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EFFICIENT FIRE PROTECTION.

The Laquin Lumber Company, a very progressive firm operating near Laquin in North-Eastern Pennsylvania, has evolved a scheme of fire protection which in its efficiency leaves nothing to be desired. This happy result is due to an enterprising superintendent and the willingness of the Company to expend a liberal sum on the necessary "ounce of protection."

The tract consists of 14,000 acres of first growth hemlock-hardwoods type. Annually 1700 to 1800 acres are cut over clean so that, it is estimated, the operation will be concluded in another five years.

The Laquin Lumber Company is merely doing the cutting, the land is owned by the Central Pennsylvania Lumber Company. The two companies share the expense of protection. Every spring as soon as the snow goes, all the slash and brush around the skidways is burnt 25 to 100 feet (usually 50 ft.) back from the track. This is very expensive as the work has to be rushed through. Indeed it costs the Company $3000 a year, but the superintendent considers this a very profitable investment.

If it were not for the proximity of green timber the company would burn all the slash every spring. During the dangerous season, a body of men is put to patrolling the railroad tracks and the boundaries of the tract. For this foreigners are employed—mostly Hungarians and Italians, who are paid $1.25 to $1.65 a day with an average of $1.49, and find their own board. These men are provided with axe, pail, hoe, and shovel and always carry the latter three utensils. The shovel is found to be the most efficient implement, except in few places.

Twelve miles of the main railroad (Susquehanna & New York) run through the Company's holdings, and from this branch logging roads radiate in either direction. Along the track the patrols are stationed at half mile (or even less than half mile) intervals where there is especial danger, as near slashings on the main line, or at intervals of a mile where the danger is less.

Patrols are also posted at intervals of about a mile along the boundaries of the tract where farmers are apt to be careless in burning their fallow, and in order that all parties entering the woods can be cautioned and watched. The Company patrols not only the standing timber but all their old slashes.

There is a regular system of communication and report between the patrols. Each man has his individual beat for which he is responsible.

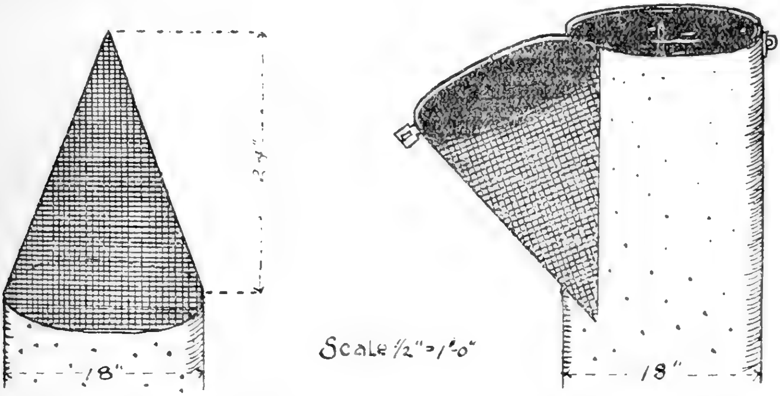
The patrols extinguish all incipient fires—by means of water, where it is available, or by beating out the flame, raking away the leaves and rubbish, or by trenching where this becomes necessary. The cost of patrol varies with the season, the region of slash, etc.

All logging train crews are instructed about fire fighting and stand ready to assist if the alarm for fire is sounded by the engine. This is usually two long and two short toots on the whistle continued for a minute at a time. Each camp has a complete set of tools for fighting fire. Each of the logging engines is equipped with a one inch hose, 50 feet long, for extinguishing small fires. Where possible water from a nearby creek, otherwise that in the engine's tank is used.

Firemen of engines and log loaders are required—and this is rigidly enforced—to dump all ashes in a safe place—*e.g.*, in a creek, or else to wet them down with the hose.

All the engines operating in or through the tract are fitted with double spark arresters—the ordinary one in the front of the engine and a cone-shaped, fine-meshed wire cap which fits over the top of the stack and efficiently prevents almost all dangerous sparks. This spark cap was devised by the Company. After experiments with various shapes the conical shape was found the best as it breaks up the cinders very fine.

These spark caps are made at the Company's machine shop. They consist, as the drawing shows, of a cap shaped from 12 gauge ¼ in. mesh (same mesh for inside arrester), wire screen 18 in. in diameter at the base and 24 in. in height. The bottom is an iron ring hinged to another ring around the stack and closing over the stack when in use with a simple latch. The wire is fastened on the sides and at the bottom with bolts. The whole device is as simple as it is efficient. They cost the Company about $3 apiece including the few hours of labor in making them.



Best of all, the engineers say that these spark arresters do not interfere with the draft. In the fall these caps are removed and stored till the following spring.

On a convenient siding stands an old tank car of 4970 gals. capacity, rigged with a hose and double pump. This is the Company's fire engine—the practical idea of the resourceful superintendent.

This tank car was obtained from the Mitschkun Co., Detroit, Mich., dealer in second hand railroad cars, for about $250. There are a half dozen such dealers, and they could also be obtained from any railroad company, so they are not difficult to obtain.

The car was fitted with a four inch suction three inch discharge Snow Pump (Buffalo) costing $120. Further, two 100 ft. lengths of water hose costing 43c a foot (2½ in. Phoenix fire hose, N.Y. Underwriters Standard, rubber lined, though a smaller hose 1½ in. or preferably 2 in. would be better), and 10 ft. of steam-hose, was purchased together with 35 ft. of 4 in. wire-lined suction hose, which with strainer and connection cost $3.86 a foot. All the hose was obtained from the Boston Belting Co. of Buffalo.

At first a one inch nozzle was used, but a 5/8 inch was found fully as effective and less wasteful.

The steam goes through a pipe from the dome to either end of the engine, with a valve at the end and a steam-hose connection to the pump,

When the pump is in operation it can throw two streams, or only one as may be deemed best. From the nozzle the water is thrown 150 ft., so the maximum distance for one stream would be 350 ft. from the track.

The tank car can be filled from any overhead water tank or by means of the suction hose from some roadside creek.

The whole equipment costs about $600.

During the winter the pump is boarded up and the hose stored away.

This tank car is especially useful for saving logs already piled along the track. Together with a system of patrols and spark arresters it furnishes a highly efficient scheme of protection. Here, as in most cases, the proof of the pudding lies in the eating—although sometimes as many as three incipient fires occur a day they are promptly extinguished and the Company has had no serious fires since the lumbering operation began.

The total amount actually paid for patroling, fighting fires and fire protection generally in 1905 was only $1710, of which $1500 for patroling and cleaning up brush along the railroad. The figure of $3000 given above may, therefore, be considered an outside figure.

The fire problem impossible of solution? Let us but cease talking about it and go at it with good will, good common sense and application, not afraid of the relatively small expenditure, if we would meet this greatest need of American forestry.

A. B. Recknagel.

MILL SCALE STUDIES.

Trees increase in value as they increase in size. This increase is due to the increment in the quantity of wood, and, to a much greater extent, to the improvement in its quality. The following table is based on actual measurements:

Proportionate increase in wood quantity	1, 2, 3, 4, 5, 6.
" " " " in the value of the tree	1, 2½, 4, 6, 8, 10.

In other words, one tree containing three times as much lumber as another, was worth four times as much as the first; one containing five times as much lumber, was worth eight times as much, and so on.

To determine as accurately as possible the rate of appreciation the Forest Service has been conducting a series of experiments known as Mill Scale Studies.

The method followed is to measure each tree as it is felled in the woods, record the measurements, mark each log so that it may be identified at the mill, and measure and inspect every board sawed out from the identified logs. The quantity and the grades of lumber from each log are recorded on a separate sheet, and by bringing together the sheets corresponding to the various logs of any given tree the exact amount and the quality of lumber obtained from that tree are ascertained.

The difficulties which beset such a study are numerous, and some of them seem to be insurmountable at present. A few of them will be pointed out in this paper, and remedies suggested.

There are two classes of factors which affect the quantity and the quality of the lumber of any tree, (1) natural, and (2) artificial.

A study of the specifications for grading lumber shows that the four main factors which affect the quality of a board are its width, the proportion of sap to heartwood, the presence or absence of knots, and pathological defects.

In any given stand, the width of the boards that may be cut from a tree, the proportion of sapwood, and the clearness of the wood are all dependent on the diameter of the tree. Generally speaking, the bigger the tree, the wider, clearer, and less sappy are the boards obtained. Since the diameter, however, is a function of the density of the stand, the first three factors mentioned will largely depend on the density of the stand, and a mill scale study made for a stand of a given density should apply to other similar stands of the same density.

The pathological defects of trees, such as rot, shake, and worm holes, are more or less uniform throughout wide areas, sometimes covering almost the entire range of a species, as is the case with worm holes in Black Locust.

Therefore, as far as the natural factors are concerned, a mill scale study made for a given species in any region ought to apply more or less accurately to a large area, if the density and the character of the stands are similar in this region. It must not be overlooked, however, that to determine what effect the density of a stand had on the shape and character of its trees, it is necessary to know not only the present density, but the past history of the stand. For this reason mill scales will be most accurate when made for virgin stands, or for even-aged second-growth stands. Still it is not impossible to make fairly accurate tables for culled forests by introducing some simple classification. For example, stands may be classified as having had their origin in a virgin forest and culled 10 to 20 years ago, 20 to 30 years ago, 30 to 40 years ago, and so on. In fact, since virgin forests are disappearing very rapidly, and uniform second-growth stands are rare, mill scales made for such culled forests would be of the most permanent value.

Since, in making a mill scale, only the actual amount of lumber obtained at the mill is considered, it is evident that for trees of a given size, the higher the stump and the longer the top left in the woods, the less lumber the tree will yield. The skill used in cutting a tree into logs, and the care with which crooks, scars, and wounds are culled may greatly affect the quantity of lumber obtained.

The efficiency of the sawyer at the mill, as well as that of the edger and trimmer, will affect not only the quantity of lumber yielded, but also the grades of the boards. In fact, this is probably the most disturbing factor of all, because the personal equation enters so strongly into it.

The judgment of the lumber inspector is another disturbing factor. Two inspectors, equally expert, may put the same board into different grades. This, however, will be only in doubtful cases where a board is as near one grade as it is the next.

Finally, the market demands may, to a certain extent, affect the grades of lumber obtained from a log. If, for example, a large order for boards of a certain width, say 12 inches, comes into a mill, all logs large enough may be cut into boards of this width, regardless of the fact that certain of these logs might have been made to yield wider, and therefore higher grade stuff. This will not often happen because the loss due to the sacrifice of grade will eventually offset the profit derived from the special order. A special market demand may sometimes also affect the quantitative yield of a log by requiring boards to be cut thinner than usual, thus increasing the waste due to saw-kerf.

These are great difficulties, but closer examination will show that most of them are not so serious as to render mill scale studies impracticable. It must be remembered that no lumbering operation is ideal or perfect. More or less waste occurs everywhere. If, therefore, a study is made in a mill where more than average care is used in handling the lumber, and a sufficient number of trees is followed through the mill, the results obtained ought to apply fairly well to the average results of any other mill, where the usual amount of care is exercised to guard against waste. Again, some of the errors that enter are compensating, and in the long run rectify each other. For example, an inspector is just as liable to underestimate the grade of a board as to overestimate it. The average height of stump, and length of top left does not vary greatly in different operations. Furthermore, the forester making the measurements can exercise his judgment and discard broken trees, or trees which were so carelessly handled that their yield was far below the normal.

Forestry is not a mathematically accurate science, and fair averages are all that may be expected from forest measurements. Mill scale studies, if made intelligently and carefully, should give such averages.

LOUIS MARGOLIN.

THE BILTMORE PACHYMETER.

In the case of trees standing (not felled), the mensuration of tree diameters, with bark, at points other than breast height has been found so troublesome, that little use is made of "upper diameters" as factors of volume.

The objects for which the measurement of upper diameters along the bole of a standing tree may be desired, are, to find the diameter at the end of the clear bole; to find along the bole that diameter, above which the tree ceases to be merchantable; to find Pressler's guide point, (one-half *d. h. b.*); to find the diameter and the taper of the tree at any point desired; to establish the form factor and the form height, or number of cubic feet per foot from the sectional area breast high as base.

Upper diameters of standing trees are, usually, measured with Pressler's telescope, with Wimmenauer's telescope, with Winkler's and Klausner's instruments, or with the help of an ordinary transit. In all cases, however, the use of the instrument is time taking to such an extent that the American forester must much prefer "to cut the tree down" when desiring to obtain its upper diameters, instead of wasting time and money in the use of instruments.

The writer has constructed a simple device, based on a most simple mathematical principle, which answers fully the purpose of obtaining "upper diameters."

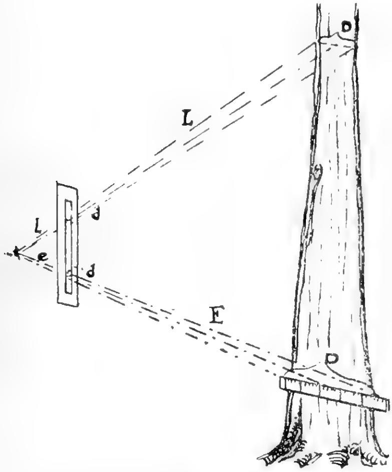
The mathematical principle involved in the use of the "Biltmore Pachymeter" appears from the following equations; illustrated by the attached sketch:

$$\frac{e}{E} = \frac{l}{L} = \frac{d}{D}$$

The Biltmore Pachymeter is used in connection with a target or piece of board graduated in inches, marked black and white, which target is fixed horizontally at any point desirable at the base of the tree.

The instrument itself consists of a piece of metal about 18 inches long and 1½ inches wide, containing a longitudinal slot about ¼ inch wide and 17 inches long. The edges of this slot must be strictly parallel. Its actual width is entirely irrelevant, from the mathematical standpoint.

It might be stated, that any stick or pole, even a walking cane, having parallel edges, will answer the purpose of establishing and measuring upper diameters. The Biltmore Pachymeter is merely a device convenient to handle.



The observer holds the Pachymeter, pendulum fashion, by the hand of the outstretched arm in a position parallel to the tree trunk, and he moves the instrument backward or forward until the edges of the slot cut off even with the desired diameter shown on the target. Then, the eye following upward along the trunk and sighting through the slot, that point on the tree bole is readily obtained where the bole cuts off with the edges of the slot. The position of this point above ground can be ascertained easily with the help of any hypsometer.

It might be wise to combine the Biltmore pachymeter with Christen's hypsometer, so that the size of an upper diameter, as well as its position, may be found by the use of a single instrument.*

It is evident that upper diameters can be ascertained with the help of the pachymeter, without any knowledge of the distance of the observer from the tree and without any reference to the position of the observer above or below the foot of the tree.

If the slot at its lower extremity, is made of double width, then it is easy to find Pressler's guide point (point along the bole where the diameter is one-half of the d. b. h.) directly before measuring the diameter of the tree at breast-height and without the use of a target and, of course, without measuring the distance of the observer from the tree.

RALPH G. BURTON.

*See simplest method on p. 195, Vol III of FORESTRY QUARTERLY—ED.

FORESTRY IN NOVA SCOTIA.

Nova Scotia is pre-eminently a forest region in spite of the fact that the mountains are neither high nor rugged, nor the climate so cold that farming is out of the question Many hundreds of barrels of apples and potatoes are shipped annually from this province. But the area of tillable land is small compared with the extent of the true forest soils. Only the river basins, filled in by rich alluvial deposits, are suitable for agriculture. The greater part of Nova Scotia is covered with a mantle of glacial boulders, between which and the bed rock there is only a thin layer of soil. Such land is not worth clearing for farms, but will produce excellent timber.

Among the softwoods, White Spruce [*Picea Canadensis* (Mill) B. S. P.], and Balsam Fir [*Abies balsamea* (L.) Mill], are the commonest species, occurring all over the province, and occupying the higher, bleaker sites to the exclusion of all other tree species. The White Spruce reaches a maximum size of 36 inches in diameter, breast high, and 100 feet in height. The growth is rapid when the light is not cut off, and the tree has very few insect and fungus enemies. No traces of serious damage by *Dendroctonus piceaperda*, Hopk., so destructive in Maine and New Hampshire, were observed in an extended trip through Nova Scotia.

The White Spruce differs markedly in its rate of growth from the Red Spruce—*Picea rubens*. Many examples were seen where the former was making as rapid height growth as White Pines right alongside of it. However, the diameter accretion is not so rapid as that of White Pine, and the bole of the White Spruce tapers more.

Fir, here as elsewhere, is a fast-growing tolerant, short-lived tree. Seldom is a specimen over 14 inches in diameter, breast high, sound.*

Nearly all of the Tamarac—*Larix laricina* (Du Roi) Koch—in Nova Scotia was killed by insects about 15 years ago, so that there are now no large living trees. Young growth, however, is springing up everywhere.

Hemlock—*Tsuga Canadensis* (L.) Carr., White Pine—*Pinus*

* The editor has seen many perfect ones of 18-inch on Cape Breton.

Strobus (L.), and Red Pine—*Pinus resinosa*, Ait.—are common on the lower and less exposed parts. A great deal of White Pine has been cut from the river valleys. Red Pine is not very abundant, but all the larger trees have been cut and sawn into lumber. Hemlock is only just beginning to be used.

Yellow Birch—*Betula lutea*, Michx. F.—is the best of the hardwoods present. It is commonly fairly straight and sound. Paper Birch—*Betula papyrifera*, Marsh—is usually straight and sound, but seldom reaches large size. Sugar Maple—*Acer saccharum*, Marsh; Red Maple—*Acer rubrum*, L. and Beech—*Fagus atropunicea* (Marsh) Sudworth—are almost without exception defective and will rarely pay for sawing. White Ash—*Fraxinus Americana*, L., and Black Ash—*Fraxinus nigra*, Marsh., are rare. Two species of popple—*Populus tremuloides*, Michx., and *P. grandidentata*, Michx.—are found in the province, but neither is abundant. Red Oak—*Quercus rubra*, L., and White Oak—*Quercus alba*, L.—reach commercial size in the sheltered valleys near the shore. Gray Birch—*Betula populifolia*, Marsh—is indigenous, but it is not the pest that it is in New England. It never takes possession of fields in the aggressive way in which the New England form does.

Since the hardwoods play such an unimportant role in the forest, the great problem for forestry is to devise some scheme of management for the softwoods. Of these White Spruce and Fir deserve the most consideration. White and Red Pine are confined for the most part to those classes of soil which are best suited to agriculture and must, therefore, disappear when the population becomes denser. Hemlock is not a tree of the future, because it does not reproduce well. But White Spruce and Fir reproduce abundantly and grow well on true forest soils. They are the forest trees of the future.

Logging has been going on in Nova Scotia ever since the Province was discovered. White Pine, Red Pine, Red and White Oak were the first species cut. Spruce, Fir, and Yellow Birch have also been staple timbers for a long time. Hemlock is only just beginning to be cut on a large scale. Maple, Beech, Ash, Popple, Paper and Gray Birch have not been cut commercially.

All of the lumbering in the past has been done with one or two horses or oxen, working in the winter when the snow covered up the boulders and gave a good hauling surface. Light sleds and small loads have been found to be most economical, so that the wood roads are comparatively narrow and inexpensive. The labor is drawn from the farming sections. These men are of Scotch and Dutch descent for the most part, and make careful, trustworthy workmen. These two factors, cheap roads and efficient labor, have had a marked effect on the condition of the cut-over areas. There are no denuded slashes with every stick of timber cut or blown down. But the most important single factor which has led to a culling of the woods rather than stripping, has been the requirement of the English market to which most of the Nova Scotian lumber has been shipped. The standard in the English market is the "deal," a board three inches thick and at least seven inches wide and ten feet long. This has been equivalent to demanding that trees should be cut to a diameter limit of 12 inches breast high, since that is the smallest tree that will yield a 7-inch board of sufficient length to make it worth while cutting.

In some regions such a culling process would leave a forest in poor condition. For example, on a steep slope the removal of the larger trees would expose the smaller to the wind. But Nova Scotia is not a country of high mountains and steep slopes, so that the danger from windfall, even with such shallow-rooted species as spruce and fir, is very slight. Likewise, with intolerant species, cutting the larger trees would leave no trees of the valuable species to seed the area. But spruce and fir are tolerant species, and in a virgin forest all ages are found, so that when the big trees are cut, there are plenty of immature trees to take the place of those removed. Another reason why spruce is especially adapted to a selection system of cutting is that spruce and fir reproduce best on a humus-covered soil in partial shade. Perhaps, instead of saying that spruce reproduces best under such conditions, it would be more accurate to say that the hardwoods do not reproduce well except in direct sunlight and on mineral soil where the delicate seeds can strike root immediately. Hence, as long as only the larger trees are cut from a spruce forest and the soil is not exposed to direct sunlight, the composition of the stand will remain the same; always assuming, of course, that fire is kept out.

The forest fire problem is not a serious one in Nova Scotia. Droughts are infrequent and except in mining sections public opinion is strongly against setting forest fires. In the mining regions fires have commonly been widespread and very destructive. The miner wants to get rid of the trees and soil which cover up the bed rock. The treeless and barren aspect of the south shore of Nova Scotia is directly attributable to the gold mining projects which have been carried on there.

As an example of the results of the Nova Scotian method of lumbering, conditions on an actual tract of 30,000 acres may be cited. For the last 10 years about 6 million feet of timber have been cut annually. This has been almost entirely pine and spruce. Hemlock and the hardwoods have not been touched and only an occasional large fir taken. No trees under 12 inches in diameter breast high were felled. The logging was done with oxen handled by careful workmen so that there was no such wholesale slashing of the woods as accompanies railroad logging. Today this property contains much valuable hemlock and hardwood, large enough for saw timber, in addition to a young thrifty growth of spruce, pine and fir fit either for wood pulp or valuable to hold for future growth. Near a pulp mill such a tract would be worth at least $5 per acre, after yielding a net annual income of over $20,000 for the last 10 years.

Briefly summarizing, Nova Scotia may be cited as a proof that where there is little danger of windfall a spruce forest may be handled by the selection system; actual practical experience shows that profitable annual cuts may be made annually, and yet the productive capacity of the forest is not impaired.

KARL W. WOODWARD.

THE BEGINNINGS OF LUMBERING AS AN INDUSTRY IN THE NEW WORLD, AND FIRST EFFORTS AT FOREST PROTECTION. A HISTORICAL STUDY.

The business of lumbering, which at the present time has the fourth place among the great industries of this country, had its beginning in the old town of Berwick, Maine, for in that town was erected in 1631 the first saw-mill in the New World, of which the date is certain, also the second saw-mill in 1634, and at the same time the first corn-mill to be run by water-power. And here also, in 1650, was built the first gang saw-mill on this continent, if not in the world.

The first document printed in vol. 4 of the Documentary History of New York, is a fragmentary Journal of New Netherland, by an unknown writer, written between the years 1641 and 1647. In this Journal the writer mentions three saw-mills erected, which were erected by the West India Company, but he does not give the date of their erection, or their location. He says: "In the beginning their Honors had sent a certain number of settlers thither and at great expense had three saw mills erected, which never realized any Profit of consequence."

Prior to the erection of the first saw-mill, or about 1629, the first settlers at Saco and Newichwannock, now South Berwick, Maine, began to manufacture the tall pines and the large oaks of the forest into lumber by hand, riving the former into cloave-boards (clapboards) and the latter into pipe-staves, which lumber formed a part of the return cargoes of the ships that came to the Piscataqua in those early days of its settlement. All clapboards, pipe-staves and shingles were made in this way until machines were invented for sawing them, during the first half of the last century.

The first mention of a saw-mill in New England history we find in the letter from Thomas Eyre, one of the adventurers or company of Laconia, to Mr. Ambrose Gibbins, their factor at Newichwannock. This letter was written in London, the last of May, 1631.

"Mr Gibbins:—Yours of the 8th April, 1630, from Plymouth I received—Your next to me is dated the 21st July last at Pascataquacke—Your third letter is dated the 14 of August by which

I perceive diverse of the commodities and provisions which you carried with you in the barke Warwicke, were not to your liking for which I am sorry—I hope by the Pied Cowe you find it otherwise. I pray you write me how you like the hatchetts sent you by that ship and how all goeth. I like it well that your governor will have a stocke of boards at all times readie. I hope you will find something to relade both the Pied Cowe and the Warwicke. I will now put on the sending of you the *moddell of a saw-mill* that you may have one going.—Your loving friend, Tho. Eyre.

"Kept until the 7th of June."

Belknap in his History of new Hampshire,* (Vol. 1, p. 10), tells us that Gibbins had the care of a saw-mill and lived in a palisaded house at Newichwannock where he carried on trade with the Indians in 1631.

The next mention of a saw-mill in the New World we find in the "Articles of Agreement" between John Mason on the one hand and James Wall, William Chadbourne and John Goddard on the other. This document is preserved in the Archives of Massachusetts. "It is written on parchment in a remarkably legible, though peculiar hand-writing.† It is dated 14th March, 1633. It represents that John Mason owns certain lands in New England and especially an estate called Newichwannock lying upon and near to the Ryver there called the Pascatawaye; that he intends by God's permission by the first and next convenyent shipping to send to his said lands and there to place and settle servants and others; that he has agreed with the three individuals above named that they are to 'go over into the said lands' and to stay there for five years, in which time they are to cut timber, build dwelling-houses, erect two mills 'and perform such other work' as the said John wants done."

A year or more passed after the making of this contract before Capt. Mason found "shipping" in which to send the mills and men to the "Pascatawaye", as can be learned from the correspondence between Capt. Mason and Ambrose Gibbins.

The location and character of these mills and the term of their occupancy we learn from the deposition of Mr. James Wall, one of the three carpenters, taken and sworn to before George Smyth

*Farmer's edition of Belknap's Hist. N.H. 1831, p. 422.

†Rev Dr. A. H. Quint, in his historical Memoranda of Dover, N.H., p. 369.

on the 21st of the third month 1652, namely at Ashbenbedick Falls, a corn-mill and a saw-mill being run for 3 or 4 years.*

The short life of these mills may have been occasioned by a freshet as may reasonably be inferred from the following deposition of Mr. James Johnson aged 50 years "or thare abouts: this deponent saith that upon the steep falls beyond Thomas Spencer' house there stood part of a mill which was said to be Capt. Mason' 16 years since, to the best of my remembrance and farther saith not."

In corroboration we find the deposition† of Thomas Small of Piscataqua in New England, planter, aged 65 years, who states that he hath lived in New England upwards of fifty years—and "that the deponent doth very well remember that Capt. Mason sent into this country eight Danes to build mills to saw timber and tend them, and to make potashes; and that the first saw-mill and corn-mill in New England was erected at Capt. Mason's plantation at Newichwannock upwards of fifty years—where was also a large house and conveniences of outhouses, and well fortified with store of arms. That about forty years since the said house and buildings were burned to the ground, but by what means the deponent doth not know—Sworn 8th Sept., 1685, at Portsmouth."

The next saw-mill of which we have any record was erected by Major Richard Waldron at Dover, N. H., about 1640. He built other mills in 1648. These mills were located on the falls near the head of tide-water on both the Cocheco and Bellamy Rivers.

About this time grants were made of timber lands on all the branches of the Piscataqua. Just then there was great activity manifested in the development of lumbering as an industry. Saw-mills began to multiply and their capacity was enlarged. In 1650, a mill carrying eighteen saws moved by one wheel was erected on the Assabumbedeck Falls, the site of the saw-mill and corn-mill erected in 1634, which was the first gang saw-mill of which we have any account on this continent.

We learn from the Kittery Records that in 1650 the following grant of land was made to Richard Leader, who had been elected a councillor of the province in 1646. "Whereas at a court held

*Belknap's Hist. N. H., p. 428 and Provincial Papers, N. H. Vol. 1, p. 89.

†From New Hampshire Provincial Papers, Vol. 1, p. 45.

at Kittery, on the 11th day of March 1650, Mr. Richard Leader made certain propositions for the erection of mills at Newichwannock, it is ordered therefore by this court and the consent of the county, that the aforesaid Richard Leader, his heirs and assigns, shall have sole property and privilege of the little river at Newichwannock, commonly called or known by that name to erect a mill or mills upon the river aforesaid, together with like property and liberty of all such timber as is not yet appropriated to any town or person." The magnitude of Mr. Leader's operations soon gave the name of Great Works to the place which afterwards became the name of the river.

In 1654 there was granted to him all the pine trees up the little river, so far as the town bounds went, for the accommodation of his mill. Following the course of the river this would be about twenty miles. For the privilege of cutting the timber he was to pay the town a tax or royalty of £15 currency.

These saw-mills had not been running many years before the citizens found it necessary to make regulations to guard against the wasteful cutting of trees for clapboards and pipe-staves, as appears from the regulations made in Kittery and Dover and Portsmouth regarding the cutting of such trees.

In Kittery in 1656 it was ordered that if any inhabitant should fall any pipe-stave or clapboard timber and let lay unused up one month, any other inhabitant might improve it as his own property. Previous to this it had been ordered that no inhabitant could have more than five trees of each kind allotted him at one time for the purpose. At a town meeting of the inhabitants of Portsmouth in 1660 a penalty of five shillings for every tree was imposed upon any inhabitant for cutting timber or any other wood from off the common except for their own building, fencing or firewood.

Elsewhere restrictions in the use of timber were enacted :*

"It is this day ordered that noe inhabitant shall fall above tenne trees for clapboards or pipe-staves until he hath wrought-y and he that shall have above Tenne Trees fallen at any time not wrought up shall forfeit for evrie Tree Tenne shillings."

"It is this day ordered that noe man shall fall any timber for clapboards or pipe-staves, plank or boards without approbation of the Townsmen."

*Historical Memoranda of Dover, p. 32. 164, 11, 6 mo. and p. 33. 8, 12 mo. 1643.

These regulations show that the manufacture of clapboards and pipe-staves was a common business, and the reference to plank and boards is evidence that saw-mills were in use here at this time.

Again: "At a meeting of the Selectmen holden the 25th of 10th mo. 1665. Ordered that whereas many persons doe fall Timber and make staves without order and take in several inmates for that end, whereby the town and the settled inhabitants are much injured, these are therefore to impower John Roberts, Thomas Nock and Phillip Chesley or any two of them to make dilligent sarch into all the woods, and when they find any that hath transgressed town orders in making staves of felling timber, what they find they shall sease for the use of the towne, the informers shall have the one half for their Paynes and the other tc be returned into the Towne Treasury."

It will be observed that this third order was made twenty three years after the first and yet there were timber trees suitable for the manufacture of clapboards and pipe-staves to be protected from wasteful cutting, which fact shows the wisdom of the orders.

It appears that prisoners in the jails were sometimes employed in making shingles, as we learn from a letter from William Vaughan, Esq. containing a journal of transactions during his imprisonment, etc., to Nathaniel Weare, Esq. Agent in London, 17th March, 1683:* "The governor (Cranfield) having formerly prohibited the prisoners from making shingles, went himself this day to the prison and prohibited John Partridge from making shoes: bade the marshal throw them into the sea."

We find the following interesting bit of history in "Old Eliot," vol. 4, p. 182, copied from Egerton MSS. 2395, British Museum, ff. 397–411. Extract by Dr. C. E. Banks.

"Nichequiwanick. About three miles from Agomentine (Agamenticus?) is the River Pascataway, which is six miles from the mouth. It brancheth itself in two branches, the South branch of which retaineth the name of Pascataway, the other Nichiquiwanick. . . At the falls of Nichiquiwanick three excellent saw mills are seated, and there and downward that side (the Maine side) of ye river have been gotten most of the masts which have come for England, and, among the rest, that admired mast which came over some time last year, containing nere 30 tunes of timber as I have been informed."

*Belknap's Hist. p. 483.

Unfortunately this extract does not give the date of the paper, but from other statements in it we infer that it was written soon after Maine was annexed to Massachusetts in 1652. About this time there were three saw-mills running at Newichwannock.

From the representations made in 1681 by the King's Council, by which Council New Hampshire was then governed, to the lords of trade pursuant to their order, we learn something of the magnitude of the lumber business on the Pascataqua at that time.* "The trade of the Province" say they, "is in masts, planks, boards and staves and all other lumber, which at present is of little value in other plantations to which they are transported, so that we see no other way for the advantage of the trade, unless his majesty please to make our river a free port."

"Importation by strangers is of little value: ships commonly selling their cargoes in other governments and if they come here, usually come empty to fill with lumber—"

By an account of the entries in the port annexed to the above, it appears that from the 15th of June, 1680 to the 12th of April, 1681, were "entered twenty-two ships, eighteen ketches, two barks, three pinks, one shallop and one fly-boat, in all forty-seven." This for ten months. If the ships, ketches and barks were all loaded with lumber, we can form some idea of the importance of this business.

At that time "taxes were commonly paid in this province in lumber or provisions at stated prices, and whoever paid them in money was abated one-third part." The prices in 1680 were as follows:

"Merchantable White Pine Boards per M.	30s.
White Oak pipe staves per ditto	£ 3.
Red Oak dito per ditto	30s.
Red Oak Hhd. ditto	25s.
Indian corn per bushel	3s.
Wheat per ditto	5s.
Malt per ditto	4s.

Silver was 6s and 8d per oz." (Belknap's Hist, N. H., p. 95).

The number of lumber-laden ships sailing from Portsmouth that year shows that the Piscataqua was at that time the center of the lumber trade of the colonies. It continued to be the center of this business for many years, or until the virgin forests of the territory drained by the Piscataqua and its branches had

*Belknap's Hist, N. H., p. 94.

been exhausted. It was the center of this export in 1650, which is so graphically described by Cornelius Van Tienhoven, Secretary of the province of New Netherland, in his "*Information relating to taking up land in that province in 1650*", which is to be found in the Documentary History of New York, Vol. 4, p. 25.

After describing the revenue to be derived from agriculture, he proceeds to point out as an inducement to colonization that revenue can be obtained by industry from the products of the forest, as follows: "Such as the making of pot and pearl ashes, clapboards, knees for shipbuilding, staves, all sorts of pine and oak plank, masts for large ships, square timber and ash and hickory planks in which a staple trade could be established. The English of New England put this in practice, as is to be seen, after the land had been brought to proper condition; they sell their provisions at the Caribbean Islands, staves at Madeira and the Canaries, masts and fish in Spain and Portugal and bring in return all sorts of commodities, so much of which returns as they do not consume are again distributed by them throughout all the islands known and inhabited in the Northern part of America. So that through the variety of the returns, which of necessity was received, a profitable trade is already established in New England which can also be right well set on foot by the Netherlands, if the population of the country were promoted."

From the above statement it seems that the Netherlanders had not begun to manufacture or export lumber at this time.

About the time of the making of the regulations to prevent waste in the cutting of clapboard and pipe-stave timber, it was found necessary by several of the New England colonies to make stringent regulations designed to guard against damage to the woods by fires. Great forest fires must have occurred in those early days as they have frequently occurred since.

Williamson tells us of a great forest fire that occurred one hundred years later, which began in New Hampshire and spread into Maine. He says: "Early in July, 1762, devouring fires did immense damage to the woods in New Hampshire and spread into Maine. They burst forth from the woods of New Hampshire and burning with irresistible fury passed through Towok (now Lebanon) in Maine, and being driven by the winds to the eastward, entered Scarborough, Gorham town, New Casco (Portland), and the neighboring forests where they raged till they were only checked by a flood of rain which fell on the 19th and 20th of August. Even the cattle in many places did not escape the violence of devouring fire. A prodigious quantity of the most valuable forest timber was destroyed, besides houses and saw-mills."

This fire covered a distance of about fifty miles from its starting point in an easterly direction and must have burned itself out at Casco Bay, north of Portland. As the country north of this was unbroken forest to the "River of Canada", it must have burned over an immense area in that direction. We cannot well imagine the damage that would be done by such a fire burning for a month or more in an unbroken forest.

Belnap tells us that as early as 1668 the government of Massachusetts, under which the provinces of Maine and New Hampshire then were, had reserved for the public use all white pine trees of twenty-four inches in diameter at three feet from the ground. These trees were reserved for masts for the king's navy. The government had a monopoly of trade in masts and maintained it up to the time of the Revolution.

Sullivan tells us that the charter of 1692 incorporated the Province of Maine and lands between Nova Scotia and Sagadahoc River with the old Colony of Massachusetts, with the provision that the general court should not grant any lands in Acadie, or east of the Kennebec River without the consent of the Crown. In the charter there was a reservation of all the pine trees of twenty-four inches in diameter for the use of his majesty, his heirs and successors. Acts of Parliament prohibited the cutting of pine trees on this reservation under very severe penalties recoverable in the admiralty courts. The Crown would not trust a jury to try causes arising on the supposed breaches of these acts of Parliament. Agents were appointed to take care of the pine trees; but as the country was cleared, fires were kindled, which ran into the forests and destroyed the pine timber wherever they came. Moreover, as the forest trees were cut down, the tall pines became unable when unshielded against the wind by the lesser woods, to withstand the storms. The agents, generally for their own emolument, gave license to cut such trees for other uses as would not answer for navy masts, and sent deputies to mark the trees which were to be preserved. This was usually managed on the principle of bribery and corruption and while the agent and his deputies became rich, great havoc was made among the king's trees.

In 1699 in King William's reign the first Surveyor of the Woods was appointed by the crown. His name was John Bridges. An order was sent to the Earl of Bellamont, who was then Governor of New England and New York, to cause acts to be passed in his several governments for the preservation of the White Pines. From this time on to the time of the revolution this office of Surveyor of the Woods was a lucrative one.

It was given to Gov. Wentworth of New Hampshire in 1743; besides perquisites and emoluments he had a salary of £800 sterling from which he paid his deputies. He held the office for twenty-five years, when he resigned and was succeeded by his nephew, John Wentworth, both in the government of New Hampshire and surveyorship of the woods. He continued in the office until the Revolution.

In Queen Anne's reign, in 1708, a law was made in New Hampshire prohibiting the cutting of such trees as were twenty-four inches in diameter at twelve inches from the ground without leave of the surveyor, who was instructed to mark with the broad arrow those which were thought fit for the use of the Navy and to keep a register of them. The penalty for cutting such a tree was £100 sterling or $500.

Williamson says that as late as 1784 a law was passed by Massachusetts to protect the innumerable White Pine yet standing upon the public lands in the Eastern forest . . by far the noblest trees. The Legislature made it penal in the sum of $100 to cut one of them, recoverable by indictment.

Two years later, in 1786, this long continued policy of protecting the White Pine was abandoned by the State and a policy adopted calculated to hasten their destruction. It is difficult for us of the present day to understand the motives that induced the Legislature to make such a radical change. But the policy then inaugurated of getting rid of the public forest lands as quickly as possible was continued by Massachusetts until Maine became a state, and was continued by this state until all the wild lands passed into private hands.

A land lottery scheme was devised to dispose of 50 townships. In the scheme there were to be 2720 tickets of £60 each. If the tickets all sold the aggregate would bring in £163,200 or $815,000. Against these there were to be put into the wheels these 50 townships of six miles square, equal to 1,107,396 acres of land, and every ticket would entitle the holder to a prize—the lowest half a mile square and the highest a township. A considerable part of the tickets sold, and at the time of drawing William Bingham of Philadelphia took what lands the ticket-holders did not draw, and bought in afterwards the greater part of their prize lots. At one time Bingham's heirs owned 2,350,00c acres of these lands—a territory nearly half as large as the state of Massachusetts. The state had disposed of 3,500,000 acres in twelve years after the close of the war.

If the wise regulations for guarding against the waste of timber on the common lands so early enacted by the "townsmen" of Dover, Portsmouth and Kittery (Berwick being then part of Kittery) had been generally adopted throughout the colonies and continued and enforced by their successors to the present day, there would have been no danger of a timber famine in this couutry for a long time to come. The wild lands of Maine and the White Mountain Region of New Hampshire, comprising in extent nearly one half the area of those states, would have been public property today instead of being in the hands of a coterie of lumber kings. But since those early days the vast forests, which then covered and adorned the continent and which had often been renewed by the processes of nature have been largely displaced by the hand of man, and the agency of man in hewing and burning down these forests has so far outstripped their natural reproduction that the present generation is compelled to consider the best methods of conserving what now remains.

John E. Hobbs.

CURRENT LITERATURE.

HENRY S. GRAVES, *in Charge.*

Research Methods in Ecology. By F. E. Clements. Lincoln, 1905, 334 pp. Illustrated.

Some years ago the reviewer defined silviculture as applied ecology. If this is a correct definition, then this volume, the first of its kind in the English, and perhaps in any language, must be welcome to students of forestry. Indeed, it is full of interest from cover to cover, not in recording facts, but pointing out the methods of securing facts of ecological import. Foresters have studied ecology for a hundred years in an unsystematic way, and so did botanists, but only within the last ten years has ecology been systematically developed into a science by itself as a branch of general biology, the name appearing for the first time in E. Warming's Oekologiske Plantegeografi, 1895, although to Grisebach belongs the credit of having laid the corner-stone of the science by pointing out the plantformation as the fundamental feature of vegetation as early as 1838. Since Warming's book a large literature has accumulated, discussing ecological relations, and a new, comprehensive terminology has developed, which in itself is needful to the forestry student if he would be abreast of the times in his forest descriptions and in reading modern ecological literature.

Briefly, the study of the relation of plant or plant formation to habitat is ecology. We cannot agree with the author in attempting to make this study co-extensive with botany or to identify ecology with physiology, and we think his attempt a failure. We accentuate this because, we believe, there is a tendency to make definitions of our arts and sciences too all-inclusive, thereby losing the value of segregation. While, of course, in nature there is a continued inter-dependence of everything that we seek to classify into separate branches, it is most useful to hold on to such classifications, which denote mere differences of the point of view from which the study is carried on : physiology has been the study of functions in the single individual, and the name had best be retained for this, while a very distinct point of view is expressed in the term ecology, which, to be sure, in its manifestations must be in part the result of function, and its study needs knowledge of physiology as well as physiography, geography, etc., being in turn a handmaiden to these, so that Schimper was induced to entitle his book: *Pflanzengeographie auf physiologischer Grundlage.* The book is so replete with interest that only an intimate study will bring satisfaction, the reviewer being restrained to merely giving glimpses into the contents.

There are only four chapters, headed: the foundation of ecology; the habitat; the plant; the formation. The first chapter gives on 17 pages a brief history of the development of the science, which culminates in the author's study of habitats by exact methods and measuring physical factors by means of instruments, which are further on fully described. The relationship of ecology to other branches of science and to arts is discussed at length. Referring to forestry, it is pointed out that a full knowledge of the character and laws of succession will prove of value in reforestation, and that the substitution of determining with precision the physical nature of the habitat for the superficial study of forest formation and guessing at the physical causes which control both structure and development, will be the greatest service of ecology to forestry; this especially in plantings in non-forested regions where it has so far been impossible to estimate the chances of success.

The second chapter discusses on 81 pages the methods studying the habitat, *i.e.*, "the sum of all the forces or factors present in a given area."

These factors are classified into biotic (animals and plants) and physical (climate and soil); the latter are discussed at length namely water contents and humidity, light, temperature, precipitation, wind, soil, and the physiographic factors, altitude, slope, exposure. The effect of each on plant-life is described, as well as the instruments for studying them, the methods of procedure in the study and of recording results. Sixty pages are devoted to the Plant, the nature and kinds of stimuli and the nature of response, adjustments and adaptations to water (hydroharmose) and to light (photoharmose), and methods of experimental evolution. The Plant Formation receives the lion's share with 153 pages.

The use of "quadrats" and "transects" of various description, or what foresters would call sample areas, to study composition of the plant societies, and their record by cartographic, photographic and herbaria method are described. Among the different kinds of plant associations, making a difference between aggregation and association, the forest receives special attention under "light association." The development of associations by invasion and succession, the kinds and causes of zonation (zonal distribution), and the disturbing elements, or causes and kinds of alternation, producing differentiation within the zones are all subjects intensely interesting even to the practicing forester. Various forest types, and their changes or successions, as in burned and lumbered areas, are adduced in explanation.

Still adhering to temperature as a basis for classification (see Forest Centers on p. 38 of this number), the following zones and provinces are recognized for the North American vegetation.

I. Polar-niveal zone.
II. Artic-alpine zone,
    Artic province,
    Alpine province.
III. Boreal- sub alpine zone,
    Alaska province,
    Cordilleran province,
    Ontario province.
IV. Temperate zone,
    Atlantic province,
    Appalachian province,
    Nebraska province,
    Utah province,
    Coast province,
    Pacific province.
V. Subtropical zone,
    Florida province,
    Mexican province.
VI. Tropical zone,
    Antilles province,
    Andean province.

To establish a uniform nomenclature, a number of lists are inserted. A list of sixty one formations, for instance, is given, their names, vernacular and scientific, being based on the habitat which they occupy, classified into hydrophytia : water plant formations ; mesophytia : middle plant formations ; xerophytia : dry plant formations. The forest formations, cited in this list, are : swamp forest (helohylium); swamp open woodland (helodium) for the first class ; the mesophytic forests (hylium) ; grove (alsium) ; open woodland (orgadium) ; thicket (lochmium) ; the xerophytic open woodland (hylodium) ; dry thicket (driodium) ; dry forest (xerohylium). Particular formations then are indicated by means of floristic distinctions, like *Picea-Pseudotsuga-hylium*, *Pinus-xerohylium*, *Populus-Picea-mictium* (transition stage to *Picea-hylium*).

In studying any formation as many examples of it as are accessible should be investigated along four lines, namely 1) determination of the factors of the habitat, 2) a quadrat or transect study of the structure of the formation, 3) a similar investigation of development, 4) a floristic study of the contiguous formation with special reference to migration. A glossary, not quite complete, is added, but an index is lacking, which is perhaps sufficiently compensated by a full table of contents.

We have given so much space to this reference, because we are convinced that no more helpful book and no more timely one has been published of late, to help the budding American forester enter upon his task with a well-laid basis. We recommend it both to the young who without much experience, are set to make ecological studies, and to the old, not too old to learn, nor too opinionated, who have lacked the benefit of such systematic procedures as the book advocates and elucidates. B. E. F.

History of the Lumber Industry of America. By J. E. Defebaugh. 1905, vol. I, 559 pp. Price $5.00

In this stately volume the editor of the *American Lumberman* has assiduously carried together a mass of information not only on the subject of the title but of cognate matter, of interest to every forester. The subject in the title has, indeed, so far found but scanty consideration in this volume, except for Canada, the history of the United States being probably reserved for the other three volumes, which it is the intention to have follow this first. This one merely clears the decks, as it were, bringing, besides matter entirely irrelevant to the subject, such as a discussion of the ecologic conditions of tree growth, climatic and geologic influences and forest distribution, and other matters of forest geography, a survey of forest conditions in Canada and the United States, a list of the commercial trees, based on Sudworth's Check List, and an exhaustive and fair discussion of the forest resources of the United States, based on census and other figures, but containing nothing new. A chapter on the Public Land Policy is followed by one on Forestry and Forest Reserves, including reclamation of arid lands by irrigation, in which incidents of the forestry movement are rehearsed.

A very interesting chapter on tariff legislation brings out the suggestion that lumber tariff legislation most concerns White

Pine. Two equally interesting chapters on Lumber Production, mainly upon the basis of Census figures, and on Foreign Trade, bringing together export and import statistics for the last hundred years, finish the volume.

