, it was still done with a Committee under the name of the Forest *Preserve* Board, and the industrial and manufacturing interests were still urged as reasons for the State's purchases. Gradually, however, not only the idea of converting the Preserve into a Park grew, but the reason for this change of aspect grew also, namely, the more and more increasing use of the Preserve for recreation purposes: hence the economic aspects fell into the background, the park idea became uppermost.

"The State of New York, being rich, can perhaps well afford to leave out of consideration the industrial element of the forest resources, and develop the pleasure park idea and incidentally the watershed protection. The amended constitution should, then, deliberately declare the policy that the State lands are to be administered with the park idea uppermost.

"That eventually a real forest management, keeping in mind all the forest benefits, the economic as well as the esthetic, might be developed is amply proved by examples from France and Germany, where pleasure seekers are not excluded from the forest; and it seems to me that the Constitution should at least not prevent that possibility. It is for that reason that I would favor the reading of the overture by Mr. Smith, which allows 'the cutting, removal and sale by the State of timber ("and trees" should be added), which are dead, fallen or mature, or which are detrimental to forest growth'; to which I would add a permissive planting clause.

"This allows a rational management of conservative character with the park idea uppermost.

"It would, of course, be incongruous, when planting and improvements of forest growth are permitted, to retain the wording of the present clause of the Constitution, which retains the lands as 'wild' lands.

"When the first Forest Commission was organized, a technical forest management was intended, but the entire lack at that time of a technically educated personnel made such management impossible. When, in 1893, the Constitutional Convention adopted the paragraph prohibiting the State from practising forestry on its own lands—which was done from fear of the Forest Commission letting in the lumberman—conditions as regards technical personnel had not changed, and it was wise enough to delay the attempt at forestry management.

"Since then, a crop of foresters has grown up, and it would be possible to organize an efficient service of practical and technically educated men. The only reason for introductiong a Commission would be to act as a buffer and to represent and defend before the public and in the political councils the policies and actions of the forest service.

"This would be best done by an unpaid Commission headed by the Governor, in which the technical superintendent of the Service has a place and three or four outside members, representative of such associations as the Scenic and Historic Society, the Camp Fire Club, the Society for the Protection of the Adirondacks and perhaps one of the forest schools. The functions of such a commission should be, once a year to discuss, amend or approve the working plan for the year, submitted by the State Forester. To further democratize, however, the administration, the forest service might be changed from the usual bureaucratic form, in which the head of the service is final authority, to a collegiate form, in which a council of his assistants forms a supervising committee, acting under majority vote. This method works admirably in British Columbia.

"One thing is certain, that the staff of the forest service must be divorced from politics, and the appointment of the head of the service must be for long enough time to assure the possibility of carrying out a continuous policy. Either Mr. Whipple's or Mr. Young's overture covers this requirement. I am inclined to favor the first as more pliable.

"Believing that in a Constitution only broad principles should be stated, leaving to legislation any detail, and keeping in mind the above stated conditions, I take the liberty of suggesting the following wording:

" 'The lands of the State now owned or hereafter acquired, constituting the forest preserves in the Adirondack and Catskill Mountains, are to be administered conservatively with a view of developing their use as a public park, and for the protection of the watersheds and utilization of waterpowers.

" 'They shall be under the care and management of a technically educated State Forester appointed by the Governor and supervised by an unpaid commission, consisting of the Governor, the attorney general, the State Forester, and four members chosen from private life. He shall be removable by the Governor only, for cause upon reasons publicly stated and after a public hearing.

" 'He shall appoint all officers and employees engaged in the service of the commission and, *so far as technical or professional knowledge is required, or the position is of permanent character,* from eligible lists, resulting from competitive examinations conducted by the civil service commission.

" 'In all technical questions he is to be guided by a council consisting of himself and two deputies.

" 'Action may be brought in the supreme court by any citizen to enforce the provisions of this section and to prevent its violation.' "

There is now need of further educational work to make sure that something as definite and yet as pliable as is contained in the above propositions, may find entrance into the Constitution which will have to be next submitted. With this in view, we shall in the next issue bring a discussion of the situation by the present Superintendent of Forests.

One of our well-informed correspondents expresses himself on the same situation as follows:

We think of New York as a state of upheavals, but the fact that the Constitutional Convention in session the past summer scarcely recommended any change in the Constitution adopted twenty years ago shows that some of its representative bodies are not easily moved.

Foresters have long looked upon the great Forest Preserve as a half-filled function and that practical forestry should be applied to the areas not necessarily required as strictly protective forests. The idea of a state letting the private owner cut to the extreme, while itself cuts none, does not seem compatible. The proper or regulated cut of both would produce the same yield and greater indirect benefits.

If the press of New York is a reflection of public opinion the people are not yet willing to trust itself to handle its own property. The argument may be advanced that its neighboring states are cutting and beginning the application of forestry, but these states do not have anything like the extent of state-owned forests. The development was different and the past history more secure.

The advance in New York has been no less noteworthy than in other states, and there has not been a scandal in its administration for ten years. The trespasses have been reduced from about $50,000 per year to a few hundred dollars; the land compromises have been set aside or are in process of determination; the future prospect looks good, but there has not yet been any continuity of administration.

The people do not seem to distrust their ability to manage their property, but there is much sentiment in the forest regions, great centers of population which look at it as a playground; and a feeling that stability of organization should be first demonstrated.

The success of the efforts of the Convention can hardly be measured, because it suffered defeat at the November election by a majority of 540,000, which is said to be the most overwhelming defeat any measure ever received in that state. The conservation article was included with many other questions which reorganized the state government and therefore the conservation idea as adopted cannot be so measured in the approval by the people.

It was attacked both for what it contained and what it omitted. It was supported because it was supposed to eliminate politics and was a decided improvement.

There is no doubt but that the Republican Legislature which convenes in January will attempt to pass certain of the proposed amendments in order to forestall a possible Democratic Constitutional Convention in 1917. What will be done with Art. VII, Sec. 7, remains to be seen, but there is grave question if any radical change is made.

During recent years the "get-together" spirit has permeated both lumbering and forestry circles to an increasing extent. The trend in this direction is particularly notable in the case of the lumber industry. The tendency in both cases was well illustrated at the Panama-Pacific International Exposition, during the week of October 18, when, on consecutive days, were held conferences of the Society of American Foresters, the Western Forestry and Conservation Association, the American Forestry Association, and the Pacific Logging Congress. In each case, the attendance was mixed, foresters, timber holders and lumbermen mixing impartially and exchanging views on the various subjects brought up in the respective programs. The result cannot fail to be a better understanding of each by the other, and a more sympathetic attitude on the part of each class toward the work and problems of the other. All the sessions were held at the Lumberman's Building and House of Hoo-Hoo, on the Exposition grounds.

The meeting of the Society of American Foresters was notable as being the first ever held in the West, aside from the local meeting of the respective sections. This meeting will undoubtedly mark a distinct step in the development of the Society, since it will bring about a keener sense of partnership in the Society by Western members, who have so long been practically shut off from active participation in and contact with the work of the parent organization through the previous procedure of holding meetings only in the East.

The program was an exceptionally good one, but space prevents mention of the individual papers, except those presented before the Society.[1] For extended report of the proceedings of this and the other sessions during the week, the reader is referred to the various lumbering and forestry publications, particularly the *Timberman, Lumber World Review* and *American Forestry.*

A feature of the afternoon session was the discussion of the forester's duties toward lumbering, and of the lumberman's duties toward forestry. Throughout the papers and the discussion ran the constant argument in favor of closer co-operation and a better understanding by each of the work and problems of the other. For the lumbermen, the discussion was led by G. M. Cornwall, and for the foresters by F. E. Olmsted.

In his paper on the place of logging engineering in forestry, Dr. J. F. Clark showed that low stumpage values are the greatest hindrance to the progress of forestry on this continent. These can be increased in only three ways, namely, raising the price of the product, eliminating waste, and reducing the cost of marketing. For some time to come, the first two can be expected to change but very slowly. The expert logging engineer finds his opportunity in being able to reduce the cost of marketing the forest crop, chiefly along the lines of reducing the cost of logging. Emphasis was placed upon the possibilities of this relatively new field, and a plea was made for a larger place for specialized logging engineering in the curricula of the forest schools.

In the evening, at the Inside Inn, was held a dinner and business meeting of the Society, at which were discussed various questions involving the policy of the organization. In particular, the old question of requirements for membership was discussed fully.