The logical arrangement of the book is not apparent, but as a handy and comprehensive reference book on all the subjects mentioned, it will be appreciated. Its value as such would have been enhanced by an index, which in this case is only poorly supplanted by the table of contents printed in running lines, which makes it difficult to catch the subjects. The work is laid out on a broad basis, and if the following volumes confine themselves to the actual history of the lumber industry in the United States and its technical detail, our criticism of disproportion in the present volume will vanish.

There are too many points of interest calling for comment, hence we must forego the desire, and recommend merely to every reader to become possessed of the volume. B. E. F.

Forest Mensuration, by C. A. Schenck, Ph. D., Biltmore Forest School, 1905. pp. 71.

This pamphlet covers briefly the whole field of forest mensuration, and contains, besides the regular chapters on volume, age, and increment of trees and forests, one chapter on lumber, and another devoted to stumpage values. Like other similar pamphlets by the same author it is meaty, interesting, and bears signs of haste in preparation. It is a compilation of methods, notes, and facts, rather than results of original investigation—the author but seldom expressing his own opinion regarding the value of one or another method or procedure. There is no reference to the sources from which most of the data have been borrowed. For one familiar with the subject, the pamphlet will be of considerable value as a concise reference book; a beginner, however, we are afraid, will be perplexed by the many different methods, not knowing exactly which to use under different conditions. Dr. Schenck, true to the traditions of the old masters of forest mensuration, devoted several pages to the mathematical formulae for determining volume of trees, although he himself admits that they have a mere historic interest. In our opinion they could be left out entirely, as unnecessary ballast. These formulae date back to the early history of forest mensuration, when mathematicians more than foresters gave direction to its development. Instead of studying the conditions affecting the volume and form of trees, the old teachers of forest mensuration tried to find a geometrical body that would approach nearest the form of a tree, and by figuring out the formulae for its volume, be thus enabled to determine the contents of any tree. By ignoring the only method of investigation justifiable in forest mensuration as in all other natural sciences, *the inductive method*, they failed to produce results of any practical value.

Our literature on forest mensuration is exceedingly scanty, and we must therefore, feel grateful to Dr. Schenck for his pamphlet, even if it is nothing but notes hastily jotted down. There is a virtue always in being first in the field to supply the demand for information, and Dr. Schenck may justly answer his critics with the words of Horace: "Feci quod potui, faciant meliora potentes:" (I did what I could, let those who can do better).

R. Z.

Future Forest Trees. By A Harold Unwin. 1905, 108 pp. Price 7/6 net.

This English translation of a series of papers, which appeared in an Austrian Forestry Magazine is of interest to American foresters only by giving them the experience and estimate of value of quite a number of American species, planted for trial in Germany, Austria, Switzerland and Great Britain. A chapter on the German timber imports of different species, at various harbors for the 11 years from 1890 to 1900, is tolerably complete only for Hamburg. The largest import at all the other harbors but Hamburg is in Pitch Pine (Longleaf), of which 145,000 cu. m. were imported in 1900. At Hamburg the relative position of species was as follows: Walnut with 40,000 cu. m. stands far ahead of all others; Yellow Popular next with 6700 cu. m.; Oak and Cottonwood each with between 4,000 and 5,000 cu. m.; Satin Walnut (spec?) enters with over 1300, then Ash, Red Cedar and Hickory with only hundreds of cu. m. and all others only in nominal quantities. An importation of 3760 cu. m. of *Cedrela odorata* is credited to the United States, which, of course comes from South America, Mexico and West Indies, making the total importation from those countries 18,000 cu. m. as against 250,000 cu. m. from the United States, Canadian exports to Germany being still quite small. Part II recites the results of the plantation experiments, rather too briefly to be of much value, and Part III gives the silvicultural characteristics and treatment supposed to be desirable. We note only incidentally such erroneous statements as the one regarding *Betula lenta*, which is said to be "in other respects very much like the European birches"—we do not know in which respect it resembles them except the fruit—and the statement, that *Carya alba* requires the climate of the Silver Fir, which is most questionable from its distribution at home.

In retrospect there are enumerated as valuable acquisitions for European forestry *Robinia*, *Pinus Strobus* and *Banksiana*, and *Pseudotsuga*. Next come hickory and walnut. Other congeners of firs, pines, ashes, oak may turn out useful for silvicultural reasons in those parts where such congeners do not exist, but appear superfluous elsewhere. Generally speaking the immunity from frost of the East American and of the Rocky Mountain species is noted, while the Pacific Coast species are sensitive; the latter more rapid in growth. The planting of European varieties in East America, the writer ventures to assert, is only likely to promise success in the British section (Canada) but it would be quite superfluous as the closely related species in those parts already fulfil their purpose. It would be a pity if this *ipse dixit* were to be taken as in any way authoritative, and prevent further inquiry and experiment in that direction. Judging from the actions of the Canadian government it has not yet subscribed to this dictum, finding Riga Pine and Norway Spruce worthy of recognition in their plant distribution.

There are other interesting points which the reader would find desirable addition to his knowledge on the use of exotics.

B. E. F.

A Hand-book of the Trees of California. By Alice Eastwood. Occasional Papers of the California Academy of Sciences IX. San Francisco, 1905. 86 pp. 12 mo.

This neat, handy volume bound in flexible covers and generally in elegant dress fills a most decided want for a short booklet for identification of the California arborescent flora; and it does so most efficiently through brief and clear, non-technical, but, for general use, sufficient botanical description and excellent illustrations, mostly from photographs. Until the recent appearance of Prof. C. S. Sargent's Manual, students of California trees have had to depend mainly on Brewer and Watson's Botany of California. Following this, Dr. Albert Kellogg's "Illustrations of West American Oaks" and Prof. J. G. Lemmon's "West American Conebearers" were excellent for the groups they covered. The addition of the few trees of Washington and Oregon and some of Arizona, which do not occur in California, extends the usefulness of the book over the whole Pacific Coast. There are 169 species and varieties, 57 of which are illustrated, a most commendable and essential feature of the book, whether it be used by laymen or experts. Besides a comprehensive botanical key to the families, there are two simple keys, by fruit and by foliage, to the genera. Sargents' nomenclature is used, not however consistently, vide *Quercus densiflora* instead of *Pasania densiflora*. The author has, we think, wisely excluded from her concise, clear, and helpful work, reference to mooted points in nomenclature, in which there is opportunity for discussion. We are glad to see even the pre-occupied name *Sequoia gigantea* still used for California's greatest tree wonder, the Sierra Big-Tree, in place of the proposed *S. Wellingtonia*—which most Californians resent. The range is probably also from the Manual. We note only one antiquated notion in the preface which requires a tree to be not less than 15 feet high. Such species as *Garrya eliptica*, *Cercis occidentalis*, three manzanitas (*Arctostaphylos*) and several species of *Ceanothus*, which have hitherto been considered as shrubs, undoubtedly assume treefrom. There are, however, in the text also mere shrubs described, like *Castanopsis Chrysophylla*, so that probably this distinction has not materially abridged the number. One new species of oak—we hope it will stand the test of time for the sake of the one after whom it is named—with a very attenuated acorn, is named after one of the prominent early patrons of forestry in California *Quercus Alvordiana*.

Every forester on the Pacific Coast needs just such a book and we predict, that the limited edition of 500 will soon be exhausted.

S. F.

Forestry in South Africa. By D. E. Hutchins, F. R. Met. Soc., Conservator of Forests, Cape Town, 1905. pp. 23.

An extremely interesting paper giving the reader in a nutshell the past history and the present condition of forestry in South Africa from the Zambesi to the Cape. The author finds about one hundred and eight trees indigenous to that part of the Continent, which are all evergreen broadleaf species and about six only are of any economic importance. These latter are each briefly discussed as to their habits, distribution and commercial value.

The scarcity of native woods renders afforestation the chief work of the forester in the South Africa Colonies. Some of the finest timber trees of the Northern Hemisphere have already been under cultivation for 200 years and may be considered to be completely naturalized. Many species of Eucalyptus, Acacia, and conifers have been introduced from Australia with success.

A great deal of successful work has been accomplished in the arresting of drift sands by the planting of Morram Grass (*Psamma arenaria*).

The training of officers for the higher grades has hitherto been either at Nancy in France, or at the Royal Indian College at Cooper's Hill, England, but recently men have been sent to the Forest School of Yale University. G. A. W.

Grazing on the Public Lands. By Albert F. Potter. Bull. No. 62, Forest Service, U. S. Dept. of Agriculture, Washington, D. C. pp. 65.

The proper regulation of grazing is the most important problem in the management of the public lands of the United States. Bitter controversies repeatedly arise as to grazing privileges and rights on these lands. The vacant public lands are theoretically open commons, but as a matter of fact they are more or less parceled out under compacts or agreements among the various interests. As the approximate area of the public range is one fifth of the total extent of the United States proper, the great importance of wise and conservative handling of these vast resources is evident.

The primary object of the bulletin is to help to bring about a better understanding of the principles upon which the conservation of the public range should be based. It is very largely devoted to the classification and summary of answers to a number of questions regarding grazing and the grazing problem sent in the form of a circular to a large number of users of the public lands.

Stockmen throughout the west sent 1400 replies to this circular. These answers show :

1st. Under the present system the pasturage value of the public range has deteriorated.

2nd. The present condition is unsatisfactory.

3rd. The adoption of a new system of management would insure a better and more permanent use of the grazing lands.

4th. A certain improvement of range condition has already been brought about by range control on the reserves.

5th. The majority of stockmen are definitely in favor of government control of the open range.

The answers to the questions appear to have been fully given and very complete. If they can be taken as a true index of the condition of the grazing industry on the public lands as a whole, they form the most powerful argument as yet set forth for governmental regulation of the grazing privileges.

The bulletin includes important extracts from the second partial report of the Public Lands Commission. Based upon the information received from the stockmen, from extensive study in the field and particularly from the investigation of the Public Lands Commission, a plan for the government control and improvement of the public grazing lands is presented.

A most important feature of the bulletin is a map showing the location and area of the grazing lands of the western United States. This map is in color, on which the public range is classified as summer range, winter range, year-long range, range depending upon tank water and snow, and range developed by wells and windmills. The bulletin is a clear presentation of the present condition on the public range, and an excellent discussion of necessary legislation in order to improve these conditions. It is worth the careful study of all those interested in our public lands.

J. W. T.

A Working Plan for the Forest Lands in Berkeley Co., South Carolina. By Charles S. Chapman. Bulletin No. 56, U. S. Forest Service, Washington, 1905.

Contains a valuable study of forest types common to the coastal region of South Carolina and of the characteristics and behavior of the southern pines and swamp hardwoods in that vicinity. A carefully drawn working plan, based on a thorough estimate of stand and yield is submitted. It is claimed that a diameter limit of 14 inches with fire protection will maintain the productiveness of the tract, which is principally Loblolly Pine. The company is putting this plan into operation, with Mr. Chapman as forester.

H. H. C.

Loblolly Pine in Eastern Texas. By Raphael Zon. Bulletin No. 64, U. S. Forest Service, Washington, 1905.

Deals with the distribution and characteristics of the Loblolly in Texas. It is a most excellent and thorough silvical study of the species with special reference to its production for cross ties. Tables of growth and tentative yield tables are given. The present methods of tie making are reviewed and criticised. The Bulletin closes with a calculation of possible future yields and expense of growing ties. This publication deals with the business problems confronting railroads in their search for future supplies of ties, and should be of considerable value to such corporations. H. H. C.

Advice for Forest Planters in Oklahoma and Adjacent Regions. By George L. Clothier. Bulletin No. 65, U. S. Forest Service, Washington, 1905.

Probably no line of work pursued by the Forest Service benefits directly more individuals than the educational literature on tree planting on the western plains.

Advice as to the character and possibilities of the hardier species such as is contained in Bulletin No. 65, saves annually many thousands of dollars, otherwise wasted in planting species in localities unsuited to their development through the advice of careless or unscrupulous nurserymen, or by mistakes in methods. Planting plans are given for the different climatic belts of the region considered and full directions for procedure in handling stock and setting out plantations. H. H. C.

The Memorial issued by the Commercial Clubs of St. Paul and Minneapolis, Minnesota, in behalf of the maintenance of the Minnesota National forest reserve gives a history of this legislation from its inception and a resumé of results obtained since the work was commenced in 1903 by the U. S. Forest Service. This reserve was created by act of Congress and provided for a systematic attempt at cutting White and Norway Pine under methods which would insure natural re-stocking of the area.

As bearing upon the success of the work and the difficulties and opposition it has had to encounter, the memorial is well worth the notice of foresters. H. H. C.

Le Bois, par Jean Beauverie, avec une préface de M. Daubrée. Paris, Gauthier-Villars, 2 vls. 1905. pp. 1402. Price 20 fr.

This is a most exhaustive and practically the only French work on forest technology. It consists of two volumes, containing over 1400 pages, 480 drawings, and an introduction by Daubrée, the director of forests in France. Of the thirteen chapters the first two are devoted to the anatomical structure of wood and its chemical composition (100 pages), and one chapter to each of the following subjects: physical properties of wood (80 p.); conditions of tree and forest growth (25 p.); methods and machinery employed in the utilization of the forest (25 p.); timber estimating and timber trade (50 p.); defects and injuries of wood (285 p.); durability of wood and lengthening of its life (130 p.); native and foreign species important in commerce (300 p.); cork tissue and cork industry (50 p.); production of wood in the world (100 p.); forest trees growing in the French colonies (130.p.); grading of timber and of the chemical products of wood (35 p.).

The work is full of valuable information and must be classed with standard works on the subject. The only drawback in our opinion is that the material has not been arranged according to a well thought-out plan and is not well balanced. Thus while the chapter on injuries to timber is spread over more than 300 pages and includes a great deal of unnecessary detail on insects, to such an important subject as the present methods of grading is given but 35 pages. R. Z.

OTHER RECENT LITERATURE.

Trees. A Handbook of Forest Botany for the Woodlands and the Laboratory. By H. Marshall Ward. Vol. III. *Flowers* and *Inflorescence.* Cambridge, at the University Press, 1905.

Following closely the appearence in 1904 of Vol. I, on Buds and Twigs and Vol. II on Leaves, comes the third volume of this admirable series, treating of the flowers and inflorescences, with special reference to those of woody plants.

A Working Plan for the Forest Reservation of the U. S. Military Academy Army Post. By Roy L. Marston, War Department, Washington, 1905. 48 pp.

Proceedings of the Society of American Foresters, Vol. I, No. 2. Washington, 1905. 109 pp.

Suggestions in Regard to the Arbor Day Tree Planting Contest. Division of Forestry of Hawaii, Honolulu, 1905. 7 pp.

Annual Number of the Mazamas, Portland, Ore., 1905. 280 pp.

Report of the Secretary of Agriculture. Washington, 1905, 100 pp.

Studies on the properties of an Unproductive Soil. By B. E. Livingston, J. C. Britton and F. R. Reid. Bull. No. 28, Bureau of Soils, U. S. Department of Agriculture, Washington, 1905. 39 pp.

Investigations in Soil Management. By F. H. King. Bull. No. 26, Bureau of Soils, U. S. Department of Agriculture, Washington, 1905, 205 pp.

Forest Planting and Farm Management. Farmers Bulletin, No. 228, U. S. Department of Agriculture, Washington, 1905, 21 pp.

The Tree Book, a popular guide to a knowledge of the trees of North America and to their uses and cultivation, by Julia Ellen Rogers, New York, 1905, 571 pp,

Forest Belts of Western Kansas and Nebraska. By Royal S. Kellogg. Bull. No. 66, U. S. Forest Service, Washington, 1905, 40 pp.

The Black Hills Beetle. By A. D. Hopkins. Bull. No. 56, Bureau of Entomology, U. S. Department of Agriculture, Washington, 1905, 22 pp.

Tree Planting in Natal. By T. R. Sims, Department of Agriculture, Pietermaritzburg, Natal, 1905.

The Natural Replacement of White Pine on Old Fields in New England. By S. N. Spring. Bull. No. 63, Bureau of Forestry, U. S. Department of Agriculture, Washington 1905. 32 pp.

The Forest Service. What it is and how it deals with forest problems. Circular No. 36, U. S. Forest Service, Washington, 1905.

Les Restrictions légales au droit de la propriété forestière privée en France. en Allemagne, en Autriche, en Hongrie et en Swisse. Par Jules Madelin. Paris 1905. 227 pp.

Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen, Vol. VIII, No. 3. Zürich 1905, 49 pp. Contains experiments with different hypsometers, Christen's being found the simplest of sufficient accuracy, if properly used.

Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs, XXI Heft, 1905, 122 pp. Contains article by A. Schiffel. *Form und Inhalt der Lärche.*

Geschichte der Naturwissenschaften in der Forstwissenschaft bis zum Jahre, 1830. L. Fabricius, 1906, 137 pp.

Bodenkunde. E. Ramann. Zweite Auflage, 1905. Price Mk 10. Leaves out the part of "Standortslehre" in the first edition, referring to the relation of plant to climate, on which a good modern book is lacking.

Die Waldungen des Königreichs Sachsen, in bezug auf Boden, Bestand, Besitz nach dem Stande des Jahres, 1900. Von Franz Mammen, 1905, 332 pp.

PERIODICAL LITERATURE.

In Charge :

Botanical Journals-------------------- R. T. FISHER
Foreign Journals--B. E. FERNOW, R. ZON, F. DUNLAP
Propagandist Journals ------------------H. P. BAKER
Trade Journals----------F. ROTH and F. J. PHILLIPS

FOREST GEOGRAPHY AND DESCRIPTION.

Forest Centers of Eastern America

Mr. E. N. Transeau furnishes a very interesting paper on zonal forest distribution in Eastern America based not on mere description but on ecological and evolutionary considerations. Instead of basing his zones like Merriam on the single factor of temperature, he secures his basis, much more rationally for floral forms, on a combination factor, namely, rainfall-evaporation ratios, the nearest approach to what the reviewer has claimed years ago as the principal factor in the distribution of arborescent forms, the transpiration factor. In a paper before the Michigan Academy of Sciences, (March 15, 1905), on climatic centers and centers of plant distribution, he points out, as have others before him, that the distribution of plants generally is centric rather than zonal, as Merriam has it, and that, by combining the figures for rainfall and evaporation, at least four climatic factors, having by necessity a powerful influence on water relations and thereby on distribution of plants, could be utilized to explain these centers. The ratios found by dividing mean annual rainfall by the depth of evaporation at the same station, percentically expressed, were used to construct a climatic map. This showed at once a remarkable coincidence between its divisions and those giving the lines of distribution, not only of grassland, prairie, open forest and dense forest regions, but also of forest types, namely, the North Eastern conifer forest center with a rainfall-evaporation ratio of between 100 to 200 per cent; the deciduous forest center with a ratio between 100 and 110; the south eastern conifer center with a ratio of 110 per cent; the great plains marked by an amount of rainfall equal to between 20 to 60 per cent. of the evaporation; and the prairie region with a ratio of 60 to 80 per cent. The ratio of between 80 and 100 per cent. seems incident with the occurrence of "oak openings", "open forest" and "groves" on the uplands and dense forests on the low lands.

In the article, here briefed, the idea is followed up and a further differentiation of forest centers made.

By center is understood a locality in which the complex of climatic factors is most favorable to the development of a certain type of vegetation, conditions for this type becoming more and more unfavorable with the distance from the center. It is not implied that plants have necessarily spread from these centers.

The St. Lawrence basin is suggested as the center of a unique type of forest, ecologically and climatically distinct, the Northeastern conifer center with *Pinus strobus*, *Picea mariana*, *Tsuga canadensis*, *Abies balsamea*, *Pinus divaricata*, *Larix laricina* forming the "climax" forest type, while the lower Ohio basin and Piedmont plateau is the center of the "climax". Deciduous forest center, with *Quercus alba* and *rubra*, *Hicoria alba*, *Acer saccharum*, *Fagus americana*, *Fraxinus americana*, *Liriodendron tulipifera* and *Magnolia acuminata* in best development, The term climax forest is used by ecologists to designate the forest type which as a result of evolutionary changes is the final type of a given locality.

With these conceptions of geographic centers for instance in Michigan the belt of maple-beech forest appears as "the attenuated border of the climax stage of the Southeastern Deciduous forest center." Similarly in the mountain region of the Southern Appalachians the Southeastern conifer forest, centering in the South Atlantic and Gulf coastal plain, the Northeastern conifer forest and the Deciduous forest center touch, and (we suggest) here on the meeting ground edaphic factors must become superior to climatic in giving preference to the one or the other formation.

If these conceptions are tenable, and, with proper reservations as to the influence of edaphic factors, the reviewer thinks they are, not only clearer ideas regarding forest-types and forest distribution must result, but practical application of the new knowledge to silviculture will suggest itself readily to foresters.

Forest Centers in Eastern America. American Naturalist. Dec., 1905, pp. 875–889.

Bogs of Huron River Valley.

Notes of interest to silviculturists are included by Mr. E. N. Transeau in a series of three ecological articles on certain bog formations in Michigan. Aside from his discussion of the physiographic history of the region and its meteorological conditions, the interesting point to foresters is his definite assignment of forest types to described formations and situations. He defines three topographic divisions of the Huron basin: "(1) The loose textured, rough interlobate moraine; (2) the clay morainic belt lying to the southeast of it; (3) the low-lying plain extending to Lake Erie." On the lake plain he finds the greatest variety of tree species, among them *Fagus atropurpureus*, *Quercus rubra*, *Ulmus Americana*, *Platanus occidentalis*, *Acer saccharum*, *Tilia Americana*, *Acer saccharinum*, *Fraxinus Americana*, *Gleditsia triacanthos*, *Liriodendron tulipifera*, *Gymnocladus dioica*, *Cercis canadensis*, *Asimina triloba*, and *Celtis occidentalis*. "The clay morainic area is dominated by *Quercus rubra*, *Qu. alba*, *Qu. velutina*, *Hicoria ovata*, *H. glabra*, *Acer rubrum*, *Ulmus Americana*, and *Quercus macrocarpa*." The forest of the interlobate moraine areas is chiefly made up of *Quercus coccinea*, *Q. macrocarpa*, *Q. velutina*, and *Q. alba*, mixed to the northeastward with *Pinus Strobus*. The articles show, in highly instructive detail, how in passing from northern Indiana into the thumb of Michigan, one passes from a region dominated by a rich mesophytic, broad-leaved forest to one of conifer and xerophytic, broad-leaved ascendancy.

The Bogs and Bog Flora of the Huron River Valley. Botanical Gazette, November. 1905, pp 351-375 (with sixteen figures).

FOREST BOTANY AND ZOOLOGY.

Phaenological Note

The influence of weather conditions, on the budding and leaf fall of larch and beech is discussed by Engler on the basis of observations made in 1905. It is pointed out that besides temperature a certain amount of light is needed to effect the leafing-out, especially in light needing species, like larch. While normally the larch leafs 15 to 30 days earlier than the beech, this year the former was late and was in leaf simultaneously with the beech. It is shown by the records that both temperature and hours of sunshine during March were below normal, retarding the larch, while April being normal produced normal result in beech. Again in 1903 a mild sunny March produced full leafing of larch, while bad April weather retarded leafing of beech until middle of May. The conclusion is, that in Switzerland for the leafing of the larch March weather, for that of the beech April weather is significant.

In the coloring and fall of leaves also unusual conditions were observed, namely belated occurrence, although October was raw. The moist warm summer is supposed to have been the cause. It is known that dry summers produce early leaf fall. Normally the larch remains green a fortnight longer than the beech, it has therefore a longer period of vegetation by one to two months, accounting for its rapid growth. This year the difference in leaf fall was hardly over a week, the beech being leafless by Nov. 6, the larch holding on till the middle of the month. The different behavior of the two species in regard to leaf development may in addition to other considerations account for the favorable behavior of the two in mixture.

Ueber Blattausbruch und Blattabfall der Lärche und Buche. Schweizerische Zeitschrift für Forstwesen. Dec. 1905, pp 313-317.

A key to the Ohio Dogwoods in winter condition is published by J. H. Schaffner, eight species of the sixteen indigenous ones, in The Ohio Naturalist, Vol. VI, No. 2.

In the same publication (Vol. VI, No. 1) the same author discusses the classification of the plant kingdom on the conception of progressive evolution, recognizing sixteen stages of development, which are grouped in seven sub-kingdoms delimited by definite transition gaps. Good characterizations of the seven sub-kingdoms are given and a diagram giving their relationships.

In Vol. VI, No. 4, the same author brings a check list of Ohio trees. Of the 155 species listed 85 are native typical trees, 21 introduced, 43 native shrubs sometimes growing in treeform, and 6 introduced shrubs of this description.

SOIL, WATER AND CLIMATE.

Wind and Soil.

The influence of winds on humidity and temperature of the soil is well known but the indirect influence on the constituents of the soil and especially the solubility of those constituting the plant food is less appreciated. Emeis recognizes the large moors and heaths of Northwest Germany as results of the seawinds, not so much directly in destroying forest growth as indirectly by spoiling the soil, inducing sour humus formation through cold and wetness, inimical to tree growth. The existence of former forest growth is attested by the buried logs and trees. Hence protection against the winds and proper fertilization to prevent sour humus formation are needed in reforesting these areas.

Ueber ungünstige Einflüsse von Wind und Freilage auf unsere Bodenkultur. Allgemeine Forst- und Jagdzeitung, Nov. 1905. p. 365 ff

ROADS AND SURVEYS.

Cost of Survey in Alpine Regions.

A trial survey to determine the proper cost of surveys in the Alps was made in the Canton Bern, to determine what subventions from the federal government would be required. The surveyor's wages in the field were $3.20, in the office $2.40. The area surveyed was a little over 26000 acres, varying from 2500 to 9000 feet in elevation, over which a triangulation with one point to every 115 acres existed. In the valley portions the regular polygonometric methods were employed ; in the higher elevations, with slopes of 30 to 50°, the direct line measuring was supplanted by the use of stadia (Reichenbach's) with a telescope of 34 magnification and fixed threads, verified once a month, which method after trials was found satisfactory. A special slide rule for reducing the oblique distances was used.

In the valley where all fine methods were used, a degree of accuracy of .04% was attained, while the stadia work showed average errors in closing of .063%, up to .08% where steepest slopes were included, a very satisfactory degree of accuracy for a scale of $\frac{1}{2000}$ to $\frac{1}{5000}$. It is believed that with a telescope of 40 magnification, satisfactory results for a scale of $\frac{1}{1000}$ could be obtained. In the higher altitudes the making of contours was dispensed with as useless and disproportionately expensive. But rocks, runs, small areas of forest growth, etc., were taken by a photogrammetric method and noted on the map.

The cost, not including triangulation and setting of boundary posts, was found for a scale of 1:1000 as $1.50, for a scale of 1:2000 as $1.04, for a scale of 1:4000-5000 as 22½ cents, or in the average round 50 cents per acre. Since during the progress of the work the best methods had to be found, this cost is believed to be relatively high.

Ueber die Ergebnisse der Probevermessungen im Kanton Bern. Schweizerische Zeitschrift für Forstwesen. Nov. 1905, pp. 279-281.

SILVICULTURE, PROTECTION, AND EXTENSION.

Pure Spruce Forest. The continued preference for spruce for planting in Switzerland, leading to pure spruce forest, induces Mr. Fankhauser, by word and picture, to point out the danger of windfall. It is also pointed out that single firs and beeches are soon overtopped by the rapid spruce, and that even groups of 40 to 50 are apt to vanish in time, considering that in a plantation of 2600 only one in ten survives to felling age.

In the pictures illustrating the results of a tornado in a 70-year old stand, curiously enough the spruce are mostly not uprooted but broken at 4 to 10 m. above ground, an experience repeated elsewhere, which leads to the conclusion that the rapid growth in its use produces a brash wood in the spruce. The resistance during the same storm of the beech and fir adds to the argument for mixed forest. "Properly mixed forest of trees of different ages can alone guarantee greatest possible safety against dangers (in the Alps), besides most valuable yields."

Reine Fichtenbestände. Schweizerische Zeitschrift für Forstwesen. December, 1905. pp. 307–311.

Silviculture on Different Aspects. A thoughtful article by Etter points out that, owing to the drying effects of both sun and wind, site quality deteriorates on the different aspects from North through South to West. Hence species making demands on humidity of soil and air are excluded from use on south and west slopes. On such exposures, occupied by open pine forests, natural regeneration is usually excluded. Here the task is to create conditions which will not only preserve soil moisture but improve soil conditions by self-manuring through introduction of shady species, *i. e.*, underplanting with beech, merely as soil-cover. The poorer the site, the more care is required in planting. Planting with ball of both beech and pine is advocated, the plants to be specially grown for such use in open sowing on tenacious soil, near the place where they are to be used, to be transplanted when three years old. This method, careful and circumstantial, will prove in the end the best and cheapest where early closing of crown-cover is desirable.

Betrachtungen über die Bepflanzung der Schläge auf Süd und Westhängen. Schweizerische Zeitschrift für Forstwesen. Jan., 1906, pp. 7–12.

A Wind-fall Problem.

In 1897 occurred an extensive wind-fall in one of Count Liechtenstein's forest ranges, the method of logging which is described on p. 56. The stand was composed of 80% spruce, 15% fir and 5% beech; nearly one-half of the 750 acres involved was in complete cover, the other half .4 to .6 of normal. All age classes from 40 to over 100 suffered, the last of course the most (67%), and those in higher altitudes more than the lower, 60% being thrown and 40% broken.

The damage consisted, besides the interference with the regular working plan, in a loss of 12 per cent. of the wood, increased cost of logging, depreciation in value, insect damage and deterioration of soil. The manager drew the following conclusion for the future as desirable for the endangered territory: Reduction of rotation to below 100 years, with smaller felling series; planting of spruce instead of natural regeneration by group or shelterwood system, but natural regeneration for beech and fir into which at proper time spruce to be planted; timely and severe thinnings. In reforesting, the enormous quantity of debris had to be burnt. The planting plan prescribes use of 3 to 4-year-old transplanted spruce in 1.5 m. spacing, spot sowing of spruce and fir only where no grass growth to be feared; volunteer growth of beech and spruce to be saved and to be filled out with spruce; shrubs to be saved and plants to be set out under the protection of rootstocks (many overturned) and stones; grass to be cut out in new plantations and these to be repaired by introduction of other species, mostly after the whole is planted, for which ten years have been foreseen. Additional species used to the extent of 25% are Larch, Douglas Fir and White Pine below 900 m., above this, Stone Pine and Mountain Maple, also Ash, Alder; Willow and Mountain Pine where steep slopes liable to landslides. In the first six years nearly 600 acres were planted and 100 repaired for about $2,500, using 462,000 plants and about 1,000 pounds of seed. In addition $600 were spent in grass cutting and $200 in fighting insects.

Hauptversammlung des Mährisch Schlesischen Forstvereins Centralblatt für das gesammte Forstwesen. Dec., 1906, pp. 521–2.

Treatment of Hard-pan.

With the purpose in view of determining with exactly what success the Scotch Pine may grow on shallow bog soils, covering pronounced hard-pan beds, the results of detailed studies of stands, respectively 109 and 82 years old, at Rotenburg in the Lüneburger Heide have been published by Tacke and Webber. Great pains is taken throughout the paper to give the reader the facts upon which the authors base their conclusions, just enough of theoretical framework being developed to give a system of arranging the data at hand.

The body of evidence given points to the existence in the eighteenth century of a *Calluna* thicket on soil, wet at seasons but not throughout the year, and underlaid with hard-pan. In 1795 the area was burned off and the following year trenches were cut through to the upper surface of the hard-pan at intervals of six feet and the sand taken out was spread over the charred surface. On the seed-bed so prepared pine was sown immediately. The young plants flourished remarkably well, due seemingly to the ash left by the fire. This thrift at an early age is one of the striking features about this old stand, and a great part of the present vigor is credited to the advantages enjoyed in its youth.

The root system is most influenced by the hard-pan, and diverted from normal development. The tap-root is not developed; heart-roots descend obliquely to the hard-pan, branch profusely and cover the surface of this with a dense mat of fibrous roots. Some of these branches have succeeded in penetrating the stratum. Neither in root system, nor in the crown were any pathologic conditions met with, though careful search was made, for it was suspected that under conditions so different from those in which pine grows best such would obtain.

Chemical analysis of the soil showed there was not the amount of plant food present that the growth of the stands indicate, for while the stands were estimated to belong between the second and third site classes chemical analysis showed it was poorer than the fifth class. This, the authors take, indicates the need of a revision of the classification of soil values as based on chemical analysis, at least for the region under discussion.

Über einen alten, gut gewachsenen Rotföhrenbestand über hartem und starkem Ortstein. Zeitschrift für Forst- und Jagdwesen. Nov., 1905. pp. 708–728.

Reboisement in Switzerland.

For a brief account of the most modern methods and cost of reboisement work in Alpine regions, to prevent torrents, soil washes, land and snow slides, the account of a journey of a number of Swiss foresters is useful. This journey was an official one, arranged by the Department of Interior for the instruction of the participants. Of new ideas we note the substitution of a system of many dams in series, each subsequent one with its crest 1.5 m above the foot of the preceding, instead of a rubble bed at the foot of each dam, these latter more widely apart. In this way small, quiet ponds are formed between the dams, while the rubble beds were liable to be destroyed by the rushing water.

Gentle slopes of dams are more liable to damage than steeper ones. Drainage by covered (filled with rock and brush), deep (4–5m) ditches is effective in preventing land slides. Iron posts for fastening barriers to hold back debris are used where hard subsoil prevents use of wooden posts. The planting of alder 1 to 2 feet apart is often more effective and cheaper than basket work. The excellent result of its use is discussed at length in Schweizerische Zeitschrift für Forstwesen 1906 p. 19–22.

The use of sod to cover walls, where large stone flags are not at hand, protects the walls against weathering. Terracing, where good material for walls is lacking, appears more effective.

A perfectly successful prevention of snow slides has been effected at the foot of Muot, protecting the Rhätish Railroad (described in detail in S.F. Sept–Oct. 1904). Greatest activity in re-foresting is found at Pontresina on the Schafberg, where sheep had destroyed all vegetation. The planting with spruce, larch and pine has been done at a cost of $11 per M., everything included. In a neighboring district this cost was reduced to $7.65. Plantations on naked lime stone slopes at Madulein, where soil for the plants had to be carried to the plant hole, and sometimes watering was found necessary, were made at $13 per M., with great success.

Forst-und bautechnische Reise. Schweizerische Zeitschrift für Forstwesen. Nov. 1905, pp. 269-277, ill.

Severe Thinnings.

Criticism recently calling to task the practice in Prussia of making heavier cuttings than the yearly growth would seem to warrant, and of making thinnings more severe than was once the rule is met by Dr. Schwappach. Such excessive cuttings the critic maintains, are inroads upon the fixed forest capital and threaten future productiveness, while it is held that established facts show there is no increase in total product obtained by heavy thinnings, such being balanced in effect by the loss in the final cut.

But the removal of over-ripe stands is just what the present conditions in Prussia demand, and with due regard to economic conditions this cannot occur too soon. The forests are still so far from the normal that the sustained yield argument must be disregarded. Reforestation is one of the ways in which this excess capital tied up in these old overmature stands may be well re-invested.

Defending the practice of thinning, and assuming first that the critic's position that thinnings exert no effect in stimulating the growth is correct, Schwappach shows the advantage of frequent thinnings which remove diseased and decaying trees before they become entirely worthless, and of early thinnings which bring a return from the capital long before the final harvest is obtained. Though these returns may be small, the fact that they come early in the life of the stand makes them important.

But the early and severe thinnings, except in the case of the Scotch Pine, have been shown to exert a beneficial influence upon the volume growth of the stand ; and in case of the Scotch Pine there is at least as good growth as with less severe thinning. The value increment is not lessened by the more severe thinning, so that even without allowing for the interest derivable from earlier returns and simply summing up the yield money returns remain about the same as where the older method is used. When one stops to consider that heavy thinnings cause the volume increment to be distributed over fewer boles, it is clear why the value increment should rise as it does.

Über die wirtschaftliche Bedeutung eines intensiveren Durchforstungsbetriebes. Zeitschrift für Forst-und Jagdwesen. July, 1905. pp 411-419.

Results of Wide Spacing.

Among the present day practices of German foresters which are open to criticism stands the departure from the dense seedling stands of the early nineteenth century. This tendency to starting out with fewer individuals to the acre is noticeable, both in planting and in sowing—in sowing especially, where but about one-fourth the amount of seed is used as was once the rule. Practical reasons for such a change are not to be found, says Frömbling, and the advantages which appear to have been expected from it appear doubtful. The lessened cost will be more than offset by the cost of replacing fail spots and in the lessening of the yield from the earlier thinnings, while the hope of producing more vigorous plants by sparing them the struggle with their neighbors is left without foundation in that in actuality weaker individuals are permitted to occupy the ground longer than nature would allow were competition a little more intense. Throughout, this sparse planting is shown to be unnatural, for when natural regeneration is resorted to the success of the plan is largely judged by the density of the young growth secured. It is but just to apply the same criterion to the results of sowing and planting.

Dichte oder weitständige Kulturen? Zeitschrift für Forst und Jagdwesen. Apr. 1905. pp 239 247.

Loss by Red Rot

Following Dr. Möller's example (see vol. III, p. 47), Dr. Hemman has made an investigation into the loss of value by Red Rot in Scotch Pine, in two fellings comprising somewhat over 32,000 cubic feet. He classifies the degree of damage in a table giving the loss for different per cents of diseased trees, which may be of more general interest :

Quantity diseased per cent.	Depreciation of Timberwood per cent. of normal.	Loss of value per cent.
10	2.5	5
12	3	6
14	3.5	7
16	4	8
20	5	10
25	6.3	12.5
30	7.5	15
40	10	20
50	12.5	25

For the two stands investigated, 110 and 119 years old, with 16 % diseased a loss of round $22. and $24. per acre was found, which discounted with 2.5% to the 80 year, when it is supposed the rot damage began, would make round $10 as the amount up to which expenditures for fighting the disease would have been financially justified.

Ueber den Schaden des Kiefernbaumschwammes. Allgemeine Forst- und Jagdzeitung. Oct. 1905. pp. 336–341.

Remedy for "Schütte"

The dread disease of "Schütte" (damping off ?) to which pine seedlings are exposed, is especially calamitous in the Revier of Fm. Schalk. In the nurseries the growing of pine seedlings had to be given up, and plantations kneehigh succumbed to the pest. Bordeaux mixture seemed to be effective. Curiously enough, an annual contingent of 100,000 pine seedlings from Halstenbeck nurseries used for 7 years remained free from the disease. A trial was made with intensive fertilizing in the nurseries, with Thomas slag, Kainit, Chili saltpetre and lupine. The result was perfect in the very year when the sowings in the forest suffered especially severely. Nitrogen fertilizer (lupine) was most effective. This explains the experience with Halstenbecker stock, which is grown on heavily manured soil; the resistance to the disease continuing in the plants through the period of danger.

Zur Bekämpfung der Kiefernschütte. Forstwissenschaftliches Centralblatt. Nov., 1905, p. 561 ff.

Fertilizer in Nurseries

Oberförster Ehrlich describes his practice in establishing a permanent 3 acre trial nursery. A compost heap is made by mixing good humus soil free from roots with layers of unslacked lime (1 liter lime to 1 cbm. soil). Each year for 3 years this heap is spaded over two or three times during the summer. In three years the compost is ready for use. After the ground is spaded, a mixture of 8 kg Kainit and 4 kg Thomas slag per are is sprinkled over the area and worked in with the hoe. After 3 to 4 days yellow lupine is sown, (2 kg per are). These are plowed under when the pods begin to form and the ground is left in furrows over winter. Next spring 1.5–2 cbm compost are applied. This three-fold fertilizing is as far as possible applied every three years. Broadleaf seedlings are further manured twice, beginning of May and end of June, with altogether 2 kg Chili saltpetre per are, brought under 4 to 5 cm, and a similar treatment is applied in the fall with a mixture of 8 kg Kainit and 4 kg of Thomas slag; with such treatment oaks made shoots 1 m long. The time of application is chosen accordingly to the nature of the fertilizer, saltpetre being effective at once, Kainit requiring time and containing chloric salts that are injurious to roots and must first be absorbed by the soil.

Pommerscher Verein. Allgemeine Zeitschrift für Forst- und Jagdwesen. Dec. 1905. p. 425 f.

Collecting Seed.

At the seed cleaning station at Annaburg, near Halle, a long series of experiments has been carried out by Haack, to determine to what extent Scotch pine seed suffered from high temperature and drying. From the detailed description of the precautions taken, and the difficulties met and solved it is evident that the greatest care has been exercised throughout and the severest criticism of his own methods employed by the author, so that his results are unassailable. Tests are recorded for some eighty thousand seeds.

As preliminary it was first determined that Scotch pine seed were ripe November 1st and capable then of immediate germination, showing quite as high germination per cent. as seeds from cones remaining on the trees until dry in March. In the drying frames, however, the dry seeds of the March harvest were unhurt by a temperature of 60° C. (140° F.) which, however, was reduced to 55° or 56° (131° F.) as soon as the cones began to open and released the seed. Green cones, on the other hand, were injured at temperatures above 49° (120° F.), temperatures so low that it became a question whether the use of artificial heat in drying is at all profitable.

Rather strangely, the seeds once separated from the cones can endure for hours a temperature such that if exposed to it while still held in the cones, they would suffer in viability greatly.

Untersuchungen über den Einfluss verschieden hoher Darrhitze auf das Keimprozent des Kiefernsames. Zeitschrift für Forst-und Jagdwesen. May, 1905, pp. 296–312.

Influences on Seed Quality.

The Swedish Forest Experiment Station has investigated the influence of locality, season, and age of trees on seeds and plant product. The low summer temperature of 1902 and 1903 in North Sweden led to the fear that the rich (*P. silvestris*) pine seed harvest of 1903 might not have a good germination per cent. Results are recorded by G. Schotte. Size of cones depends on age of trees: it required 6 per cent. more cones from 150 year stands than from 80 year trees to make the same measure. While 1000 seeds from South Sweden weighed 4 to 5 g., those from North Sweden only 2 to 3 g. With age, weight of seed declines. In 50 to 60 year old stands, size of seeds is the same in both localities, but later those of the northern region declines more rapidly in size. Seeds from Lapland did not germinate, the per cent. as well as the harvest, increasing gradually to normal in seeds from more and more southern localities. Germination of South Swedish seed took place in 15 days as against 55 days in more northern seeds, and the length of needles and height of plants of the latter were only half those of southern stock, which also had better roots. Seeds of 40 to 60 year trees produced stouter plants than those of 100 to 150 year old, and also than those of 20 to 30 year old.

Tallkottens och tallfroëts beskaffenhet skördearet, 1903–4. Skogsvardsföreningens Tidskrift, 1905, p. 165 ff.

Tree Planting in Canada. Since the Spring of 1901, the Forestry Branch of the Canadian Department of the Interior has co-operated with settlers on the western prairies in the formation of shelterbelts and farm woodlots. Seedlings have been furnished free, about two million having been sent out during the season of 1905. About 75% of these consisted of native Green Ash and Boxelder, the former having remained two years in the nursery and the latter only one.

Small areas at the Brandon and Indian Head Experimental Farms had previously been used for nursery purposes, but in the spring of 1903, 160 acres were secured, a mile south of the town of Indian Head in the new province of Saskatchewan, on the main line of the Canadian Pacific Railway. This area will be devoted exclusively to nursery and demonstration work. Cultivation has been begun, and buildings and fences erected. Hedges and shelterbelts have been planted, and a small beginning made in the raising of seedlings for distribution. Conifers have been raised to only a small extent so far, Colorado Blue Spruce (*Picea pungens*) giving the greatest promise.

Cultivation of the broadleaf varieties is done by horse cultivators, the drills being 30 inches apart.

The young conifer seedlings are protected by lath screens for two years, then transplanted to rows ten inches apart, where they remain two years longer before being set out in permanent plantations. Cultivation in the plantations is done by means of the double wheel hand hoe.

It is expected that an annual output of from three to four million seedlings will be needed in order to supply the future demand.

C. L.

Tree Planting in the West. Canadian Forestry Journal. October, 1905. pp. 155-158.

MENSURATION, FINANCE, AND MANAGEMENT.

Increment Autograph While we are still wrestling with the crude methods of determining increments, Friedrich has devised instruments for studying the finesse of accretion, by which the daily growth can be measured. He used these increment autographs for studying the influence of weather on increment and published the results in 1897. The instruments have since then been improved, but, outside of Japan and Spain (strange contrast!), they have not been used. The instrument is constructed similar to self-recording thermometers, etc. As to the practical value of such investigations the author points out that a recognition of the different factors influencing tree-growth must be the basis of silviculture and that these detail studies lead to definite knowledge instead of random opinion.

The newest improvements consist in an electric connection which permits the observations to be made in the office. "Visitors are usually not little astonished to hear that the signal just sounded was given by a tree in the park changing its periphery, so that while I may not hear the grass grow, I can hear the trees grow."

The cost of the apparatus is about $80.

Zuwachsautograph. Centralblatt für das gesammte Forstwesen. Nov., 1905, pp. 456-461. Ill

Forest Finance

Although real finance calculations in forestry matters are in the United States still almost unknown, and even abroad are more matters of discussion than of practice, the forest management of governments not being based on financial considerations, and private forestry mostly imitating the practices of the government, it is worth while for us to follow the discussions, if only to secure a better understanding of the nature of the forestry business and of the difficulties, which surround the attempt to place it on a true financial basis. In these discussions the expositions by Schiffel are most illuminating, which are the results of a controversy, the gist of which we briefed in Vol. II, p. 186, and Vol. III, p. 200, regarding the propriety of applying the soil-rent or forest-rent theory in calculating financial problems. He defines not two but three different principles of finance management, namely,

1. A management which tries to secure the highest net annual yield (rent) without reference to the forest capital involved (Waldreinertragswirtschaft—forest net yield management);

2. A management which tries to secure the highest interest on the soil capital (Bodenrenten—or better rentabilitätslehre—soil-rent management);

3. A management which tries to secure the highest interest on the entire forest capital (Waldrenten—or rentabilitätslehre—forest-rent management).

The first, which does not consider the relation between income and investment, can hardly claim to be a financial management. It accepts inherited conditions, and does not consider whether a better employment of the capital represented by soil and forest could be found. It is the financial basis of government forestry.

The main financial problem is, of course, the determination of the rotation, *i. e.*, the normal financial felling age. According to the soil rent theory the soil value should be the basis of the calculation and that rotation which will yield the highest interest rate on this value would be the one to chose. Schiffel points out that instead of taking real actual soil values as basis, an unreal, fictitious or artificial value, the expectancy value, is substituted by the soil renters, calculated with a given or demanded, unreal or fictitious interest rate. Indeed, the result depends wholly on the interest rate chosen. The fact that by calculating with actual soil values the resulting interest rate falls below desirable ones induces the soil renters, so Schiffel declares, to avoid this method of approaching the problem. "The soil value, the only investment capital of the soil renter, which should be considered as of given amount, becomes a plaything of the interest rate and to a smaller degree of cost of cultivation and other expenses."

"This method, derived from agriculture, fits the peculiar characteristics of forestry, with its longtime element and the stock of wood standing not as yield but as capital, only when no other means of determining the soil value are to be had."

The forest rent theory recognizes as forest capital both soil and normal stock and seeks the rotation which pays the highest attainable interest rate on it ; and it tries to use as far as possible real values. In figuring the normal stock, for the older age classes, sales values, for the younger, cost of production with an assumed interest rate, or else an interpolation curve (a straight line from o to last sale-value) are to be used. In a given example the soil-rent theory finds a 60 year rotation, the forest rent theory a 90 year rotation financially most advantageous. Of course, the rotation so found is merely a guide to be deviated from by considerations of value and price increases, etc.