Tuesday, October 19, was devoted to the program of the Western Forestry and Conservation Association. The entire day was

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[1]The American Forester—His Opportunities, by C. DuBois.
The American Forester—What the Society Has Done and May Do for Him, by D. T. Mason.
Professional Ethics, by B. E. Fernow.
Forestry in Borneo, by F. W. Foxworthy.
The Forester's Duty toward Lumbering, by G. M. Cornwall.
The Lumberman's Duty toward Forestry, by F. E. Olmsted.
Place of the Logging Engineer in Forestry, by J. F. Clark.

devoted to a consideration of ways and means of securing better fire protection, with particular reference to the Pacific Northwest. The reports all indicated that very material progress has been made, but that much still remains to be accomplished. Points particularly emphasized were the need for the closest co-operation between all interests affected, whether governmental, state or private; the effectiveness of intensive patrol in reducing fire losses; the fact that public sentiment can be made favorable to fire prevention and fire protection by the adoption of scientific methods of publicity; and the need for a careful advance study of the fire hazard in each locality, with adequate provision of men and mechanical equipment, under a definite plan of mobilization.

The following day, October 20, was American Forestry Association Day. Perhaps the most striking paper was that presented by H. D. Langille, of Portland, Oregon. Mr. Langille's paper was entitled "Can Manufacturers, Timber Owners and Protective Agencies Unite to Advantage?" The answer was in the affirmative, and the development of the subject and the line of argument constituted an admirable summing-up of the general trend of discussion in connection with the greater part of the extensive programs of the various meetings in session during the week.

The present unsatisfactory condition of the lumber industry the country over was shown to be largely due to lack of proper organization, and a strong plea was presented for more complete and more intelligent co-operation among all branches of the lumber industry.

The difficulty now existing has been the result of sticking too long to the old principles of individualism that other great industries have had to discard or greatly modify in order to reap success. The result of the individualism has been an accumulation of evils, including over-production, unnecessary waste, undue loss of markets to substitutes, unfair tax legislation in some cases, inefficient fire protection over great areas, and a general failure of the industry as a whole to make a concerted effort to protect and develop its broad and legitimate interests in an intelligent manner.

The volunteer agencies have been numerous, but only partially effective, due for the most part to lack of paid experts in charge of each line of work. Marked success has followed the efforts of the limited number of local cooperative organizations which have secured the paid services of experts. Examples are the Oregon Forest Fire Association and the Western Forestry and Conservation Association. Similarly, success may be expected to follow the new campaign of the National Lumber Manufacturers' Association, which has recently established a trade extension department, under a paid expert, to advertise the wider legitimate use of wood in all lines of industry. In Canada, similar examples of increased efficiency in fire protection work, resulting from a greater degree of co-operation, are the St. Maurice and Lower Ottawa Forest Protective Associations.

The program which Mr. Langille advocates is in the interest of true conservation, as being calculated to bring about the better utilization of our forest wealth, better fire protection, and, in general, the perpetuation of the forest as a forest, upon which the continued existence of the lumber industry must in the long run depend.

The plan advocated is the amalgamation of the many existing organizations of timber, manufacturing and marketing interests into single units as broad in scope as may be the requirements of the territory over which their respective activities should extend; these to be organized into departments, with competent men at the head of each, their work to be standardized and results required.

Under the timber department, the suggestion is that the activities should include such subjects as statistics, forest protection, taxation, legislation, forest policy, publicity, and logged-off lands.

The manufacturing department would cover such lines as logging methods, log scaling, accounting, prices, lists, grades and inspections, traffic and claims, production, utilization, and efficiency.

Under the marketing department, Mr. Langille suggests that the work be along the lines of advertising, market conditions, building codes, designs and plans, wood-block paving, new uses, by-products, technical research, exhibits, trade marks, and salesmanship.

The program of the Pacific Logging Congress, Thursday, October 21, was largely technical in character, and reference is made to the published Proceedings for details. The most enjoyable feature of the Congress was the excursion to Eureka and return, by special Pullman train, about 180 people making the trip. Several of the large redwood operations were visited, and methods of logging studied at first hand. Opportunity was also given to go through some of the very extensive sawmills, where modern methods of close utilization were everywhere in evidence. The trip was thoroughly instructive and, through the courtesy of the local hosts, was most enjoyable in every way.

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