The determination of the normal stock value is the weak spot of this method, the actually obtainable sale value will probably always remain below the figured one, but this means merely that relatively the actual interest rate obtained will be higher than the figured one, and nearer reality.

The difference, then, between the two theories lies in the conception of the working capital and the methods of its evaluation; furthermore the soil-rent theory starts with a demanded interest rate, the forest-rent does not recognize this necessity.

Using the cost of production, as the soil-rent does, makes the value of the stock independent of wood prices, which is illogical; only for the younger stands no other way is possible, and their relative value is small. But the main objection is making the interest rate the most essential factor for determining capital, yield and rotation.

It is acknowledged that to apply the forest rent theory to the practice is not much easier than the soilrent theory; in both cases the data are both difficult to evaluate and are liable to rapid changes. Hence Schiffel would make the value increment the criterion of profitableness, and Vogl's method (see Vol. III, p. 200) would here be serviceable in directing the choice, when the highest value accretion is found to lie in more than one period, as in the example, which leaves the choice between the 90 and 110 year.

UTILIZATION, MARKET, AND TECHNOLOGY.

Mountain Logging in Austria.

In 1897 a tornado threw on the extensive forest property of Count Liechtenstein, the largest private forestowner of Austria (350,000 acres), some three million cubic feet (17% firewood) on about 750 acres of steep and high mountain country (Sudeten). To remove this large mass of wood a railroad system was developed, which did the work in shortest and cheapest manner. The operation described extended over a mountain side with an average slope of 30%, the height being 900 feet with a length of 3000 feet. This was divided into four sections, for each of which one down track served; at the top of each a brake regulates the speed of the loaded cars descending by cables.

The empties return, being pulled up by the descending load and passing by on a switch placed half way. Sidelines with 2 to 4% grade operated by man power bring the wood to the main track. Such a system with about 8 miles of side lines to build had cost about $9000. The total investment cost on the 3,000,000 cubic feet (about 12 million feet B.M. and 5600 cords) being about 45 cents per 100 cubic feet (or 62 cents per M ft. B.M. and 28 cents per cord). The cost of moving was less than 10 cents per 100 cubic feet (20 cents per M ft. and 9 cents per cord). Parts having been moved by slides, parts by hand sleds, a comparison of the different methods showed the proportion of 183 : 168 : 120 respectively for slides, rail (including amortization) and hand sled. The last method was the cheapest but as it could not be used until the following winter a considerable deterioration of quality was experienced which was estimated at nearly 12 cents per 100 cubic feet.

Hauptversammlung des Mährisch Schlesischen Vereins in Mährisch-Schönberg. Centralblatt für das gesammte Forstwesen. Nov., 1905, p 478 f.

Timber Physics of Japanese Woods.

Weight, shrinkage and use of the different Japanese woods have been investigated by Kitao Moroto, a member of the Japanese Forest Service. The results are only of preliminary value, preceding a more extensive investigation. Of interest to us is perhaps the enumeration of species for different uses. The building timber is furnished by *Cryptomeria Japonica*, *Chamaecyparis obtusa*, *Thuyopsis dolobrata*, and *Abies Sachalinensis*, besides *Pinus densiflora* and *Thunbergii*. *Zelkova* which was formerly considered indispensable for large buildings has, like our White Pine, become too scarce and expensive. A number of oaks furnish carriage material, while this class of wood does not seem to be used for cooperage, which relies on the three first mentioned of the cedar tribe with *Chamaecyparis pisifera* added. For packing boxes several species of *Abies*, *Pinus* and *Picea* with the all-important *Cryptomeria* is used. Joinery material is furnished by the first two mentioned cedars, and in addition by *Paulownia tomentosa*, *Thuja Japonica*, *Taxus cuspidata* and, for clothes chests, *Cinnamomum Camphora*. Small lacquered woodenware is made from *Chamaecyparis* and *Thuyopsis* in addition to *Magnolia hypoleuca*, and *Cercidiphyllum Japonicum*. Three or four minor woods are used for special purposes. The absence of hardwoods except oaks is noticeable.

Gewicht und Schwindungsgrösse Japanischer Holzarten. Centralblatt für das gesammte Forstwesen. Dec., 1905. pp. 490-502.

New Lumber Supply

Despised woods become valuable when prices rise and supplies wane. We recall the difficulty of marketing our Eastern Hemlock only 25 years ago; the Western Hemlock tried to sail on the market under the assumed flag of "Alaska Pine," not more than 10 years ago, and then failed; Noble Fir needed the name of Larch to make it desirable; Red Gum had to be called Hazelwood to make it palatable, and now comes Bay Poplar, disguising the well known, long despised Tupelo of southern forests, to find a market. It is stated in a reported address by the secretary of the Southern Cypress Manufacturer's Association, that members of that Association, own almost 4,000,000,000 feet of timber of that description. Experiments so far to utilize this supply have not been successful until lately, when several mills have solved the problem of turning it into satisfactory stock for siding, moldings, finish, carsiding etc.

Here as in other directions the propriety and usefulness of the Timber Physics work of the old Division of Forestry, which was for a time despised and abandoned as not germane to its functions, appears justified.

Bay Poplar and its Approaching Importance. American Lumberman. Feb. 24, 1906.

Wood Pulp Processes.

A poorly composed, nevertheless highly interesting paper by Philipps describes in detail with historical background the various processes of wood pulp manufacture, the writer having visited the most up-to-date mills in Sweden, Norway, Finland, United States and Canada.

It appears that the first suggestion of the use of wood for paper was made by Réaumur in the first part of the 18th century, although a practical application of the idea did not materialize until 1844 when the German Keller patented the first grinder. All woods can be used for mechanical pulp, although some are preferable. Paper made from this pulp discolors, due to the chemical change in the encrusting substances, lignin, etc., which are removed by chemical processes. An improvement, by Cushman of Vermont, cooks the blocks of wood in boiling water to which lime, soda-ash or other chemical agents are added, the grinding then requiring less power and the pulp being of superior quality, especially as regards toughness.

Common news paper requires about 20 to 30 per cent of chemical pulp, to add the necessary strength, although when, as in America, the ground pulp goes directly to the paper machine the felting power is such as to permit even 100 per cent to be used, a point of considerable economic importance.

Boards for bookbinding, box making, etc., are made of wood pulp ; this being the cheapest material.

It takes about 90 H.P. to make a ton per day, and can in Can. ada be produced at about $10 per ton dry weight, requiring for a mill producing 3000 tons dry a capital of $100,000 or more.

The question as to the inventor of the first chemical process for making wood pulp is still not definitely settled. The author devotes the better part of six pages to a discussion of the controversies. Apparently Mitscherlich, (1876), who was professor of chemistry at the forest academy of Münden (not München as the author says), retains the credit of having put the sulphite process on practical basis, although a patent to the American, B. G. Tilghman, in 1867, covered broadly the various chemical processes.

Of these there are at least three different in character in practical use, the chemicals being bi-sulphite of lime, caustic soda, and sulphate of soda, quality and quantity of pulp produced varying with the chemicals. Chemical wood pulp now enters into the manufacture of the highest class papers, and such a degree of excellence has been achieved in this that only an expert could tell the difference between a chemical wood fiber paper and an expensive all rag paper. The sulphite process saves, next to the grinding process, the largest amount of fiber of best color, the soda process produces a grayish brown pulp in smaller quantity, but is easier to bleach. Of late this process is largely supplanted by the sulphate process, which is cheaper, and in the market is substituted for the soda paper.

As to the permanency of wood papers there is still difference of opinion, but every year sees improvements resulting in a more lasting and durable fiber.

Great Britain in 1903 imported altogether twelve million dollars worth of paper pulp, 554,000 tons, of which four million for mechanical pulp (343,000 tons). Of greatest interest is the extension in the use of wood pulp, namely as a substitute for jute and possibly coarse cotton yarn. There are two processes in practical working. The one produces "xyloline", a strong yarn, so cheaply that a whole suit of clothes can be sold for less than two dollars which can be washed without damage. The other produces "silvaline" for the same purposes, one factory being at work in Spain, another in Holland, and others in Germany. The use for nitro-cellulose (explosives), for cellulose wadding (surgical bandages) and for artificial silk has been known for some time.

The use of the sulphite liquors for watering roads with excellent results may solve the knotty question of getting rid of them in some districts.

The Use of Woodpulp for Papermaking. Journal of the Society of Arts 1905, 34 pp. Reprint.

STATISTICS AND HISTORY.

White Pine Famine

The rise and decline of the White Pine industry is graphically shown by the statistics of the lumber cut in Michigan, Wisconsin and Minnesota during the last 32 years. Rounding off the annual output as given by the American Lumberman, from year to year in billion feet, the series reads: 4. (1873), 3.5, 4., 3.9, 3.6, 3.6, 4.8, 5.7, 6.8, 7.6, 7.6, 7.9, 7., 7.4, 7.8, 8.3, 8.2, 8.6 (1890), 7.9, 8.6, 7.3, 6.8, 7., 5.7, 6.2, 6.2, 6., 5.5, 5.3, 5.3, 4.8, 4.2, 3.6 (1905). While in 1899 White Pine still constituted 18% of the total lumber product, in 1905 it is estimated to be less than half that proportion.

If a change in prices for the last 15 years were noted in juxta position to the above figures of cut it would have shown the opposite tendency in exaggerated form, and the date of the White Pine famine would have been readily fixed about the year 1900, precisely the date, at which the men, daubed in ridicule "forest denudatics", by the American Lumberman, had placed it 20 years before. The realization of the limited supply then standing came suddenly and brought prices nearly to a level with that of fancy woods. A famine is a time of high prices, and the rapidity of rise notes the growing scarcity of supplies. From 1890 to 1900 the price for Uppers rose from $44 to $57.50, or 2½% per annum; from 1900 to 1903 the phenomenal rise to $80 took place, or at the rate of 6% per annum, and at present the price hovers between $80 and $95.

It should be added that the decline is probably even greater than the figures indicate, for the later statistics are probably closer to the truth than the former, which may be understatements.

The cuts of hemlock and hardwoods in the three States have during the years 1900 to 1905 remained practically the same, with slight annual variations, hemlock around 1.25 billion feet, hardwoods from 800 to 1,000 million feet.

The figures are the American Lumberman's, the reflections are the Editor's.

Incidentally we recall the following language of the same journal used about one year ago: "While no careful comparison has been made to demonstrate the fact, it is extremely probable that were all of the white pine mills operated at full capacity the timber of Wisconsin and Minnesota would be exhausted in comparatively a short time, some operators going so far as to say that five years would see the end of the white pine production."

Northern Lumber Output of 1905. American Lumberman. Feb. 24, 1906.

Stumpage Prices.

Not less instructive than the change in cut is the change in stumpage prices for White Pine, for which the same authority records the following as fair averages: From 1850 to 1860 White Pine was sold by the acre. Between 1860 and 1870 values were adjusted on a stumpage basis of 25 to 50 or 75 cents per M., and in Michigan by 1870 $2 to $2.50 were attained. From 1870 to 1880 the advance was only 25 to 50 cents, but stumpage of Wisconsin and Minnesota had come within $1 to the Michigan prices. From 1880, after the Census figures were published, it is well known, a more rapid rise was noted, so that by 1890 \$4.50 to \$6.50, in the other two States \$2.25 to \$4.00 were ruling prices. From 1890 to 1900 prices very nearly doubled, and in the last five years they rose from \$10 for the best to \$20, doubling again; the year 1899 being phenomenal in the rise of price for lumber.

There is, however, still stumpage to be had at \$4.00, a price which was maximum 25 years ago. Indeed, if we compare the average between high and low prices, then the rise for 15 years before 1890 was really more rapid (3.6%) than after 1890 (below 3%); but if the high prices alone are compared the rise in the first 15 years was 3.6%, like the average, in the last 15 years the rise was at the rate of 5¼%.

To appreciate these figures, it should also be understood, that tracts which to-day are bringing \$8 or \$10 a thousand feet could not have been sold at any price 30 years ago. Only the first-class timber was salable in those days and only first-class timber was logged. An estimate in 1870 included only one-third of the timber which would be included to-day.

"But little White Pine is left in either the upper or lower peninsula of Michigan. Wisconsin also has yielded the greater portion of its pine, and Minnesota contributed more than half of the amount it contained originally. Tracts of pure White Pine timber scarcely can be bought at any price to-day."

White Pine Stumpage Prices and their steady Advance. American Lumberman, Jan. 6, 1906.

Yellow Pine Lumber Prices

The change in price of Southern Yellow Pine is shown for ten years for the different grades, with monthly variations, in a table compiled from records of the Southern Lumber Manufacturer's Association. Up to 1899 prices remained tolerably steady, but in that year corresponding to the rise of White Pine lumber, Yellow Pine prices rose rapidly, namely on an average of 6 per cent, and taking a number of grades together the rise has continued through the six years at a rate of nearly 5% per annum, and if July prices had been taken which were the lowest in 1900, the rise would have figured fully 6 per cent. These are significant figures with regard to conditions of supply.

Range of official Yellow Pine Lumber Prices. American Lumberman, Jan. 6, 1906.

Prices of Woodlands

At a private auction in Ottawa on February 13, several timber limits were bid out and sold, subject of course to the stumpage rates and ground rent payable to the government. A bid of $187,000 for 97 square miles was refused, a limit of 225 square miles was sold for $200,000, making the bonus above the stumpage dues ($2 per M) and the ground rent of $3, nearly $900 per square mile or perhaps another $3 per M feet. The tract is located on Lake Temiskaming, about 300 miles north of Toronto.

At the Canadian Capital. American Lumberman, Feb. 24, 1906.

Prussian Forest Administration

During the 35 years from 1868 to 1903, the productive area of the Prussian State forests increased 9.5%; the total cut increased 86%, and from 40.3 to 69.4 cubic feet per acre; the workwood from 29 to 63% of the timberwood (3 inch) or from 7.5 to 37.4 cubic feet p. acre, the latter being 54% of the total cut. The gross returns rose from $1.66 to $3.89 and for wood alone from $1.56 to $3.80 per acre or 143%; prices for wood per unit, rising 45 per cent. or not quite 1.5% per annum. The net yield rose 167 per cent. and from 83.8 cents to $2.05 for every productive acre.

Can there be a better demonstration of the efficiency and profitableness of a forest administration? The 7,000,000 acres involved are administered in 762 districts. In the four years 1901 to 1904, 96 "larger" forest fires, 24 per year, occurred destroying 6,000 acres entirely and 60 acres partially, and in the 32 years preceding 28 fires per year are recorded with about the same average loss.

Amtliche Mitteilungen aus der Abteilung für Forsten. 1905. pp. 67.

Forest History.

The Archives of the Department of Interior in Vienna contain carefully collated the important documents which record the progress of forestry in Austria, the oldest forest order dating from the year 1379. So far this interesting material has not been used, Austria still waiting for a comprehensive history of forestry like those, of which Germany can boast several. Dr. Mocker prints with some annotations one of the ordinances to forestmaster Goltamer in 1599 giving instructions as to the administration of several royal forests under his charge, which gives a comprehensive insight into conditions at that early age. Police duties in protecting forest and game, logging and river driving and proper disposal of the harvest are of course, the main subjects; yet at least conservative lumbering was then thought of: "We desire that tops and branches shall not be left in the woods, but shall be worked up and, as opportunity offers, be sold to our advantage, and in case such cannot be utilized or turned into cash on account of the distance from market, the wood is to be left free to the people or, finally, to be carried together and burnt, that the young wood may grow the better and the game can exist therein."

The same is to be done with dead trees, and the leaving of undesirable trees by the woodchoppers on account of being hard to split, is to be discouraged "that they may not in falling, kill the saplings or impede young growth." Again and again care of the "re-growth" is insisted upon. The salary of the forstmeister was less than $50, and not even the fishing in the waters for his account was an additional emolument.

Bausteine zur vaterländischen Forstgeschichte. Centralblatt für das gesammte Forstwesen. Jan., 1906, pp. 6–17.

POLITICS AND LEGISLATION.

Private Forestry in Germany and Austria.

At the meeting of the Deutsche Forstverein, Dr. Schwappach and Forstrat Graser discussed the means for promoting private forestry. The first speaker stated that in Germany forest management on small and medium-sized forest properties at least was not of a high order, and that since 1883 private ownership had decreased by 500,000 acres, that while 48% of the total forest area is in private hands, the yield from this area represented only 37% of the total cut: a part of the private forest must, therefore, be in poor condition. Graser confirmed these deductions for South Germany and especially for Bavaria, where the fear of the results of this mismanagement had already led to the following measures, which have been followed in part by good results:

1. Instruction of forest owners by wandering teachers, excursions, publications and forestry courses in agricultural and winter schools.

2. Providing good plant material at low prices and advice as to its best use.

3. Money prizes and diplomas.

4. Financial assistance for larger public undertakings (reforestation of waste lands, etc).

5. Increase of supervising forest officials and opportunity to secure counsel from them. But the best plea, the speaker contended, is purchase by the State or corporation.

In addition to these measures Dr. Schwappach's propositions were formulated into resolutions:

1. Preservation and promotion of such forms of ownership, which suit best a forest management (entailed estates and associated ownership).

2. Removal of such rules and regulations (or statutes) which in loan and sale transactions threaten the existence of the stock.

3. Securing efficient administration through the State, by local commissions of interested owners or associations, (such as exist under the modern social organization), or by the owners themselves.

4. Improvement in the wood trade and in obtaining plant-material.

5. Creation of an efficient fire insurance.

The formation of association ownership is especially recommended, although the associations for reforestation have fallen off to about 11% of what were once in existence due to the objection to State supervision.

The same subject, namely the need of improvement in private forest management, was also discussed in Styria, where 65% of the forest area is in small holdings. The retrogression of this property, slowly but surely, was pointed out. The lack of sufficient personnel, the laws for the promotion of private increase of forest officials and management remain useless. Popular education were the methods mainly advocated to secure improvement.

Hauptversammlung des deutschen Forstvereins and *Generalversammlung des Steiermärkischen Forstvereins.* Centralblatt fur das gesammte Forstwesen, Dec., 1905, pp. 514-516, Jan., 1906, p. 35 ff.

Woodland Taxation

An article by Dr. J. F. Clarke, Provincial Forester for Ontario, discusses the theory of woodland taxation with especial reference to conditions in Canada.

The effect of including the value of standing timber with that of the soil in assessing woodlands in private ownership for taxation purposes, is shown in the system of clean-cutting that has prevailed, followed by the abandonment of the ruined tracts to the state through non-payment of taxes.

The inequity of levying an annual tax upon forest property, the return from which is periodic, at the same rate as that levied on agricultural lands, yielding an annual return, is set forth, and a table is given, showing in percentic values the proportionate taxation which woodlands, yielding periodic crops, can bear as compared with agricultural lands of similar net producing capacity. The table follows, column 1 giving rotations from 40 to 100 years, and columns 2, 3 and 4 giving percentages according as money is valued at 4, 5 or 6% per annum.

Rotation	*4%*	*5%*	*6%*
40 years	42.1	33 1	24.9
50 "	32 8	23.9	16.5
60 "	25.2	17 0	10.7
70 "	19.2	11.9	6 8
80 "	14.5	8 3	4.3
90 "	10 9	5 7	2.7
100 "	8.1	3.9	1.6

Thus, if the rotation be 60 years and money worth 5%, the rate of taxation upon woodlands should be 17% of that upon farm lands.

The method of disposing of timber upon public lands has resulted in a constantly increasing devastation of the forest area.

Timber on the public lands of the different Canadian provinces is disposed of under some form of lease or license. Payment for timber cut under these leases is in the form of:

(1). "Stumpage dues", at some fixed rate per M., usually only a small percentage of the actual value; these dues are paid on the amount of material removed, at the time of logging. Payment in this form tends toward conservative lumbering; and the higher the dues, the more careful is the lumberman not to cut any material whose stumpage value is less than the rate to be paid.

(2) "Ground rent," of so much per square mile per annum,

covering all or a portion of the surplus value above what is paid as "stumpage dues." The following table gives the annual "ground rent" payments per square mile for the different provinces and on Dominion lands, and the sums to which these annual payments amount for different periods of from 30 to 100 years, interest being figured at 6% :

RELATION OF GROUND RENTS TO CONSERVATIVE LUMBERING.

	Ground Rent	30 yrs.	40 yrs.	50 yrs.	60 yrs.	80 yrs.	100 yrs.
Ontario and Quebec	$ 3.00	251	492	923	1,686	5,611	18,418
Ontario (recent sales) and Dominion lands east of Yale, B. C.	5.00	419	820	1,539	2,809	9,352	30,697
New Brunswick	8.00	670	1,312	2,462	4,495	14,964	49,114
Dominion lands west of Yale	32.00	2,682	5,250	9,848	17,979	59,856	196,458
British Columbia	96.00	8,045	15,749	29,544	53,938	179,568	589,373
	160.00	13,408	26,248	49,240	89,896	299,280	982,288

Thus, in order to make it profitable to hold lands for a second logging, the lumberman must find on his return of the trees left from the first logging, a stumpage value over and above the then government stumpage dues, and in excess of the value of the ground rent with compound interest, which, as is shown by the table, mounts up very rapidly with increase of the time between loggings. It is natural that this method creates a strong tendency toward a low diameter limit, and discourages conservative lumbering. The higher the "ground rent," the more inexorable is this tendency.

(3) A "bonus" is paid when the lease has an estimated value in excess of the amount paid as "stumpage dues" and "ground rent," and the limit is put up at public auction. In recent sales in Ontario, the largest portion of the value of stumpage sold has been paid in this form. The amount of the "bonus" being fixed before logging begins, and only a small portion of the value of the stumpage being paid in the form of "stumpage dues," the financial interest of the lumberman compels him to cut everything that will yield a profit over this low rate. Thus, a low diameter limit prevails, and the natural re-seeding of the forest is prevented by the destruction of the seed trees.

Woodland Taxation. Canadian Forestry Journal, October, 1905, pp. 159-172.

MISCELLANEOUS

The materially increased interest displayed by the lumber publications recently, in printing practical papers on forestry and items of general interest from the forestal standpoint, is worthy of especial comment. This expression of a growing intimacy between the interests of the lumberman and the forester will serve to further the aim of both—to obtain the greatest value from our woodlands. This need has been felt more and more keenly during the last five years, being manifested largely through the utterances of many lumbermen and their associations. Now that the publications are entering very actively into the field, increased good to both lumbermen and foresters is bound to result.

The American Lumberman, *The St. Louis Lumberman*, and *The Southern Lumberman* rival each other in printing articles of interest to the forester. Nearly the entire list of issues at hand contain from one to three articles to the number, the largest percentage devoted to one line of work being reprints from Forest Service publications.

"The Growth of the Bureau of Forestry into Forest Service," "The Endowment of a Chair of Lumbering in the Yale Forest School," and "The Union of the Forest Service and the Lumbering Associations in the Compiling of Accurate Lumbering Statistics," are extensively and favorably discussed in most of our prominent lumber journals. The removal of the discrimination by Belgium against "American Oak" accomplished by our consular service, is an item less generally noticed, and really undesirable, despite its great financial importance through insuring the resumption of export of oak to that country.

Strode's Lumber World, a new Chicago journal, is entering a field already rather full. It is worthy of a place, however, and resembles the *Saturday Evening Post* in cover and type. A two-page article on "Forestry in Indiana" is in the July 15th number.

A favorable discussion of the FORESTRY QUARTERLY occurs in the June 15th issue of the *St. Louis Lumberman*, and the same number contains a two-column article, with occasional reprints of salient points from Dr. Fernow's "Stumpage in Relation to Lumber Prices."

From the forester's standpoint, the July 15th number is the best of the year. "Trans-Pacific Rafting" and "Sawmilling in the Philippines" are of prime forestal importance. This trans-Pacific raft will probably be built in the Columbia River and will be the largest of its kind ever made, containing ten million board feet of logs—the present record for coast-going rafts is eight million board feet. In case this shipment to the Orient is a success, it will be followed by numerous other assignments of a similar nature, and a new epoch in timber transportation will be at hand. Handling lumber in similar rafts has been a failure.

"Lumbering in the Philippines" by Victor Clarke discusses fully the timber supply over the islands and the labor problem both as to natives and as to whites. Mr. Clarke advocates the use of native labor, except as superintendents of operations.

"Deforestation and Climate" in the November 1st edition is the title of a short extract from the German, very general in its nature, mentioning the countries wherein the greatest climatic changes have resulted after deforestation and counselling the application of the best treatment to all remaining woodlands. The same issue contains an article on the need of "Tree Planting, Especially by Railroads," in which there is an extract from an article by William E. Curtis in the *Chicago Record-Herald*. It is interesting to note that the estimate of the number of cross ties in use is placed at 620,000,000 with a requirement of stripping 200,000 acres of timber each year to supply replacements and extensions. In the building and maintenance of the Pennsylvania Lines, labor consumes about fifty per cent of the entire cost, ties about fourteen, rails seven, ballast three, and road-bed twenty-four per cent.

The American Lumberman has several articles of decided merit. In the August 12th issue is an article by Dr. Schenck on "Utilitarian Forestry" as applied at Biltmore, North Carolina, which recounts very fully the work done by Dr. Schenck for the Vanderbilt estate at that place.

The August 19th issue has a long article on "The Manufac. ture and Distribution of the Hardwoods in Michigan." Some mention is made of the devastation which has occurred in the Michigan fields, and forestry is recommended in future treatment. Emphasis is made of the fact that no State is better adapted for timber growth than Michigan. The importance of the hardwood industry in Michigan is evident from the fact that in 1904 the total output approximated 552,178,000 board feet.

"The Status of Lumber Conditions of today in the Maine Forests" is an article very similar to the preceding one on Michigan, containing detailed statistics. The article deals largely with spruce and is very optimistic as to future supplies.

"Cuba's Forestry Resources and Timber Trade" and "Growth and Changes in the Lumber Trade of the Philippine Islands" are articles of decided interest to the forester and should be read by everyone interested in those islands. Both subjects are treated from the statistical standpoint.

"City Parks and Their Use as Forest Reserves" is the subject of a short article in the September 2nd number. It advocates combining the idea of large recreation grounds with that of an arboretum of scientific value and a forest to be treated along well-defined silvicultural lines and as a source of revenue.

The Southern Lumberman also publishes many articles of decided value to the forester. In the May 25th issue there is an excellent article on "The Tennessee Red Cedar Belt," which has been characterized as the finest body of Red Cedar in the United States. This stand of Red Cedar made this species of first importance to the State, and it was mostly cut over between 1845 to 1860, the product being used for nearly all general purposes. Since then the area has largely re-grown with greatly inferior stock which, however, is bringing as much revenue as the unrivaled material of earlier days. "At the shipping points are huge piles of knotty poles from eight to thirty-six feet long and often longer, which in old times would not have been accepted for stove wood or for the charcoal pits. 'Barn' poles, thirty-six feet long and of good size, have sold for $6.00 apiece delivered at the cars." Two examples of durability are cited, in which the timber is stated to have been used since 1808 and 1835, respectively.

In the July 25 issue there is mention of a new and interesting use for Red Gum. Mr. Edward Olcott of London, England, had just shipped 75,000 tons of Red Gum from Mississippi to be used for paving purposes in London. The size of the blocks vary in diameter, as 5 x 3, 6 x 3 and 4½ x 3 inches, but all are 9 inches long. Mr. Olcott declares hardwood pavements superior to brick.

In commenting on the scarcity of timber and improved machines, the September 10 issue mentions the fact that not many years ago lumber stocks ran as high as sixty to seventy per cent firsts and seconds, while now it is difficult to find large stocks with one-third that percentage of best grades. "With the best of machinery and methods of working there probably will be as much profit made in the future from low grade, narrow lumber as there was in working the best of lumber when there was plenty of it." The lamentable feature, however, is a constantly decreasing supply which verges towards exhaustion.

The September 25 issue records the shipment of 1,500,000 gallons of creosote to the Sante Fe treating plant at Summerville, Texas. This is the largest shipment of creosote ever made. Last year the total amount of creosote produced in the United States was only 13,000,000 gallons. The increasing demand for it is shown by the fact that "in 1885 there were treated in the United States only 211,000 ties. In 1894, practically ten years later, there was an increase to 950,000. In 1904 the figure was 13,711,000."

In the October 25 issue there is a timely article on the barrel industry. This issue quotes from consular reports that "there are upward of three hundred million barrels and circular packages manufactured in this country annually, and the demand increases so that this output must be steadily broadened to keep pace with the growth of the business. The largest demand is in the cement business which requires approximately 35,000,000 a year; while flour comes next at 22,500,000; fence staples, bolts, nuts and nails require 15,000,000 and sugar 15,000,000. Coffee, spices, crockery, and fruits and vegetables use 5,000,000 a year, while glassware, baking powder, distilled liquor, candy, tobacco, and cheese manufacturers use from 2,000,000 to 3,000,000 barrels." The average life of a barrel is given at one year, though general usage prolongs this estimate.

Paper and Pulp is a most interesting publication and among its numerous articles of the year, "Quebec's Forestry Policy" is especially worthy of mention.

The mutual interests of Canada and the United States are given much more prominence in *The Canada Lumberman* than in any of our own journals. A very general interest is also displayed in the work of our Forest Service, forestry associations, and private foresters. The management has also embraced the idea of a "Forestry Department." Most of the numbers at hand ontain interesting items, and especially some very pertinent editorial notes.

The London *Timber Trades Journal* of July 10, prints a very strong three-column article on "Afforestation in the United Kingdom," which is worthy of the attention of every reader interested in British forestry. Articles of a similar nature are "The Swedish State Forests" (June 17) and "The Timber Resources of Liberia" (September 2). Quoting from the July 1 edition,—"The account given of the number of trees planted upon the Brocklesby and Manby estates of the Earl of Yarborough from 1787 to 1905, makes the total number of trees planted 23,260,887 in the 119 years, made up of 157 different timbers. We make bold to say that few, if any, private land owners can show such a record as this." Other articles of note are "Structural Timber" and the "Felling of White Wood in Russia" (July 29).

The devotion of a page or section of a lumber publication to news and items of forestal interest seems to be the logical outcome of the interest in articles of pure forestry value. In this connection it is interesting to note that *Wood and Iron*, of San Francisco, has already embraced this idea, devoting most of its space to reprints and articles of interest to Californians.

The Hardwood Record is following an excellent practice in giving silvical and botanical descriptions of most of our common commercial hardwoods and devoted on an average two well-illustrated pages to each tree. The September number contains by far the best editorial on and reprint of the proceedings of the Michigan Forestry Association meeting last August.

NEWS AND NOTES.

E. A. STERLING, *in Charge.*

Since our last number was issued the following increase in the National Forest Reserves is recorded :

New Reserves : Yuba, California, 524,297 acres, situated between and adjoining the Tahoe and the Plumas Forest Reserves ; Beaver, Utah, 261,593 acres, north of the Sevier Forest Reserve ; La Sal, Utah and Colorado, 158,462 acres, west of the Uncompahgre Forest Reserve, Colorado.

Additions to existing reserves ; Uinta (formerly Uintah), Utah and Wyoming, 428,878 acres, on the north and west ; Sevier, Utah, 353,920 acres, on the east ; Manti, Utah, 193,280 acres, chiefly on the north ; Fish Lake, Utah, 89,760 acres, on the southeast. Making a total addition of 2,010,180 acres. Copies of any of the above proclamations will be furnished by the Forest Service. A diagram or map is included in each proclamation.

Examination of lands for new forest reserves continues especially in the southwest, where several parties are engaged this winter.

As an additional note to the determination of British Thermal Units in wood, mentioned on page 275, Vol. II, of the QUARTERLY, it may be stated that of five samples of heartwood of the common apple the heat units were found to be 9,315.5 per pound of dry matter which is more than that of any one of the four samples of hard maple and next to the highest of the four samples of beech. The one sample of beech showing a larger number of heat units was a heart piece near the stump. This piece showed 9,718.5 units. It is further interesting to note that in each of the five samples of heart and sap apple wood there was no difference between the heat units of the heart and sap wood. The per cent of moisture was not determined.

E. E. Bogue.

A modest invention, yet of the very highest interest to foresters and to paper manufacturers, which has been overlooked, is a machine designed to make the chestnut wood, from which the tannic acid has been extracted, available for paper purposes. The invention is that of Mr. Oma Carr, who begun his investigations in this direction some years ago with the Division of Forestry in its Timber Physics work. The practical importance of this use of a hitherto useless waste cannot be overestimated. A company having acquired the patent is building works in North Carolina where the process will be used. Acid wood is worth about $3 per cord and all refuse, including bark and even saw dust, can be used in extracting tannins, but for paper stock freedom from bark and a whole fiber are required. The invention consists in avoiding the destruction of the fiber, which the ordinary chipper produces.

In response to the call of the Premier, the Right Honorable Sir Wilfrid Laurier, a forestry convention was held in Ottawa on the 10th, 11th, and 12th of January, which if a large and representative attendance, able addresses, and enthusiastic discussion can be taken as indicative, will give a greater stimulus to forestry in Canada than any previous effort which has been made in its behalf. All the main interests of the country, lumber, pulp, agriculture, mining, railroad, education, and commerce, and boards of trade were well represented, as well as Ministers of the Crown, members of parliaments, and other officials.

The fact that the Governor General, the Premier, the Leader of the Opposition, and a large number of members of the federal and provincial governments were in constant attendance shows that the importance of establishing a rational conservative policy in the administration of Canada's forests has at last forced itself upon the attention of those in whose hands the welfare of the country is placed. In all about 300 delegates were in attendance, including eight from the United States.

The results which may be expected from the convention are indicated in the resolutions passed on the last day of the meeting, which asked that the Federal Government inaugurate a general forest policy for Canada ; urged the exploration of the public domain in advance of settlement and the withdrawal and permanent reservation for the production of timber of lands unsuited for agriculture ; approved and favored the extension of the policy of forest reserves ; recommended the supervision by properly qualified officers of the cutting on forest reserves in order to insure reproduction ; approved the establishment of the fire ranging system which has been the means of saving so much timber throughout the Dominion and urged that it be extended ; urged that special means be taken for the preservation of forests on watersheds, especially of that on the eastern watershed of the Rocky Mountains, which has such an intimate relation to the irrigating works in Southern Alberta ; urged the encouragement of tree planting in the prairie regions by means of education and of facilities for obtaining nursery stock suitable for afforestation ; called attention to the danger of loss by fire incident to the construction of projected railways through coniferous forests and recommended the requirement that such railroads furnish the equipment and control necessary to prevent fire ; recommended the making of such regulations as will prevent the loss which follows the cutting of trees after the season of snow and in using the ax instead of the saw, the latter not only increasing the scale from 6 to 10 per cent, but diminishing the risk from fire due to the chips ; expressed its opinion that the retention of rough areas under wood and the replanting of areas unsuited for agriculture would be encouraged if some action in the direction of relieving the same from taxation could be put into effect by the Local Government and the Municipalities.

An international agricultural congress is to be held in Vienna in 1906 or 1907, at which forestry is to have prominent representation. Besides a special section (VIII) with four subsections : forest production, forest engineering, forest management, forest administration and forest politics, there are provided subsections in the sections on education, experimentation, industries, and water management.

The great need for trees on the plains of Texas, and the failure of the farmer to secure a full measure of success by individual effort, has resulted in the formation of a tree planting association at Amarillo, Texas. It is known as the Panhandle Forestry Association, and at present has a membership of about 600, most of whom are landowners who need trees as shelter belts or for fuel and post production. The organization was effected last September, and the plans have been given wide publicity through the local press. A representative of the Forest Service met with the Association in January and gave recommendations for the contemplated forest planting. The service will continue to keep in touch with the work and give assistance through advice and publication. The general scheme is for the members of the Association to act in harmony and do a definite amount of planting annually. Plant material will be obtained in wholesale quantities from nurserymen, or grown in an Association nursery.

The study of white fir (*Abies concolor*) and the application of methods of fire protection on a definite tract, which the Forest Service has been carrying on in coöperation with the State of California, are practically finished, and P. D. Kelleter, who had charge of this work, has returned to Washington. The investigation of White Fir is a commercial tree study and is of particular value since the exploitation of this tree has been neglected, and its value little understood. The work on fire protection was done on the large tract of the McCloud River Lumber Co., in Siskiyou County, and is a continuation of work started last year. The object is to demonstrate to lumbermen that systematic plans of fire protection, which lay particular stress on fire prevention, are practicable, and that preventive measures and prompt action with fires that start will result in a marked saving over the loss and cost of fire-fighting under unsystematic management.

The work of the Forest Service on the Wassamasan tract of the E. P. Burton Lumber Company, in South Carolina, which was mentioned in the last issue of the QUARTERLY, has been finished. H. G. Merrill is now in Washington preparing his report. The preparation of this working plan is of especial interest since it is for lands of a large southern lumber company which has a trained forester in its employ, and which carries on lumbering operations according to plans of management insuring a continuous timber supply.

The Forest Service is attempting to arouse the farmers of the Middle West to a realization of the possibilities and value of forest planting on their lands, through the medium of Farmers' Institutes. F. W. Besley has traveled three weeks through western Colorado with a Farmers' Institute party, giving lectures on farm forestry and related subjects. He is now with another party giving a similar series of talks in the plains region of eastern Colorado. In Nebraska, C. A. Scott has been engaged in the same line of work. S. J. Record, also of the Service, is giving a course of lectures at the University of Indiana.

A commercial tree study of Red Cedar is being carried on in the South this winter by the Forest Service. L. L. White is in charge, and is studying the tree in Florida and other Gulf States, where it originally was of high commercial importance for pencil wood.

The office of Indian Affairs has secured the co-operative assistance of the Forest Service in connection with the disposal of timber on the Bad River and Lac du Flambeau Indian Reservations in Wisconsin. W. G. Weigle is now on these reservations marking timber for cutting.

In keeping with the interest in forest and water questions continually manifested in California, is the application recently made by the Pacific Light and Power Co., of Los Angeles, for plans for the improvement of the watersheds of the San Luis Rey River. The waters of this stream are to be impounded for irrigation and the development of electric power, and the company desires to establish a forest cover to prevent erosion and conserve water. As the result of an examination made by G. B. Lull, about 52,000 acres have been found to be in need of reforestation.

The State of New Jersey has entered the list of those with forest reservations. Modestly starting with a few hundred acres, it is now proposed to purchase 25,000 acres, which will permit a good start for practical management.

Prof. A. J. McClatchie died at Montebello, California, on February 12. Prof. McClatchie had been in poor health for some time and his death was not unexpected. Although not a professional forester, he was well known as an expert on Eucalyptus, and is the author of the excellent monogrhph on Eucalyptus cultivated in the United States.

Among the special lecturers in lumbering at the Yale Forest School this winter are Mr. T. E. Ripley of Tacoma, Washington; Mr. C. I. Millard of St. Louis, Mo., and Mr. M. H. Alling of Providence, R. I.

Announcement has been made of the resignation of Mr. Roy L. Marston from the Yale Forest School. Mr. Marston has been compelled to retire on account of the death of his father and the necessity of taking up the large lumber business, of which his father was the head. Mr. Marston's retirement will take place April 1.

Mr. H. H. Chapman, of the United States Forest Service, is acting as instructor at the Yale Forest School during the present winter. He is giving a course in State Forest Law, and assisting in the course in Forest Management.

A department of forestry has been established at the South African College at Tokai. Its head is Mr. D. E. Hutchins, the distinguished pioneer of forestry in South Africa. The school has been established by the Government for the scientific training of forest officials and for research. The regular course will cover a period of two years, proceeded by a preliminary scientific course of one year specially arranged for students not qualified to enter the regular course. The curriculum is as follows:

(a) Preliminary Scientific Course for Forestry.

General Botany, 6 hours a week
" Chemistry, 6 hours a week.
" Physics, 5 hours a week
Pure Mathematics, 3 hours a week
French or German, 3 hours a week
General Geology, 5 hours a week
Introduction to Forestry, 3 hours a week

(b) First Year Forestry Course

Botany (2 terms Physiology, 2 terms Mycology, 2 terms Forest Botany), 6 hours a week.
Chemistry (Soils and plants, 2 terms) 6 hours a week
Climatology and Meteorology (1 term), 3 hours a week
South African Geology (1 term) 3 hours a week
South African Arboriculture and Silviculture, 4 hours a week
Survey and Elementary Engineering, 6 hours a week
Forestry (Lectures and Field Work) 6 hours a week

(c) Second Year Forestry Course

Forestry (Lectures and Field Work) 6 hours a week

South African Arboriculture and Silviculture, 4 hours a week

Climatic influence of forests, 2 hours a week

Forest Entomology, 3 hours a week

Forest Law, 1 hour a week

Forest Geography and History, 1 hour a week

In addition to the instruction given by Mr. Hutchins, Mr. G. A. Wilmot (now studying at the Yale Forest School) will act as an assistant lecturer and demonstrator in forestry and lecturer in Forest Management and Forest Law. The professors at the South African College will assist in the instruction in auxiliary sciences.

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THE MEASUREMENT OF SAW LOGS.

The English speaking peoples the world over have earned an unenviable distinction for non-progressiveness in matters concerning weights and measures. This reputation is, I think, somewhat more than sustained so far as concerns the measurement of saw logs and other round timbers.

The prevailing unit of measurement for saw logs throughout the various States and Provinces of North America is, of course, the foot board measure. But the foot board measure as applied to unsawn timber is essentially a unit of *product*, not a unit of *volume*, and herein lies the secret of the great multiplicity of "log rules" and the great—one might indeed say amazing—diversity in their scaling scores.

Millmen, engineers, mathematicians, and perhaps others have from time to time endeavored to compute log rules which would forecast with accuracy the lumber product (as inch boards) which could be sawn from logs of various dimensions. Their efforts have resulted in the production of some forty odd log rules all giving essentially, and in many cases radically, different scaling scores.

Notwithstanding the great variety provided, there is, sad to relate, no satisfactory log rule before the public, aud it remains for the forester who should combine the requisite knowledge of logs, mills, and mathematics, to compute a rule that shall be equally fair to buyer and seller with logs of all dimensions. This paper has to do with an attempt along this line, and the rule which has been computed and is here discussed is submitted to the public with some confidence as being in advance of any previous effort. It is hoped that if any flaws in the reasoning be detected, some other forester will take up the task of making another forward step.

Before proceeding to discuss the principles on which the proposed International Log Rule is based, I shall pause to remark for the benefit of those outside the profession, that if the forester had his own way, he would discard the product unit in all log measurements, substituting a volume unit with a classification of the logs measured into three or four diameter classes. The purchaser could then saw his logs into boards or deals with thick or thin saws, unroll them as veneer, pulp them, or burn them, and in all cases be equally without ground for complaint as to the measurement. For the present, however, we bow to usage and content ourselves with evolution where we would gladly see revolution.

The Natural Taper of Logs. From the sides of logs there may be sawn square-edged boards of merchantable dimensions which do not reach to the small end at all and are consequently disregarded by the ordinary log rule which makes no allowance for the natural taper of the log in its scaling score. Naturally, the longer the log the greater the advantage to the buyer from this defect. It is, of course, ridiculous to assume that because the log on the saw carriage measures 19 feet in length, the sawyer cutting it will cut only such boards of even width as will be free from wane the full log length. That no modern milling business is conducted on such wasteful lines goes, of course, without saying.

Heretofore it has been customary on the part of log rule makers to compute the scale for the logs of various diameters for a *single log length*, finding the scale for logs of other lengths by simple proportion as with true cylinders. This method of rule making discriminates in favor of the seller in the case of all logs of less length than the computed length (usually 12 feet) and in favor of the buyer in the case of the longer lengths. In other words, if the scale for the computed length be correct, all shorter logs will be over-scaled and all longer logs under-scaled. The longer the log and the smaller the diameter, the larger will be the percental error. The absurdity of this method of getting the scaling score for the different log lengths may easily be demonstrated practically by cutting long logs into sections and comparing the scale given for the entire log with the sum of the scales given by the same rule for the parts after being cut into shorter lengths. For example, 4-inch logs, 19 feet long, scale by the Champlain Rule *nine* feet board measure. Cut such logs into two sections of 8 and 11 feet, respectively, and the parts will be found to give an average scale of four and ten feet board measure, respectively, or an average total of *fourteen* feet for the logs after sectioning. Or, to take a more extreme case: 6-inch logs, 40 feet long, scale by Doyle *10 feet board measure.* Cut to 8-foot sections and again scaled by Doyle the parts will be found to give an average scale of *55 feet board measure* per log, or an increase of some 400%. These results were demonstrated by measurements of the taper shown by over four thousand pine and spruce logs.

As is well known, trees of the same species, age, and stand differ greatly in the amount of taper shown. Individual logs from the same tree differ widely also. Here as elsewhere in forest measurements, the forester falls back on the great law of averages. The average taper in any given locality for any particular species may be easily determined with sufficient accuracy for practical purposes by the measurement of a few hundred logs. If greater accuracy be required for scientific purposes, a few thousand will be ample. Measurements of the average taper shown by logs representing the commercial trees of Northeastern America have revealed the welcome facts: (1) That the *average taper* does not differ greatly in different localities or with different species; (2) That it is less in good straight clean sawing timber and greater where the logs are rougher, the larger taper in the latter case compensating largely for the increased waste in edging the lumber from the inferior logs; and (3) That it never falls below one inch in eight feet when the logs are taken as they come in modern logging operations. Below are summarized the results of a few such studies:

No. of Logs measured.	*Species.*	*Diameter of Logs measured*	*Taper in in per 8 ft lineal.*
1070	White pine	6 to 33	1.22
3000	Spruce	7 to 18	1.30
300	Balsam Fir	6 to 14	1.26
——	Chestnut[1]	11 to 25	1 42
——	Loblolly Pine[2]	10 to 20	.96 to 1.20
——	" "	over 20	1.20 +

A mixed lot of Adirondack hardwoods gave an average taper of 1.17 inches. On page 87 of Bulletin No. 22, Bureau of For-

[1] Chestnut in Southern Maryland, R. Zon. Bulletin No. 53, Bureau of Forestry, p. 28.

[2] Loblolly Pine in Eastern Texas, R. Zon. Bulletin No. 64, Bureau of Forestry, p. 21

estry, is recorded a series of measurements on 165 white pine trees cutting 894 16-foot logs. These measurements give a taper of 1.62 inches per 8 feet, bark inclusive, for the merchantable portion of the trees above breast height. This would indicate a taper exclusive of bark of fully 1.40 inches. This is a very high average for white pine and is doubtless due to the large size of the trees, the average diameter being 25 inches breasthigh. It is a general rule that the taper shown increases with the diameter after trees have passed the pole stage. This is especially marked in the case of dominant trees.

The Baxter rule gives an allowance for taper in its scaling score in the case of logs 18 feet long and over, the New Brunswick rule for logs 27 feet long and over, and the British Columbia rule for logs 50 feet long and over. The International rule allows for an average taper of one inch per eight feet in the case of all logs regardless of length. This is safely conservative for all diameters and all species.

Allowance for Shrinkage in Seasoning. A point that has been overlooked by some rule makers is that the scale given should refer to the amount of *seasoned* inch lumber which can be sawn from the logs scaled. Inasmuch as logs are ordinarily scaled green, it becomes necessary to allow for the shrinkage of the boards in thickness and in width which accompanies the seasoning. The margins of safety adopted by different mills vary considerably, but usually run from $\frac{1}{8}$ to $\frac{3}{8}$-inch in the width of the boards and from a scant $\frac{1}{20}$ to $\frac{3}{32}$-inch in the thickness.

In computing the International Rule a sixteenth of an inch was uniformly allowed for shrinkage in thickness and all fractions met in measuring the widths of the boards were disregarded which is equivalent to a shrinkage allowance in width of nearly half an inch.

The waste incident to sawing any log into lumber is of two distinct kinds: (1) *the saw kerf* and (2) *that lost in square-edging the boards.* The deduction for saw kerf must in all cases be a proportion of the *area* of the cross-section of the log, and hence increases as logs increase in size in direct proportion to the *square of the diameter.* The deduction for square-edging the boards is, on the other hand, in proportion to the *bark surface* of the log. But the bark surface of logs increases as the logs increase in size in direct proportion to the increase of diameter (not squared). To illustrate: a 12-inch log has $\frac{1}{4}$ of the bark surface of a 48-

inch log, and will, if they be similar in form, have ¼ the waste in square-edging the lumber. But the area of the small end of the 48-inch log is 16 times as large as that of the 12-inch log, and if both be cut into inch boards by the same saw, there will be 16 times as much loss due to saw kerf in the larger log. To repeat in other words, the 48-inch log has *four* times as much waste in square-edging the boards as the 12-inch log, the increase being in direct proportion to the increase in diameter. The 48-inch log has *sixteen* times as much waste from saw kerf as the 12-inch log, the increase being in proportion to the increase in the *squares of their diameters*. If a rule is to be equally fair to large and small logs, it is evident that the deductions to be made for waste due to saw kerf and to square-edging the lumber, respectively, must be kept absolutely separate and distinct in the computation of the rule. In any rule where, as in the Doyle, but a single uniform deduction is made, the rule can give correct values for any given width of saw kerf at *one point only*, above and below which the logs must be over and under-scaled, respectively, or *vice-versa* as the case may be.

The first log rule maker to recognize this fundamental principle in the computation of a rule must have been a Mr. Baxter, for the Baxter rule is the oldest of the four rules so computed. The allowance for edging given by the Baxter rule is .5 inch beneath the bark. The British Columbia rule followed with an edging allowance of .75 inch beneath the bark. The only other log rules similarly computed are the recently produced Universal and Champlain rules in which the edging allowance is made proportional to the top end diameter (or circumference).

Allowance for Saw Kerf. The relation between the different amounts of lumber which may be sawn from logs by saws cutting different widths of kerf is a *percental* one. That is, if the product that can be sawn out by a saw cutting any particular width of kerf be known, the product that can be sawn out by saws cutting narrower or wider kerfs may be got by simply adding or subtracting the necessary percentage to or from the known scale. This implies that the sum of a, b, and c as follows is practically the same regardless of the diameters of the logs manufactured or the width of the saw kerf cut by saws used in their manufacture.

a=Waste due to square-edging the boards.

b=Allowance for shrinkage in width of boards.

c=Proportion of saw kerf waste which goes with a and b.

With narrow saw kerfs *a* and *b* increase with the increase in the amount of lumber produced, but *c* decreases sufficiently to compensate for the increased loss from *a* and *b*. Likewise with wider kerfs *a* and *b* decrease with the decreased production of lumber but their decrease is offset by the increase in *c*.

Perhaps a concrete case will illuminate this somewhat. Suppose a certain log contains 125 cubic units; that 25 units be lost in kerf; that 20 units be necessarily allowed for edging waste and shrinkage (*a* and *b* above); and that the remaining 80 units be lumber. The lumber is to edging (*a* and *b*) as 80 is to 20, therefore of the 25 kerf units 20 go with the lumber and 5 with the edging (*c*). In other words, the total allowance $(a+b+c)=25$ units. With different widths of kerf *a*, *b*, and *c* necessarily vary individually, but their total remains practically constant for the same log regardless of the thickness of the saw used in its manufacture.

This interesting and most important fact solves one of the difficulties in the way of producing a universal log rule in that it makes it possible to adapt a correctly computed rule to saws cutting different widths of kerf.

The standard scaling score of the International Rule is computed for a $\frac{1}{8}$-inch kerf and may be adapted to saws cutting the various standard widths of kerf as follows:

		100,000 feet as scaled by the rule will cut out:
For $\frac{7}{64}$ inch kerf	*add* 1.3%	101,300 ft. B. M.
" $\frac{3}{16}$ " "	*subtract* 5.0%	95,000 " "
" $\frac{1}{4}$ " "	" 9.5%	90,500 " "
" $\frac{5}{16}$ " "	" 13.6%	86,400 " "
" $\frac{3}{8}$ " "	" 17.4%	82,600 " "
" $\frac{7}{16}$ " "	" 20.8%	79,200 " "

Most modern band saws cut a $\frac{1}{8}$-inch kerf. Some 16-gauge band saws cut as low as $\frac{7}{64}$-inch kerf. Gang saws ordinarily cut from $\frac{1}{8}$ to $\frac{3}{16}$-inch kerf. Rotary saws of the dimensions now commonly in use cut a kerf of about $\frac{1}{4}$-inch. Large rotary saws cut kerfs varying from $\frac{5}{16}$-inch to $\frac{3}{8}$-inch. The old-time "$\frac{3}{8}$ and $\frac{1}{16}$" inch kerf is now happily practically obsolete.

Allowance for Edging. It has already been noted that with logs of varying dimensions but similar form the amount of wood necessarily wasted in square-edging the lumber is in direct proportion to the bark surfaces of the different sized logs. The allowance to be made for neglecting the fractions of inches in measuring the widths of the boards sawn from logs is likewise in proportion to the bark surface and may most conveniently be grouped with the edging waste in computations.

Edging waste is due (1) to the *circular form* of logs, (2) to the minor crook (irregularity of surface), and (3) to major crook or "sweep" in logs. In the case of perfectly straight smooth logs the allowance for edging need provide for waste in trimming the wane from sawn boards only. Few logs, however, are either perfectly straight or free from superficial irregularities. It is therefore necessary that in the computation of any practical log rule due provision be made for these normally occurring defects in the form of the average log.

The allowance for edging the lumber from logs of various diameters and degrees of crook was first determined theoretically by mathematical computation aided by draughting. The amount to be added to this theoretical allowance to provide for the additional loss due to human and mechanical imperfections was next determined by sawing out very carefully measured (white pine) logs having all degrees of crook. I shall not here go into the details of this interesting study but content myself with a statement of my results.

1. The discovery that the edging waste remains practically constant regardless of the width of kerf cut by the saw has been already noted and fully explained.

2. It was found that the waste due to crook (major and minor) of all degrees was in direct proportion to the circumference of the logs sawn; *i. e.* the waste due to any particular degree of crook in a 20-inch log was practically double that caused by a similar amount of crook in a 10-inch log.

3. When provision is made in the scaling score for an average taper of 1 inch per 8 feet lineal, and when the logs show an average major crook of 1½ inches per 12 feet, the necessary allowance for edging waste as above defined was found to be .8 *foot board measure per square foot of bark surface* for white pine logs of all dimensions.

The effect of increasing major crook on the product of sawn lumber was also studied. The results of such a study depend directly on the size of the smallest board which is regarded as merchantable by the investigator, for with increasing crook there is a greatly increased out-put of short lengths sawn from the heavy slabs. The rules of the National Hardwood Lumber Association, the Louisiana Cypress Association and other similar bodies, have set the minimum dimensions of boards entitled to pass inspection and measurement in the case of most species at 3 inches in width by 4 feet in length. Using a minimum unit of just double this size I found that as logs were cut for ordinary commercial purposes in the mill in which I made my tests, an increase in the average major crook of one inch per twelve feet increased the allowance required for edging .1 foot board measure per square foot of bark surface. With a minimum unit of 3 inches in width by *12 feet* in length the additional waste in edging for the same increase in average crook was just three-fold or .3 foot board measure per square foot of bark surface.

As already noted, there have been four log rules—Baxter, British Columbia, Universal, and Champlain—which have had the allowance for edging provided for in a rational way. In computing the International Rule the allowance for edging was in all cases made proportional to the circumference at the *middle* of the logs and hence is strictly proportional to the bark surfaces. This differs somewhat from the method adopted in the computation of the Universal and Champlain rules, where the allowance is proportional to the top end circumference, and somewhat more from that used in the computation of the Baxter and British Columbia rules, where the allowance is a certain depth beneath the bark. Both these latter methods—and more particularly the last—give a relatively higher scale for the smaller logs.

Re Computation and Formula. The simplest mathematical formula for the International ⅛ Rule is $(D^2 \times .22)$—$.71D$ for 4-foot sections. Taper ½-inch per four feet lineal. The scaling score has been computed for logs from 3 to 60 inches in diameter and from 8 to 20 feet in length, longer logs to be measured as two or more logs. After computation the scale for the individual logs was, at the suggestion of Mr. Price of the Forest Service, rounded off to the nearest 5 or 0. The saving thus affected in the clerical labor of computing tallies is from ⅓ to ½, while the liability to error in multiplying and adding is reduced to a minimum. Any error due to the rounding off is of course absolutely negligible where more than a dozen logs are measured.

The Adapting of Log Rules to Universal Conditions. The product in merchantable lumber which may be sawn from a sound log of given length and top diameter depends on the skill of the sawyer, the quality of the mill equipment, the width of the saw kerf, the straightness of the log, and the amount of taper present. No log rule could or should concern itself with the varying skill of sawyers or the quality of mill equipments. It is, however, quite necessary that a log rule intended for general use be adaptable to the different widths of kerf cut by saws of various thicknesses and perhaps to the varying qualities of logs in different districts as regards straightness and taper.

Variations due to varying widths of saw kerf have been shown to bear a *percental relation* to the *scale* of logs of the various dimensions, and a table has been given above by means of which any total scale as given by the International ⅛ Rule (*i. e.*, rule for saws cutting a ⅛-inch kerf), may be adapted to saws cutting other widths of kerf. It remains to be shown how a standard scaling score which has been computed with special reference to white pine as it is logged and sawn to-day may be adapted so as to be equally satisfactory for the scaling of logs of radically different taper and sawing qualities.

That the edging waste, whether great or small, is in proportion to the bark surfaces of logs of all diameters has been stated. It is equally true that any increase or decrease in the amount of merchantable lumber that may be sawn from logs because of increased or decreased average taper is also directly proportional to the bark surfaces of the logs concerned. The reason for this will be evident if the portion of the log represented by the taper be thought of as forming a ring about the cylindrical portion and thus being practically proportional to the circumference. These two conditions being granted it follows that any variation in the sawn product of sound logs due to roughness of surface, crook, or taper, must bear a *percental relation to the bark surface of the logs sawn.*

Fortunately a discount or a premium directly proportional to the bark surface of the logs measured may be very simply added to or deducted from the scale given by a rule by using a scaling stick which shall measure the diameters of all logs scaled scant or full as may be desired. Thus, should the necessary edging waste be unusually large—due to excessive average crook or roughness—the scale may be correctly discounted by using a scaling stick on which the 0 point is placed somewhat more than 1 inch from the 1-inch graduation on the stick. Likewise should the logs cut in any locality prove to saw out a larger amount of lumber than called for by the rule, the scale given by the rule may be correctly bonused by using a scaling stick on which the 0 point of the measure is somewhat less than 1 inch from the 1-inch point on the stick. The amount of adjustment necessary to meet any given set of local conditions can only be determined by a careful investigation by a competent person of the sawing qualities of logs cut in the locality. It is fortunate that increased roughness in logs is all but invariably accompanied by increased taper and that while the former tends to decrease the lumber product from logs, the latter has the opposite effect. In most cases the one will be found to offset the other more or less completely, and herein lies an advantage of a top-end measuring rule computed for a conservative taper allowance as compared with a caliper rule which being applied at the middle of the log credits the full amount of taper.

Mill Tests with the International Rule. In making mill tests with the International Rule it must never be overlooked that the standard scaling score (published herewith) is computed for a kerf allowance of $\frac{1}{8}$-inch and a factor of safety in the thickness of the boards of $\frac{1}{16}$-inch (for uneven sawing and shrinkage) or a total allowance of $\frac{3}{16}$-inch. The first step in making a test is to determine accurately the corresponding margin for kerf and shrinkage being made by the mill in which the logs are to be sawn. This can be most conveniently and accurately done by observing the loss in width of square timbers (*i. e.* logs after slabbing all four sides) from cutting any particular number of inch boards from their sides. The larger the number of boards sawn in this test the better will be the average figure for the total allowance. For example, let it be assumed that the cutting of 40 "inch" boards cost the square timbers under measurement a total of 52.5 inches, thus giving an average of $\frac{5}{16}$-inch total allowance, which corresponds with a $\frac{1}{4}$-inch kerf + $\frac{1}{16}$-inch for shrinkage. The 40 boards cut under the standard conditions (*i. e.* $\frac{1}{8}$-inch kerf + $\frac{1}{16}$-inch shrinkage) would cost the timbers but 47.5 inches. Therefore the total scale given by the rule for the logs tested must be reduced for that particular mill in the proportion of 52.5 to 47.5, or in other words 9.5 per cent.

The next step in the test is to measure the logs sawn together with their product in square-edged lumber after manufacture. In my work I have measured the log diameters, top and butt, twice at right angles correct to tenths of inches, the mean being taken. The crook in the twelve feet towards the small end of the log was also measured by applying a straight-edge to the side showing the greatest curvature. Unless it is desired to discover the *cause* of any variation from the rule scale the measurement of the crook and the butt diameter may of course be omitted.

Further procedure can perhaps be more easily made clear by assuming a concrete case. For this purpose let the task be to determine the correction to be made—if any—in adapting the rule for specially accurate work with, say, Adirondack spruce. Let the assumed conditions be as follows:

Logs sawn (16 feet long)	1000
Average diameter at top	10 inches
Kerf cut by saw used	$\frac{3}{16}$ inch
Allowance for shrinkage	$\frac{1}{16}$ inch
Scale by International $\frac{1}{8}$ Rule	71,585 ft. B.M.
Scale adapted for $\frac{3}{16}$-inch kerf (see page 84)	68,006 " "
Actual product after manufacture	69,606 " "
Over-run of scale by saw cut	1,600 " "
Average over-run per log	1.6 " "

By using the rule formula it will be found that with a $\frac{3}{16}$-inch kerf it takes an increase of just .1 inch in the diameter of a 10-inch log to increase the scale 1.6 feet board measure. In other words, if the above supposed case were a real one, the saving in the edging waste of 1.6 feet B.M. per log on account of the greater straightness of the logs would have as great an effect on the product in sawn lumber as an increase of .1 inch in the diameter of all the logs would have on the scale. The application is obvious. If it be desired to adapt the International Rule for logs sawing out as economically as in the supposed case above, the zero point of the graduations on the scaling stick must be moved .1 inch to the right so that from 0 to the 1-inch mark on the scale, the actual distance will be but .9 inch. So adjusted, the scaling stick would be a local rule for the species or the locality giving as favorable results from actual mill tests as have been assumed for illustration purposes.

Mill Test with White Pine. The results of a test with white pine logs made in the summer of 1905 on the Ottawa under ordinary commercial conditions will be of interest. In scaling the logs for the following comparative statement, all fractions of inches in the measured diameters were disregarded if of the even half inch or less, while all greater than the half were counted as full inches, except in the case of the Champlain scale where *all* fractions were disregarded as directed by the maker of the rule. The logs were cut almost entirely to inch boards (1 $\frac{1}{16}$ inches thick) by a band saw cutting a ⅛-inch kerf :

Diam. of Logs	No. of Logs	Over-run (+) or under-run (—) of Saw Cut as compared with scale by Doyle	Scribner	Champlain	International ⅛ Rule
6–8	28	+143%	+33%	+10 3%	+2.6%
7–9	54	+115%	+35%	+ 8.8%	+2.3%
8–12	101	+ 72%	+34%	+ 7 1%	+0 0%
10–17	104	+ 45%	+23%	+ 4.7%	−1.1%
18–20	90	+ 24%	+14%	+ 6.7%	+0 5%
21–24	126	+ 18%	+14%	+ 5.2%	+1.1%
25–33	31	+ 10%	+ 9%	+ 3.3%	−0.5%

The groups of smaller logs are over-lapped somewhat to show intermediate steps in the decreasing error of the Doyle scale as the logs grow larger. The 10–17-inch group of 104 logs represents the average log as cut on Ontario public lands in 1904, the scale of the average log being 61 feet according to Doyle. The Doyle rule is of course increasingly unsatisfactory as a measure of log values as the average log milled grows smaller. The decrease in the size of the average pine log cut in Ontario has been 35% during the last 12 years. The Scribner rule is much less extreme than the Doyle but is quite out of touch with modern conditions. The theoretical allowance for edging used in the computation of the Champlain rule was a 1-inch board from the centre of the logs sawn. This is equivalent to about .3 foot board measure per square foot of bark surface, and is much too low even for the straightest, smoothest logs. The absence of any allowance for taper in the scaling score is equivalent to adding at least .5 ft. B.M per sq. ft. of bark surface when 16-ft. logs are sawn. Where the fractions of inches are all disregarded in measuring the diameters in scaling, this edging allowance is further bonused to the extent of about .22 ft. B.M. or a total edging allowance of a trifle over one foot board measure per square foot of bark surface, which is larger than necessary. Were the Champlain rule a ¼-inch kerf rule as intended by its author, the band saw cut should have over-run its scale 10 per cent. throughout. Its kerf allowance is really $\frac{3}{16}$-inch when the boards are cut plump to allow for shrinkage, as is always done. The test proved very satisfactory for the International $\frac{1}{8}$ Rule. The total scale given the 403 logs sawn was 82,920 feet, board measure, as compared with a product of 83,288 feet measured after manufacture, an over-run of the scale of four-tenths of one per cent. It will be noted that the scale proved equally satisfactory for small and large logs.

JUDSON F. CLARK.

THE INTERNATIONAL LOG RULE.

Formula: $(D^2 \times .22) - .71D$ for 4-foot sections.
Taper allowance: ½ inch per 4 feet lineal.
Standard scale for saws cutting a ⅛-inch kerf.

Dia	Length of Log in Feet. 8	9	10	11	12	13	14	15	16	17	18	19	20	Dia
3	--	--	--	--	--	--	--	--	--	5	5	5	5	3
4	--	--	5	5	5	5	5	5	5	10	10	10	10	4
5	5	5	5	5	10	10	10	10	15	15	15	15	20	5
6	10	10	10	15	15	15	20	20	20	25	25	30	30	6
7	15	15	15	20	20	25	25	30	30	35	35	40	45	7
8	20	20	25	25	30	35	35	40	45	45	50	55	60	8
9	25	30	30	35	40	45	50	50	55	60	65	70	75	9
10	30	35	40	45	50	55	60	65	70	75	85	90	95	10
11	40	45	50	55	65	70	75	80	90	95	105	110	115	11
12	50	55	65	70	75	85	90	100	105	115	125	130	140	12
13	60	65	75	85	90	100	110	120	130	140	145	155	165	13
14	70	80	90	100	110	120	130	140	150	160	175	185	195	14
15	80	90	105	115	125	140	150	160	175	185	200	215	225	15
16	95	105	120	130	145	160	170	185	200	215	230	245	260	16
17	105	120	135	150	165	180	195	210	225	245	260	275	295	17
18	120	135	155	170	185	205	220	240	255	275	295	310	330	18
19	135	155	175	190	210	230	250	270	290	310	330	350	370	19
20	150	170	195	215	235	255	275	300	320	345	365	390	410	20
21	170	190	215	235	260	285	305	330	355	380	405	430	455	21
22	185	210	235	260	285	315	340	365	390	420	445	475	500	22
23	205	230	260	285	315	345	370	400	430	460	490	520	550	23
24	225	255	285	315	345	375	405	440	470	500	535	565	600	24
25	245	275	310	345	375	410	445	475	510	545	580	615	650	25
26	265	300	335	370	405	445	480	520	555	595	630	670	705	26
27	290	325	365	405	440	480	520	560	600	640	680	725	765	27
28	310	350	395	435	475	520	560	605	645	690	735	780	825	28
29	335	380	425	470	510	560	605	650	695	740	790	835	885	29
30	360	405	455	500	550	600	645	695	745	795	845	895	950	30

THE INTERNATIONAL LOG RULE.

Formula : $(D^2 \times {\cdot}22) - {\cdot}71D$ for 4 foot sections.
Taper allowance : ½ inch per 4 feet lineal.
Standard scale for saws cutting a ⅛-inch kerf.

Dia	Length of Log in Feet.												Dia.
	8	9	10	11	12	13	14	15	16	17	18	19	20	
31	385	435	485	540	590	640	695	745	800	850	905	960	1015	31
32	410	465	520	575	630	685	740	795	850	910	965	1025	1080	32
33	440	495	555	610	670	730	790	850	905	970	1030	1090	1150	33
34	470	530	590	650	715	775	840	900	965	1030	1095	1160	1225	34
35	495	560	625	690	755	825	890	955	1025	1095	1160	1230	1300	35
36	525	595	665	735	800	875	945	1015	1085	1160	1230	1305	1375	36
37	560	630	705	775	850	925	1000	1075	1150	1225	1300	1380	1455	37
38	590	665	745	820	895	975	1055	1135	1210	1295	1375	1455	1535	38
39	620	705	785	865	945	1030	1110	1195	1280	1365	1450	1535	1620	39
40	655	740	825	910	995	1085	1170	1260	1345	1435	1525	1615	1705	40
41	690	780	870	960	1050	1140	1230	1325	1415	1510	1605	1700	1795	41
42	725	820	915	1010	1100	1200	1295	1390	1490	1585	1685	1785	1885	42
43	760	860	960	1060	1155	1260	1360	1460	1560	1665	1770	1870	1975	43
44	800	900	1005	1110	1215	1320	1425	1530	1635	1745	1855	1960	2070	44
45	835	945	1055	1160	1270	1380	1490	1600	1715	1825	1940	2050	2165	45
46	875	990	1100	1215	1330	1445	1560	1675	1790	1910	2030	2145	2265	46
47	915	1035	1150	1270	1390	1510	1630	1750	1870	1995	2120	2240	2365	47
48	955	1080	1205	1325	1450	1575	1700	1830	1955	2085	2210	2340	2470	48
49	1000	1125	1255	1385	1510	1645	1775	1905	2040	2170	2305	2440	2575	49
50	1040	1175	1310	1440	1575	1715	1850	1985	2125	2265	2400	2540	2680	50
51	1085	1225	1360	1500	1640	1785	1925	2070	2210	2355	2500	2645	2790	51
52	1125	1275	1420	1565	1710	1855	2005	2150	2300	2450	2600	2750	2905	52
53	1170	1325	1475	1625	1775	1930	2085	2235	2390	2545	2705	2860	3015	53
54	1220	1375	1530	1690	1845	2005	2165	2325	2485	2645	2810	2970	3135	54
55	1265	1430	1590	1755	1915	2080	2245	2410	2580	2745	2915	3085	3250	55
56	1315	1480	1650	1820	1985	2160	2330	2500	2675	2850	3025	3200	3375	56
57	1360	1535	1710	1885	2060	2240	2415	2595	2770	2955	3135	3315	3495	57
58	1410	1590	1775	1955	2135	2320	2505	2685	2870	3060	3245	3435	3620	58
59	1460	1650	1835	2025	2210	2400	2590	2780	2975	3165	3360	3555	3750	59
60	1510	1705	1900	2095	2290	2485	2680	2880	3075	3275	3475	3680	3880	60

THE SPITZENBERG PLANTING TOOLS.

The problem of reforesting timberless areas in the United States is one which will confront American foresters for many years to come, however conservative the lumbering in the future may be. To restock the areas at present bare and unproductive would require many decades and many millions of dollars, and yet there are many thousands of acres of land in the United States which can be planted and which, beyond peradventure, would prove a paying investment, even for private owners. Nevertheless the National Government and the various States can better afford at the present time to engage in planting on a larger scale than can individuals.

Conditions in the United States differ so widely from those in European countries that we may perhaps as yet not be able to profitably practice such intensive methods as the European forester is warranted in using. However, we can gain much of value from knowledge of the methods employed by him and of the instruments and tools he uses in his forest work, especially those connected with the process of planting. The highest stage of development in the number and uses of planting tools has been reached quite naturally in Germany, and at Eberswalde a set of tools on more or less new principles has been worked out by an underforester, Spitzenberg. Although not yet generally adopted, these Spitzenberg tools promise to be of great value in planting, nursery, and other cultural work. Descriptions of these and others in use in Europe may be of interest to the readers of the QUARTERLY. The following descriptions and accompanying illustrations cover specimens of these tools which are to be found at the Yale Forest School.

The essential feature of the Spitzenberg tools is that they are to loosen and stir the soil without turning it up.

The Wühlspaten, or Revolving Spade. This tool (figure IX, plate A) is used in nursery rows and beds to loosen the soil about the roots of the young seedlings, thus stimulating the growth by enabling the roots to penetrate more easily into the soil. It is used on pure humus soils, in soils previously worked over, and also on bare soils. The tool is had in two sizes. One with two spade-points is lighter and is used for rougher work in mountain soils, and in Germany is used by women as

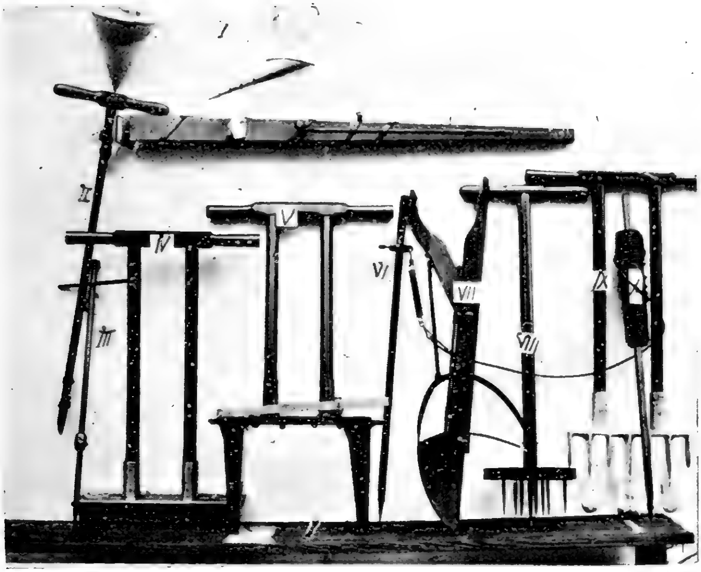

PLATE A.

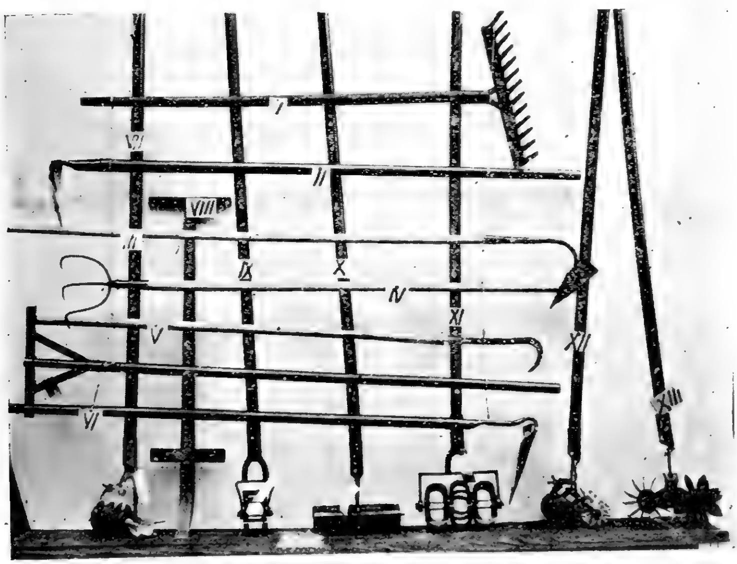

PLATE B.

PLATE C.

PLATE D.

well as men. For all rough work, it is to be preferred to the three spade-point size (in the picture), which is larger and heavier, and to be used on sandy and level surfaces.

Some instruction as to the handling of the Wühlspaten is necessary before one can use it to the best advantage. The spade is pressed into the ground, at the same time moving it back and forth, and this is repeated, working across the plat of soil and then at angles, so that the soil is thoroughly loosened but is not turned over, as is the case when a mattock or an ordinary American spade is used.

The Wühlrechen, or Rotary Hoe. This tool, shown in figure XIII, plate B, serves the double purpose of a hoe and a rake. The star-shaped discs on the right as they appear in the picture, have sharp edges and are useful in loosening the soil for the reception of the seed. The tool is used for mixing manure or fertilizer into the soil and to distribute evenly the seed and also to cover it after it is sown.

Figure XI shows another form of this tool with three wheels, while figure IX shows the same instrument with a single wheel. This particular form is used generally for leveling and pulverizing soils preparatory to making the rills. A certain amount of weight is necessary to make the rollers go deep enough into the soil, and to facilitate this a stone is sometimes placed upon the flat U-shaped iron at the base of the handle.

The Rillenzieher, or Rill-marker. This tool, which is shown in figure VII, plate B, is used mostly for nursery beds in gardens and small patches. After the surface has been loosened sufficiently, this tool is run over it, both leveling the ground and marking the drills. Cylinders of different sizes can be put in to give the desired distance between the rows, the distance and cylinder depending on the kind and age to which the seedlings are to be grown, a different rill being necessary for acorns, pine, spruce, fir.

Another type of rill-markers are those that press the rills, and hence need considerable weight in their make-up. This is shown in the illustration, figure IV in plate A. The handles on both sides are grasped firmly and the tool is raised a foot or more above the ground and then placed firmly on the surface, making two rills of equal depth and parallel. This is repeated until a row of the desired length is obtained.

There is yet a third type which may be called a rake rill-marker. This is supplied with rake-like teeth and when drawn across the soil loosens it and at the same time marks the rills by means of rollers.

Covering Tools (*Bedeckgeräthe*). One type is shown in figure X, plate B, which might be called a covering-hoe ; the advantage of this tool over an American hoe is that the danger of covering seed to too great a depth is obviated, owing to the shallowness of the blade. This is used in covering heavy seed, such as acorns or nuts.

Another form of this tool is shown in figure XII, plate B. This is used in seed-rills for covering small seed requiring a light covering. It consists of two cylinders, one of wood and the other of barred iron.

Dibbles. In plate C, figures I, V, IX, and X show different types of dibbles. Figure V represents two forms, the smaller a very long, narrow one for planting seedlings with long tap roots, the larger one being of iron with leather-covered handle. This is the old Butlar dibble, which in handling used to be thrown on the ground with such care that it struck on the point. Its weight, with the momentum given to it in throwing, caused it to make a hole sufficiently large for the seedling, a second thrust being aimed to close the hole and plant the seedling. Considerable skill was required in the use of this tool in order to correctly space the distances. It is now provided with a long handle and cross bar, and, under the name of Wartenberg iron (fig. X), widely used for planting yearling pines, or for large-seeded species, such as walnuts and hickories.

Figures I and IX represent other dibbles with handles, the latter a useful type in heavier soil.

In plate A, figure V shows a tool for making holes in soils of seedbeds or other prepared ground where careful spacing is required. Its weight enables the user to obtain the necessary depth by raising it above the surface and letting it fall in the correct position. Its weight, however, is an argument against its general use.

Another form is shown in figure VIII, plate B. This approaches a spade in purpose, though made of wood with the point covered with iron to secure durability.

Nut--planter. A device for planting acorns or other large seed is shown in figure II, plate A. This consists of a tube with an opening at the bottom covered by an iron flap which can be opened by a lever, worked from the top of the handle, to allow an acorn to fall out. The lower end is pointed and thus it can be used for making an opening in the soil. The tube is filled with acorns or whatever seed are to be planted and the process of planting is made quite simple, requiring no bending over, nor making of openings in the soil to receive seed other than that made by the pointed end of the planter.

Plant-lifter. In plate C, figures III, IV, and VII represent three types of spades for lifting plants with a ball of earth without disturbing the roots. These are used also for making openings in which to transplant seedlings with the ball. Another form useful in less compact soil is shown in figure VII, plate A, which holds intact the ball of earth around the seedling when lifting it.

Figures VI and VIII, plate C, show the type of heavy German spade used in forest work, well made and evidently with a view to lasting ; but the weight of which would not be tolerated by the ordinary American laborer.

In plate D are shown a number of instruments for pruning, such as the pruning-saw, pruning-shears, pruning-hook, pruning-cane, etc. There is no elaborate mechanism about these and no explanations are thought necessary, as the illustration shows the different forms. The pruning-cane (I) is the only one to be especially noticed. This consists of a small saw which, when not in use, fits snugly in a groove in the side of the cane.

In plate A, at the top, are shown several kinds of receptacles for holding seed when planting, the ordinary German seed-horn, etc., and the square tube for holding acorns, with an opening at the bottom, worked by the lever on the side, the whole instrument to be slung over the back of the planter by means of the strap.

JNO. D. GUTHRIE.

ROCKY MOUNTAIN SEEDLING GROWTH.*

The following study of seedling growth in the Pikes Peak Forest Reserve was carried on incidentally throughout the season's work. Notes were taken by locality, giving situation and brief physical description of each. In each, a number of observations on reproduction were recorded, guided by its most striking features, as well as by a general outline of the subject. To condense these observations, digest certain other data, and draw a few conclusions that bear on reforestation, and apply to the region covered, but will also apply to some extent elsewhere, is the object of this summary.

The few deciduous species of the tract covered, are confined to watercourses and a limited area of chaparral slopes. The coniferous type of forest is of course altogether dominant, and numbers eleven species. The reproduction of these follows in order of amount and importance :

Picea Engelmanni (Parry) Engelm.; *Pinus flexilis* James ; *Pseudotsuga taxifolia* (Poir.) Britton ; *Pinus ponderosa scopulorum* Engelm.; *Abies concolor* (Gordon) Parry ; *Abies lasiocarpa* (Hook.) Nutt.; *Pinus aristata* Engelm ; *Picea Parryana* (Andre) Parry ; *Pinus edulis* Engelm.; *Juniperus scopulorum* Sargent ; *Pinus Murrayana* Oreg. Com.

Reproduction of the eight last named species is found only in limited numbers, or on restricted territory. The last mentioned is represented by possibly a dozen young trees in various parts of the tract. A few Red Juniper occur near Little Fountain Creek. A number of bush-like saplings of Piñon are found in the same locality, some as high as 9700 feet altitude. The Blue Spruce reproduces sparingly and in only a few locations in the southwest part of the reserve, and on Little Fountain Creek. The Bristle-cone Pine, while in mature state quite widely distributed at highest forest altitude, and on dry, exposed slopes down to 1900 feet or less, appears to be almost a doomed species. Though seed-trees seem to bear every year, it reproduces only very

*This paper is based on material gathered in 1903, on that part of the Pike's Peak Forest Reserve lying south of the peak itself, where the writer with others, was engaged upon certain problems for the Bureau of Forestry. He wishes to express his thanks to Mr. W. J. Gardner, of the Forest Service, through whose encouragement the personal observations were made possible, and a part of whose general data were drawn upon for this digest.

sparingly near mountain tops and on exposed high ridges. The Alpine Fir is curiously restricted to north slopes in the upper North Cheyenne Basin. Here it forms as much as five per cent in some very dense young Engelmann Spruce growth. Age counts prove that it came in after the fire of 50 years ago, and four to six years ahead of the Spruce. The White Fir and its reproduction are limited to altitudes below 9000 feet, and here mainly to the southeast part of the reserve. Here the young growth, in a few old burns, makes one-half to two-thirds of the stand. The young Bull Pine, or Rock Pine, is limited to the lower South Cheyenne Basin, so far as considerable numbers are concerned. Very sparingly is it found throughout, and almost co-extensive with the Red Fir zone.

The Red Fir makes the most abundant and most generally distributed reproduction below the 9000-foot limit. The Limber Pine is the tree which, barring accidents, will eventually thickly dot nearly all south, east, and west slopes between 9000 and 11,000 feet. The process of recovery from past denudation, however, will be very slow at best. The Engelmann Spruce in the number of its young trees outnumbers those of all other species combined. It is by far the best plant factor to conserve snow and water that these mountains possess. Following creeks as far down as 7000 feet, its ideal home is on northerly slopes next timberline, at an altitude of 11,000 to 11,500 feet.

The period of greatest mortality could not be definitely determined because the reproduction is not represented by all ages. It is safe to say, however, that this period for all species would fall within the first three years of the seedling's life.

Seeds often germinate on decaying logs, on thick, moist duff, or in other less favorable situations. Presently these places dry out, and the seedlings perish for want of moisture. Or, particularly in case of Engelmann Spruce, they may start in genial shade, and by removal of the shading object or shifting of the sun's course, be exposed to the murderous rays of the latter. Or, they may find every favorable condition but mineral soil, and die for want of mechanical support and plant food.

Not enough infant seedlings were observed to determine under what conditions they best germinate and grow. They are rare things in the region covered. In the case of Engelmann Spruce on favorable locations, no harmful mortality takes place, for seedling growths persist in very great density to 40 years of age.

Only a few localities with reproduction under ten years old were found. These exceptions are the result of fires and of logging. In both cases the exposure of the mineral soil has furnished a seedbed. Logging has not only the effect of producing seedlings by trampling and skidding, but the removal of the forest cover releases, as it were, long-suppressed seedlings, which at once burst into vigorous growth.

The Engelmann Spruce nearly always occurs singly. The Limber Pine, as often as singly, is found in bunches produced by the germination of several seeds from a buried cone. These bunches frequently occur along recent skidways. On certain slopes are found trees at least 20 years old in groups that give the appearance of coppice woods, although, to be sure, none of the conifers of this region are found to be coppice. These groups evidently come from cones buried by soil movement due to gravity or washing, or less probably covered by squirrels. It may be that single seedlings of tender age were wiped out while bunches were able to persist. There is a hint to the planter in the foregoing facts.

The Engelmann Spruce divides its tap root within the first ten years of its life. A lateral system develops, which is imbedded in the first inch of mineral soil, just beneath the humus. In the most vigorous growers, the length of these lateral roots is equal to the length of top, while bulk of root-system is equal to bulk of top. With decreasing vigor, size of root-system decreases very much faster than size of top. The facts just stated were observed in considerable numbers of Engelmann Spruce, seven and eight years old. The few observable examples of uprooted larger trees indicate that the depth of the root-system is about equal to the basal diameter of the tree, and keeps pace with it. Several large roots, radiating horizontally, form the framework of the system. Red Fir, Limber Pine, and Engelmann Spruce all form shallow root-systems, doubtless due to the thin layer of soil. The last produces the shallowest. Yet there is little or no evidence of windfall, so much dreaded in the spruce forests of Europe, probably because of the open stand.

By far the greater part of the reproduction on the territory covered is practically even-aged. This throws it into sapling size, though it laps over, on the one hand into seedling, on the other into pole size. The great majority of young Engelmann Spruce are between 35 and 45 years of age. The younger of these trees probably invariably occur in the same stand with the older, and vary from one to five or six feet in height, while the older vary within much greater limits, viz., about three to forty-five feet. This great variation corresponds to variation in situation and density. The latter varies from 1000 to about 8000 trees per acre. The reproduction under virgin forest is very much scattered and dwarfed, and of widely varying ages. A tree of the latter type was found to be 60 years old and one foot high. The other extreme occurred in an open stand following the fire of 50 years ago. This gave a tree 45 years old, 45 feet high, and 11 inches in diameter. Another of the same age made a growth of 16 inches per year for the last 20 years. The best reproduction considered as a forest occurs on cool, moist, northerly slopes. The drier, warmer slopes, where any reproduction took place at all, show an open or scattered stand. The individual here is larger on the average, and its diameter in relation to its height one-third greater.

Reproduction surveys indicate that Engelmann Spruce in these conditions requires an average of 27 years to reach breast height; Red Fir, 19 years. The former, under best conditions, first bears cones at 25 years of age; Limber Pine, at about 20 years. At least two instances were observed where Engelmann Spruce about 35 years old had reproduced.

Of the four principal species, Bull Pine ranks first in average rapidity of growth up to 40 years of age. Red Fir probably takes second place, Limber Pine third, and Engelmann Spruce fourth.

The ratio of heartwood to sapwood in the sapling of the three species last named above, will be nearly as two to one. In Engelmann Spruce, the number of annual rings in the heartwood will approximately equal the number in the sapwood. In Red Fir, the number is about 25 per cent greater in the former than in the latter, and in Limber Pine, 10 to 15 per cent greater.

Many observations show that seed of the three species just named needs bare mineral soil on which to germinate. Recent broadcast sowing of the Bull Pine in the Black Hills indicates the same thing for that species.* Surprise has been expressed at this in certain quarters. John Muir notes the same fact in the Sequoia of the Sierra.* Thos. Southworth, Director of

*Forestry Quarterly, Vol III, page 412.

*Mountains of California, page 191–192.

Forestry for Ontario, has pointed out a similar observation in the white pine forests of Canada.* To German foresters the fact was axiomatic more than a quarter century ago.†

In the case of Engelmann Spruce it was everywhere apparent that after the seeding is once established, the more humus, the better. Where it exists without any soil cover at all, it does very poorly indeed. For best results seedling growth and humus formation should begin at the same point and proceed hand in hand.

The large areas of thinly scattered young trees have been noted before. Probably the larger number of these bear cones, and in the case of Englemann Spruce, have borne them for a period of 10 to 15 years. Yet there are no young seedlings. The question not yet clear is: Why have they not reproduced? It might be denied that viable seed has been produced. However, at least two incontrovertible instances have been observed, in which seed from such trees has reproduced. Climatic influences may complicate the problem. But the lack of proper condition of seedbed would seem to be the most likely solution.

Half a century ago, 75 per cent or more of this whole region was laid waste by fire. Since then the seedbed has remained nearly barren and dry, or become grown over with grass, or scattered with Aspen litter. On a few northerly slopes, several inches of dry duff remain, too moist at the time of the fire to be consumed. On these, a properly controlled fire, to burn off the duff and expose the bare mineral soil for the reception of the seed, might prove effective. The young seed-trees, scattered thinly over the area, are easily large enough to escape being killed. Where too much inflammable material is gathered about them, it could readily be removed by hand. But a good scorching might make them bear seed all the more profusely. The burning should be done in the autumn of a seed year, before the falling of the seed.

The needle cover exerts upon young growth an effect that is the same in kind, but less in degree, as that had by humus cover. In drier situations, more needles and less humus are found, owing to less rapid decay. The rapidity of formation of a needle and humus cover depends principally upon the number

* Canada Lumberman and Woodworker, 1904.

† Gayer, Waldbau. 2d ed., page 300.

and thrift of trees present to shed needles. Both have the effect of preserving the all-important soil moisture, whereas the needles do not furnish nitrogen and other essential elements to the soil until they have changed to humus. It is then that the bacteria, under the proper degree of moisture, temperature, and aeration, liberate from the needles these elements and reduction products, to be re-combined with soluble minerals for the use of the trees. The relative meagerness of the granitic soil, both in quantity and quality, is such that this return of fertility to the soil should not be overlooked as a factor in establishing seedling growth.

In the Engelmann Spruce, an important factor in the ground cover is dead wood. Trees of all sizes and stages of decay lie thickly upon the ground throughout the greater part of the range of this species. On the more favorable north slopes, reproduction has covered the ground thickly and evenly. But that which emanates from under fallen trees is as a rule the largest. On the less favorable slopes, all the reproduction in some situations, and much the best in others, occurs either in clumps at crossings of dead trees, and about snags and piles of rubbish, or in strips along fallen stems. The young spruce profited either by the long-continued snow cover, or the preserved soil moisture, or the fertile humus, or the shade, or the attending coolness and humidity, or other protection, or by some or all of these combined, which the dead wood furnished. It has now served its purpose, and had better be removed, where not too much decayed, in order to lessen danger from fire. But on unfavorable planting areas, if left on the ground, it may serve the same purpose that it has served before. On many inhospitable slopes, this may prove a most important factor. The fire argument bears little weight here, for a dense young stand of spruce without dead wood is far more inflammable than an area thickly strewn with dead wood but without young spruce. There must be fire protection in any case. Quantity and quality of material to be removed, in a climate so inimical to decay, will suffer but little by later removal. The greater care necessary will be offset by growing scarcity of wood. Of course, if left, it will somewhat impede planting operations. But future versus present removal may mean the entire difference between reforestation and no reforestation.

No reproduction exists in heavy grass sod, and *vice versa*. This goes to show what has been shown time and again, that the two are incompatible. Some bare slopes in the spruce zone, however, have grown over with grass to an extent which may permanently prevent natural or even artificial regeneration.

No brambles and few weeds are present. Brush occurs only on warmer and lower slopes to any extent, out of the proper range of the Engelmann Spruce. Here it may probably benefit to some extent the young Limber Pine and Red Fir. A few cases are at present found where Aspen (Populus tremuloides Michx.) stands as nurse to the young coniferous seedlings. However, the bulk of the evidence points to the conclusion that this species had little or no influence upon the generation of Engelmann Sprue and Limber Pine that is now in its ascendancy. To be sure, where Aspen is present, it sprouts the first season after a fire, and thus may shelter the tardier and more slowly growing conifer. But if the dispersal of a crop of coniferous seed should be delayed some years, the leaves and twigs of the Aspen may cover the seedbed so well prepared by the fire to an extent that prevents the contact of seed and mineral soil. And this may be all that is needed to prevent regeneration. However, many observations teach that good reproduction exists among Aspen, and that just as good or usually better reproduction is found where there is not a trace of Aspen. Also conversely, very sparse or no reproduction occurs both where Aspen is present and where absent.

The density required for natural pruning in the Engelmann Spruce is very great. Trees three or four inches in diameter, 15 to 20 feet high, and 40 years old, must usually stand not over one foot apart in order to lose their branches up to three or four feet from the base. A typical Red Fir stand of the same size but younger, was noted, where the density was but one-half to one-third as great, and the trees had pruned four to five feet from the base. No stands of like thrift and density, but of younger age, being found in either species, the age at which pruning begins was not determinable. The density required for this pruning of course checks the growth of the individual very greatly. While in both species, under otherwise similar and best conditions, a stand of minimun density (1) makes a height growth of 100 per cent, a stand of maximum density (10) will show a height growth of approximately 50 per cent only. If in the former stand diameter also be represented by 100 per cent, the latter will show but 20 to 25 per cent.

No damage is done the reproduction by grazing at present. The cattle on the reserve confine themselves to the more abundant alpine grass of the "parks." Logging has done very little injury, since little young growth occurred on cut-over tracts.

Not enough humus is present to cause ground fires. Two fires, five and nine years ago, respectively, destroyed considerable areas of dense young Engelmann Spruce. These were neither surface nor crown fires, but what might be called brush fires.*

Of Red Fir, Limber Pine, and Engelmann Spruce, the reproduction of the latter only is subject to what seems to be a serious insect enemy, viz., the Spruce gall louse (*Chermes* spec.) It attacks and deadens great numbers of growing points. When the lateral branches are attacked, this may only serve to prune the tree, and thus be a help rather than hindrance. But frequently the leader is killed, robbing the tree of one to several years' growth.

Snow and ice do no appreciable damage. In the Red Fir only were observed occasional specimens evidently broken by these agents. One case was found where a freshet had deposited a bed of gravel one foot deep in a stand of young Engelmann Spruce, completely killing it.

J. C. BLUMER.

*Probably included in the new term "stand fire." (Bul. No. 61, Forest Service.)

GROWING LOCUST IN HUNGARY.

The good qualities of Locust wood (*Robinia pseudacacia*) have long been recognized, and, with the need to grow timber, comes a strong desire to plant it. But the borer says no, or rather, he promises to eat up the plantations as fast as they are made. Locust is, perhaps, our most valuable tree species when rapidity of growth, adaptability to soil and climate, and quality of wood, are considered collectively. One of the problems pressing for solution is that of ridding the species of the insect pest which, sooner or later, finds almost every tree in the eastern part of the United States, and destroys it.

But the object of the present paper is to describe the Locust plantations that have been made on the steppes of Hungary. All Europe has known the Locust for two hundred years; one constantly meets it in the streets, in the parks, and on railroad embankments, yet Hungary has gone farther than any other country in planting the tree on a large scale. With a knowledge of this fact, I visited the chief district in the spring of 1901. At the Forestry Bureau in Budapest no other introduction was needed than the personal statement that I was an American interested in forestry. Every facility to see the forests of the Kingdom was offered. The center of the planting district is Szabadka, or Maria-Theresiapol, lying in the Great Danube plain, about one hundred miles south of Budapest, and there I was advised to go. The land is low and nearly level, much of it is exceedingly fertile, but large areas are sandy and poor, the soil sometimes strongly alkaline, and often so light that it is set in motion by the wind. The annual rainfall averages 21 inches, most of it falling in summer, so that the greater part of the year is quite dry. The temperature is extremely variable and ranges from zero in winter to 95 degrees Fahr. in summer. Here are conditions that in many respects resemble those found in the eastern part of our plains region. Throughout the district there are numerous towns and villages but the population is chiefly agricultural and the peasant class is very poor.

The plantations have been established chiefly by the Government; primarily to make the poor soil yield something, secondly to employ the people, and thirdly to see if the Locust will not enrich some of the land so that eventually it can be used for farming. An experiment station, with nurseries and a school for forest rangers, is maintained, and efforts are made to find other tree species suitable for the locality. Here and there Willow, Austrian Pine, native Ash and Oak are made to grow, but as a rule, the land fit for other hardwoods is wanted for farming, and Pine is less productive than the Locust. Thus Locust is the preferred tree, and it meets every requirement so well that there is no strong inducement to plant others. Besides the Government plantations, there are many others, some quite large, on private land. The Agricultural Department does everything it can to encourage tree planting and distributes freely every year between five and six million Locust seedlings. In 1899, one hundred and fifty thousand acres of pure Locust forest had been established, and the plantings since must have brought the total to at least two hundred thousand acres. I have been unable to find any late official figures.

The cultural methods practiced in Hungary are little different from those employed here. The value of the tree's sprouting power is fully recognized and is always taken advantage of. In establishing plantations on new ground, root sprouts from recently cut-over stands are sometimes used, but, as a rule, nursery-grown seedlings are preferred. The trees produce fruit early and almost every year. The seeds are gathered in the pods and put in sacks. When the pods are dry the sacks are beaten to release the seeds. The seeds are usually treated with boiling water, dried in sand, and planted in beds in the spring. The seedlings commonly grow to a height of two to three feet during the summer and are set in place in the field in the fall of the same year. Fall planting is preferred because that season is moister than the spring and because labor is freer. In planting, the trees are set in triangular holes 18 inches wide on a side, and 24 inches deep. These holes are dug piece-work for $1 per thousand, though that figure and the whole cost of making the plantations–about $5 per acre–must be referred to the low wage that prevails. The rows are usually made from 5 to 6 feet apart and the trees spaced 3 to 5 feet in the rows. Sometimes the seedlings are set 10 to 12 feet apart and when well grown, say three years old, a plow with a sharp cutter is run midway between the rows of trees in both directions. This severs the roots that have filled the unoccupied ground and causes a thrifty crop of sprouts to spring up. Theoretically it is a pretty good plan, but in practice there is a loss of time which even the vigorous sprout growth can scarcely make up. Where land is valuable and stock and labor cheap such expedients really save nothing. A plan often followed on the better soil is to lease the patch to be planted to a peasant who cultivates the land and plants a crop of potatoes or turnips : when that is harvested he cultivates again and plants winter grain. After that crop is taken off, the land is again cultivated, and in the fall of the second year trees are set out. In the third spring the land is again worked, and another crop of tubers raised between the rows of trees. After that is harvested the forester takes over the plantation and cares for it. As a rule, the lessee pays no other rent than the labor he puts upon the land.

The first work of the forester is usually to cut back each seedling to the root collar in order to produce strong, vigorous shoots. This is done in the spring following the planting.

In most districts thinnings are begun when the plantation is five years old, and repeated at intervals of five years. Sometimes, naturally where the planting is closer, the thinning is done at intervals of three years. This is usually the practice in all sprout stands. Fortunately, material of very small size is salable. Fellings are commonly made in fall and early winter.

The treatment of second-growth sprout forest differs from that of seedlings only in the beginning. The mature trees are never felled in the ordinary way, but their roots are cut off below the surface of the ground and the tree toppled over. This plan makes the stump available at once, and keeps the ground clear, but, more important, it enables the sprouts that are to form the new crop to start from the roots instead of from the stump, and thus be strong and vigorous. In some cases the hole left by the old stump is partially filled up ; in others it is left to collect sand and litter, blown in by the wind. When the crown of sprouts is a year old, all but the stoutest two are commonly cut off, though sometimes all are left to grow for two years, and the cuttings used for vine stakes.

The plantations naturally vary in quality and rate of growth ; sometimes a poor development is ascribed to the soil, sometimes to the want of proper care. It is everywhere evident that even the Locust needs cultivation in so unfavorable a situation if trees, not bushes, are to be produced. The Hungarian forester has learned that in his work "what is worth doing, is worth doing well," and thorough cultivation is now the rule until the trees are established. When that is done they require only ordinary care. Stock is commonly allowed in plantations that are well grown, for the light crowns of the trees always permit a good growth of grass beneath them.

Most of these plantations are still too young to furnish conclusive figures of growth and yield, yet some are being cut every year, and data of value are accumulating. As a rule, the rotation for seedling stands is thirty years, and for sprout stands fifteen years. Either produces salable material that will average 1,900 cubic feet per acre, while the maximum may reach 6,300 cubic feet. Single stems often are 12 inches in diameter and fairly straight for 30 or even 40 feet. Older growths almost invariably show a falling off in the rate of accretion and hence are less profitable.

Oberförster Kallivoda kindly allowed me to look over his books and take from them the following figures:

STAND OF SEEDLING LOCUST ON SAMPLE PLOTS OF ONE ACRE.*

Plot	Soil quality	Age Years	Number of trees	Average diameter breasthigh Inches	Average height Feet
a	Good	30	558	5.3	63
b	Best	31	512	7.5	60
c	Fair	30	594	4.3	38
d	Poor	30	288	3.0	20

STAND OF SECOND-GROWTH LOCUST ON SAMPLE PLOTS OF ONE ACRE.*

Plot	Soil quality	Age Years	Number of trees	Average diameter breasthigh Inches	Average height Feet
e	Fair	8	452	3.3	30
f	Good	15	643	4.3	47
g	Fair	15	391	3.7	33
h	Poor	15	324	2.3	20

The chief value of these figures lies in the proof of quick maturity in the second-growth stands when compared with those produced from seeds. In explanation of the apparently slow growth of both sprouts and seedlings, it must be remembered that the best soil devoted to plantations is very poor from an ag-

*The Hungarian unit of area is the joch=1⅛ acres.

ricultural standpoint. Hungary can not yet afford to grow trees on arable land.

In connection with the yield of these sample plots the record of actual returns from 119 acres of 30-year-old seedling forest is of interest. Of the total crop of 147,801 cubic feet, 6 per cent was timber or posts, 38 per cent first quality firewood, and 56 per cent roots and branch wood.

There is no need to follow these figures out further to show the money yield and the profit on the investment, because everything depends upon local values. The Hungarian foresters calculate that their plantations yield a net return of 2½ per cent. on land worth $20 an acre, and they are well satisfied with that profit.

As further evidence of the rate of growth of Locust in pure stands the following figures may be quoted. They are taken from an article *Die Zucht der Akazie*, by Karl Bund, in Zeitschrift für Forst und Jagdwesen, April, 1899.

YIELD OF LOCUST SPROUT FOREST.

TABLE PREPARED BY THE PRINCE OF COBURG'S OFFICE OF FOREST ORGANIZATION.

Age Years	Diameter breasthigh Inches	Height Feet	Number per acre
	Locality Class I.		
5	2.6	34	796
10	4.2	49	579
15	5.6	59	447
20	6.7	67	366
25	7.7	74	314
30	8.5	79	288
35	9.1	83	268
40	9.7	86	261
45	10.1	89	255
50	10.4	90	253
	Locality Class III.		
5	2.1	26	1213
10	3.4	39	935
15	4.6	48	730
20	5.4	56	607
25	6.3	62	507
30	7.0	66	434
35	7.5	69	398
40	8.0	72	367
45	8.3	74	350
50	8.5	75	338

Locality Class V.

5	1.5	19	1620
10	2.5	29	1358
15	3.4	37	1162
20	4.2	43	993
25	4.9	48	861
30	5.4	52	771
35	5.9	55	700
40	6.2	56	655
45	6 4	58	623
50	6.5	59	610

Manifestly, these tables must be used with considerable care, since it is evident that the data upon which they were constructed are meager. Moreover, the exact value of any locality class is always doubtful.

Locust is limited in its uses only by its size. It is rarely large enough to be sawed, but in the round it is used for posts, poles, scaffolding, roof beams, wagon parts, and general farm work. Good logs sold in 1901 for 17 cents per cubic foot, and firewood for about $7 a cord. Vine stakes 7 feet long brought $11 per thousand. The woodsmen have no trouble with the thorns, either in felling or in thinning ; they soon learn how to avoid them.

Locust, apparently, has come to stay in Hungary, and the chief reason is that the enemies which offset its valuable qualities here, are unknown there. A scale louse, *Lecarium robinarium*, is sometimes observed on the twigs but it appears to do no harm. No dangerous fungus has been observed. The late growth of the shoots subjects them to damage by frost, as in this country, but frozen tips occasion no great loss unless the tree be planted in a situation much colder than that of the steppes. The brittleness of the twigs is not a serious matter, for in pure stands they are not much exposed. In short, the statement that "The Locust is the tree of the future" for Hungary, seems to be well justified. It ought to be quite as important here, for no other known species is so well adapted to regions where planted trees are most wanted.

ALFRED GASKILL.

AMERICAN AND GERMAN SAW MILL PRACTICE.

An anonymous writer in the German lumberman's journal *Der Holzmarkt*, who has spent some time in our Southern pineries, attempts to compare the mill practice in the two countries with regard to the difference of mill output from a given log supply. The question is of interest to millmen from the financial point of view and to foresters, in addition, from the economic point of view. The natural assumption is, and the above mentioned writer at least intimates, that the German pratice is less wasteful of material, but on closer examination this does not seem to be the case. Following the statements of the writer, it appears to be the common usage in Eastern Prussia, Russia, and Poland to send pine lumber in unedged (waney) boards to the market, while in America it is always sold as square-edged lumber. This makes comparisons of market conditions difficult. It is evident that the Prussian usage, while apparently utilizing the product more intensively, furnishes to the consumer a less convenient product for handling. The cubic contents of the unedged, tapering German board are in practice determined by taking the middle diameter and the depth, multiplied together by the length, in which calculation equal taper at both ends is assumed. The consumer who, like the furniture maker or box maker, can use short lengths may utilize a larger amount of material out of such a board than would have been available in the square edged board of the American practice. In modern American mills, to be sure, more and more of the slabs are cut into marketable short stuff, so that the utilization has grown from one-half of the actual log content to somewhere near two-thirds.

Nevertheless, the writer contends, the difference in utilization of log material can still be figured as 3 : 4 in favor of the German practice, for, as the reported trial sawing showed, the East Prussian mill secures in top logs 71%, in butt logs, 74 to 80%, in the average, 77% of the log contents. A part of this, to be sure, becomes waste in the hands of the user. This waste finds expression in the price paid, *i. e.*, the consumer discounts it, so that market prices of lumber in Germany and in America cannot be directly compared. A lumber merchant in Western Germany figures that best East Prussian waney pine lumber, which costs

44 cents per cubic foot ($36.65), is as expensive or more expensive than American Longleaf Pine, costing 60 cents per cubic foot ($50 per M), if the form quality is considered. If this corresponds to the average of conditions the unedged waney form depresses the price more than 25 per cent.

The American lumberman has other conditions to calculate with. The raw material is still relatively cheap, labor expensive, hence the problem is to produce with least amount of human labor, and hence the wholesale manufacture of stock sizes still prevails (although with increasing stumpage values the admission of odd sizes is now being ventilated). Not everywhere is a close utilization of the slabs for lath, etc., attempted, and the burner still consumes much material that could be utilized. In the Southern mills certainly the use per cent rarely goes above 60, and the Doyle rule would average hardly more than 50 per cent.

The German practice, dealing with higher stumpage values, and lower labor cost, is probably preferable for German conditions.

A series of trial sawings in usual practice at an East Prussian mill developed the following relations, the figures being derived as averages from ten logs for each position. The diameter measurements of logs refer to diameters in the middle of the log without bark, which reduces them by ten per cent from the measurement with bark. The market demands an allowance of $\frac{1}{16}$ inch for shrinkage, *i. e.*, all boards must be $\frac{1}{16}$ inch plump, and besides for unedged boards an excess measure of $\frac{1}{8}$ inch is demanded by the consumer, so that in the price-making the dimensions are reduced by so much. The logs, with the exception of the No. VI., 14-inch series, were butt logs, the log length, 20 to 25 feet. In the translation of measures, slight inaccuracies are unavoidable.

Series	Number of logs	Average diameter	Volume	Output of Various-Sized Boards. $\frac{11}{16}''$	$\frac{3}{4}''$	$\frac{7}{8}''$	$1''$	$1\frac{3}{16}''$	$1\frac{3}{8}''$	$1\frac{11}{16}''$	$2''$	Top diameters of last four classes	Total	Use per cent
		Inches	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Inches*	*Cubic feet*	
I	10	18	437	7.5	----	21.0	42 0	----	----	----	280.0	17 +	350.5	80.0
II	10	17	353	7.5	----	----	21.3	----	----	243.6	----	15 —17	272.4	76.7
III	10	14+	278	6.8	17.5	----	----	----	183 0	----	----	12.5—15	207.3	77.4
IV	10	12—	198	5.8	10.6	----	----	135 8	----	----	----	10 —12.5	152.2	76 7
V	10	10+	139	4.2	12.0	----	----	94 8	----	----	----	8 2—10	111 0	73.7
VI	10	14—	238	--	172.0	----	----	----	----	----	----	--------	172.0	70.7
Total	--	--	1643	31 8	212.1	21.0	63.3	230.6	183.0	243.6	280.0	--------	1265 4	77.0

It is difficult to make a comparison of the output which could be secured by American practice from the same material. It can be done accurately only by sawing a similar series of logs, or else roughly by making certain assumptions. We may assume that all the logs were 24 foot logs, which was very nearly the case in the average (23.7 feet), and that in American practice these would be cut into 12-foot lengths; we may then assume a taper of 2 inches in 12 feet, hence that all the top logs would average 2 inches less at the top. Then scaling by the International scale, described in this issue, which appears to come more closely to actual mill practice than any of the log scales in use, we would come to the following relations:

10----18 in. logs----scaling	----------------	1850
10----17 " " ---- "	----------------	1650
10----16 " " ---- "	----------------	1450
10----15 " " ---- "	----------------	1250
20----14 " " ---- "	----------------	2200
30----12 " " ---- "	----------------	2250
20----10 " " ---- "	----------------	1000
10---- 8 " " ---- "	----------------	300
	board feet	11950

This may be set equal to 1000 cubic feet, which would bring the output to a little less than 61 per cent of the log contents. The lath and other small dimension cut from the slabs would somewhat improve this figure. If now we assume that the waste—which in German practice is transferred from the mill to the consumer, and which as we have seen is discounted in the price, by a casual calculation at 25 per cent—reduces the German output by that much in material, namely to 58 per cent, we must come to the conclusion that the best American mill practice, where stock sizes are made and the slabs are worked up, is probably not inferior and very likely superior not only in efficiency of production and saving of freight but in utilization of material,

A loss, however, unquestionably occurs in the woods, due to cutting to standard lengths. But, even here, a change to odd sizes may not in the end secure as much saving as we might theoretically figure out; at least a part of the saved lengths will appear again as waste in the consumer's hands, our whole system of wood use being based on standard sizes, which do not readily allow changes.

B. E. Fernow.

CURRENT LITERATURE.

HENRY S. GRAVES, *in Charge.*

Trees. A Handbook of Forest-botany for the Woodlands and the Laboratory. H. Marshall Ward. Cambridge University Press, 1904-5.

This is the first text-book of forest botany published in the English language. As is natural, since the work is by the author of such helpful popular books as The Oak, Timber and some of its Diseases, Disease in Plants, etc., we find the subject matter presented in a clear, logical manner, comprising all the principal facts on the morphology of woody plants. The work appears in a series of volumes, three of which have already been published. These are: Vol. I. Buds and Twigs, 271 pp., 1904; Vol. II. Leaves, 348 pp., 1904; Vol. III. Flowers and Inflorescences, 402 pp., 1905. Succeeding volumes will treat of Fruits and Seeds, Seedlings, and the Habit and Conformation of the Tree.

Each volume is divided into a general and a special part. In Vol. I, after the first or general part has dealt with a general description of the shoot system, the bud, the tegumentary system, leaf scars, twigs, lenticels, etc., in which every detail of external character and internal structure is discussed, a second special part is devoted to a classification with a key to woody plants, most of which are European, based on bud and twig characters.

In a similar manner Vols. II and III are arranged, the first part treating the subject in a general way; the second part being devoted to a classification of the woody plants according to their leaf characters in Vol. II and their flowers and inflorescence systems in Vol. III.

One admirable feature of the series is the purpose shown throughout of laying stress on the *permanent* characters of woody plants; that is, those features by which they may be recognized the year around, making of secondary or at least of only coördinate importance those more or less fleeting characters of flower and fruit to which so much attention is paid in our manuals of botany.

The object of the author, as he states in his preface is "to encourage an acquaintance at first hand with the plant in its own home: not merely a knowledge of the characters of the flowers, fruits, etc., which have been chosen by systematists as useful in accepted schemes of classification, but also of those features of buds, twigs, leaves, seeds, seedlings, etc., which are necessarily absent from the typical Flora, although they are employed in special Floras and hand-books used by experts."

In these days when it is expected that a well-trained forester can recognize every twig in the forest, such a work is invaluable to students of forest botany both in England and America. However, since only a few of the species in the special part are American, this half of the work is better adapted to English students, although valuable to us in containing many of our cultivated species.

Aside from this practical value, however, a far more important result of such a publication is the stimulus which it will inevitably produce to a purely scientific study of the permanent characters of our own woody plants, a field which with us has suffered considerable neglect. A. H. G.

Fremdländische Wald und Parkbäume für Europa. Von Heinrich Mayr. P. Parey, Berlin, 1906, 623 pp. 612 fig. Price 26.4 k.

For more than a quarter of a century Prof. Mayr has been a close student of the trees of the northern hemisphere. In 1885 he travelled extensively through the forests of the United States and later published the results of his observations in a volume well known to American foresters, viz., Die Waldungen von Nordamerika. From North America Professor Mayr went to Japan, China, Java and India. Since these earlier explorations he has traveled extensively through nearly all of the other important forest regions of the northern hemisphere. Professor Mayr's extensive travels, together with his association for 25 years with the eminent forest botanist, Dr. Robert Hartig, has peculiarly well fitted him to write with authority on exotic trees suitable for forest and park use in Europe.

About one-fourth of the volume is taken up with a description of the exotic forest and park trees cultivated in Europe as they appear in their natural habitat. Prof. Mayr points out that these trees naturally occur widely distributed over the northern hemisphere. This section of the book is, therefore, very largely descriptive of the important forest regions of North America, Europe, and Asia. The forest regions of North America from which Europe obtains exotic species are divided into the Atlantic, the Prairie, the Pacific, and the north Mexican. Under the prairie region are not only included the forests of the Dakotas and the other prairie States east of the Rocky Mountains, but also the widely different Forests of southern Arizona and New Mexico; the latter, however, really belong to the North Mexican region. The description of North American forests is necessarily brief, and American foresters will find but little new and considerable to criticise in its presentation.

The forests of the old world are described under the Atlantic or European forests and the Pacific or Asiatic forests. The Atlantic forests are but briefly noted, but the Pacific forests from which Europe draws a large number of exotic species are described at some length, particular attention being given to the forests of Japan, China, Korea, Siberia, Asia Minor, and the Himalayas. This account of the Asiatic forests will be of particular interest to American foresters because a large number of the exotic species grown for forest and park purposes in the United States are from these forests.

Following the descriptions of the forest regions Dr. Mayr presents an extremely useful and interesting discussion of the climatic and species parallels of the forests of North America, Europe, and Asia. The important factors taken into consideration in the determination of forest zones are the relative humidity of the atmosphere, the precipitation and the temperature, particularly of the season of principal growth, viz., from May to August inclusive. The elevation above the sea is also considered and the lowest temperature of winter. The classification of forest zones is as follows:

A. Tropical forest zone, the Palmetum.

B. Subtropical forest zone of evergreen oaks and laurels, the Lauretum.

C. Warmer half of the warm temperate zone of broadleaved species, the Castaneum.

D. Colder half of the warm temperate zone of broadleaved species, the Fagetum.

E. Cold temperate zone of pine, fir, and larch, the Pinetum, Abietum, or Laricetum.

F. Cold zone of crooked and stunted trees at tree limit, the Alpinetum or Polaretum.

The tropical forest zone is not described, as this zone does not reach as far north as Europe. The other five, however, are repeated in Europe as well as in North America and Asia. Each of these zones as they occur in America, Europe, and Asia are subdivided into two or three divisions, and lists of the trees characteristic of each division are presented. These lists should be of considerable aid to foresters in selecting exotics to introduce into various parts of the United States as well as Europe.

Dr. Mayr in the third section of the volume discusses the inherent capacity of various exotic species to become naturalized and acclimated when shifted from their natural environment. This is followed by a most interesting discussion of the inherent merit of various exotic trees for decorative use and for forestry. He points out that the greatest number of exotic species are chiefly useful for decorative planting, but even here Dr. von Salisch, the father of aesthetic forestry, states only indigenous species can be aesthetically fine.

The great difficulty that the forester finds in the study of different species from uncertainty in nomenclature is clearly pointed out. Numerous illustrations are given showing the great confusion in the names of many of our own forest trees. The Kew nomenclature is followed throughout.

An interesting part of the volume to American foresters is the discussion of the results attained to the present time in the growth of a large number of exotic trees in various parts of Germany, many of which are among the important timber trees of this country. Some of these species have been grown in Europe for a century or more and their relative value as compared with the indigenous species is fairly well known. As to the growth and vigor of the American trees, that have been grown for some time in Germany in forest stands, White Pine, Douglas Fir, Jack Pine, Sitka Spruce, Lawson Cypress, Red Oak, Pin Oak, and White Ash are placed in the first rank. Among those that have been the least successful are the Big Tree, Black Walnut, and Black Locust.

About one-third of the volume is devoted to a more or less detailed description of the exotic species capable of being grown in Europe for both forest and park purposes. No attention, however, is given to varieties and garden forms. Special attention is given to the recognition of species in their juvenile form and diagnostic characters are largely derived from the leaves, buds, and bark. For the most part each species is illustrated by small, poorly executed figures representing but mere scraps of small twigs.

The crown habit of a few species is illustrated by drawings or photographic reproductions. The descriptions include many personal notes on the silvicultural characteristics and associates of the trees described, and occasional notes on the relative importance for forest or park purposes. The structure and physical characteristics of the wood of a number of species are briefly described and a series of plates in color are intended to assist in the identification of the species. It is impossible from these plates, however, to get more than the vaguest notion of the structure or physical properties of the wood.

A number of new species are described. It appears to the writer, however, that it would have been far better for these descriptions to appear in a technical paper, rather than in a general work of this character.

A section of the volume is devoted to a number of general rules necessary to observe in the growing of exotic species. These are largely based upon biological principles and apply as well to the growing of exotic species in this country as in Europe. Special lists of trees are given suitable for different forestry purposes, on various soils, in each climatic zone. These lists are very complete and should be of interest to American foresters. Special lists are also given for park and other decorative planting, for the flowers, foliage, color effects, etc. General instructions are given regarding the protection and training of exotic species. A brief account is given of the propogation of plants for decorative purposes by budding, grafting, cuttings, etc.

The volume contains a large amount of exceedingly interesting information regarding the more important trees of the northern hemisphere and in many respects it is as useful to Americans interested in trees for forestry and park purposes as it is to Europeans. J. W. T.

Forest Policy in the British Empire. Volume I, Schlich's Manual of Forestry. 3rd. edition. Bradbury, Agnew & Co., London, 1906. 246 pp. Price 6 shillings.

When the second edition of this volume was published in 1896, the author stated that alterations in the original plan were likely to be introduced. Accordingly the third edition of Volumes I and II have been re-arranged. The second half of Volume I, "The Foundations of Silviculture," has been transferred to Volume II in the third edition which appeared in 1904—and in its place, a revise and enlargement of the part dealing with forestry in Britain and in India—so that it has become an abstract of "Forestry in the British Empire." This re-arrangement, therefore, in place of containing any silviculture, gives much more needed space to discussion of the advancement of forestry in the British possessions.

Parts I and II are identically the same as in the second edition. The remainder of the volume is now given to Part III, so the reader is enabled to understand clearly and concisely the forest conditions, policy, and organization of the entire British Empire under the headings of Asia, Australia, Africa, America, and the United Kingdom. Each heading is sub-divided into districts so that a full discussion of the forest conditions of each British possession is arranged systematically.

Forestry in the United Kingdom includes a discussion of the importance, the measures which should be adopted, and studies of certain types of woodland in England and Ireland. Much stress is laid upon the necessity for an improved forest policy in Canada and Australia. There is a valuable appendix showing the progress in forestry in the United States and the organization of our Forest Service, this being apparently an inducement to Canadians to profit by the advance made in the last few years by their neighbors across the border. Numerous photographs illustrating the characteristics and conditions of forests in different parts of the world have been introduced; also charts showing the average annual rainfall and the direction of prevailing winds in different sections of India.

In general the volume is a marked improvement over the second edition in the increased scope of its work and in permitting the whole subject of silviculture to be concentrated in the revised edition of Volume II.

J. H. F.

Economie Forestière. Par G. Hüffel. Vol. II. Lucien Laveur, Paris, 1905. 484 pp., 126 fig. Price 10 fr.

An account of the first volume of this work was given in Number 4, Vol. III of the FORESTRY QUARTERLY. The second volume, now before us, deals with Forest Mensuration, Factors of Forest Production, and Forest Valuation. Mensuration forms a part almost complete in itself, and is undoubtedly the most original and interesting one of the whole work. The author pays due attention to the theoretical and scientific sides of the subject, but his sympathies are unquestionably on the side of the simplest and most practical methods. One finds, therefore, together with a very full account of nearly all the most interesting methods of cubing, also a description of many "short cuts" to rapid determination of the volume of felled and standing trees, so useful to the practitioner, who will not fail to appreciate such a feature.

The methods in vogue in France for determining the volume of stands by means of special graphically constructed volume tables are, for the first time, fully and clearly described.

Under the Factors of Forest Production is, as usual, discussed the importance of nature, labor, and capital in the production of wood crops, the author fully sharing the accepted views on this subject.

Forest Valuation, in spite of the intricate character of the subject, is treated in a wonderfully clear manner, and from a somewhat new standpoint.

In general, the second volume, although it contains much drier subjects, produces a better impression than the first.

R. Z.

Traité d'Exploitation Commerciale des Bois. Alphonse Mathey. Tome premier. Lucien Laveur, Paris, 1906. 488 pp. Price 1.35 fr.

The French forestry literature of later days is growing not only in size but in quality. Huffel's great work of encyclopædic character promises to cover the whole field in adequate manner, while the stately volume before us treats entirely of what we would call forest utilization and is to be followed by another which will discuss commercial uses, valuation, and usages in the wood trade.

The chapter on the constitution of wood (97 pp.) discusses, with illustrations, the structure not only of the indigenous but a large number of exotic species, including many of our own. The curious statement is made that the sap of the yellow pines always blues when used. Sixty pages are devoted to a discussion of properties of wood. Over 100 pages treat of diseases and are especially well illustrated with colored plates. Preservative processes are discussed on 48 pages, and several processes not in general use are described. The balance of 225 pages discusses logging methods, fully illustrated, in nine chapters, the bulk being of course devoted to methods of transportation. While many of the devices here described, would hardly appeal to the American lumberman, and naturally American practice is not represented, there are yet valuable lessons to be learned in the construction of slides and flumes, cableways and moveable track, etc., which are not to be found with as much detail, especially as to relative cost and efficiency, in other literature.

B. E. F.

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FOREST BOTANY AND ZOOLOGY.

Light Relations

Dr. Cieslar, who published an extensive study on the influence of different degrees of light on soil conditions and on volume production, based on entirely novel and scientific methods, (briefed in vol. III, p. 167) rehearses the contents of his monograph and enlarges further on the rôle which light plays in the forest, and develops in most interesting manner a wealth of new knowledge.

Calling attention to the difference in composition of the soil cover in an open field and in the forest and to the gradual change and transformation which takes place as a young plantation grows up and closes its crowns, and as well in opposite sense when in old age the crowns thin out and the crown cover is broken, he concludes that first and last this phenomenon is a result of changes in light conditions directly or indirectly.

What are the changes in the soil when the crown cover of a dense forest is opened up and larger amounts of light are admitted to the soil? Not only the soil cover but the substance of the soil itself is changed. The first effect of a thinning is to accelerate the humification of the foliage and litter on the ground, for larger amounts of air, *i. e.*, oxygen, are admitted. At the same time the temperature of the air and soil is raised, as proved by Hoppe, favoring this humification. This investigator also showed that the humidity of the soil in the more open stand is in the average greater than under the denser cover, which also favors humification. Finally, however, an absorption of the humus takes place and the humus contents of the soil decrease, for while in the fully stocked areas the humus contents were found by Hoppe to be 2.09 to 2.14 per cent., in the thinned areas these figures were reduced to 1.70 to 1.74 per cent. in a few years. These changes in humus contents naturally produce changes in physical conditions, so that in the end, not only light conditions but soil conditions have changed and influence the soil cover.

To study the influence of soil treatment, grass, and weed growth on young plantations, a series of experiments was instituted, which showed that while the loss of plants on soil under a leaf cover during the first two years was from 2 to 18 per cent., the loss on soil on which grass had been sown among the plants was four times as great, namely from 8 to 74 per cent., and on all but one bed over 30 per cent., showing what great importance the character of the soil cover has and accentuating the necessity of reducing the competition of weed growth to the utmost by proper management of light and treatment of soil.

A long series of observations on a number of areas thinned to varying degrees and systematically observed for five to twenty years, described in detail, gave the basis for studying the influence of light changes on soil flora and accretion. To determine the degree of light which different densities of crown cover admit, the Bunsen-Roscoe-Wiesner method of measuring by means of photographic paper was employed (see Vol. III, p. 167). It consists of exposing sensitive paper for a given time (gauged by a chronometer which allows reading to 0.2 second and estimating to 0.1 second) and comparing with a standard color which was secured by exposing at the same time under the open sky, so that relative intensities were ascertained. By choosing cloudless days and making a long series of measurements within one and the same hour, beginning in the open and returning to it at the end of the series, the needful checks and points for interpolation were procured. The results (averages of 6 to 10 observations) are expressed in fractions, the light intensity in the open being taken as 1. For instance the relative intensities on a beech area of which parts were thinned to varying degrees, namely to 0.8, 0.65, 0.5 of the cross-section area, and one still more severe, were found respectively to be 0.26, 0.38, 0.43, 0.48 of the intensity in the open. The results have shown that the method is sufficiently correct for practical use, as is readily seen when the results are plotted. Some of these have been briefed in Vol. III, p. 167. They show that even severely thinned stands absorb remarkably large quantities of light (60 to 80%), and they accentuate the difference in the light-absorbing power of shade-enduring and light-needing species, the former allowing perhaps 10 to 20 per cent. of active light to reach the soil, when under similar conditions the latter may allow twice that amount to pass through. Of interest is the observation that parallelism between cross-section area or stem number and light intensity exists only to a certain degree. "The numerous, but in crown and shaft form less developed beech stems of the lightly thinned area do not absorb in their crowns proportionately the same amouut of chemically active light as the fewer, but in crown and shaft better developed, stems of the moderately and severely-thinned stand."

The "shade coefficients" ($\frac{i}{n}$100; when i = light absorbed, n = number of trees), which express relatively the amount of light absorbed by a single tree in the average, showed the following relations.

		Light Thinning	*Moderate Thinning*	*Severe Thinning*
Light Intensity	Leafless	.28	.36	.44
	Full leaf	.032	.038	.059
Shade coefficient	Leafless	3.2	5.3	6.4
	Full leaf	4.4	7.9	10.7
Difference in coefficients		1.2	2.6	4.3

In other words, each crown in the more open position absorbed double (or more) the amount of light taken by those in the denser position: the crowns in the lightly-thinned stand are less fully foliaged, more open.

The differences between the shade-coefficients in leafless and leafy condition, namely 1.2, 2.6, 4.3, furnish a tolerably good measure of the amount of foliage (assimilation apparatus) in the three areas. They express that the stems in the moderately-thinned area work with an assimilation apparatus of double the size, those in the severely-thinned, of nearly four times the size, of the lightly thinned area.

The shade coefficient can also be used to express the relative rate of crown expansion. For instance, the relation of the light intensities of four differently thinned areas varied as follows:

1899	1	1.5	2.2	3.3
1903 (5 years after thinning)	1	1.6	2.4	3.8
Difference	0	.01	.02	.05

i.e., crown expansion and crown density had progressed at a relatively greater rate, the more open the position.

While, as would be expected, in the leafless condition the difference of absorption of light from the lightest to the severest thinning is relatively small (1 : 1.3 : 1.9 : 2.7), in the leafy state the difference becomes greater (1 : 1.6 : 2.4 : 3.8). From the difference of the shade coefficients in the leafless and leafy condition the relation of the size of assimilation apparatus of the average tree appears. This relation appears on the beech areas under comparison as 1 : 2.6 : 4.7 : 7.7.

It is now indicated to compare this relation to the actual performance in the increment, when it appears that the latter is not proportional, the relation here being 1 : 1.9 : 3 : 4.7 ; in other words, the large and dense crowns of the open stand do not assimilate with intensity equal to that of the trees in less open position, for while the size of crown in the open is 7.7 that of the close stand, the performance is only 4.7 in increment. Here, then, is a numerical demonstration of the fact, which R. Hartig had recognized before. He demonstrated that the crowns of broad-crowned trees in the open could be trimmed of their lower branches to a certain degree without influence on the volume increment. Apparently there are in large crowns more numerous but less intensively working "shade" leaves, than in the smaller, more open crowns.

According to Hartig, open stand produces usually more leaves than are necessary to assimilate the nutrients from the root ; a moderate pruning promotes assimilation of the remaining crown, but it also reduces the transpiration and hence produces heavier wood.

In further support of these relations the work of the Swedish investigator, Dr. Hesselman, (Zur Kenntniss des Pflanzenlebens schwedischer Laubwiesen, 1904) is cited, who investigated the relations between assimilation and the loss of shoots in various tree species. He found that some of the notoriously intolerant species—ash, birch, mountain ash—excel by a uniform distribution of assimilation throughout the whole crown, while densely-foliaged species, like maple, alder, hazel, show a great difference of starchy contents in the interior and exterior leaves, the latter assimilating more. The light-needing species show in their leaves a nearly uniform anatomical structure, while the shade-enduring show two greatly differentiated types of "shade" and "light" leaves, which latter assimilate much more.

In consequence the volume increment of the single tree in severely-thinned beech stands compared with that in dense stand does not increase in proportion to the size of crown. Respiration and transpiration stand in similar relation. Physiologically the disproportion of increment and intensity of assimilation is in beech the greater, the more severe the opening. This does not, however, mean that severe thinnings may not produce larger total increment than lighter ones. At the same time the investigations furnish proof of the uselessness of removing the subdominant growth which does not interfere, and accentuate the desirability of thinning in the dominant.

Relations are somewhat different with the light-needing Austrian Pine.

To illustrate the method of statement, we reproduce one of the tables.

AUSTRIAN PINE THINNING AREA NO 2. AGE 57 YEARS.

	Light Thinning	*Medium Thinning*	*Severe Thinning*
Number of trees in 1902	8296	6071	3476
Volume per tree, in 1902, m^3	.028	.038	.058
Light intensity May 3, 1902	.17	.23	.31
Light absorbed; per cent. of light in open	83	77	69
Shade coefficient, $\frac{i}{n}$ 100	1.	1.3	2.

Compared with beech the smaller numerical difference of crown density is striking; the shade coefficients for beech of nearly the same age (63) having been found as 4.4, 7.9, 10.7, as against 1, 1.3, 2.

In another pine stand the increments of differently thinned areas were as 1 : 1.4 : 1.7 : 2.2, while the shade coefficients were as 1 : 1.3 : 1.6 : 2.1, showing a striking parallelism, entirely different from the beech, and accentuating what has been said about the difference of light-needing and shade-enduring species. It is stated by the author, however, that, on account of their concrete conditions the pine areas are not fully comparable to the beech areas. Having been allowed to grow up in abnormally dense position for 37 and 57 years before the thinnings, the crowns had not yet been able to attain the optimum of their development, beyond which first a reduction of assimilation may take place. In this connection Hartig is cited as having found that *White Pine grown in dense stand for 20 to 25* *years resents by a loss of increment in the lower shaft all pruning which takes more than one or two of the lower poorly-foliaged whorls.*

The same experience was had with the Austrian Pine, and the proportionality of increment and crown density may be merely due to the relatively poor development of the latter.

The relations between light intensity and lower vegetation and its influence on soil and regeneration can be discussed only with reference to concrete conditions and botanical survey, which determines the different species and their relative number under different light conditions and soils.

A number of tables enumerating the plants are given, in which the dominant species are noted by heavy type. The general law is readily visible that with the same tree species and soil, the number of species in the soil flora, as well as of individuals grows with the greater degree of light. In one series of beech areas the species numbers were 9, 15, 29, 41 ; in another series 17, 25, 79. In pine areas the numbers were 10, 15, 14, 16, the difference being much less than in beech.

In the beech stands no dense cover, only single individuals develop in the thinned areas until the thinning goes to 65 per cent. of the cross-section area, when, in a few years a dense soil cover of herbs and shrubs results, and when thinned to 50 per cent. a luxurious dense mat of vegetation covers the ground. In these concrete conditions, therefore, from the standpoint of soil preservation the removal of one-third of the full stand or more, or when more than 40 per cent. of the light was admitted, becomes critical. The increment per cent. appeared highest where the thinning had taken but one-fifth of the cross-section area, which may, however, have been only an accident.

It should be possible to secure, at least for the principal types and sites, such data regarding light intensity as may be utilized in practical silviculture.

The progress of gradual *change in the soil vegetation* with increasing light intensity may be traced as proceeding in the same sense in which the species vary from the less-severely to the severely-thinned areas. The first members of the plant society under the dense shade will be the true humus plants, *Neottia* and *Monotropa ;* then, as in opening up the minimum of light requirement for each species is reached, it appears, and vanishes when this minimum is again lost, for just as in the arborescent vegetation so in the lower, a series from the tolerant to the intolerant plants can be constructed, with some exceptions which seem independent of degrees of light. The most shade enduring were *Carex silvatica*, *Luzula albida*, *Anemone nemorosa*, *Dentaria bulbifera*, *Oxalis acetosella*, *Viola silvestris*, *Asperula odorata*, with which in lesser number were associated *Cyclamen europaeum*, *Symphytum tuberosum*, *Galeopsis speciosa*, *Stachys silvatica*, *Veronica montana*, *Lactuca muralis*. Especially *Dentaria bulbifera* and *Asperula odorata* were found significant gaugers of light intensity, vanishing or at least decreasing in number and development when a certain degree of light intensity was exceeded.

At the opposite end of the series, some 33 species could be enumerated, with true grasses Gramineae, Cyperaceae, Juncaceae in preponderance, especially *Poa* and *Festuca*, also *Carex* and *Luzula* in dense sod-forming growth, strong competitors with arborescent regeneration. Furthermore, *Hieracium*, *Picris*, *Leontodon*, several thistles, *Eupatorium*, and *Rumex* are characteristic of the open beech forest.

Some elements of the soil flora avoid the most open situations, less on account of too great light intensity than on account of changed soil conditions, especially deficiency of humus. The beech regeneration, even in severely thinned areas remained insignificant in number and poor, retrograding in time. The closing-up of crowns produced in the herb vegetation not so much a reduction in numbers as in species, the composition becoming simpler, with *Carex silvatica* most persistent. The greatest change in six years was most noticeable in the most open area, both in number of species and individuals, the light intensity having changed here most.

Carex silvatica and *Fagus* apparently having similar light requirements, the difficulty of regeneration in the presence of the former is pointed out; the *Carex* vegetation becoming all-powerful and interfering greatly.

Under the Austrian Pine, a light-needing species, the difference of the vegetation in the different areas was found much less developed, the number of species from the denser to more open position showing the series 10, 15, 14, 16. And here the opposite from the beech forest occurs, the number of species which are found only in the most open areas is the smallest. In other words in stands of intolerant species even a small opening-up of crowns will call forth a soil vegetation which through further openings experiences only a small addition of species and individuals, while in tolerant species with increasing opening both number of species and of individuals are considerably increased.

With increased opening and hence denser soil vegetation competition among the species begins, and finally, certain species remaining victors (those which are able to form a felty mat) the composition changes at least in numerical direction. These weeds are to the silvculturist the most objectionable, as they prevent regeneration ; and to cope with them is his greatest problem, in the solution of which underplanting may play a part.

Finally the author discusses the question *whence comes this soil flora so quickly after the crown cover has been opened ?* The theory of its origin from seeds lying dormant in the ground has been long held, and A. Peters, some 13 years ago, attempted to prove this experimentally. The experiments consisted in exposing old forest soil and farm soil that had been reforested to conditions favorable to the germination of whatever seeds might be found in them. The former produced almost only forest weeds, the latter mainly farm weeds, and Peters concluded that the seeds had remained germinative for 22 and 46 years. This Cieslar doubts, believing that the facts do not warrant or require this explanation. Analyzing the case of the 22-year-old plantation, assuming 3-year old plant material the spruces had been in place 18 years, but they had probably not closed up until 12 to 15 years after planting, so that only 3 to 6 years of retention of germinative power would have been required. Moreover, a large number of the plants developed were perennials which are known to be able to preserve rhizomes and roots alive. Moreover it is known that many annuals and biennials growing under conditions which render flowering and fructification difficult or impossible become perennial, and this occurs often in shady woods.

The second series of Peters came from a 46-year-old larch stand. While pure larch stands close up in the second decade so dense that the green soil cover vanishes, this dense crown cover does not last long, and by the fourth decade such stands thin out naturally so that phanerogamic life probably never ceases in them.

A third series of Peters came from a 100-year-old beech stand. The 11 species produced prove with one exception to be not only perennials, propagating by rhizomes and sprouting, but their flowering occurs during the leafless period of the beech, hence they complete their cycle before the shade influence sets in ; moreover, they are the species which find favorable conditions in the dense beech forest. All these species are capable of living through the entire rotation without ever running the risk of being entirely killed out. Only in the most open stands may they recede or succumb entirely in competition with the other more light-enduring flora. But where the *light-needing* species in the open stands come from requires explanation, for these are decidedly immigrants. This is furnished if we consider that even in dense forests there are always openings, smaller or larger, where these species find satisfactory conditions or can at least subsist and they get there by the usual means of distribution, wind and animals, and spread from these points when further openings are made.

Birds are responsible for the propagation of raspberries, blackberries, cherries, elderberry, strawberry, and other animals carry *Atropa*, *Convallaria*, *Solanum*, while *Sanicula*, *Circaea*, *Asperula* wander in the pelts of animals. Peculiar hurling devices, which permit seed to be thrown several yards, assist the progress of *Oxalis*, *Impatiens*, *Mercurialis*, *Viola*, *Euphorbia*, *Geranium*. Wind carries fern spores by the million for miles; one pond may produce 15 million spores. Moss spores and grass seed are carried similarly, the latter being not only exceedingly light but provided with wings in *Poa*, *Dactylis*, *Holcus*. And so are carried *Urtica*, *Serophularia*, *Veronica*, *Monotropa*, *Hypericum*, *Viola*, *Epilobium* and a host of composites. On sunny days the winged seeds of these plants are lifted by the warm upward air current many yards and a very slight breeze will carry them miles over field, meadow, and forest. And these wind-carried species are the very ones which find favorable conditions in open situation. There is, therefore, sufficient explanation of their occurrence and rapid spread to be found without assuming a long duration of germinative power in the seed. Moreover, as an experiment demonstrated, conditions for rapid germination are found in the open situations, where the thick, loose layer of leaves of the dense forest filled with the mycelia of fungi has been transformed into a compact seedbed, which gives chance for immediate germination.

It was also found that the soil flora in the forest is made up largely by perennial species, from 80 to 96% being of this description, and in the number of individuals the annuals and perennials are even to a greater extent outstripped by the perennials. This fact insures to a high degree the permanency of the existing soil flora, especially as in the forest shade even annuals and biennials become perennial.

The results of these highly interesting expositions are summarized in 13 theses, which appear clearly in the text as briefed above.

Einiges über die Rolle des Lichtes im Walde. Centralblatt für das gesammte Forstwesen. February and March, 1906, pp. 49-73 and 97-122.

Heredity in Seeds.

The question whether the seed of poor trees produces a poor progeny can be answered only through experience. Guse records two stands of pine, one 47 year old, another 70 to 75 year old, which originated from seed collected from unthrifty, bushy and crippled seed trees, "Bauernkusseln." Neither of them showed any signs of crippling, the trees being slender and straight.

Auf alten Bahnen. Allgemeine Forst- und Jagdzeitung. Oct., 1905, p. 349

Heredity in Seeds.

The question of the influence which seed derived from different localities and conditions exerts upon the progeny, is being studied at the Swiss experiment station. Prof. Engler publishes first results on spruce, fir, larch, maple, with seeds from different altitudes, from trees of different age, from straight and crooked or otherwise poorly formed trees and from different diameter classes.

Regarding the seeds themselves, the following results are stated (compare on same subject the findings of the Swedish station recorded on p. 51 of this volume.) Spruce cones from low and medium elevations are larger and heavier than from high altitudes. No decrease, however, was noted between 500 and 1,400 m. Up to that altitude, no influence upon weight and germination of seed could be demonstrated. Seed from higher altitudes lost germinative power more rapidly than those from lower elevations. It is then only seed from the higher altitudes that is deficient in quality. These also furnished smaller and lighter plants. The conclusion is reached that the characteristic rapid growth of the spruce from the low altitudes and the slow growth of those in higher altitudes, is inherited by the progeny. But whether this characteristic continues or is outgrown, remains still to be seen. The plants from the low lands show stouter stems, the alpine ones stouter root system and considerably fewer of the latter succumb in the plantations in higher elevations.

In the low lands all spruces grew better than higher up, but with elevation, the low land spruce declines more rapidly than the alpine stock. No influence of size and weight of the seed could be noted on these growth relations; only the climate of the seed trees counts.

"The duration of the growth period and the heat requirement for vegetative activity is transmitted to the progeny."

Morphological differences are also transmitted. In the alpine stock the type of "light" leaves, in the lowland stock of "shade" leaves is more prominently developed. In the former, bast and bark of the year's shoots are more strongly developed in comparison to the woody fiber. They are more resistent to early frost, drouth and to loss of chlorophyll by strong insolation. They suffer, however, as much from late frost as the lowland stock. Alpine seed, then may grow in lowland nurseries into useful stock for alpine planting, but lowland stock may not advantageously be used in such situations.

That damage and poor growth, due to suppression, is not transmitted, has again been proved. But an experiment with seed from a bushlike variety produced plants both normal and roundheaded as well as transition forms.

Regarding the fir, the author fails to find physiological races, and adaptations are not transmitted, hence the species is adaptive to climate.

With larch, two climatic races, as in spruce, were noted, but the differentiation as regards power of germination and growth rate was found to begin at a higher elevation, 1,700 m. Shorter period of vegetation and slower growth characterize the alpine stock. Growth forms influenced by soil may be hereditary. For the maple, similar race differences were found.

The practical conclusions are, to use seed from localities similar in climate to those where the stock is to be used, and as far as hereditary selection is concerned, natural regeneration is the best method.

Einfluss der Provenienz des Samens auf die Eigenschaften der forstlichen Holzgewächse. VIII Band, 2 Heft der Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen, 1905.

Respiration of Perennial Foliage.

Respiration is a measure of physiological processes in leaves in general, and in so far of practical interest. G. Schmidt in *Beiträge zur Wissenschaftlichen Botanik* (1903), publishes a comprehensive study on the changes in intensity of respiration of evergreen plants during the several periods of vegetation during which their leaves persist. The same weight of leaves of *Rhododendron maximum* emitted during the first summer 2.66 volume per cent CO_2, in the following winter only 1.36, in the second summer 1.38, the second winter 1.16, the third summer .95. Similar results are recorded for *Buxus* and *Hedera*, the old leaves respiring about half as much as the younger.

For experiments with spruce twigs from botanical garden in the neighborhood of Leipzig covered with soot to over 13 per cent of their own weight (which the rains, however, wash off) and others from a distant forest. The leaves of two years duration of both specimens respired in summer equal amounts of CO_2 (1.45 %), but those of the first year in the garden specimen respired more (2.07%) than the forest specimen (1.83%). In winter the older leaves again worked approximately with equal intensity, but the young leaves of the garden considerably less (1.41 : 1.76). Generally speaking, however, similar gradual reduction with the age of the foliage takes place, as recorded for *Rhododendron*, the performance in the second winter being reduced by 35 to 50 per cent of that in the young leaves. Twigs respire in the same sense. The respiration curve sinks in winter, rises, but not to the level of the first summer, in the second summer, falls deeper in the second winter and continues sinking in the following seasons.

Ueber die Atmung ein- und mehrjähriger Blätter im Sommer und im Winter. Centralblatt für das gesammte Forstwesen, March, 1906, p. 139.

Chemistry of Wood.

Some of the results of a very comprehensive work on investigations of the wood substance by V. Grafe, are summarized as follows:

1. The reactions of wood substance, discovered by Wiesner, namely yellow color with aniline salts, red color with phloro-glucin-hydrochloric acid and coloring with other

phenols are produced by combinations of the wood substance with these bodies, the hydrochloric acid serving as a medium.

2. Wood substance is not a chemical individual, but consists of vanillin, methyl furfurol, pyrocatechuic acid, coniferin which are partly combined with the cellulose of the membrane in ether combination, partly are dissolved in the resin, and exist only to small part uncombined in the membrane.

3. The ether combination may be broken up by hydrolysis with diluted acids or alkalis. To obviate the formation of resinous combinations of furfurol, which are difficult to remove from the wood, water at 180° in vacuum or an electric current must be employed.

4. The intensity of the coloration even when only the smallest traces of wood are present, is explained by the sensitiveness of the phenol colors and by the exceedingly fine distribution of these substances through the resin, as well as by the capacity of cellulose to retain substances tenaciously.

5. The average methyl number of wood substance is 48.

6. The possibility of securing in a simple manner methyl furfurol and pyrocatechuic acid from cellulose, and the fact that vanillin may also be derived from the lignified membrane make it probable that wood substance is derived from cellulose. Wiesner's reactions are therefore undoubted proofs of lignification.

Untersuchungen über die Holzsubstanz vom chemisch-physiologischen Standpunkte. Centralblatt für das gesammte Forstwesen, Feb., 1906, pp. 93-94.

Again Spruce Droppings.

Causes for the dropping of branch-tips of the Norway Spruce, which often takes place during winter and spring have again and again been discussed. Squirrels have been held responsible, but the number of such droppings are against the theory. Periodicity and connection with seed years has been suggested, but the appearance of the droppings does not allow conclusion of an organic process.

Frost producing brittleness and wind storms mechanically breaking off the tips by whipping them against each other first suggested by Ratzeburg, seems a plausible cause.

Dr. Sedlaczek records that he has found in the forest invariably the buds on the droppings injured, indicating at least participation of squirrels, but the droppings were also observed after storms in localities where squirrels are entirely excluded and then without or with less injury to the buds.

Forstzoologische Notizen. Centralblatt für das gesammte Forstwesen, March, 1906, p. 122-125.

Photosynthesis and Temperature

The Botanical Gazette notes the results of experimental work by Miss Matthall and F. F. Blackman on temperature as a limiting factor for photosynthesis. In these investigations, they endeavored to interpet the quantitative variations of the process in terms of the three limiting factors, viz.: (1) intensity of illumination, (2) temperature of leaf, (3) pressure of CO_2. "When light is the limiting factor equal intensities produce equal photosynthesis with leaves of most various structure and type. At low temperatures leaves as different as helianthus and cherry laurel have similar photosynthetic maxima, but at high temperatures these diverge. Thus, at 29.5° C. the former can fix twice as much CO_2 as the latter, requiring twice as much energy to do it, of course. The essential difference in the photosynthetic activity in different leaves lies, then, in that they have different coefficients of acceleration of this function with increasing temperature. So in nature it appears that the low pressure of CO_2 (entailing slow diffusion after solution at the surfaces of the leaf cells) and the low temperatures are the serious impediments to food making."

Notes for Students. Botanical Gazette. March, 1906 pp. 215–216.

Two interesting paleobotanic finds are reported from France, namely, a cone which seems to belong to *Sequoia gigantea* and thus demonstrates, that both Sequoias were in existence in the Jurassic period ; and two pine cones, one of the *Strobus* type, the other resembling *Pinus Laricio*, showing that both types existed in the Jurassic period.

SOIL, WATER AND CLIMATE.

Drouth and Forest Growth.

The summer of 1904 from middle of April to end of August was specially drouthy in middle Germany. Oberforstrat Thaler records observations of the behavior of forest growth during this period under varying conditions, secured by circular. As regards species the conifers suffered most and especially *Pinus Strobus*, especially in sandy soils of the Rhine and Main. Many plants of this species which were supposed to be past such danger, were killed, so that it has become questionable whether this species is to be used here in future. *P. divaricata* died in some districts, in others did well. *Picea pungens* did better than the native Norway spruce in the plain and *Abies pectinata* came next in resistance. Scotch Pine yearling plantations suffered. No scale of drouth resistance among deciduous trees could be ascertained ; even 6 to 8 year old plantations of White Birch and Black Locust suffered severely, while Ailantus did excellently.

Elevation exercises a most potent influence : in situations above 1200 feet no special loss from drouth was experienced ; the plain and especially the sandy soils which dry out quickly, suffered most. The growth on shallow soils and southern exposures is, of course, most readily damaged.

Plantations made late in the fall, as well as those made late in the spring, suffered most, while early spring plantings are most resistent. Sowings suffered somewhat more than plantings. Cultivation, of course, reduces loss by drouth, especially deep plowing.

Crown cover and side shade have invariably been beneficial. Conifers planted into deciduous growth have suffered little. "Side protection by grass, weeds, shrubs, coppice has been beneficial. Where weeding was done plants died." "Cutting out of grass, ferns, etc., has been detrimental and is in future to be done only in the fall."

As to means of counteracting drouth, the author recommends selection method or small, narrow clearings running from northeast to southwest ; leaving shrubs and small trees to furnish a light cover ; especially on southern exposures. On outer boundaries (wood lots) a strip of one hundred feet should be treated in selection or park method, preserving or planting a wind mantle.

Die Einwirkung der Hitze und Dürre des Sommers 1904 auf die Waldvegetation. Allgemeine Forst- und Jagdzeitung, Jan., 1906, pp. 5-9

Forest Influence on Rainfall.

A complete and satisfactory answer to the effect of forest cover on the amount of precipitation is yet to be heard. Among the many factors entering into a comparison of rainfall between wooded and open country none is more potent than altitude, which, by affecting the temperature, exerts a marked influence on the rainfall ; into most data upon the basis of which our problem will be answered, altitude will enter to a greater or less degree.

Recent studies in Silesia by Schubert indicate the precipitation in millimeters varying with forest cover and altitude as $529+0.78p+0.57a$, that is, precipitation varies above a constant amount by 0.78 *mm.* for each per cent. of the surface of the country under forest cover and 0.57 *mm.* for each meter in altitude.

However, beyond about 50 per cent of the total area forest cover seems to exert little additional influence upon the rainfall, so that for the conditions in Silesia with about 660 *mm.* rainfall and 29 per cent. forest cover, complete deforestation would reduce this amount by but 5 per cent., and 20 to 80 per cent additional forest cover would raise it by but 1 per cent.

The assumption is made that one-half the increased amount registered by a rain gauge within the forest as compared with one in the open is due to the difference in exposure to winds. Another series of data from a particular area, averaged for four years, indicated a variation between 600 and 650 *mm* ; agreeing closely with the formula. Crediting one-half of this to wind we have a forest cover exerting an influence equal to that of an elevation of 40 meters.

Wald und Niederschlag in Schlesien. Zeitschrift für Forst. und Jagdwesen. June, 1905. Pp. 375–380.

Simple Hygrometer.

Take the topmost whorl of a young spruce, cutting off the stem 2 inches below and above the whorl, remove all the branches except one good straight one and bark both stem and branch. Nail this tight to a wall through the stem, so that the branch lies flat against the wall, and its height can be marked. Its position will vary with the humidity, being higher in wet, lower in dry weather. The arcs which it describes can after some experience be graduated and the humidity expressed in per cent. This behavior of the branch is supposed to be also of benefit to the living plant in directing the run off of rain toward the stem and in dry hot weather reducing transpiration by change of position toward the sun.

Note in Centralblatt für das gesammte Forstwesen, Feb. 1906, p. 95.

ROADS AND SURVEY.

Transportation in Mountains

A well illustrated article by Dr. Fankhauser describes the logslides which are to a large extent in use in the Austrian Alps. Here wood is still relatively cheap and branches and tops unsalable. Coniferous wood ranges in price between 3 to 9 cent per cubic foot, say $4 to $10 per M ft., hardwoods up to 11 cents. Hence cheap methods of transportation are needed. Moreover, felling areas are concentrated and clearing system alone is in favor. A well planned system of roads, sled roads and log slides, each adapted to the special conditions of topography make profitable utilization possible.

The slides are constructed for permanent use, and so as to bring the logs long distances, 2 to 3 miles without stops, various constructions being combined to utilize the topography. The simplest construction is a simple ground slide improved by laying down, partly buried, "ribs", short logs, obliquely pointing forward, V-shape; or else laying the ribs horizontally and boom-logs along the two sides. In curves, the inner side is then laid lower, so as to relieve the outer boom. If the grade is insufficient the base of the slide is laid out with logs placed lengthwise to reduce the friction. The width between booms varies usually between 2.5 to 4 feet, and, in the curves, which have a radius of at least 150 to 200 feet, 5 to 8 feet. Broader slides are not desirable because in these the logs are apt to wobble and perhaps jam. One of the described slides passes through a 100 foot tunnel, another through a ditch blasted in the rock; trestles and bridges are frequent features, and superimposed and fortified booms, especially along narrow rock hangings, etc., and curves. All these features are combined into one homogeneous runway.

The grade is an important point, but varies within wide limits, up to 60 per cent. and even 80 per cent., one of the described slides averaging 60 per cent. Such high grades cause a certain amount of loss in the wood, which in this case where the base of the slide had in some parts to be paved with rock to avoid damage by water is calculated at 30 per cent.

The minimum grade is preferably not under 10 per cent. except where ice roads are utilized. For short portions a lower grade and even an up-grade is possible, if the base is laid out with logs or the ribs are laid close. The best grade is 20 to 35 per cent., especially in curves if the jumping of logs is to be avoided.

On very steep grades the logs can be slid only in summer and dry weather, which in all respects is the best time in the high mountains. Early in the morning dew and in rainy weather the logs slide well even with less grade. If the grade is less than 20 to 25%, winter becomes the more favorable season, when the wear and tear on logs and slide is also reduced. The snow turns soon into ice, when small dimensions run well, but for logs it becomes necessary to roughen the ice to reduce their speed. Heavy logs, especially when peeled, run most easily, hence in summer they are run with dry weather, in winter with wet snow. It is desirable to sort the sizes and run them separately. Altogether the possibility of adaptation to topgraphy and other conditions in building and operating slides make them a better means of transportation than wagon or sled roads, especially as regards changes of grades. Only as regards curves special caution is needed. In no case should these have less than 150 to 200 feet radius, especially on steep grades, where there is danger of jumping out. Here the convex side must be built high and solid with booms 50 to 60 feet in length and 12 to 18 inch diameter, braced with rocks and otherwise.

Special attention must be paid to drainage, which on slight grades require ditches every 60 feet, on steep grades every 30 feet, draining underneath the outer boom. These must be kept in careful repair.

A well kept logslide—and it must be well kept especially with regard to drainage—will on cool slopes last as much as 15 to 20 years, on south slopes not more than 4 to 6 years. The cost varies so greatly according to conditions that statements have meaning only with relation to described situations. A standard slide cited had cost, without counting the wood, about $1.20 per yard running, while in another case it had been 30 cents. The cost of operation, however, is minimal. In a given case on a slide, 2½ mile long, the contract price running for all sizes over 10 inch, middle diameter, was not quite one cent per cubic foot, (or say $1.20 per M. feet B.M., which with our labor cost would have to be about double). In this case 43 men were tending the slide, namely 8 to 10 at the loading, 3 at the landing, the rest as watchers on the run.

In running, the logs are run with the butt end first, being "nosed" to two-thirds of their diameter, which not only makes them run better, but saves the slide. At the end of the slide the grade is reduced so that the logs arrive with less velocity, and often several switches, worked by movable booms, are introduced to assort the sizes. In order to be able to transport fuel wood and small dimensions the slide might be adapted for use as a sled road by keeping the grade between 15 and 25 % and avoiding narrow curves.

Rieswege in den Ostalpen. Schweizerische Zeitschrift für Forstwesen, March and April, 1906, pp. 69–77 and 113–122.

Wire Rope Transportation

A remarkable wire rope line of over 20 mile length, Bleichert system, for carrying ore—it could carry logs as well—with an elevation of nearly 12,000 feet to overcome has been for two years in operation in Argentina belonging to the government It includes spans of 1500 to 2800 feet and grades of 45°, the rope sometimes passing 1200 feet above ground. The cars make the distance in four hours, carrying not only ore, but building and other material, provisions, water, mail, and passengers. In the mountain section the capacity per hour is 90,000 lbs. in 80 cars running 360 feet or 45 seconds apart. In the valley section the capacity is reduced to one-half. The line is run in eight sections, worked from as many stations, each with a separate rope, drums and engine. Gravity, of course, saves largely in the power needed. In spite of the difficulties of locality, which required nearly 80 miles of road building, the installation was effected by the German firm in 18 months. The cost of transporting which formerly by mules, possible only 4 to 5 months in the year, had been about $12 per ton, has been reduced to $1.35. Smaller such rope ways are in use in various mountain districts.

Eine grossartige Drahtseilriese. Centralblatt für das gesammte Forstwesen, March, 1906, p. 138.

Cheap Logging

The details of logging forty acres of longleaf pine in Alabama illustrates the cheapness at which the southern lumbermen can operate. A forty-acre tract in Calcasieu parish, representative of the best longleaf now standing, produced 2,053 trees ranging from 9 to 36 inches in diameter, of which only 73 were less than 12 inches in diameter on the stump. Log lengths ranged from 14–48 feet, with the long lengths predominating. From the 2,053 trees, an average of 51.3 trees to the acre, were secured 3,128 logs, or an average of one and one-half logs to each tree. The average production of each acre was 16,498 board ft. log scale.

Quality of logs	Board feet log scale	Per cent.
Star	282.131	43
No. 1	210 977	32
No. 2	124,895	19
No. 3	41,904	6
Total	659,907	100

In the longleaf pine districts, spurs are built 900 feet apart, and the logs hauled 450 feet each way. The cost of putting in a spur one mile long in this district is figured at $528, which includes the depreciation of steel, cost of bridges, trees, grading and cribbing, and maintenance of the track. A spur one mile long would haul the timber from approximately 109 acres, making the cost for each acre $4.85. As the timber averages about 17,000 feet to the acre, the cost for each 1000 feet would be 28 cents. With this as a basis, the cost of cutting and delivering 1000 ft. of logs at the mill may be given as follows:

Spur construction	$0.28
Felling (contract)	.40
Hauling to skidway	.70
Loading	.20
Hauling to mill	.60
Unloading	.02
Miscellaneous	.10
	$2.30

On this basis it cost $1,517.79 to cut and deliver to the mill the timber on forty acres of land.

Methods and Cost of Logging Forty Acres of Louisiana Longleaf Pine. American Lumberman, May 12, 1906, p. 24.

In the forest district Hubertus stock (Prussia) a 50 to 60 H. P. locomotive run by alcohol and gasolene is used, so constructed, that when not in use as locomotive, it may be employed as stationary engine for running a sawmill.

SILVICULTURE, PROTECTION AND EXTENSION

New Nursery Practice. The practice of transplanting into nursery rows, especially of spruce, which is most widely practised, is described by Oberförster Petith, who points out that the introduction of machinery and proper utensils has permitted desirable changes in the practice. The principle of transplanting in the youngest possible stage, one-year-old if feasible, has become practicable by the use of Hacker's transplanting machine, because of its quick, cheap work and saving of space, while for hand setting the one-year old plants proved too tender. [The machine consists of a two-wheeled, self-propelled seat from which the planter directs a rill board which presses the rills into which the plants are to be set into the ground, and the lath, into which the plants are hung in equally-distant slots, which are fed independently. The full apparatus costs $50 ; a simplified form $12. —Ed.] All means should be employed, therefore, to produce stout yearlings by early sowing, lengthening the period of vegetation and cultivation. Early sowing is not well done by hand on account of frosty hands. Here again the use of the machine, Hacker's, (or, with us, the Planet Junior) secures uniform results. Only under unfavorable local conditions is it necessary to leave the seedling two years in seedbed. Formerly two years were considered necessary to produce a result in root and top development which gave a perference to transplanted stock. With the transplanting machine experience has shown that 75 per cent. of the stock attains in one year proper form for use. The balance, transplanted a second time, furnishes in another year most superior material with bushy roots and not unduly developed top, but if left two years in the first bed roots lengthen too much (up to two feet) and become unmanageable.

The objection to cost, which might be urged against a second transplanting, is not justified. With labor cost for men at 53 cents, for women at 30 cents, digging the ground costs at the rate of $3 to $5 per quarter acre (we would plow it for about that price). Weeding, covering and taking up require about $18 per quarter acre. Fertilizing has been omitted. The transplanting, very much influenced by the spacing, *i.e.*, length of time during which transplants are to remain in bed, cost 17 cents per M. if in rows 4 inch apart and 2 inch in the row. This means 160,000 plants per quarter acre, including the necessary 12 inch path between beds, costing round $48. Assuming only 50 per cent. useable after the first year instead of the more likely 75 per cent. the cost of transplanting the other half, spacing 3 by 5 inch, will be $38 and the 160 M. plants will have cost $86 or 54 cents per M. If the plants were to be left two years, the spacing would have to be 4x5, hence only 65,000 per quarter acre would find room and the cost of transplanting would be about $15 and with a second year's weeding the total cost would come to round $40, or 60 cents per M. The difference in favor of the former plan would actually prove greater.

The cost for raising the seedlings is figured at only 8 cents per M., there being paid out to secure 500 M. from one-quarter acre, for 44 lbs. of seed $10, soilwork and sowing $25, fertilizer $2.50 or altogether $37.50.

For seedlings left two years in seedbed before transplanting the author figures the cost of the seedlings at 12 cents and of the transplants at 67 cents.

Besides the financial advantage in the stock when treated as in the first position, the planting of that material is easier, cheaper and surer, the saving on the whole being estimated as between 25 and 50 cent per M. Other advantages are that on account of the closer spacing less area is required ; one half the nursery can now be annually green-manured with lupine as against one-third formerly, and the soil is worked over annually. Instead of using a puddle for keeping the roots moist, which does not work well with the transplanting apparatus, the roots are moistened in pure water before being hung into the lath, which is altogether better practice.

The weeding, where weed growth is rank is best done with the Planet junior rake, which does the work 5 to 6 times as cheaply as by hand. Otherwise the Spitzenberg weeding tool (described in this issue), which at the same time loosens the soil and hills the plants, works well, one man weeding ⅛ acre per day, the cost through the year being less than half that with the common garden hoe.

In conclusion the author accentuates the advantage of watering (by forcepump) and the need of proper location for nurseries.

Die Hacker'schen Verschulungsgeräte in ihren Beziehungen zu einem intensiven Pflanzgartenbetrieb. Allgemeine Forst- und Jagdzeitung, March, 1906, pp. 76–80.

Practices in Silviculture.

It had been the intention of Dr. Danckelmann, late director of the Prussian Academy of Forestry at Eberswalde, to publish the results of his studies of the silvicultural behavior of trees as observed during his long and active career in forestry. This unfortunately he never did. Indicating his views in this direction a short description has been published by Boden of the practices resorted to in the demonstration forest Freienwalde, a part of the equipment of this school, and hence directly under Danckelmann's hand during his long directorship.

Pine is clear-cut and replanted after the strip method or in some cases in groups, and in either case the local areas cut are very small, cutting being carried on in a number of places simultaneously. Where pine appears on soil good enough for broadleaved trees damage has been done by fungi (*Trametes pini* and *Polyporus annosus*); the indicated change to broadleaved stand is being made more or less gradually as the severity of the damage requires. The ultimate result will be oak with an understand in places of beech.

Especial attention was turned to maintaining and extending stands of oak, for in this was seen the field of greatest usefulness as furnishing in coming years a material to which too little effort was being given to maintain and establish. Oak stands were reproduced by shelter or nurse-tree methods and stands of birch or beech were cleared and the area planted with seedlings or sown with acorns.

Beech has required little care, establishing itself regularly as a secondary crop under oak. In pine stands where the fungi have severely broken the crown cover, beech seedlings have been transplanted from where they grew densely and served to protect the soil from the sun.

Birch strips along roads and elsewhere serve to guard against fire and besides have helped materially in the collection of June beetles when these became so numerous as to do great injury.

Spruce and larch have also found limited use, many exotic species have been planted to furnish students an idea of their growth and behavior and many forms of forest growth, such as coppice, have been introduced for the same reason.

Erinnerungen aus dem Wirken des Landforstmeisters Dr. jur. Danckelmann in seiner Eigenschaft als Oberforstbeamter der akademischen Lehrreviere mit besonderem Bezuge auf die Oberförsterei Freienwalde. Zeitschrift für Forst- und Jagdwesen, December, 1905, pp. 778-790.

Modern Thinning Practice.

Forstmeister Michaelis, who with Heck (see Quarterly, Vol. III, p. 40) is an advocate of reform in the application of thinnings, cogently formulates the following instructions for carrying out a thinning in the dominant. The general rule is: always take away a stem if it evidently damages or narrows in the important part of the crown of one or more well formed, clear, valuable neighbors. With Metzger, he classifies the trees into useful, obnoxious and dispensable. The useful are (a) the more valuable stems and kinds and, within the same species, the more clear and better formed; (b) the bushy, densely foliaged, subdominant stand, which does not reach into the upper crown cover, cannot do any damage above and serves as soilcover, and as nurse, helping to clear the dominant and preventing formation of watersprouts, especially when of shade enduring species. Obnoxious are those which limit the upper crownspace of the more valuable, especially when they are themselves poor, stoutly branched, knotty, crooked, shortboled, broomlike, etc. All the rest is dispensable, especially the hopelessly suppressed, doomed to die. The struggle for existence taking place in the upper crown level, here a helping hand is needed. Hence those which here interfere with the more valuable must first fall, and of the subdominant, whatever threatens interference, provided the desirable length of clear boles is attained, for then every branch is needed for the best diameter development. The most suitable length of clear bole is 50 to 60% of the total height, *e.g.*, 30 to 35 feet when 60 feet in height, 45 to 55 feet when 90 feet in height.

Generally speaking the obnoxious and dispensable are the ones to be cut. But where equally valuable stems interfere with each other assistance is required, for finally each main stem needs in all directions free space for its crown development which produces diameter development. Hence not to hunt up and mark all less valuable members is the method, but the reverse, hunt up the valuable and then determine the question which are to be removed to the advantage of the most valuable. In this the conical crowns in the dominant, the broad crowns in the subdominant are to be favored. Even of the poor stems only so many are to be removed as is *necessary* for the improvement of the more valuable.

If the choice is between two equally obnoxious and equally formed specimens of different diameter, consideration of future value production leads to the removal of the smaller, for generally speaking the increment on the larger diameter produces greater value.

In beech (shade-enduring) stems with watersprouts even in the dominant are to be removed, for they cannot be cured. This is different in oak, (light-needing) in which by dense undergrowth the watersprouts can be suppressed. Final decision is always based on most appropriate distribution of the upper crown space, and on securing this object by the removal of the smallest possible number. Hence in small groups the trees from the center are indicated for removal. Living and viable undergrowth is to be preserved unless it damages the dominant.

The degree of thinning depends upon the time of return, whether in 3, 5, 10, etc., years. The best results in diameter increase are secured if the degree is so chosen, that complete crown-cover is again established just at the time when the thinning is planned to be repeated, anticipating any struggle. Yet, it should be kept in mind, that in older stands one broadcrowned dominant tree taken away may never be replaced in future ; hence more frequent return, *i. e.*, less severe opening, keeping in mind the general rule, that only *evidently* damaging parts are to be removed, is indicated.

Where oak and other valuable species are being narrowed in by poorer material and for some reason a thinning cannot be made, girdling may be resorted to ; also where damage by removal is feared or sprouting is to be prevented. It is not necessary to cut through, but merely with the back of the axe to break the bark all around, when death will occur in a few years, the change being gradual.

Anleitung zur Auszeichnung der Durchforstungen im Herrschenden. Allgemeine Forst- und Jagdzeitung, pp 70 72. Feb., 1906.

Thinning and Shaft Form.

Mr. Schiffel reviews Dr. Kuntze's article on the influence of different degrees of thinning on shaft form, published in Tharandter Jahrbuch, Vol. 55.

Kuntze, upon the basis of observations continued through 42 years on sample areas thinned in three different grades, comes to the conclusion that, for spruce at least, the general belief that a severe thinning influences shaft form undesirably cannot be maintained. He even concludes, that "every increase in the degree of thinning up to the C grade improves the shaft form (reduces the taper), and especially the part above the middle of the shaft improves in form."

To this statement, which is in contradiction of all experience, Schiffel takes exception, and finds the error of the deduction in the mathematical method employed for utilizing the data, namely by comparing the quotients of diameters at different heights divided by the diameter in the middle of the shaft, not of all the trees but of trees of the same height and diameter. All that is thereby proved is Schiffel's prior finding, namely that on similar sites trees of the same height and diameter have the same form factor.

Basing the diameter quotient on the diameter in the middle of the shaft is also objectionable since that implies at once grouping by equal heights

Schiffel then makes the comparison of the average trees, using a diameter quotient based on diameters of symmetrical parts, namely $d_{3/4} : d_{1/4} = q_{3/1}$. These quotients for the same diameter class remain nearly constant under all degrees of thinning, as shown by Kuntze, and hence permit the forming of averages of stems taken from any thinning area, thinned to any degree, for the purpose of determining whether one or the other degree of thinning produces more or less taper.

The comparison of these diameter quotients in different diameter classes show that they sink with increasing diameter, just as is known to be the case with form factors, and a comparison of the diameter quotients of the average trees shows that they sink, although not much with increase in the degree of thinning, *i. e.*, the proposition that every increase in the degree of thinning produces more cylindrical form is not proved. The opposite is more likely true.

The investigations, however, prove that on medium to poor sites a severer thinning which does not interrupt the crown cover for some time produces no noticeable difference in volume or form accretion, if the thinning is made in the later polewood stage after the clearing process is well completed. If, on the other hand, open plantations or stands opened in early life were compared with continuously dense growths, the relation of shaft form and crown density would at once be apparent, namely one extreme form represented in the open and the other extreme in the close stand, between which extremes all other forms can be interpolated as functions of the density.

Ueber den Einfluss verschiedener Durchforstungsgrade auf die Schaftform der Fichte. Centralblatt für das gesammte Forstwesen, Jan., 1906, pp. 26-29.

Time of Thinning.

German forests are not wholly lacking in spruce stands which show the effects of early and of tardy beginning in thinnings quite as strikingly as was revealed to Schwappach in Bohemia. From reviers of which he himself has had charge, Dr. Martin draws examples both of delayed thinning where an even-aged stand had an excessive number of stems and the increment had fallen to nearly zero in the fourth decade, and of most uneven growth with trees of widely different diameter, the dominant growing very vigorously, and rapidly exterminating the oppressed.

These examples are cited, however, because, by reason of the local demand for smaller sortiments, the denser even-aged stand was held to be the more valuable and yielded the more important product. Market conditions widely different from the Bohemian, but rather general throughout Germany, called for a different practice in thinning. Thinning has no existence except in relation to the broader aim of management; knowing the end in view principles are guide boards and its practices, roads, and choice between them is not only profitable but necessary.

Die Regelung des Wachsraums bei der Begründung und Durchforstung von Fichtenbeständen. Zeitschrift für Forst und Jagdwesen, July, 1905, pp. 419 427.

Propagation of Poplar

The desire for rapidly growing trees for certain purposes, as for instance matchwood, gunpowder, etc., has led to the growing of Aspen (*Populus tremula*) and other poplars in some of the German forest districts. It has been found that the use of cuttings does not lead to satisfactory results, and hence seedlings have been substituted. Mr. Thaler describes the method of raising these. The seed is gathered in cloudy weather, shortly after the opening of the seed capsules, about May 20. Only the seed which contains a small oval yellow-brown kernel in the woolly envelope is germinative. Since poplar is dioecious, it is necessary to collect from female trees which stand near to the leeward of male trees. Single trees not so placed do not produce germinative seed. The seed is either sowed at once or spread out in a well roofed place, sheltered from drafts. The sowing must be done on a windstill day. The seed cotton is placed on top of the seed bed at a rate of 2 to 3 ounces for each 10 square feet and pressed down so that the wind cannot disturb it, and is then covered very lightly (until it vanishes from sight) with fine compost soil or sand sieved over it. It is then watered with a fine rosette, covered with conifer twigs (without foliage), and kept moist. In a few days the plants appear, and in the first year reach a height of 5 to 7 inches. The root develops very strongly, hence transplanting in nursery rows early in the spring, spacing 10 to 12 inch apart is recommended, although the stouter plants may be set out at once.

With us gathering of seedlings from natural regeneration can probably be practised to better advantage.

Für Nachzucht der Pappeln und der Elzbeere. **Allgemeine Forst- und Jagdzeitung, April, 1906, p, 117–119.**

Forest Litter and Growth

A long series of systematic observations, continued through 24 years by the Austrian experiment station, on the effect of the removal of forest litter in a pinery on the growth of the trees is recorded in greatest detail by Böhmerle.

Some areas, all stocked on poor soil, were raked every year, others every five years, others not at all and the growth was also compared with regularly thinned areas. One series was begun in a 37-year-old stand, another in a 57-year-old stand. The litter harvest in the yearly areas averaged about 4 cords or 3000 lbs. (when dry) per acre; in the quinquennial areas the average annual harvest was only 51 to 53% of this figure, that is to say if the litter is raked only every five years, actually not more than half the yearly leaf fall can be secured, perhaps two years fall altogether, the rest being decayed or nearly so. Indeed, investigations showed that about 1½ years' fall was harvested intact, the balance consisting of partly rotten two and three-year-old needles. In th equinquennial areas, it was observed, much more moss was developed than in those raked annually.

Comparison of rates of growth reveals the unexpected result, that the removal of litter had little, if any influence, but the thinning influenced the production very visibly. This fact that removal of litter does not produce proportional loss of increment, had been before stated by Ramann, the stirring of the soil in raking perhaps compensating for the loss in mulch or humus.

Interesting, too, is the observation that the more frequently raked areas produced less moss cover, and in the unraked areas the moss development was the most prolific. In these the leaf litter, falling on the moss, is more rapidly rotted: "the moss eats the litter." The moss, like any other living vegetation, withdraws water from the soil, the more the better it is developed, hence the annual raking which prevents the establishment of a dense moss cover was a benefit.

Die Streuversuche im Grossen Föhrenwalde. Centralblatt für das gesammte Forstwesen. April, 1906, pp. 145-165.

Moss-cover and Soil Treatment

The changes in the composition of the moss-cover in the experimental areas referred to in the previous brief were made the subject of a special investigation by Dr. Zederbauer. These show the influence of light and humidity as well as of the mechanical disturbance of the moss-cover. The different structure and biological behavior of the different species, influencing their transpiration, account for the different moss societies found under different conditions.

Foresters distinguish among the true mosses, *musci*, several groups, only partly corresponding to systematic classification, based upon ecological and biological characteristics. The "branch mosses" lie loosely on the ground and are much-branched, besides some *Hepaticae*, the *Hypnum* family and their relatives *Hylocomium*, *Thuidium* and almost the entire series of *Pleurocarpi* belong here. As "cling-mosses" are designated those which with their rhizoids are closely imbedded in the soil. Most of the *Acrocarpi* belong here, with the best known genera *Dicranum* and *Polytrichum*, *Mnium*, and *Tortella*. A third group is formed by the "peat, or white mosses," mainly *Sphagnum* and *Lycobryum*.

A survey of the moss-cover in the different experimental areas shows that in the unraked areas only few species find their place; namely the rapidly growing *Hypnum Schreberi*, *Hylocomium splendens* and *Dicranum scoparium* are almost the only occupants. Here a dense fungus mycelium covers the tips and assists in rapidly decaying the fallen leaf cover. In the areas annually raked, double the number of species occur, with the delicate "branch-mosses" *Hypnum cupressiforme* and *Thuidium tamariscinum* prevailing. In the quinquennial area *Tortella* and *Thuidium* occurs in small cushions, but *Polytrichum* is the most prominent being able to resist the rake and working itself up above the leaf litter, while *Hypnum cupressiforme* succumbs to the rake to a large extent, is injured by the leaf litter and cannot grow through it. While the difference in the composition between the unraked and the annually raked areas is very decided, the quinquennial areas are less characteristic. The unraked thinning areas show the same composition in the mosses as the unraked, undisturbed areas. With the degree of thinning, however, the moss-cover increases. Similarly with irrigation the number of species, especially near the ditches, increases.

Of lichens it was observed that on unraked areas they are absent, here, being of slow growth, the annual leaf fall prevents them. On the raked as well as in thinned areas *Peltigera horizontalis* and *Cladonia pyxidata* were frequent, the latter most so on the quinquennial areas.

Moose und Flechten in den Versuchsbeständen im Grossen Föhrenwalde. **Centralblatt für das gesammte Forstwesen. April, 1906, pp. 165–175.**

Damage by Bark Bugs.

The Pine Bark Bug (*Aradus cinnamoneus* Panz.) is pretty generally distributed throughout Germany and has been reported from as far north as St. Petersburg and Finland. In all this wide range it only seldom reaches such numbers as to become a menace to the pine, under the flaky bark of which it is at home, and many observers of recent years have been unable to find instances in which its attacks have proved fatal. Dr. Eckstein however assures us such does occur, citing examples.

This weevil lives under the loose flakes of bark on stems of the Scotch Pine thrusting the slender bristle with which its mouth is provided into the living tissue of the bark and drawing thence its food.

Cases where its attacks threatened the existence or thrift of the stand may sometimes be best remedied by application of kerosene emulsion if the pine must be kept for soil cover. In the majority of cases such extreme remedies are not warranted and it is to be merely borne in mind that when opportunity offers upon the removal of the present stand a change of species is desirable. *Pinus Banksiana* has a smooth bark offering no shelter to the pest, and remains uninfected where Scotch pines succumb, and hence the change to this exotic species is recommended.

Aradus cinnamoneus Panz., *die Kiefernrindenwanze.* Zeitschrift für Forst-und Jagdwesen, September, 1905, pp. 567-576.

Fungus Disease of White Pine

The White Pine plantations in the Jura mountains, where this species thrives in spite of wintersnows and frost, have during the last year and one-half suffered from a bark-rust-fungus, *Cronartium ribicolum*, which so far has not been reported from the United States, although in Germany it was described by R. Hartig as long ago as 1874. It appears that *Ribes* species are the intermediate host. A description by v. Tubeuf is given. The plants, even vigorous 6 to 7 year old ones, become yellow and finally top dry, or die entirely, and must be removed to avoid spreading the trouble.

[*This is an important discovery for us, pointing out the need of careful inspection of imported material* !]

Ein neuer Feind unserer Weymuthskiefernkulturen. Schweizerische Zeitschrift für Forstwesen, Feb., 1906., pp. 46–48.

Seedling Blight.

The blight (*Schütte*) of seedling and thicket growth of pine and spruce is now pretty generally recognized as a fungus disease, distinct, at least in plants more than a year old, from "damping off." Like bacterial diseases in human communities attacks are warded off by such cultural methods as further the development of vigorous plants, while crowded stands, stunted in their struggle for light, water, and soil fertility, offer an opportunity for the most rapid development and the widest spread of the pest in its most virulent form. Where fear of blight is entertained planting is to be preferred to sowing, and sowing, where necessitated, should be sparse and on well prepared ground.

Once the pest breaks out, copper salts, used as sprays, have been found an efficient preventative against its spread. The very effectiveness of this method proves beyond controversy that blight is of fungus origin and not an effect, as some maintain, of meterological factors, frost, drought, etc.

Bordeaux and Burgundy mixtures alike gave good results but the latter is to be given the preference as it is cheaper and more simply prepared. The requirements of a suitable apparatus for applying the solution are given and numerous commercial brands discussed by Dittmar. Spraying is most effective when done in the summer months.

The cost of spraying has been found to be high, and this, coupled with the uncertninty as to the results obtained, has served to discourage resort to this practice, but when considered in relation to the cost of planting fail spots and the permanent damage done to the stand, it becomes quite inconsiderable indeed.

Schütte und Schüttebekämpfung. Zeitschrift für Forst- und Jagdwesen. June, 1905, pp. 343-356.

Fighting Insects

For successfully combating all the small insect pests which attack young spruce and pine in the nursery rows, satisfactory means have not yet been discovered, nor is there any promise of satisfaction until the complete life histories of the insects have been worked out. In the meantime, however, shift must be made and practices in agriculture and horticulture noted for possible suggestions. Dr. Eckstein finds one such in the practice of sprinkling white sand on vegetables, especially on early radishes attacked by springtails (*Erdflöhe*).

A note calling attention to this fact suggests that experiments to determine the value of similar treatment of the seedlings be made where these pests appear and gives the source from which the sand for this purpose may be procured.

It has long been known that certain small insect pests were not found and could not be introduced upon certain soils containing very small quartz grains—spicules so small that they remain suspended in water longer than clay, or for several weeks. Those who have studied the question trace the effects to these finest grains of sand, though it is not entirely clear just how they act.

Zur Bekämpfung der kleinen Schädlinge der jungen Nadelholzkulturen. Zeitschrift für Forst- und Jagdwesen, pp. 356–358, June, 1905.

MENSURATION, FINANCE, AND MANAGEMENT.

Cross Section Area by Space Number

One of the propositions to reduce the amount of measuring in determining contents of stands has been that of König by the use of the "space number".

The space number is the relation between distance and diameter, *i.e.*, the average distance at which the trees stand apart, divided by their average diameter. The total area of a stand may be conceived as divided into as many squares as there are trees, each square being the standing room of the tree, the average of the sides of the squares being the average distance, and $a = \frac{s}{d}$ is the distance number. We have then the proportion A (area) : c (cross section area) $= s^2 : \frac{\pi d^2}{4}$,

$$\text{hence } c = A\frac{d^2}{s^2}\frac{\pi}{4} = \frac{A}{a^2}\frac{\pi}{4} = \frac{.7854A}{a^2}.$$

The difficulty lies in determining s with sufficient accuracy. Schleicher investigates the methods proposed by various authors, shows them faulty and liable to grave errors. He proposes a new method which apparently furnishes tolerably accurate results (at most not over 7% error) and requires only one-third the time of calipering the whole stand.

It consists in making the measurements in groups of 6 or 8 trees at regular distances apart, say 50 to 100 steps, without selecting; the distance of a center stem from the others (outer stems) being measured and all being calipered and recorded by diameter classes. As can be shown, if the number of outer stems is n and the average distance of the latter from the center stems e, then $s = e\frac{n}{1,4142n - 16568}$. For groups of 6, 7, 8 trees ($= n$), respectively the factor becomes .8786, .8492, .8284. The rest of the calculation is self-evident.

Die Ermittelung der Bestandes-Stammgrundfläche mit Hülfe der Abstandszahl. Allgemeine Forst- und Jagdzeitung, Feb. 1906, p. 37–45.

Forest Valuation in Practice

To show that the principles of the soil rent can be and are practically applied. Dr. Wimmenauer publishes with full details on 23 quarto pages such a valuation of rather complicated conditions used in a subdivision of properties. Failures to come to practically tenable results he ascribes not to the method but the faulty application of the same. In the part which brings together the basis for the valuation, the elaborate determination of wood values for the different species and diameter classes is especially interesting. The relationships appear from the following table, giving values per fm.

Diameter. c.m.	*Beech.*	*Oak.*	*Pine.*	*Spruce.*
10	5.1	4.5	5.	5.7
20	6.4	8.8	6.4	8.1
30	6.6	12.1	9.1	10.6
40	6.8	15.5	12.1	13.
50	6.9	18.	13.9	14.4

In the calculation the older stands appear with their sale value and soil expectancy values, the younger stands with their stand expectancy value. Regarding the soil expectancy value the author states: "If soil values were figured with a predetermined interest rate, soils of equal value would appear as of very different value according as to whether accidentally they are stocked with one or another species."

This, of course, would not do. Soil values are to be determined so that they will be in conformity with prices lately obtained in sales. He finds these to have been for smaller parcels about $31 per acre and arbitrarily reduces them for larger areas to about $24. "Nevertheless for all existing site classes and methods of management the soil expectancy value is to be figured for two purposes, namely (1) to determine the interest rate which for a soil of medium quality will produce the value of $24; and (2) to determine the value relation between such average soil and the better or poorer soils. With such limitation the calculation of soil expectancy values serves its real purpose, namely to furnish a precise expression for the profitableness of the different site and management classes." [This modification seems to us substantially an abandonment of soil rent theories, for if estimated sale values of average soils are to be used for the basis of the calculation, we might as well continue estimating all the other values. REV.] The interest rate figured out with assumed rotations of 100 years for beech, 60 years for pine and 80 years for spruce is found as 2, 2¾, and 3.5% respectively. The cost of administration is divided not according to actual areas, but areas reduced to average quality. The soil values finally show the following relations :

Deciduous site classes	II	III	IV	V	. .
Coniferous site classes	. .	I	II	III	IV
Soil values	50	37.5	25	15	75
Net soil rent for beech and oak	10	7.5	5	3	. .
" " " " pine	. .	10.3	6.9	4.1	. .
" " " " spruce	. .	13.1	8.8	5.3	2.6

In plotting sales values and expectancy values it was found that they become identical with deciduous stands from the 80, with conifers from the 40 to 50 year.

Praktische Waldwertrechnung. Allgemeine Forst und Jagdzeitung, Jan., Feb., and Mar., 1906, pp. 9–15, 45–52, and 80–88.

STATISTICS AND HISTORY.

Cost of Staves

The shortage of timber supply for staves has caused considerable alarm to interested manufacturers, and the problem is daily growing more serious. Recent reports from six members of the Valuation Committee of the National Tight Barrel Stave Manufacturers' Association shows that in the past 10 years there has been an increase in the average cost of timber per cubic cord in the tree of 337 per cent. It shows that timber to-day is costing nearly four and one-half times as much as it did ten years ago. The average cost of cutting bolts per cubic yard has increased 60 per cent, and the average cost of hauling bolts from the tree to the mill has increased nearly 300 per cent, which is probably due to mills hauling timber greater distances, as well as the advance in the cost of labor. The cost of custom bolts has advanced 78 per cent, and the cost of mill labor per thousand staves has increased 40 per cent, the cost of hauling staves from country mills to railroad stations has increased 125 per cent, which is probably due to mills being located farther back from the railroad, as well as the increased labor cost.

"The average of fixed charge in connection with the operation of stave mills has increased 75 per cent. On the other hand, there has been a decrease in the same period of time of the number of staves procured from a cubic cord of timber of about 100 staves to the cord, which is equal to a 15 per cent reduction. The average number of whiskey staves secured from mill run timber to-day is 26 per cent as compared with 45 per cent ten years ago, which shows a loss of 42 per cent."

The selling price during this period has increased only 40 per cent, and hence is decidedly disproportionate. Counting back three years, one manufacturer reckons the advance in the cost of manufacturing staves at 25 to 33 per cent. A further increase is to be expected since the future supplies of timber are limited.

Tight Stave Meet. Barrel and Box, January 1906, pp. 58–59.

Hardwood Cut 1905

The reports of the hardwood cut in the Central States, which are much more complete than in previous years, show a total of 1,580,570,000 board feet. Cypress, which has been wrongly classified as a hardwood, has a reported cut of 561,853,000 feet, in which Louisiana ranks first with a cut of 475,690,000. Necessarily all manufacturers were not heard from, so these reports furnish only a most general criterion.

Deducting the Cypress cut, the respective States rank as follows:

Arkansas	399,281,000	board	feet
Tennessee	342,452,000	"	"
Kentucky	325,451,000	"	"
Ohio	189,864,000	"	"
Indiana	156,588,000	"	"
Mississippi	134,671,000	"	"
Louisiana	80,422,000	"	"

The production of hemlock in Michigan and Wisconsin for the last six years is given at:

1900	1,766,288,000	1903	1,334,444,000
1901	1,264,943,000	1904	1,291,169,000
1902	1,277,814,000	1905	1,195,073,000

It is probable that the production will steadily decrease after the record year of 1903. Hemlock in Michigan and Wisconsin grows for the most part upon agricultural land and will eventually largely disappear. The variation in the price of the product for the last sixteen years shows marked extremes, a conservative estimate placing the present values at $16–$17, double what they were in 1889.

Hardwood Cut in 1905. American Lumberman, March 3, 1906, pp. 26d 42.

Encouragement of Private Forestry

In Prussia as in other German states the returns from forest management and the advantageous influences accruing from proper forest practices on the smaller private holdings are not entirely satisfactory. There are ten million acres of such lands that it is estimated could be made to produce per year an additional value of fifteen million dollars, or $1.50 per acre per year.

Before the Silesian Foresters at their last meeting in July, 1905, von Salisch reviews the measures which have been tried in Prussia to make these laws useful, and the results of both those provisions which have in view the improvement of private forestry and those of other primary objects which, in their administration, affect forest management on privates estates. One of the worst of these latter is the stamp tax on the transfer of standing forests which makes it of immediate advantage to first sell the wood crop and afterward the land itself, rather than the two together.

The law providing for the establishment of stock companies for managing forests has never been made widely enough known to show its real worth. Every means should be taken to indicate to investors its advantages, especially in the case of small owners, whose forests could thus be consolidated.

Great good is also done where the state foresters are given opportunity and encouraged to extend their influence beyond their own reviers to the private forests of the neighborhood. Under present conditions the men to whom this work would fall are transferred so frequently from place to place that they have barely time to become acquainted with their proper field, and none at all to devote to conditions outside.

But all these measures do not go far enough to bring the best results. It is a better plan to have a bureau, or at least one official, say of the Provincial Board of Agriculture, which seems most available for this, devote his entire time to this work, and not only take care of such requests for aid as come to him, but, besides, make an active campaign for new work, educating private forest owners to an appreciation of the needs of their forests and of the use they can make of the aid the state offers.

A closer consideration of the work of the Provincial Boards of Agriculture in the way of furthering private forestry has since appeared from Dr. Schwappach's pen. In nearly all parts of the kingdom some advantage has been taken of the opportunity offered these boards to extend their efforts into the realm of forestry, the lengths to which they have gone differing widely, and the directions in which the greatest advances have been made varying according to the needs of the various provinces. The best results are only there attained where the board goes far enough to retain for its work the services of technically trained men who devote their entire time to this work and ceases to depend on the gratuitous aid given by state forest managers, whose first duty remains to care for their own reviers. As regards the extent to which advice should go it is clear this should be as continuous and persistent as possible. A good start is useful only when followed by persistent effort, maintaining the management at the same level at which the work was initiated.

Wie ist der Privatwaldbesitz zu erhalten? (Salisch) (with discussion and resolutions adopted). Jahrbuch des Schlesischen Forstvereins für 1905. Pp. 92-129; 180-191.

Die Bedeutung der Landwirtschaftskammern für die Privatforstwirtschaft. Zeitschrift für Forst- und Jagdwesen, September, 1905. pp. 557-567.

Prussian Statistics

Continuing the well known work of v. Hagen and Donner, the Prussian forest department has published an account of the progress of its administration to the year 1903, in a series of tabular statements, which exhibit most interesting changes. Comparing with the year 1868, 35 years ago, it is shown that the State forest area has increased 8.8% and the wooded part (*nutzbare Fläche*) 9.5%. The cut per acre has nearly doubled, namely from 2.86 fm. per ha. (40.3 cu. ft. per a.) to 4.92 fm. (69.4 cu. ft.) and the timberwood cut has more than doubled (from 2.05 to 4.14 fm), the workwood forming 63 percent of the timber wood as against 29 per cent in 1868.

While in 1868 the gross yield was 10.4 million dollars, and the net yield 5.2 million, in 1903 both figures are far more than doubled, namely to 26.4 and 13.2, so that the net yield at present is $2 per acre. The rise in prices during this period was slow during the first 20 years namely 8 percent, then very rapid, reaching in 1900 a figure 64 percent higher than in 1868, and in 1903, 45 percent higher. During the 15 years from 1888, since when the general advance in wood prices is noted, the rate of increase has been at the compound rate of 2½ percent per annum, while during the 20 years preceding, the rate of increase was about 1 percent. Although the rise in prices accounts in part for the increase in the net yield, improvement in forest conditions, means of transportation, etc., exercise the greater influence, for while prices setting those prevailing in 1868 as 100, rose to 145, the net yield rose from 100 to 267 in 1903.

Amtliche Mitteilungen aus der Abteilung für Forsten des Königl. Preussischen Ministeriums für Landwirtschaft, Domänen und Forsten, 1900-1903. Berlin 1905. 67 pp.

Bavaria

The second largest forest administration of Germany, with 2,041,455 acres of productive area, (270,000 acres unproductive) reports for the year 1903 a cut of 54.4 cu. ft. per acre; a net yield of 7.7 million dollars or $3.72 per acre, the price per cubic foot of wood having been 7.6 cents on the average, workwood bringing 11¼ cent and fuelwood 4⅓ cent. In addition to wood sales, other sources of income increased the revenue by $325,000 or 14 cents per acre. For plantations only, $400,000 or less than 20 cents per acre, were spent, and nearly the same amount for roadbuilding.

Persian Forests

Although Persia is not supposed to be a forest country, its export of forest products reaches nearly one million dollars, consisting of cedar, oak, walnut and palm for parquette, and some firewood, mostly to Russia. The Elburs mountains in the northern part to the coast of the Caspian sea, contain still some valuable forest areas, mostly belonging to private owners and mostly unworked, except in the more accessible portions, where they are devastated by roughest exploration. Palm is nearly exhausted, Cedar, which is found in limited localities, is there used for all building purposes. Persian Oak is noted for quality and size.

Der Waldreichtum Persiens. Allgemeine Forst- und Jagdzeitung, Jan., pp. 35-136.

Japanese Forestry

In Japan, different from China, as well as other countries, the forests have had more or less care in their exploitation from olden times. At first the priests protected them while making lucrative use of the timber. After a period of warfare and devastation, the great shogun Tokugawa (1603) instituted a forest management in the province of Kiso, which, even now, contains the largest and best forest area.

At that early age, forest culture was encouraged in peculiar ways, as by allowing peasant planters to bear a family name, which otherwise was a right reserved to the Knights or Samurei. In 1870 the large forest properties in the hands of the priests were incorporated in the State forests and a forest system, modeled somewhat after the German, was introduced in 1880.

At present the forest area comprises nearly 90,000 square miles or 59 per cent of the total area (omitting Formosa), largely mountain country ; State and Crown own two thirds of this, private owners hold 26 per cent, and 7.5 per cent are in communal ownership.

Reforestation was begun by the State in 1875 and, since 1895, has progressed upon a systematic plan, so that by 1901 nearly 250,000 acres had been planted, largely with conifers. The rapid development of industries, but still more the growing export trade, has necessitated an increased cut, which in later years has been around 2.5 billion cubic feet or 384 cubic feet per acre, undoubtedly an overcutting. The export in the decade previous to 1903, represented over 25 million dollars, against an import of about 3 million dollars.

Some 60 species, from sub-tropical hardwoods to conifers of the cold zone, form the flora, among which the genera *Cryptomeria*, *Chamaecyparis*, *Thujopsis*, *Pinus*, *Larix*, *Zelkova*, *Quercus*, *Castanea*, *Cinnamomum* furnish the most valuable species.

Note in Allgemeine Forst- und Jagdzeitung, April, 1906, p. 143.

One of the Masters

A reprint from Dr. Hess' biographies of German foresters, recalls the great service which Gustav Heyer has rendered to forestry science. He, with Pressler and Judeich, was the founder of the soil rent theory and elaborator of forest valuation and forest statics on strict mathematical and scientific basis. His essay on the relations of trees to light and shade, forms the foundation of modern silviculture, his *Lehrbuch der forstlichen Bodenkunde und Klimatologie* is still a classic, and so is his illustrious father's, Karl Heyer, *Waldbau* (silviculture), of which the son published several enlarged editions.

Dr. Hess, successor to the Heyers, father and son, in the professorship at Giessen, prepared a later edition (1893) of this great work, piously preserving Karl Heyer's spirit, and refers to it as "surely a rare case, for only too often would a successor tear down what his predecessor has built."

Gustav Heyer. Allgemeine Forst- u. Jagdzeitung, Jan., 1906, pp. 1-5.

Requirements for Forest Service

New regulations regarding requirements for acceptance into the forest service in the Prussian department, are stricter than before in demanding perfect eye sight, ruling out spectacles, and laying down specific rules. The right eye must be entirely free from faults, the left eye must have at least three quarters of normal sight. Shortsightedness of the left eye when the distance difference is 28 inch or less, excludes from acceptance. Another requirement accentuates the need of full mathematical knowledge.

MISCELLANEOUS.

Raising Sunken logs

The raising of sunken or "deadhead" logs from the bottoms of streams in Michigan and Wisconsin is becoming a recognized and profitable practice. At present it is being carried on extensively on the Manistee and Menominee rivers with considerable success ; due to the fact that these rivers were used for driving enormous quantities of logs. It is usually estimated that in driving logs 5–10% become deadheads. Reckoning 5% of the total 3,750,000,000 feet of logs which have been driven on the Manistee, there would be a total of nearly 200,000,000 feet of logs to be raised. Most of these logs are of the larger and better classes, making a powerful incentive to raise and convert them into lumber.

The logs are raised by means of large scows which are equipped with steam derricks and drums. The recovered logs are piled on skidways along the bank and will be driven to the mill as soon as dry enough to float.

Mining for Timber in the Beds of Northern Streams. American Lumberman, March 17, 1906, pp. 27–28.

NEWS AND NOTES.

E. A. Sterling, *in Charge.*

The Senior Class of the Yale Forest School left New Haven on April 24, for Waterville, N. H., for the field work of the spring term. The work is being conducted in the Mad River valley and on surrounding mountains and consists principally of the preparation of a 100-foot contour map of 25,000 acres, under the direction of Dr. Henry Gannett, Chief Geographer in the U. S. Geological Survey.

The class will be given work in timber-estimating and logging methods by an experienced timber-cruiser and lumberman during the month of May.

The regular spring lectures on Forest Entomology will be given by Dr. A. D. Hopkins, of the Bureau of Entomology, U. S. Department of Agriculture, and on Fish by Dr. B. W. Everman, of the Bureau of Fisheries, U. S. Department of Commerce and Labor. Mr. H. H. Chapman, on furlough from the Forest Service, is with the class and has direct charge of the work.

As an evidence of the better understanding which is growing between the lumbermen of the country and foresters, may be mentioned the number of foresters who have become members of the lumbermen's organization, the Concatenated Order of Hoo-Hoo. The Supreme Nine of the Order of Hoo-Hoo has ruled that foresters are eligible to membership. The first technical foresters to be admitted to membership were : Dr. Herman von Schrenk, M. Smith, Jr., R. P. Imes, and G. E. Clement. These men, all of whom were then employed in the Bureau of Forestry, were initiated in the spring of 1903 at St. Louis. Subsequently foresters have been received into the order as follows : At New York City in April, 1905, J. E. Barton, J. D. Gutherie, P. T. Harris, J. M. Nelson, J. H. Ramskill, A. C. Ringland, and H. O. Stabler, all of whom were then members of the Yale Forest School, and are at present Forest Assistants in the Forest Service. In February, 1906, eleven men from the Yale Forest School became members at a Concatenation held in New York City. The men joining then were F. E. Ames, R. L.

Fromme, D. C. A. Galerneau, S. L. Moore, A. B. Recknagel, and R. Y. Stuart, of the Senior Class; C. S. Judd, F. B. Kellogg, C. S. Martin, and W. C. Shepard, of the Junior Class, and Assistant Prof. Marston, of the Faculty. In March three men from the Forest Service were initiated at a Concatenation held in Baltimore. They are, E. J. Clapp, H. M. Hale, and J. DeWitt Warner. In April at Washington, D. C., H. H. Chapman, P. D. Kelleter, C. A. Lyford, A. S. Peck, and L. L. White, joined.

The Concatenated Order of Hoo-Hoo has a membership of some 20,000 men, including the most prominent lumbermen of the country, and is a social organization purely.

One of the most extensive pieces of coöperative work undertaken by the Forest Service was inaugurated under the direction of R. S. Kellogg nearly a year ago when plans were made for the annual collection of statistics of forest products in the United States.

The object of the work is to determine the annual drain upon the forests of the country and to ascertain the amount of each species cut and the source of supply, together with other information of interest and value.

The need for specific information of this character has long been recognized and that the effort to supply it is being appreciated is shown by the prompt response which lumberman have made to the request for information and the coöperation rendered by the various lumber associations.

Aside from the production of lumber itself, statistics on the following forest products have been collected: Railroad crossties, tanbark, pulpwood, tight and slack cooperage stock, veneer, charcoal, wood used for distilling purposes, pencils, etc.

To make the results available at an early date preliminary statements in the form of press bulletins have been issued from time to time, giving the results of the tabulations up to the date of issue. These statements are, as a rule, estimated to represent 70% to 80% of the total production.

The final results of the tabulation will be published within a few months under the title: "Forest Products of the United States." The preliminary statements on a few of the more important industries are as follows:

Sawed lumber, 27 billion feet, estimated as 80% of the total.

Tanbark, 1,060,000 cords.

Railroad cross-ties, exclusive of electric lines, 80 million.

Pulpwood, 3 million cords, estimated to be 85% of the total.

Dead and down timber on the national forest reserves is now being made the object of a special investigation by the Forest Service. The object of this work is to determine the approximate amount on each reserve, its condition, accessibility, and the demands of the market.

A strong effort will be made to procure the removal of as much as possible where a market already exists and to create a demand for it where there is no market at present.

Experiments to prove the worth of the various species are being considered ; the most promising opportunities for the utilization of this material now appear to be railroad cross-ties and box lumber. E. R. Hodson and J. D. Warner have commenced investigations on the Pecos River Forest Reserve in New Mexico.

J. P. Wentling, who has been conducting a study of the woods used in box making, will determine the suitability of this dead and down and mature timber for boxes. Particular attention will be given to the adaptability of the Lodgepole Pine. Lumber will be shipped east, made up into boxes, and tested in the laboratory and in actual trade use. The scarcity and high price of suitable box-board lumber is becoming a serious matter with the large users of boxes, and if these woods prove to be suitable, there should be a large demand for them. Plans are under way for making a practical test on boxes made of some of these woods, in coöperation with a packing house in Chicago.

The forest fires which have been raging in the northern peninsula of Michigan have covered an area of 200–400 square miles and destroyed a dozen towns and several lives. Practically all this land, which had been cut over for pine, was still producing valuable hemlock and hardwood, and the loss will be extremely great. The fire shows conclusively the striking inadequacy of the Michigan fire law and the paucity of combined effort in its execution. It is to be hoped that this last lesson will awaken the people to their danger and bring forth measures productive of the long needed protection.

The Michigan State Forest Reserve work is progressing rapidly under the efficient management of Prof. Filibert Roth, and this example is bound to produce far-reaching results in the management of forest lands and the probable enlargement of the State Reserve. This season there have been planted about 200,000 trees, all from stock grown on the reserve nursery, which now contains from two to two and one-half million trees. The principal species planted have been Scotch Pine and White Pine, with smaller numbers of Western Yellow Pine, Norway Pine, and Pitch Pine ; all are two years old from the seed, non-transplants, and in perfect condition for forest planting.

In addition to these there were set out a number of one-year-old seedlings of Catalpa and Black Locust which were excellent plant stock from the Reserve nursery. The object of planting these two species is to determine their possible utility in this particular region and on the much mis-used plain lands ; it is believed that a fair trial of this kind could not be made by using imported stock.

Besides this planting of seedlings, forty acres were devoted to planting seed of Western Yellow Pine in seed-spots. These were cleared and planted by the use of a hoe, were placed irregularly at distances varying from five to ten feet apart, with an average of 1,000 to 1,200 spots per acre, and required the work of one man per day for each acre.

In the nursery, seed amounting to approximately one hundred pounds of Western Yellow Pine, ten pounds of White Pine, and ten pounds of Red Spruce was sown, besides small amounts of Sugar Pine, Cryptomaria, and Sequoia. The seed of the Western conifers, both for seed-bed and field purposes was furnished by the U. S. Forest Service as a matter of coöperation with the Michigan Forestry Commission.

The results of these experiments, especially with the Western Yellow Pine, are awaited with a great deal of interest, for this pine appears to possess all the requirements necessary to make a first-class forest tree on these light, sandy lands. It will also be of interest to readers of the QUARTERLY to know that the plantations of 1904 and 1905 have thus far proven perfectly satisfactory. The Scotch Pine planted in 1904 now has a height up to twenty-three inches, and has wintered apparently without the loss of a single plant. Norway Spruce, Black Locust, and Catalpa, have proven least satisfactory. The Spruce has produced by far the greatest per cent. of loss of any species, and the least amount of growth, while the Locust and Catalpa, though apparently all living, have not had as thrifty a growth as was expected. However, in each case, judgment must be withheld until a few more years shall have demonstrated the possibilities of these species.

Of interest to the forester, and showing what these mis-used pine lands are capable of doing, is the showing made on the lower Reserve south of Houghton Lake, where all efforts thus far have been restricted to protective work. This protection extends over nearly 45,000 acres, and has been accomplished at the small expense of about $600 a year, while the sales from timber alone on this same area, without involving any live or green material, brought in over $800 the first year and about $1,100 during the present year of 1905–6 ; this proves conclusively the feasibility of protecting and improving these forests without actual cash expense to the State, and makes the present policy of the State in throwing away these holdings, and even expending money to dispose of them, all the less warranted.

At the request of Hon. J. D. Hawks, President of the Detroit and Mackinac Railway and one of Michigan's foremost railway men, the forestry department of the University of Michigan undertook the establishment of a forest nursery, some forest plantations, and also the incidental embellishment of property belonging to the road, known as Tawas Beach. The ground is a remarkable piece of filled beach. Ancient dunes running in parallel series, almost east and west at this particular point, make up the dry land and are separated from each other by lines and areas of swamp lands which are partly bogs and marshes but are more generally grown up to Tamarack and White Cedar. As is the case with a goodly portion of the Tamarack in this State, the greater part is attacked by the saw-fly, and its future, therefore, is stiil uncertain. The dry stretches of dune lands were occupied at one time by forests of White Pine and Norway Pine, which were lumbered and burned over at a very early date. At present these dry sand lands are occupied by broken stands of Scrub Oak and Jack Pine, frequently interspersed with young stands of White Pine and Norway Pine ; these better species having found their way from various and distant sources.

The object of the railway company is to hold this tract of approximately 1200 acres as forest land, managing it in the most conservative manner. At the same time, a stretch along Saginaw Bay is being used and continually being developed as a summer resort, because of unusual facilities for boating, bathing, and fishing.

The nursery and plantation work is intended to supply material for the complete restocking of the more or less denuded lands and at the same time to serve for experimental purposes in determining the relative value of different species and also in the encouragement of forest planting among the people of the district by furnishing an object lesson and by supplying plant material at cost, or even free of charge.

The first year's work involved the setting out of about 38,000 trees, representing 16 species of conifers and 5 species of hardwoods. In addition, a nursery was established, in which the seed of a number of different species of hardwoods and conifers were planted under very favorable conditions. Besides the forest plantation and regular nursery work, about 2000 trees and shrubs were set out for decorative purposes, and here again the idea of experimentation, the determination of hardiness, and the adaptability to locality of a variety of shrubs, formed important points of consideration.

During the summer of 1905 a detailed survey and division of the land into 40 acre lots was made by Messrs. Nelson Macduff and George Thorward of the University, and a detailed topographic map with a forest description by compartments preliminary to a regular working plan, has resulted. This spring the work was continued, the nursery increased, and an additional 10,000 trees set out. An attempt was made to stop sand-blows and moving sands which had become annoying along the beach, by seeding them to Black Locust. The greater part of the seedbed work involves White Pine and Western Yellow Pine, thus making this station on Lake Huron the second point in the State where the value of Western Yellow Pine is to be determined.

The work of the Forestry Department of the University of Michigan on its Saginaw Forestry Farm, the estate given to the University by Hon. Arthur Hill, was continued this spring with the assistance of the classes in forestry under the direction of Assistant Professor Mulford. The work of establishing regular forest plantations was continued as well as experimental work being undertaken in coöperation with U. S. Forest Service.

The forest planting of this year consists of a total of about

40,000 trees, comprising twelve species of hardwoods planted in separate or pure stands, and an additional plantation of White Pine. The hardwoods planted were: White Oak, Red Oak, White Ash, Basswood, Elm, Hickory, Walnut, Locust, Boxelder, Russian Mulberry, Norway Maple, and Beech, one-half to two acres of ground being devoted to each species. The spacing was generally 4x4 and 5x5, but was occasionally varied to 3x3 or 6x6.

The ground was plowed and harrowed and the trees dibbled in by the use of a spade, and an unusually favorable season has greatly facilitated the work. In addition to the regular planting considerable work was done in the forest arboretum, where a number of new species were added, and the plantation of old species augmented and improved. Fifty-six seed-beds were established, in which the plant stock of eight conifers and three hardwoods is to be provided. Among the species introduced here for the first time were the Western, Yellow, Sugar, and Jeffrey pines, the seed having been provided by the Forest Service.

The work on this farm was begun in 1904, and the plantation now involves about 80,000 plants and includes most of our common forest tree species, for which information is likely to be desired. Practically no cultivation was done on the 1904 plantation during the year of 1905, everything being left to itself. But in spite of this fact, all the plantations are in excellent condition and are continually proving instructive object lessons.

Assistant Prof. Mulford of the University of Michigan Forest School, left June 1st to study forest conditions abroad. His tour will last four months and take him through Germany, Switzerland, and Northern Austria, special attention being given to the Black Forest. On the completien of his trip, Prof. Mulford will resume his duties at the University of Michigan.

Frank B. Moody was recently appointed Assistant State Forester of Wisconsin. Mr. Moody is a graduate of Bates College, Maine, and of the University of Michigan Forest School. His field experience consists of nine seasons in the Maine lumberwoods and two field seasons with the Forest Service. His duties for the ensuing five months will be a preliminary study of the northern portion of Wisconsin with considerable work in timber sales and trespass cases.

As is well known, the Forest School at Cooper's Hill, England, was discontinued last year, and Dr. Schlich and his associates were transferred to Oxford where a course in forestry was organized. The course is designed to train students for the Forest Service in India and other British colonial possessions. The course covers a period of three years, two of which are spent at Oxford and the third on the Continent, chiefly in Germany. The course of study at Oxford comprises:

FIRST YEAR.

(a) Mathematics, (b) Chemistry of Soils, and selected chapters of Organic Chemistry, (c) Geology, (d) Botany, (e) Forestry, comprising Silviculture and either Forest Protection or Utilization, (f) Geometrical Drawing and Elementary Forest Engineering, (g) German.

SECOND YEAR.

(g) German, (h) Geology of India, (k) Botany, comprising Pathology, the Structure of Timber, and Special Systematic Botany, (l) Entomology, (m) Forestry, comprising Forest Management, Forest Administration, and either Forest Utilization or Protection, (n) Forest Law, (o) Surveying, (p) Bookkeeping in relation to Indian Forest Accounts.

During the two years' course at Oxford excursions are made to neighboring forests and a short tour of three weeks is taken to the forests of France. The practical course of the third year covers nine months. For the first seven months students are placed with selected German forest officers who give them practical instruction in forest management and in language. The last two months are spent in a visit to interesting forest districts on the Continent.

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UNPROFESSIONAL FORESTRY.

It ought to be a source of satisfaction to foresters when they find the work they have at heart going on outside the range of their knowledge and immediate assistance. When simple business interest dictates careful and conservative management on the part of forest owners, and this fact is clearly recognized, then, indeed, the cause is won. Just what the measures that embody it shall be, and just who are the best men to carry it into effect are matters that may be safely left for settlement by trial and time.

The Canadian maritime provinces afford many examples of such unprofessional forestry. In that region are numerous forest properties that have been cut over for many years and yet retain their growing power and value. A moist climate and a law-abiding population have secured considerable exemption from fire. Logging methods conservative of the forest have been employed. The temper of the owners has not been such as to force timber ruthlessly on the market. As a general thing only trees of good size have been cut, an amount of lumber frequently within the power of the lands to produce. That this policy has been a good one for all concerned would seem to be indisputable. The people and the operators have done well, and the lands, in spite of 50 years cutting, are more valuable at the present time than ever before. Some of these properties are handled today as nearly according to the principles of true forestry as is practicable.

An illustration of such methods was encountered by the senior class in forestry at Harvard University on its trip among the lumber camps last winter. The Hollingsworth and Whitney Company of Boston, whose mills are at Waterville, Me., is one of the largest paper manufacturing establishments of New England. This company, some 10 years ago, began a policy of land purchase, which it has consistently carried on until, at the present time it owns 100,000 acres of spruce land on the Kennebec River. This land they have operated carefully, intending to make it a permanent source of raw material for their mills. They tried logging by contract at first, but finding that the work was not done to suit them, bought teams and developed an organization of their own. This organization is fairly started now, and while methods of work are not yet perfected as they will be, enough has been done to demonstrate the intention of the company, and to furnish considerable insight into the best methods of controlling such work.

The principle of conservative cutting was adopted at the start, and is exemplified by the high size limit adopted as a general rule for cutting, namely 12 inches in diameter, breast high. Next the company early determined to mark the timber for cutting. This presents no obstacle in the way of cost—2 or 3 cents per M will cover that—but it does take determination on the part of the company, and it does mean thorough-going superintendence on the part of its responsible representatives to make logging bosses and choppers adhere to it. That it can be done, however, the experience of this company proves, and, as is so often the case with reforms of this kind, carried out in the face of strong opposition, former objectors, since they have got used to the new method, rather like it than otherwise. The company's lands, to be sure, were of such a character as to lend themselves to conservative cutting. It may, therefore, be safely said that, as far as the work has gone, a favorable result has been reached.

Economy in the utilization of the timber cut was, of course, the first thing looked after in the work of such practical, business-like men. Saws are used instead of the ax in cutting down and cutting off; all dead and down stuff in the territory cut over that remains sound is picked up as a matter of course; logs are run up into the tops of trees as far as the wood can be used in the mill; stumps are cut low enough to put to shame the standard of some much lauded examples of "forestry" elsewhere. A little trick used to secure economy in the latter direction is well worth noting. The trees to be cut are marked not on the trunk but at the base, at a height just above that at which the stump should be cut. The choppers then are required to take the spot off with the log, a very simple and conclusive evidence of good work.

It would be strange if in the course of only three or four years a large organization doing work of this nature should have come to the state of efficiency which could be desired, or which with time and effort will be attained. Habitually, in Kennebec logging two horses and a sled four feet wide for yarding purposes are employed, a type of rig which necessitates a wide road and a good deal of destruction of small trees. Much of the country and timber of the H. & W. Co. appears to be adapted to the Adirondack methods of yarding with a single horse, trailing or snaking one or two logs directly on the ground. The company is aware of the saving of growth by the latter method, and as soon as it can be done under favorable conditions will give it a thorough trial. The final decision between the two will depend on ratio of saving to expense.

Another point in which the work of the company may be criticised with a show of reason is that its method of cutting is too rigidly uniform; it does not allow sufficient variation to meet the needs of the case. The territory is in general well adapted to conservative cutting, but there are directions in which the present system does not meet the full requirements of the case. A good deal of fir below size limit standing on the ground will surely go to waste if left for the next cutting. Then there are places where the land had better be cut clean, and other places where scattering trees of merchantable size had better be left to stand either on account of expense or for the sake of young growth around them. The present practice of the company is perhaps best for the present, all things considered, but there can be no doubt that in the near future it should be changed. Possibly such change will require that a better class of men shall do the marking than those now employed, though the points involved are neither many nor difficult.

Lastly there is the matter of destroying small growth in felling trees, in swamping roads and similar operations. Change in the yarding method would do much to relieve that, but outside of this measure, reform is a difficult matter involving training of the woodsmen and, if possible, more permanency in the woods force. How much can be done in this direction is uncertain.

The statements above cover the main points involved in the system of conservative cutting, but there is one other achievement of the H. & W. Company which is well worthy of note. Like every other man and corporation doing business on the Maine rivers, though not all like them have been aware of the fact, they have been sufferers from the peculiarities of construction and from the tricks in manipulation of the common board rule. With the business in their own hands from the stump to the mill, they did not have to remain subservient to the custom of the region in which they operated. They have in fact gone back to first principles and devised a rule of their own which gives the actual contents of logs in cubic feet from measured length and middle diameter. A measure like that, discounted for bark as careful studies have shown them should be done, gives exactly the information about its logs the company requires when they are to be used in pulp and paper manufacture.

A few general reflections, which seem to be worthy of note, are suggested in this connection. The first is that work of just the nature here outlined is under the circumstances of the case, real forestry. That admitted, it is instructive for one thing to note what kind of men have been instrumental in bringing success about. William Lanigan, the head of the land business of the company, is an old Kennebec lumberman and log driver, one of those forcible and clear-headed men without much schooling, so common in all lines of American business. For a woodsman he has more than ordinary thoughtfulness and hospitality to new ideas. His time is spent mainly outside the woods directing logging operations only in a large way, keeping in touch with business both inside and outside his own concern. He is the man who devised the system of mountain watch stations, connected by telephone with the wardens below, which proved so efficient in preventing forest fires on the upper Kennebec last year.

Under him come the walking-bosses so-called, men who have general charge of a section of the company's woods operations. Lewis Oakes, who has charge of the eight or ten camps east of Moosehead Lake, is a land surveyor by training who has been familiar with timber and with logging since boyhood; and, while he may never have chopped, or run a camp himself, he knows perfectly well how it ought to be done. He looks out the location of the camps and main roads in summer, and, after logging begins, he sees to it, that the camps are stocked with tools, supplies and men, giving advice, settling disputes, and in general keeping things in smooth running order.

Camp foremen are an important item in the organization. These are men of the usual type and training, though a sifting process is constantly going on for the best and most efficient. The workmen, too, are like those found in other concerns in the region, many of them French Canadians. Nothing perhaps to secure the best work either need or can be done with them except to organize and watch their work and use them liberally in the matters of food, quarters and pay. The marking is done by bright young woodsmen who are paid about the wages of a cook or foreman. One man in the course of three months in the fall will mark all the timber that two or three camps will cut all winter. Here, if anywhere, in the matters of marking and inspection of logging work, is the weak place in the company's system.

The work of the Hollingsworth & Whitney Co. is believed by the writer to come very close to securing true forestry, as near certainly as any logging work carried on in the spruce woods of New England; and yet it is seen that in the company's organization there is no man of technical forestry training, no man who even calls himself a forester. That suggests to the mind of the writer that perhaps we who assume the professional name may in our enthusiasm and eagerness have valued our own usefulness and efficiency too highly. While we have been theorizing about forest management and drawing up plans which may or may not have had some effect on the lands to which they applied, other men in their own territory have been going ahead without advertisement or parade actually securing the real thing. The idea is worth pondering and the question that follows it—whether it is not they rather than we who are the real foresters of the country.

The writer believes that there is much truth in this suggestion; yet further reflection will show that neither forestry educators nor technically trained men need depreciate their services in the past, nor feel discouragement over future prospects. It is true in the first place that any attempt at conservative lumbering, such for instance as that described, is not altogether self-developed or self-maintained. In a measure the way in which they have gone to work, and in still greater degree the fundamental attitude of the Hollingsworth & Whitney Co. toward the timber land tributary to their mills are very largely the fruit of the literature with which the country for the last twenty years has been thickly sown. Business permanence as dependent on the woods, the forest as a field not a mine, the time element in the production of timber crops, the essential value of reproduction, the achievements of forestry in Europe—these ideas, propagated through forestry literature, are behind every attempt at better forest management today, and nothing has been or is more necessary than their propagation.

In regard to future management and the school-trained man there is just one thing to be said, but that is full of meaning and cuts in a multitude of ways. It is that when technically trained men can do the work required better than those who are now conducting it, they will get it to do.

Austin Cary.

RECENT FOREST PLANTING IN CONNECTICUT.

There are three main reasons why forest planting has been neglected in this part of New England. These are: (1) Danger from forest fires; (2) Ignorance as to the suitable species, methods of planting, probable returns, etc.; (3) Lack of plant material.

In Connecticut we are trying to overcome these difficulties, and the results are already reassuring. A law providing for forest fire wardens acting under the direction of the State Forester was passed by the last legislature, and although it is too soon to prophecy the results of this law, there is already a feeling of greater security, and some towns which have annually suffered severe loss have been free from fires the past spring.

Planting experiments by the Agricultural Experiment Station bear out the general testimony that White Pine is the best tree for planting, with Chestnut, Red and White Oaks, and possibly Scotch Pine as secondary species. In advising farmers and other land owners regarding the planting of old fields we avoid elaborate planting plans with complicated mixtures, usually advising a pure White Pine stand, the instructions for the establishment of which are naturally very simple.

Except in the case of very extensive plantations it is undoubtedly better policy to purchase nursery stock than to try to raise it, as the present high price of labor makes it impossible to raise seedlings on a small scale economically. This spring we sowed fifty pounds of White Pine seed in our nursery with the expectation of having in two years plants for sale as well as for our own use on the Station and State property. This seed cost on an average $1.90 a pound. As our experiments have shown an average of 6,000 seedlings from a pound of seed, this should insure a crop of 300,000 seedlings.

With the exception of a few thousand seedlings raised in our nursery and in those of various Water Boards there was no native supply of seedlings in the State this spring. Letters were written to the large nurserymen of the country asking their lowest figures for 100,000 two or three-year-old White Pine seedlings. The most favorable bid, for two-year seedlings was $3.75 per thousand. Other bids were up to $12.00 or even more per thousand. Order blanks were then sent to landowners of the State who were known to be interested in forest planting, stating that they could procure this nursery stock from the Forester at $3.75, plus cost of express. Orders were received for 80,000 White Pine, besides several thousand Norway Spruce which were purchased from the Evergreen Nursery Company at $3.00, and a few thousand Scotch Pine and Chestnut. No orders were accepted for less than 1,000 trees. In all 115,000 White Pine were ordered from the nurserymen, 20,000 being used on the new State forest in Union, and 15,000 on the Experiment Station sand plain at Windsor. Where 5,000 plants or more were ordered by one owner the shipment was made direct to him from the nursery, but the smaller orders were sent out from a central point in the State. Supervision of planting was supplied to all owners who desired it.

The first planting of the season was done early in April on old fields in Union, belonging to the State, at an elevation of about 600 feet. The shipment sent here arrived in much better shape than any of the later shipments, almost all of the plants looking vigorous. The ground was moist at the time of planting, and there were frequent rains the first week or so after planting, so that everything was favorable for success. Counts of several hundred, made the first of July, showed 85 per cent. alive. Though one of the least populated parts of the State, it was possible to get plenty of good American farm labor at $1.75 per day, while in some portions of the State not even the poorest labor could be obtained in sufficient numbers. Good labor even at high prices is decidedly economical in forest planting.

Summary of expense, reckoning forester's time at $1.75:

Cost of 1,000 plants	$3 75
Transportation of same	25
Cost of planting	1 66
Total cost of planting 1,000 trees	$5 66

As the trees were planted 5 x 6 feet, i. e. 1,500 trees per acre, the total cost of planting per acre amounted to $8.50.

Dr. Schenck offered one-year White Pine seedlings for sale at $2.50 per thousand, and 20,000 of these yearlings were planted in drills. It was thought that these could be set out in our nursery and grown for a year at a cost making them more economical than the two-year stock purchased at $3.75; and at the same time producing a more thrifty and acclimated stock. While the latter result may be realized, the cost of setting them out in nursery beds amounted to

$1.27 per thousand, so that with fifteen cents per thousand for transportation they have already cost $3.92, and the weeding for the season will no doubt add at least twenty cents more.

The planting for private owners followed that done on the State land, and lasted until the 20th of May. Most of this was an unfavorable season for planting, since it was extremely dry. None of the stock was equal to that sent to Union. Many of the bundles were either of poor stock or were so tightly tied and packed that the seedlings were mildewed, so that whole bundles had to be thrown away. For the first fortnight after planting it seemed that fully twenty-five per cent. were dead, but in many cases after the old needles had entirely dropped off a timely rain brought signs of life out of the buds, and the loss is apparently much less than was feared.

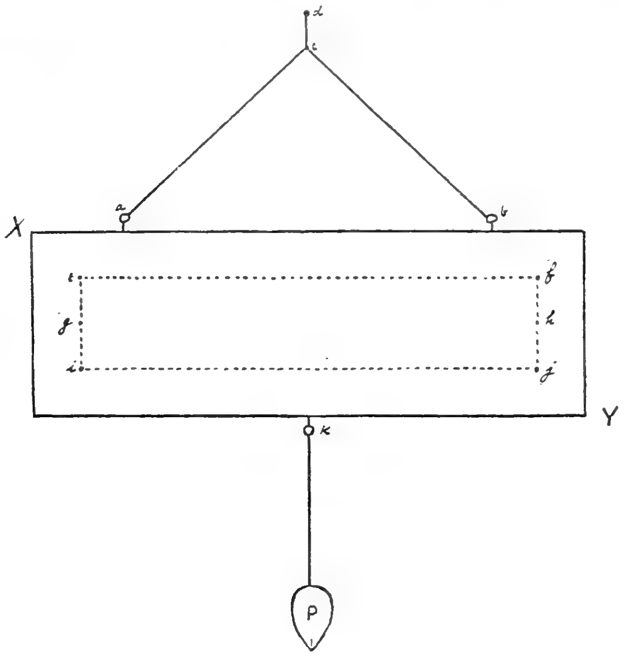
Some of the private planting was made on brush lands, so that while these are in foliage it is impossible to estimate the percentage of loss. One owner brushed out considerable land before planting at a cost of about $3.00 per acre. The total cost of planting in this kind of land with efficient labor was about $13.00 per acre.

The one-year Chestnuts which were planted have done particularly well, and the Scotch Pine and Norway Spruce seem to have withstood drought better, if anything, than the White Pine.

AUSTIN F. HAWES.

A HOME-MADE CLINOMETER.

It may happen that the forester located in some rough section of the country will wish to lay out a trail or road on a uniform grade. Should his kit lack a regular instrument, the following device will prove adequate for all practical purposes.



XY is a piece of board, preferably pine, one-half inch thick. For convenience it should be cut 12″ x 4″. On the upper edge are two light staples or screw eyes, equally distant from either end. A hard cord, *acb*, is carefully knotted at *c*, so that $ac = cb$. A large knot also is tied in the cord at *d*. In the center of the lower edge of the board, a plumb-bob, *P*, is attached at *k*. The points, *e, f, g, h, i,* and *j*, represent ordinary pins, driven perpendicularly into the wood, with about one-quarter inch remaining above the surface. The distance of *e* to *f* is ten inches. Along the lines *ei* and *fj* pins may be placed at any desired distances. In the illustration, the pins are placed one inch apart, so that in each case *eg, gi, fh,* and *hj* equal one inch.

To prove that the device is accurately made, the knot, *d,* should be taken between the thumb and finger and a sight made on some distant object across the pins *e* and *f*. The apparatus should then be reversed and the sight taken from *f* to *e*. If the two sights coincide, the object sighted at is on a level with the eyes of the observer and the device is in working order. If the second sight falls above or below the first sight, a point intermediate between the two should be selected, and the lines *ac* and *bc* so adjusted with the screw eyes or staples at *a* and *b* that the desired result is obtained. This last operation may require some patience as well as a little intelligence.

If a ten per cent. down grade is desired, the sight should be from *e* to *h,* or *f* to *g*. If the grade is up, the sight should be from *h* to *e,* or *g* to *f*. If a fifteen per cent. grade is desired a pin should be placed one and one-half inches from the upper pin on either vertical line. To arrange the apparatus for any desired per cent. of grade, taking it for granted that the distance between the parallel lines *ei* and *fj* remains ten inches, the per cent. should be treated as a whole number, one decimal place then pointed off, the result regarded as inches and a pin inserted at that distance on the lines *ei* and *fj,* measured from *e* and *f* respectively.

In actual operation surprisingly accurate results have been obtained with this simple device. It is to be hoped it may prove of value to some of the readers of the FORESTRY QUARTERLY.

G. W. PEAVY.

CURRENT LITERATURE.

HENRY S. GRAVES, *In Charge.*

Experiments on the Strength of Treated Timber by W. K. Hatt, Circular No. 39, U. S. Forest Service, Washington, 1906.

A concise summary of over 6,000 tests of the strength of treated and natural wood, made at the St. Louis Exposition during 1904.

A small timber preserving plant and testing labratory was erected by the Forest Service upon the Exposition grounds, in the "Mining Gulch," and treating and strength tests carried out according to plans drawn up by Dr. H. von Schrenk and Dr. W. K. Hatt. The treating cylinder and plant and the material for the experiments, which was in the form of railway ties, chiefly loblolly pine, were supplied gratis by parties interested.

The object of the tests was to determine the effect upon the strength produced by the processes of treatment; namely, steaming for various lengths of time under different pressures; impregnation of zinc chlorid solutions, commercially known as the "Burnettizing Process," and impregnation of creosote by means of pressure and vacuum.

The plan was to saw the ties into two portions, from which the specimens 2 x 2 inches in cross section for the various tests were subsequently cut according to a prescribed method. One portion of the tie was subjected to the desired treatment in the cylinder while the other portion was retained in its natural condition to be used for the "control" tests, the "control" being the basis of comparison for the tests made upon the treated portion. Tests were made immediately after treatment, soaked, air dried, and resoaked after air drying. The tests of strength were for compression, bending, shearing, spike pulling and impact.

In the results presented in thirteen tables the strengths are given in percentages of the control, thus showing clearly the relative values. It is pointed out that on account of the variability in the material used inherent differences may exist between the treated and control pieces which in themselves may cause a difference of as much as 6 per cent. in the strength. For this reason a variation of 6 per cent. or even more, in the tables may not of itself be of any significance.

In spite of the variability of the material, however, many points are clearly demonstrated. The effect of steaming only is shown to decrease the strength of the wood when subsequently wet according to the length of time under treatment or the pressure of the steam. Beyond a certain point in time and pressure a discoloration or scorching of the wood occurs. This limit beyond which scorching occurs depends upon size, quality, kind and moisture condition of the specimens. Seasoned full-sized lobolly pine ties began to discolor at 30 pounds steam pressure for 4 hours and 20 pounds for 6 hours. Green wood stands a greater degree of treatment than dry.

It will surprise many to learn that this steamed wood when again air dried, provided it has not been scorched, regains the strength of normally seasoned wood, but falls below that of green wood when again resoaked. It appears that the "Fiber-saturation Point" is permanently increased by the steaming process. In fact, as has been shown by tests made at the Yale Forest School, even air drying at normal temperature permanently increases the fiber-saturation point, thus reducing the strength of wet wood.

The creosote does not decrease the strength, according to these experiments, but it retards the seasoning operation.

When wood has been previously steamed and then creosoted, the strength is not less than that of the steamed wood. The creosote likewise retards the re-absorption of moisture.

The zinc chlorid does not weaken the wood, as shown by the tables, below that of the simply steamed wood, for static loading, but appears to do so for impact stresses.

A number of tests were made on full sized ties of seasoned loblolly pine and western yellow pine, but the results are very erratic or are inconclusive on account of uncertainty as to the exact moisture contents.

Experiments now being conducted by the Forest Service at the timber testing labratory of the Yale Forest School relative to the effect of various processes of drying in air and in steam at different temperatures and pressures should throw further light upon this subject. Great care is used in the selection and preparation of the specimens for the latter tests which was evidently impossible in the case of railway ties. The inherent variability between comparative specimens is thus reduced to a minimum, and the results show greater regularity.

The main points of the investigation are clearly recapitulated in the conclusion:

1. A high degree of steaming is injurious to wood, the injury depending upon quality and condition of the wood and the degree of steaming. For loblolly pine the limit of safety is 30 pounds for 4 hours or 6 hours at 20 pounds.

2. The presence of zinc chlorid does not weaken wood under static loads, but appears to make it brittle to impact.

3. Creosote of itself does not weaken the wood, but retards the seasoning.

The circular comprises 31 pages, 13 tables and 2 figures. The information given is not only new, but of great practical value to engineers dealing with treated wood. It will doubtless give an impetus to the use of proper preservation treatments.

H. D. T.

Sugar Pine and Western Yellow Pine in California, by Albert W. Cooper. Bulletin No. 69, U. S. Forest Service, Washington, 1906.

This bulletin reports the results of a study by the U. S. Forest Service in cooperation with the State of California. The author has given an excellent silvical description of the two species, including their distribution in California, and a full description of the forest types which they form. Many points of interest are brought out in this description, for example, it is stated that sugar pine is the most intolerant conifer in the Sierras, thus placing it below yellow pine and Douglas spruce. The scale of tolerance is: incense cendar, white fir, Douglas spruce, yellow pine, sugar pine. Such a scale is, of course, somewhat misleading because the requirements for light in different periods of the life of the trees, and it is very difficult to distinguish between the demands for light and demands for moisture. Thus Mr. Cooper states that sugar pine demands a certain amount of shade in early youth. This, taken together with other statements in the bulletin, would indicate that young sugar pines are sensitive to drying influences in youth. The silvical description of the trees is unusually complete, the author giving not only the scale of tolerance of the various species, but also comparing their capacity to bear shade and to resist fire.

One of the interesting statements made is that the Sierra forests are for the most part composed of even-aged stands. In view of this fact it is unfortunate that the stand tables were made to show only the relative occurrence of trees of different sizes. Readers would like to know olso the character of the forests with reference to the distribution of the age classes. The recommendation for the treatment of the forest is on a basis of cutting to a diameter limit. This is suggestive of the similar conditions obtaining in the pine and cedar forests of the mountains of India. There the forests in many places are composed of intolerant species occurring in even-aged patches similar to the conditions described in California. The first work of forestry on such areas is necessarily a conversion from the irregular virgin forests which are composed of even-aged groups of varying sizes to the regular even-aged stands which result after the lumbering.

The recommendations of Mr. Cooper seem to be very practical and they should result in a forest of high productiveness. They should insure excellent silvicultural results. A working plan for a specified forest reserve or a portion of a reserve would be of great interest, particularly in connection with the future yield of the even-aged patches, the distribution of the age classes and the guarantee of an indefinite supply of merchantable timber. The volume tables and tables of growth are of interest and value. It is unfortunate that the tables of growth are given without any explanation of the number of trees and range of trees classes on which they were based. It is my belief that the volume tables would be of greater value if constructed for a larger range of heights than merely two classes. Altogether, Mr. Cooper's bulletin is one of the best contributions recently made to the knowledge of American forestry.

H. S. G.

Grades and Amount of Lumber Sawed from Yellow Poplar, Yellow Birch, Sugar Maple and Beech, by Edward A. Braniff. Bulletin No. 73, U. S. Forest Service, Washington, 1906.

This bulletin is of special interest because it records the results of a new and very practical line of work by the Forest Service. The investigation is designed to show the amount of lumber of different grades in logs and trees of different sizes. The bulletin shows the results of the measurement of yellow poplar in the South and of the common hardwoods of the Adirondacks. The work is based entirely on mill scale studies. The yellow poplar was studied in large sawmills in south-eastern Tennesee and in Virginia. Nearly 1,500 trees were traced through a Tennesee mill and 315 trees were measured in Virginia. The actual product of each tree in lumber of different grades was determined at the mill and tables constructed to show the yield of trees of different diameters. From this table the actual value of the tree is obtained by assuming for each grade of lumber a certain value per thousand feet.

The various tables are of distinct practical interest. Thus, for yellow poplar, it is shown that although the amount of lumber of each grade increases with the size of the tree, the tendency is for the good grades rapidly to out-strip the poor ones. For example, the better grades increase from 16% for 13″ trees to 74% in the 70″ trees. The tables indicate what sizes of trees are profitable to cut and they indicate that lumbermen are now cutting a good many trees from which they obtain no profit, or which result in an actual loss. The tables show further that the increase of value of trees is so great with the increase in size that it will pay lumbermen in many cases to leave standing for future growth trees which are now being cut at a small or no profit. Thus the profitableness of care in lumbering and the desirability of conservative forestry is shown in a very practical way. The tables are not only useful in deciding upon questions of forestry, but are of great importance in placing a value on standing timber.

The results of Mr. Braniff's investigations are necessarily of local value. Ordinarily volume tables, and especially graded volume tables, based on diameter alone can be applied only to conditions where the average yield of trees is the same as that of the matrial used in the tables. In applying Mr. Braniff's tables to a specified tract of land it must be assumed that the number of logs in each tree will run about as in the trees used in constructing the tables, that the average crook will remain about the same, that the method of manufacture will be the same, including the waste by the saw, and that the portion of lumber of different widths will remain constant. Mr. Braniff's volume tables have the same effect as all volume tables for trees of different diameters, namely, that they are not applicable where the average merchantable length of timber differs from that of the trees constituting the basis of the tables.

The author has included a log table for the southern Appalachians. This table is of practical value where the forest conditions and the conditions of manufacture are the same as in the regions studied. Such a table is valuable locally just as a local volume table. I believe, however, that there should be a standard log table showing the product of sound straight logs and of the best conditions of manufacture and that local volume tables should be based on this standard table. Until the question of a standard log rule is settled, the construction of new local log tables is a misfortune rather than otherwise, unless it is thoroughly understood that it is intended only for local use.

H. S. G.

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Correction.—In the last number of the Quarterly, p. 122, the price of Mathey's *Traité d'Exploitation Commerciale des Bois* was erroneously stated as 1.35 fr. The actual price is 15 francs, a low one for the size and completeness in illustrations.

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FOREST BOTANY AND ZOOLOGY.

Cause of Flowering

The celebrated plant physiologist, J. Sachs, maintained that flowering was dependent upon the presence of certain materials, produced at certain periods and acting as stimuli. In the "Naturwissenschaftliche Wochenschrift" (1905, p. 573) the primary cause is sought in certain weather conditions which produce these materials and act upon them. That light is an essential factor in forming flower materials can be proved by placing plants in dark rooms, when no flower buds will develop; similarly, shrubs shaded on one side and exposed to sunlight on the other flower mainly on the latter side. Flower materials may, however, be deposited as reserve materials in bulbs, which may then develop flowers in the dark. Temperature also influences flowering favorably, but in the tropics excessive humidity may counteract the favorable temperature influence, so that trees from the temperate zones fail to flower, and the flowering time of the indigenous plants falls in the dry season. Again the practice of pruning roots to induce flowering means a reduction of water supply or of the formation of water-conducting tissue; on the other hand pruning shoots and thereby increasing water supply reduces flowering.

Prof. Loew, of Tokio, considers sugar the flower-forming material, and light, temperature, increase and diminution of water supply favor its formation, the latter concentrating the sugar in the plant; hence the remarkable flower show of cherries and plums in Japan, where the climate is the cause of the fall of fruit before ripening, which induces the deposit of the unused sugar as starch and fat in the bark and this concentration accounts for the profusion of flowers (152 flowers on 10 inches of shoot were counted).

These considerations may give a cue to the prediction of seed years even in forest trees.

Die Ursachen der Blütenbildung. Centralblatt für das gesammte Forstwesen. June, 1906, p. 286.

Germination Tests of Conifers.

A series of germination tests on a number of coniferous species made for several years at the Austrian Experiment Station is published by Cederbauer. The tests were made on clay plates with a temperature daily raised to 22 or 23 degrees C., sinking to 16 degrees. Other tests were made with filter paper in a germination chamber, keeping the temperature constant at 23 degrees C. The results in necessary time—of varying value according to the number of tests made—were as follows:

Picea excelsa, pungens, omorika	14 days
Picea nigra, sitkaensis	21 days
Pinus nigra, banksiana, rigida, balfouriana	14 days
Pinus pinea, halepensis	21 days
Pinus silvestris, murrayana	28 days
Pinus strobus	30-40 days (?)
Larix europaea	21 days
Pseudotsuga	28 days
Sequoia	14-21 days
Tsuga mertensiana, pattoniana	21 days
Chamaecyparis, various species	21 days
Cupressus sempervirens	14 days
Thuja gigantea	21 days

Hence from 14 to 21 days are sufficient with most conifers, only the pines requiring longer time. In *Pinus strobus,* after 30 to 40 days, the grains still found fresh should be added to determine the germination per cent. For *Abies* the knife test alone is desirable.

The germination is found by the author to be in relation to the time of seedfall, those seeds which are shed in the fall germinating very slowly, the ones falling in the spring or late winter germinating rapidly. The seeds which remain in cones during the winter, unlike those reaching the ground in the fall, find the conditions of keeping in rooms but little different from those in nature; they are easily kept and germinate readily at any time. Some, however, like *Abies,* require a "seed rest" before germinating. Fir seed placed in the germination chamber on November 12 did not germinate until the middle of December; those placed there on December 15 began to germinate on December 24.

Die Keimprüfungsdauer einiger Koniferen. Centralblatt für das gesammte Forstwesen. July, 1906, p. 306-315.

Ancient Forest Conditions.

Excavations of the old Roman town which existed near Königsfelden have produced a rich variety of utensils, among which are very many wooden ones; a wall built of oak piles, ties, and fir planks, all cut with axes, has some of the oak pieces 14 inches square and over 22 feet in length. The oak has turned deep black, the fir has retained its color, both being relatively sound, but upon exposure rapidly disintegrating. Identification of the woods has been made and will assist in determining ancient forest tree distribution. From the disclosures so far made it would appear that no changes of climate have been experienced.

Holzfunde aus römischer Zeit. Schweizerische Zeitschrift für Forstwesen. July-August, 1906, p. 215-217.

European Chestnut.

An exhaustive article by Böhmerle on the silvicultural characteristics and forestal use of the European Chestnut (*Castanea vulgaris*) is of interest to us only by suggesting similarities to our native species. In a stand of beech with chestnut, the latter, at 60 years of age, showed the following dimensions: heights, 18 to 24 m., diameters, 16 to 32 cm., with clear cylindrical boles. In other locations diameters run to 35 cm. at the same age.

gesammte Forstwesen. July, August, 1906, p. 289-306.
Die Edelkastanie in Niederösterreich. Centralblatt für das

Chlorosis in Spruce

A Norway Spruce in Aargau, Switzerland, 16 cm. in diameter and about 12 m. high, normally grown, has for several years produced annual shoots, all of them beset with needles varying from snowy white to pale green, gradually changing the color until in August it is normal. The tree stands on the outside of a woodland; hence lack of light cannot be the cause, and no other of the spruces show the phenomenon. The tree is about 23 years old, but the peculiarity has not been observed until about 5 years ago.

Migration of Birds. A very exhaustive discussion of the known and also of the unknown elements under controversy in the annual migration of birds by Dr. F. Knauer, makes interesting reading through four numbers of the Centralblatt.

Der Vogelzug und seine Rätsel. Centralblatt für das gesammte Forstwesen. April, May, June, August, 1906, pp. 212-217, 261-265.

ROADS AND SURVEY.

Transportation by Slides. The Swiss journal reprints in full with illustrations the chapter from Meister's well-known work on the city forest of Zürich which deals with the use of log slides of varying construction, specially developed in that forest. There are three types in use, the wire rope (overhead) slide, the wooden slide, and the wire rope road, a combination of the two. The earth slide is excluded, because steep slopes and horizontal terraces alternate.

The wire rope slide, with a carriage moving on the rope, is one of the most effective means of transportation in the Alps for the highest and least accessible points, capable of transporting small and large amounts across coves and valleys through the air. It requires yarding at the top and at the base and means of tightening and of braking the rope. It is applicable mainly for log transportation, working without regard to weather conditions and without damage to the logs. Its disadvantage is the necessity of working from a terminal yard and not along its line. It is also difficult and expensive to re-locate, hence is to be used mainly where permanent transport from a collecting point is intended.

The wooden slide, built of logs (see Forestry Quarterly, Vol. III, No. 2), is more generally serviceable than the former. It depends, as does the former, on proper grade, which, for the upper third, was found to require at least 15 degrees, if the two-thirds are to be run with less than 15 degrees. This consideration determines the possible length of the slide. The conditions in the Sihlwald terraces, with a maximum grade of 5 degrees, exclude long slides, which are otherwise desirable, the longest being less than 1,000 feet. They are either permanent or movable. The former, which used to be constructed of round poles, 5 to 8 meters long, with 12 to

25 cm. diameter, making the channel 0.7 to 1.2 m. wide, are now for the purpose of saving material, made of slabs from the mill 6 m. long and 3 to 4 cm. thick, which can be done more cheaply, and the saddles are made solid of sawed material. This is more expensive, to be sure, but the material can be used over again. This structure is also more cheaply kept in repair. The landing where the logs are ejected is constructed of stout beech planks and iron facings.

When constructed of logs, the cost used to be 40 cents per yard (m.) without, and 50 cents with the value of the wood included. Their efficiency is very high, the slides lasting about seven years. Their cost of operation is very low, consisting merely of throwing in the logs and in the amortization of the cost.

The movable slide is made of trough sections, each consisting of two half-inch boards, 10 to 14 inches wide and 16 to 20 feet long, to be placed on saddles of two poles, set in the ground slanting toward each other and tied together at the top, costing about 40 cents per meter and 4 cents for placing the trough. These are very effective, lasting 3 to 5 years, and by using thin beech boards on the inside may be made to last even longer.

Neither of these devices, however, was efficient in transporting small firewood. To facilitate this, a combination of the wire-rope and log-slide systems is used. In this wire-rope road a sled-like, solidly constructed carriage moves on a roadway, constructed by laying and fastening leading poles, 4 to 5 inches in diameter, along the inside of the log slide, the cross ties of the sled being cut out so that it must move on the poles. The wire rope, running over two rolls, has a loaded sled at one end, and an empty one at the other end, the velocity of the movement being regulated by a brake. Near the middle of the road the empty sled is switched vertically above the loaded one by running upon a short stretch of higher balanced sledway, which elevates it above the loaded sled and automatically returns it to the slide. This structure has proved itself in all respects superior and can be used either without the sled as a slide for transporting logs or with the rope and sled.

Die Riesen. Schweizerische Zeitschrift für Forstwesen. July, August, 1906, p. 217-226.

SILVICULTURE, PROTECTION, AND EXTENSION.

Length of Life of Trees.

Dr. Kanngiesser has collected authentic (as far as possible) data on the age of known trees, beginning with the *Cupuliferae,* a family which contains only trees and shrubs. The two sub-families, *Betulaceae* and *Fagaceae,* differ in duration and in diameter growth, the former being in this respect at disadvantage. *Betula alba* is said, as a rule, not to exceed 150 years and 50 cm. in diameter, but a specimen on the decline to be sure, of 250 cm. circumference (16 inch diameter), is found at Landshut. *Alnus glutinosa* may reach 100 years and 1 m. diameter. The same age is ascribed to *Corylus avellana,* with circumference of over 1 m.; while *Carpinus* may reach an age of 250 years, and a specimen with a diameter of 3 feet is in existence. *Ostyra,* on the contrary, is rarely found over 100 years. *Fagus silvatica* is said to grow rarely beyond 250 years, and less in the valley. The age can, of course, be only estimated by the use of growth rates. Kerville has carefully determined the age of the beech at Montigny, the largest on record, with a circumference of 8.2 m., as at least 630 years, and possibly 930; other beeches with circumferences of 5.43 and 5.55 m. were estimated by him as between 375 and 575 years old, while two beeches in Switzerland and Hesse, with 5.3 and 5.39 m. circumferences, are estimated as 300 years.

Of the two species of German oak, great difference in age and size is noted, *Quercus sessiliflora* being the smaller and shorter-lived, the largest near Plantis in Normandy having a circumference of 5.03 m. This seems to be also the case with the American oaks, the circumference of 8.4 for a specimen of *Q. bicolor* near Genesee, being considered unusually large. [Much larger trees are often found —see Sargent's Silva—but when for purposes of the Centennial Exposition the editor tried to secure a tree actually 400 years of age, he was unsuccessful. Ed.]

In a list of 22 noted oaks of *Quercus pedunculata,* the largest living one is found in England, the celebrated Cowthorpe oak near Wetherby, which is estimated to be 1500 years, with 13.5 m. circumference at 92 cm., and 11.5 m. at 1.65 m. A very close second is found at Villedieu, France, 12.29 m. at 1 m. height, the age not estimated. Quite a number range between 8 and 10 m. and estimates of 700 to 1,000 years are supposed to be within reason.

Castanea vesca seems in age not to fall behind these oaks, and the celebrated Chestnut at Tottworth, Gloucestershire, measures at 1.23 m. even more than any of the oaks, namely 15.2 m. in circumference. A tree at Donnersberg, Germany, with an estimated age of 700 years, has only 9 m. circumference at a height of 1 m. The chestnuts on Mt. Etna, with 20 and 21 m. circumference, are widely known, but their age is not ascertainable.

The *Pinaceae* seem to be as much favored in regard to longevity as the *Cupuliferae,* and they attain, at least in height, as large and larger size.

Juniperus communis, perhaps the smallest of the European species, according to Killman's exact investigations on northern plants, attains more than 400 years, and one tree, of only 8.3 cm. diameter at the base, was 544 years old.

Thuja occidentalis (?) of 2.9 m. circumference at the base and 1.97 m. at 2 m. is estimated at 300 years.

Of *Sequoias* only one, measured by Seeman long ago (1859) with 9. 6 m. at base and 4.5 m. at 30 m., 1120 years old, and another of 4.7 m. diameter and 1316 years of age, are noted. [We know that they grow to 30 feet in diameter and over 2,500 years of age.] The specimen of *Taxodium distichum* in Santa Maria de El Tule, Oaxaca, Mexico, with a height of 34 m. and a circumference of 33 m. at 1 to 1.5 m., was estimated by DeCandolle at 6,000 years, an age which is also supposed to be attained by *Adansonia digitata* and *Dracaena draco,* two African species.

Cedrus deodara, with dimensions of 11 and 12.5 m. circumference, are variously estimated at 500 to 600 and 2,500 years, the latter number probably very much too high.

Abies pectinata have been estimated at 200 to 360 years, with 4 to 5.6 m. circumference and 35 to 36 m. height. The stoutest and probably the oldest is to be found in the Jura mountains near Cergnes, which at 1.2 m. (breasthigh) has a circumference of 6.9 m., and a height of 32 m.

Picea excelsa with 5 to 6 m. circumference are frequent in the Bohemian forest. A spruce in Silesia 5 m. in circumference and 48 m. high, and others in Switzerland and Bavaria with smaller dimensions are estimated at 350 to 400 years. Some dwarf specimens near the timber limit on the Kola peninsula with diameters of 32 to 80 cm. allow from the ring counts of some an estimate of 700 or more years.

For *Larix europaea* an age of five centuries is assigned to a specimen in Switzerland at 1350 m. elevation, with 7.5 m. circumference breasthigh and 29 m. height. Actual counts in *Larix dahurica* show 166 and 217 years, with 8.5 cm. and 21 cm. diameter respectively.

Pinus silvestris reaches ages above 300 years, but is rarely over 3 m. in circumference. A specimen near Liegnitz, Silesia, is reported with 4 m. and a slightly larger one was cut at Lauterbach, Bavaria. A dwarf from the Kola peninsula with only 8.7 cm. circumference and 11 m. height counted 316 years; another from Siberia, 413 years.

The Mountain Pine, *Pinus montana,* attains an age of 150 to 200, and *Pinus cembra* an age of at least 600 years.

Some data of the New Zealand conifers, Kauri Pine, Dammaris, etc., show them capable of attaining 8 m. in diameter and probably 4,000 years of age.

Some 28 specimens of *Taxus baccata* are tabulated, in which English trees especially figure. These are estimated at ages from 900 to 2,000 years, up to 18 and 20 m. high and with circumference in many cases exceeding 5 m.

Ueber Lebensdauer und Dickenwachstum der Waldbäume. I. Cupuliferen. II. Pinaceen. III. Taxus. Allgemeine Forst- und Jagdzeitung, June, July, August, 1906, pp. 181-184, 217-220, 253-255.

Dormant Seeds.

In support of the theory that the sudden appearance of a different vegetation in deforested places is due to seeds which have lain dormant in the ground (see Forestry Quarterly, Vol. IV, No. 2, pp. 141 ff. for opposing theories), an anonymous writer cites two cases.

In 1872 the botanists of Nancy were surprised by the appearance of *Euphorbia lathyris,* a milkweed, in large quantities in a two-year old cutting where it had not been known before. Two years later it had vanished entirely, but was found in dense thickets in another cutting of two years before, while in a three-year old cut only scattered individuals were found. Experimentally *Fliche* established as correct the natural assumption that the growing forest drove out the weeds. These places were distant from human habitations, but some forty years before the remnants of some Gallo-Roman iron furnaces were discovered, and since the Romans used to cultivate this plant for medicinal purposes, Fliche does not doubt that it was introduced by them and its seeds continued to exist in a condition of retarded life.

The other case was observed in the forest range of Hersfeld, where in the 90's a fire destroyed a 10- to 15-year old pine plantation, which had replaced a poor pine stand of 50 to 60 years of age. Afterwards the five large masses of *Spartium* (*Sarothamnus*) *scoparium,* hitherto unknown here, covered the burned area so that in the replanting with spruce it occasioned trouble and expense. Dormant existence of the seed for at least 60 to 70 years is supposed to be the only explanation, as the seed is too heavy to be carried by the wind, and since none, or few plants, of this species are to be found in the neighborhood, the work of birds is excluded. Since the plants did not appear when the old stand was removed, the need of fire to start the seed seems also proved.

Schlummernde Samen. Centralblatt für das gesammte Forstwesen. May, 1906, p. 234.

Theory and Practice in Regeneration.

In a short article Forstmeister Blum points out that, although from the instructions on paper of the Bavarian forest administration one would think that regeneration under nurse trees is general practice, actually these instructions are not and cannot be followed generally. *"In the over-mature, dilapidated and thinned out virgin stands and remnants of such stands, with soils partly covered with raw humus, partly weedy, which the Bavarian forest administration has worked for decades and will have to work for decades, the practice has developed a management which has little or nothing to do with the compartment system under nurses."* In such old stands, which, since they were culled, have developed an undergrowth of beech, this advance growth, so far as it is not worthy to be preserved, is cut out; the better are placed in position to hold out and grow into the stand. *Then broad strips are cleared and planted to spruce, using the beech groups, if any, as filler.* [A method similar to that which was adopted by the New York State College of Forestry. Ed.] Only in small portions is the natural regeneration practiced; in large areas it requires too much assistance by planting. The larger part of the young growths of the last decades has its origin in artificial plantations. "In spite of the most beautiful *termini technici* this management can hardly be called natural regeneration."

Aus der Theorie und Praxis des Femelsclagbetriebes. Allgemeine Forst- und Jagdzeitung. May, 1906, pp. 149-151.

Difficulties in Regeneration. An advocate of natural regeneration, Forstmeister Eulefeld, in an address to private forest owners admits the difficulties which beset the methods of natural regeneration. The results of these methods in young stands do not in most, or many, cases justify the hope that they will grow into the same satisfactory old stands which we inherited from the past. While soil exhaustion may have something to do with this failure, conditions of soil cover and of the tree crowns are most essential factors in the success of natural regeneration.

The soil cover consists of humus layers and plants. While the significance of the former is recognized, it is not well understood. The soil surface conditions may offer almost insuperable difficulties to regeneration. In the close deciduous woods an excess of foliage litter prevents access of air to the lower strata and keeps out a soil flora which would assist in desirable humification, or when thinned out conditions are so changed, especially on south and west exposures, as to produce a turfy humus, absence of time facilitating this deterioration. In the dense coniferous forest on rich and moist soil excessive moss growth is apt to come in on sand soils. and in open stand heather, huckleberry, and moss make a dry, powdery humus.

These malformations of the soil cover the forester must try to avoid by early management of the stands. This is done by developing proper crowns, not broom-like, short crowns, occupying 1-6 of the bole, which are the result of densest position; but crowns which extend to 1-4, 1-3, or even a larger proportion of the bole length. Rounded crowns with horizontal, much ramified branches are able to re-establish easily a desirable crown cover after thinnings. They admit a satisfactory degree of water, air, and light to the interior and the foot of the trees, which expedites satisfactory humification.

The herbaceous vegetation and the oxygen from water and air increase and invigorate bacterial life, which, by assimilation of nitrogen and otherwise, influences tree growth to an as yet unknown extent.

The increased access of light not only increases wood formation, but, by increasing the albuminous reserve materials, stimulates seed production of viable seed. Better seed is formed on polewood than on the old trees which have stood in close stand. The lack of thinning practice in the past seems to be the main reason for the diminished seed production and less frequency of seed years.

To avoid the ills in the coniferous forest, especially the growth of heather and huckleberry in the pine forest, mixing with shady deciduous species or spruce is the remedy. Underplanting with beech is good, but expensive. "If such care is exercised, which, to be sure, makes great demands on the manager, the soil will be kept in such condition as to make regeneration by natural as well as by artificial means easy," and especially by developing larger crowns (1-4 to 1-3 of the shaft length) better seeds will be secured. Examples to show the dependence of the character of the crown on the quality and quantity of the seed and the results in the regeneration are adduced.

Again, the author accentuates the difficulty of securing desirable natural regeneration, which he desires to see accomplished in groups, beginning by opening up over volunteer growth, avoiding any regular opening up, but enlarging the groups gradually and planting in where natural regeneration does not find appropriate conditions.

In deteriorated soil conditions of the pine forest, he advocates the use of fire, hoeing off the surface, burning it in heaps, mixing the ash with the soil, and sowing pine and spruce and larch. The greater expense, the author claims, is repaid by the fine development of the growth which closes in a few years.

He formulates his advice as follows:

(1) Natural regeneration is to be employed wherever it can be successfully done.

(2) Artificial reforestation is to be done by sowing wherever possible. Especially the light-needing species, which as a rule have also deep-growing roots, are to be so regenerated. For conifer sowings broadcast sowing with 14 lbs. to the acre is preferable.

(3) If possible, the artificial regeneration should be started under the shade of the overholders, and under such conditions planting is also successful. Or else, in spruce, the clearing is to be made in narrow strips.

(4) If clearing cannot be avoided, then at least the areas should be kept small.

(5) Always, even with conifers, secure mixed forest.

The author admits that over large areas planting cannot be avoided. He reviews the history of planting, which would show that the practice has become general only since the 80's, since when spruce especially has been planted in large quantities, and further increase in this direction is predicted. Commercial nurseries have supplied the plant material at lowest prices ($2 per 1,000 transplanted 4- to 5-year old spruce at Halstenbeck). Planting with the ball of earth, which was extensively practiced in the 40's and 50's, is almost for-gotten. Lately the practice of making light sowings in the nurseries and thinning out the sowings to secure without transplanting plant material fit for the woods has come into use. This the author considers an advance—to the more natural. In managing the nursery, aeration of the soil by constant cultivation supplants a good deal of fertilizer; a saving here is as erroneous as in not currying a horse.

In the future transplanted plants will become necessary and then more careful selection of the expensive plant material is indicated. With spruce, transplanting with balls from sowings in the woods is most successful, and the cost should be kept within $1.25 per thousand, whereas sowing cost $1.50 to $2.00 per acre. Only the best seed and the best selected plant material should be used.

Waldverjüngung und Pflanzenerziehung im Walde. Allgemeine Forst- und Jagdzeitung. August, 1906, pp. 259-264.

Influence of Thinnings on Form.

Following up the strictures which Schiffel made on Kuntze's work on the subject (briefed on p. 158 of this volume of the Forestry Quarterly), a short controversial correspondence between the two would make it appear that a misunderstanding gave rise to the strictures, Kuntze disclaiming to have discussed the broader question of the influence of different degrees of thinning on *stands.* Merely the influence on the shaft form of the *single tree,* the average class tree was investigated, with the result that thinning up to the C-grade improves, or at least does not impair, the form of spruce.

Machinery in Forest Culture.

While most forest land is located where soil conditions do not admit of the use of plows or other machinery for cultivation, yet there are sufficient areas where such tools can be advantageously used, especially where labor is high and scarce, and hence rapid work needful. The many failures of natural regeneration and the need of more intensive management for saw timber have led in Germany to abandonment of the method of natural regeneration, substituting clearings in narrow strips, followed by artificial cultivation. Deep plowing with an underground plow after surface plowing with a shallow surface plow produces conditions which, especially for deep-rooted species like oak and ash, are reflected in superior development. The ash, inclined to forking and growing slowly with open crown in shallow cultivation, produces fine stands when the ground is deeply plowed and densely sowed. Under similar treatment oak will furnish a dense stand over 12 feet high in seven years. Scotch Pine plantations respond similarly favorably to such deep cultivation.

The surface plow makes a shallow furrow, turning over a balk on each side; it is run so shallow that the humus surface cover remains as much as possible in the furrow. The furrows are run north and south in order to utilize the protection of the balks against frost.

The underground plow stirs up the soil in the furrow to the depth of 10 to 12 inches. Naturally soil conditions influence the applicability and the cost of this method.

The underground plow in the market under the name of Eckert has in many cases proved undesirable, but by a mere substitution of a disk (2 feet in diameter) and two wheels, for the coulter knife, Thaler has so improved the utensil that it has become more generally useful. These improvements lift the plow over impediments, and only two, rarely three horses are required to work the underground plow. A forked chain attached to the stem and two front wheels, which can be regulated as to length, give a steadier motion to the plow.

The surface plowing with two horses and two men, making the furrows 1 m. apart and 16 inches broad costs about $2 per acre; the work of the underground plow with three horses and three men, going 12 inches deep, about $3 per acre. In another case where only two horses were employed and handwork in part substituted, the cost came to nearly $9 per acre. In a light soil and not much roots, it could be kept as low as $4. These improved underground plows, illustrations of which are given, may be had for less than $30.

Mitteilungen über die Leistungsfähigkeit des verbesserten Eckert'schen Shäl- und Untergrundpflugs nach mehrjährigen Erfahrungen im grössern Kulturbetrieb. Allgemeine Forst- und Jagdzeitung, May, 1906, pp. 145-149.

Black Walnut.

An attempt to encourage the planting of our Black Walnut (*Juglans nigra*) in Austria is being made, and instructions for its propagation are formulated by Boehmerle. Rapidity of growth is one of the foremost recommendations of this species, and a number of measurements are given. These run in a 14-year old stand as follows: Height, 6 to 11.5 feet; diameter, 0.8

to 2.4 inches; while two 80-year old trees, grown in the open, were 55 and 66 feet in height and 35 and 24 inches in diameter, with crowns spreading 50 and 65 feet 8 to 10 feet above the ground. This tendency to spread and grow into branches, behaving somewhat like beech, makes it necessary to plant close, and, if possible, with even more rapid growers, like ash, as nurses or admixture. The species is lightneeding, hence if mixed with shady species like maple or beech, these must be slow growers.

In an 80-year old stand of 2 acres, where it is mixed with oak and maple on a favorable site—deep, humase, sandy loam soil in a cove with southern exposure—the 38 trees have diameters of 11 to 27 inches and a height of 90 to 95 feet, with excellent form, the crown diameters being 18 to 38 feet, and the average contents 92 cubic feet per tree. The oaks and maples, planted at the same time, have hardly the diameters and are lagging far behind in height. These trees bear annually from 24 to 28 bushels of nuts, which showed a germination per cent. of 90; usually 80 per cent. is considered good. One bushel weighs about 175 pounds and contains about 1,150 nuts or 66 nuts to the pound, which is sold at 4.5 cents in Vienna.

Other points in favor of the species, besides its great usefulness and high price for wood, are its immunity from insects and damage from game animals. It is said to be very sensitive to late frosts, which is not the case in its native habitat.

Regarding its cultivation, the following points are given:

The most suitable soil is a deep, fresh, not too compact, mild, loamy sand. The nuts, freed from the green shell, are wintered in sand. [Unless planted in the fall, which is better.—Ed.] In planting them, preferably using nuts directly, they should be carefully placed with the germinating point downward, 2 to 3 inches deep. If plants are first grown in the nurseries, the pruning of the very large tap root, as with all taproot trees, has the effect that at least for two years the height growth is retarded. Though lightneeding, it requires in its youth side protection and partial shade.

Die Anzucht des Nussbaumes in Walde. Centralblatt für das gesammte Forstwesen. May, 1906, pp. 203-211.

Afforestation of Mossy Wastes.

Afforestation and reforestation of wastes will soon become good policy in the United States, as it is in the older countries. This restoration of lands to useful production does not refer to mountainous country only, but also to swampy lands or moors in the plain. The methods and results of a rather extensive afforestation which has been in progress for 20 years on the "Grosse Moos" near Murten, Bern, Switzerland, comprising about 18,000 acres, of which 2,500 were planted, are reported by Liechty, with illustrations.

The moor was apparently at one time forested, as fossil logs and roots testify. An impenetrable loam subsoil at a depth of from one to six feet, accounts for the formation of the moor. Twenty-five years ago, by the lowering of the level of the two adjoining lakes, this area was drained and made accessible to agricultural cultivation. At the same time the shorelands, to the amount of about 7,000 acres, were laid dry, presenting sand dunes and rocky wastes. Partial reforestation of the former and entire afforestation of the latter by government and municipalities was decided as necessary. On the moor, it was decided by the cantonal forest department to plant strips of coniferous forest, Scotch Pine, Norway Spruce, and White Pine, Alder being used as nurse—a daring plan considering the site, but by its results proved satisfactory.

From the start the Spruce showed as thrifty development as on better sites, rapidly covering the ground, suppressing the grass, and forming the best windbreak. Lately the planting is done on balks, formed by plowing together two furrows the year before planting.

Little damage by frost was experienced, due to the thorough draining. In a 17-year plantation, after the Alder nurse stand had been removed, the Spruce stand was perfectly closed, with a height of 25 to 30 feet, annual leaders sometimes exceeding 3 feet. It is expected from the appearance of older stands that they may satisfactorily grow to telegraph poles and small dimensional material.

On loose, brown imperfectly decomposed turf the Spruce showed undesirable development, which was corrected, with good effect hitherto, by application of Kainit and Thomas slag; but it will probably change to deciduous forest (poplar and alder).

The Scotch Pine, otherwise so adaptive, does not do well on the moor, remaining short and spreading, good for a wind mantle on the outside of the plantations.

The White Pine, planted with Alder as nurse, has proved itself adapted, at least on the better sites, in the mixture with the other species.

On other, deeper portions of the moor a composite forest was attempted, with Ash and White Birch as overwood, and the same species with Black Alder added, as underwood. All three made thrifty growth, the first cut being made in 6 to 7 years, after which a rotation of 10 to 12 years is proposed. It was found that accidental White Alders were preferable, propagating by suckers in addition to stock sprouts. The Ash first suffered from frost, but became better and better adapted. The Birch was found good for overwood but poor for underwood, its stocks often giving out in 20 years.

On the shorelands (absolute forest soil) composite forest was also established, with Ash, various poplars, Elm, and Black Elder as standards, White Alder, Ash, Caspian, White and Fragile Willow as underwood. The poplars, Black, Silver, and Aspen, did particularly well.

On the poor shifting sands, willows are planted only for soil cover—for osier rods the sites are too poor—and hence, the cheapest method was desirable, sticking 14-inch cuttings at 3-feet distance with an iron dibble for about $3.00 per acre. This produced the desired result, binding the shifting sand in the second year. After 10 to 12 years the willows could be cut, and were then replaced by Alder with the addition of Poplar, the evolution from waste to forest.

On the better portions of the shorelands White Alder was planted, and after two thinnings underplanted with Spruce with good result.

Altogether some 2,500 acres were reforested, and within 30 years have produced the desirable climatic changes which permit successful agriculture.

Beobachtungen auf dem Gebiete der Moosaufforstungen. Schweizerische Zeitschrift für Forstwesen. May, 1906, pp. 141-151.

Reforestation in Nova Scotia

The owner of a hundred-thousand-acre tract of forest land in Nova Scotia makes some very interesting observations with reference to reforestation in Canada, from a practical as well as from an economic point of view. On a burned-over area of 10,000 acres of spruce land in the above-mentioned tract, all the timber, large and small, is being worked into lumber and the ground cleared. Following the Swedish system, seed is planted instead of young trees. About a dozen boys work in a row, from 3 to 6 feet apart. A small hand iron is used for making planting holes. A man goes behind to keep the boys in line. Four or five seeds are dropped in each hole. Boys average about 5 acres each per day. It is expected that in 25 years the trees will have reached sufficient size to be suitable for pulp. Under natural conditions that time would have been consumed in making a valueless crop of bushes and hardwoods, before the beginning of spruce reproduction. In Sweden, this planting is done for 25 cents per acre, as against a cost of about $10 per acre, where seedlings are planted.

It is stated that the accessible Russian forests are practically all exhausted, and that those of Finland and Sweden are very nearly the same. In 15 years the pine in our Southern States will be exhausted. The future demand upon the Canadian forests, both for Great Britain and the United States, will be far greater than ever. The Canadian forests have been grossly mismanaged, and an immediate and effective system of reforestation is absolutely essential unless the process of depletion is to become total.

Letter from Mr. Louis Miller. Canadian Forestry Journal. May, 1906, pp. 74-78.

Cure for Avalanches and Torrents.

The details of engineering works and reforestation for the purpose of preventing damage by avalanches and torrents in Tyrol (Schmittenbach) are discussed, with illustrations, by Dr. Fankhauser. Generally, in this part of the world, forest destruction and the consequent abrasion and denudation of the mountain slopes has progressed to such an extent that more reliance is placed on dams and other engineering works than on forest planting; but in the particular place under discussion, considerable planting has been done after the danger from avalanches has been removed. This was done with perfect success by building a wall on the very crest of the somewhat steep slope of the Schmittenbach. It was observed that here every winter a hanging snow shield was formed under the influence of west winds, which, protruding, often attained a height of 25 to 30 feet, and breaking off with mild weather, caused the avalanches. The wall, about 150 feet long, was built in three tiers, 10, 12, and 13 feet high, each 32 feet, the middle tier 22 feet in front of the snow field. The following winter it was observed that the snow accumulated uniformly on both sides of the walls and within 25 to 30 feet assumed its natural depth; no snow shield formed along the structure, but on both ends of it; hence an additional dam of about 1400 feet length, 12 feet high and 3 feet top width, loosely constructed from material at hand, was erected. To protect the slopes of the dam sloping 1 in 4 feet, they were carefully paved, and in addition short spurs were built on both sides every 75 to 100 feet, to induce more even distribution of snow. These simple structures have worked with perfect success in preventing avalanches for the last 8 or 9 years.

In order to secure the full benefit of the reforestation work, the pasture of goats had first to be stopped and the torrent regulated by engineering works of the familiar type, barrages of dry wall work, and drains by covered and open paved ditches, and wickerwork to hold steep ground. The effectiveness o fthe latter is illustrated by three illustrations of the same area, showing the changes after three and five years. In three years a close wood growth of White Alder was already established and after five years, spruce had begun to creep in by natural sowing, and the protection was perfect. The wickerwork, of course, presupposes a quieting of the waters by the other means cited. Without such, the wickerwork can only retard the superficial washing, but is apt to slide together with the ground. Usually this wickerwork is expensive (20 cents per yard) and hence is dispensed with.

Reforestation was begun by sowing Alder seed mixed with sand and wild flower seeds, followed by planting 3-year-old spruce transplants and 2-year-old larch seedlings, and, in the higher altitudes, 4- to 6-year-old Pinus cembra; here, near the region of the avalanches, group planting is most adequate. The cost of the different works and plantings is given.

In addition to the work at the head to regulate the lower course of the torrent, the building of overall dams, a stone chute, and 4,000 feet of side walls to keep the waters within bounds were required. A special feature here are series of traverses, made at small distances across the bed, by driving into the river bed three to four rows of piles 5 feet long and 5 to 6 inches in diameter, and filling between them solidly with stones cemented together, where needful, so that a fall of 12 to 20 inches is formed. These traverses have proven very effective where in front of larger dams the tendency to wash out the bed is to be prevented.

All this work, the author states, quite unostentatious, is nevertheless not only most effective, but done with relatively small means and in such a manner as to require a minimum of maintenance cost.

Die Bezähnung des Schmittenbachs. Schweizerische Zeitschrift für Forstwesen. July, August, 1906, pp. 205-214.

Protection against Snout Beetles.

A novel method of protecting young plantations against snout beetles and other insects is proposed by Forstmeister Lischka in Oesterreiches Forst- und Jagdblatt, namely by ants, where these are attainable. For this purpose every 60 yards or so holes one foot deep and 16 inches wide are dug in the newly-made plantation and filled with dry brush. The brush is burned, and enough fed in to fill the holes half full of ashes. Accessible ant hills with eggs, pupae, etc. are then taken up with spade and bag, and from 8 to 10 quarts of this material placed in each hole, when a new ant hill will be established in each hole and the adjacent area kept free from insects.

Waldameisen zum Schutze junger Waldkulturen. Centralblatt für das gesammte Forstwesen. June, 1906, p. 287.

MENSURATION, FINANCE, AND MANAGEMENT.

Taxation of Woodlands.

The question of taxation of woodlands, which lately has been much agitated in the United States, is not finally settled even in the old countries. It formed a leading question at the sessions of the German Forestry Association two years ago and of the Forstwirtschaftsrath one year ago (see FORESTRY QUARTERLY, Vol. III, p. 209), without any practical outcome, although the arguments were supposed to be theoretically correct, even if practically not readily applicable. Oberforstrat Frey attempts to bring theory and practice into harmony and to secure a just assessment of taxes merely as a property, peculiar in its character, but not especially to be favored.

There are three kinds of realty tax recognized in Germany: soil tax (Grundsteuer), property tax (Vermögensteuer), and income tax (Einkommensteuer).

The first, or soil tax, is a purely objective tax, which attaches to every realty without reference to personality or financial capacity of the owner, assessed upon the capacity of production (Ertragsfähigkeit) of the land, and is expressed as a percentage of this capacity. Not the actual yield, but the yield capacity is assessed, no matter whether the owner lets the land lie barren or uses it not in a manner most suitable to its capacity. Hence this tax leaves out of consideration whether the piece of land bears forest or is improperly stocked; the site quality alone is involved in determining the amount of average wood growth to be estimated, which, figured at the current price per unit, less hervest cost, gives the capacity of production of a properly stocked woodland, relatively as correctly as the capacity of a farm land or meadow may be estimated on a similar principle. Since, however, such a yield can be secured annually only when the area is stocked with the normal stock, the annual interest on the capital involved in the normal stock is to be deducted in order to secure the correct net yield on which to determine the soil rent.

For instance, if timber forest is managed in 80-year rotation, coppice in 20-year rotation, an expression for the value of the normal stock or wood capital is found according to the formula $N = {}^{r}/2\ I$, i. e. multiplying the net money yield by 40 and 10 respectively; and if an interest rate of 2% for timber forest, and of 6% for coppice is assumed,—differences in interest rates for different conditions being considered proper,—the annual interest on the wood capital is $\frac{40 \times I \times 2}{100}$ and $\frac{10 \times I \times 6}{100}$ i. e. 4/5 and 3/5 of I respectively; hence the taxable value is 1/5 or 2/5 of the actual yield. The author does not make any difference as regards annual and intermittent management. It is faulty to use for soil tax caluculations the accidentally actually present wood capital or building or factory, etc.; these are to be considered only in the property or income tax. On account of the difficulty of estimating the yield capacity the author advocates the abolishment of the soil tax, at least for State purposes. It could however, be used with fairness for local taxation, since "it may be assumed that all realty belonging in a municipality participates according to its yield capacity in the advantages of communality, hence should bear the burdens in equal proportion."

The property tax is a personal one, consisting in a percentage on the possessions of the owner free from debt. In assessing the taxable value the sale or exchange value is to be the basis, and if it is a business, its sale value as a whole under normal conditions with a view to its continuance. In the case of forests a simple summary method of ascertaining the value approximately is required. Such a method the author has developed in *Forstwissenschaftliches Centralblatt,* 1905, requiring no determination of rotation or formation of management classes. Again the author accentuates that he recognizes no difference between annual or intermittent management as regards just and correct assessment of value. As with every kind of property, the sale value varies and should be re-assessed from time to time.

The income tax, also a personal tax, is assessed as a percentage of the actual annual net income, no matter what the source. A just value of forest income can be based on the property value as just elucidated. It consists in the money value of the annual wood increment on the actual stock, no matter whether this is harvested annually or intermittently or not at all; and for simplicity's sake the income assessment may be conceived as merely an adequate interest rate on the property value ascertained as shown above. The author considers 2% for broadleaf forest, 2.5% for conifer forest, and 3% for coppice, adequate.

Zur Frage der Waldbesteuerung. Allgemeine Forst- und Jagdzeitung. June, 1906, pp. 184-189.

Prussian Budget.

The Prussian forest department has this year exceeded the hundred million mark limit of receipts, showing an increase of over one million dollars over the previous year (1905), and altogether round $24,000,000, the expenditures having been little less than 50 per cent. of the gross increase, or $12,000,000. In the receipts for wood sales the increase of the proportion for woodwork as against firewood is of interest. While in 1895 the 58 million marks resulting from sales were apportioned between the two classes as 38.4 : 20; in 1904 the 108 million mark receipts were apportioned as 86.1 : 22.4; that is to say the firewood reperesented little over one-fifth.

Among the extraordinary items of the new budget there appears nearly $500,000 provided for the promotion of forestry and agriculture, over $1,000,000 for river regulation, and about $750,000 for carrying out forest protective service and assistance to private forestry.

Lumbering in Southern United States. Through a series of issues of two journals (not yet concluded) are recorded the observations on timber conditions and logging and sawmill practice which several older and younger German foresters have made during a journey mainly through the Southern States, in connection with the St. Louis Exposition. The articles are of interest and value, bringing together a large amount of field notes by men of experience. Especially those of Dr. Jentsch, professor in the forestry academy at Münden, are worthy of perusal by American foresters for the suggestions which they incidentally contain. We may brief these when they are concluded.

Forstliches aus Nordamerika. Zeitschrift für Forst- und Jagdwesen. June, July, August, 1906.

Forstwissenschaftliche Reise in den Vereinigten Staaten von Nordamerika. Allgemeine Forst- und Jagdzeitung. June, July, August, 1906.

UTILIZATION, MARKET, AND TECHNOLOGY.

Use of Rotten Wood. To find use for the enormous quantities of rotten wood which our forests produce would be one of the greatest boons to forestry. An interesting use, although of no practical value for us, is discussed by Pillichody, namely for the polishing of the fine parts of watches. While in general this polishing material has been supplanted by machinery and benzine, the finest Swiss and French watches, especially in the escape parts and small screws, are still polished by hand and rotten wood. In Switzerland it is estimated there is still $4,000 worth of rotten wood annually used for this purpose, and since suitable wood has become scarce, the price for ordinary wood is from 18 to 60 cents per pound, and for the best quality as much as $1.00 per pound, which is sold in pieces half as large as a fist. Not every kind of rotten wood, however, is fit for such use; not only is the species of wood, but the species of fungus is determinative in producing the desired result, namely a yellowish-white silky wood, soft and spongy, brittle and of featherweight, in which the annual rings are still recognizable. Such is produced in the stumps and roots of beech, also of maple, ash, aspen, willow. The fungi probably active in producing such wood are *Polyporus comatus* and *Trametes odora.*

It is not easily found; usually in the mountainous regions, on southern exposures, on dry, stony, shallow soils. Conifers do no produce any suitable wood.

Die Verwendung von Faulholz. Schweizerische Zeitschrift für Forstwesen. June, 1906, pp. 173-176.

Hardness of Wood.

In a more or less exhaustive, highly interesting discussion, Janka reports the results of a series of tests made at the Austrian Experiment Station on the hardness of wood. It was not so much the object of the tests to establish a scale of hardness of a large number of woods, although some 27 woods were tested, as to find a suitable method of testing and to determine the influence of various factors on hardness, notably moisture and specific weight. The author refers, somewhat critically, to preceding work on the same subject, to Nördlinger's scale, based on mere judgment, copied in all books, and points out the deficiency in method of Büsgen's determinations with a pin (briefed and criticised in FORESTRY QUARTERLY, Vol. II, No. 4, p. 232). He defines hardness as the resistance which a body opposes to the penetration of another body between its molecules. Practically, in speaking of hardness of wood, we think of utensils used in shaping wood, but it is evident that axe, adz, hatchet, wedge, knife, chisel, plane, saw, rasp, file, each work in a very different manner upon the wood substance and test different combinations of strength factors; moreover, the use of the instrument by either thrust or push or pressure or drawing and the rapidity with which they are moved, influence the exhibition of relative hardness. It would, for practical use, appear necessary to make tests with each of these tools and conditions. To establish a general scale of relative hardness, however, an indentation test must suffice, and in such a test the form of the indenting body or piece is most essential.

The method used in this work was an adaptation of one designed by Brinell for testing hardness of steel, namely by using as indenting piece the half of a steel ball of 1 cm.^{2} largest circle ($r = 5.642$ mm.), which is pressed into the test piece to its full depth, when the mere reading of the pressure gives the relative hardness. The test pieces were 2.5 cm. thick and 10 cm. square, the surface divided in 9 squares, and each square was tested to secure an average, and in the comparative tests care was taken to test pieces of the same structure.

A series of tests with differently shaped indenting pieces was made, namely, with a cone, a wedge, and a cube. The interesting results shown in a diagram reveal the fact that the indentations with the wedge remain proportional to the pressure—a straight line, while the curves of ball indentations after a certain pressure is reached become convex, and of the cone concave, i. e., disproportionate to the pressure, showing that other and different factors in the two cases than hardness have exercised an influence.* With the cube in dry coniferous wood a maximum resistance was soon found, as in the ball curve, while with moist conifer and broad-leaved wood the curve of the cone is imitated.

Factors which influence hardness of wood are:

(1) Anatomical structure; hence character of annual ring, its width, heartwood and sapwood and the face, tangential, radial or cross-section, vary; (2) Specific weight; (3) Moisture per cent.

The hardness of the cross section was found to be in conifers 30 per cent., in deciduous wood 20 per cent., less than that of the arithmetic means of the two length sections (radial and tangential). This is an opposite result to that of Büsgen's, the difference being due to the indenting piece, a pin.

Generally speaking, the relation of specific weight and hardness is the same as in other exhibitions of strength; at least in the same species the heavier is the harder wood, though not from species to species; similarly, the increase of summerwood per cent. increases hardness. In conifer wood, the more definitely bounded, the darker, and the broader the summer wood, the greater the weight, and hence strength and hardness. The same holds good in broad-leaved trees. In these the colored heartwood shows increased hardness, but the increased resin contents of the conifer heartwood has the opposite effect, as with other exhibitions of strength, is experienced with moisture additions. Wet wood is about half as hard as dry wood; the coniferous wood especially loses hardness by wetting. Surprisingly,

*[It is a pity that, like Büsgen, the author overlooked or ignored the work of Mr. Sharples for the Tenth Census on American woods, which was carried on with a wedge-shaped, dull, indenting piece. This design appears to us still superior to the ball in the case of such a non-homogeneous body as wood, because it averages up soft and hard tissues better, and comes nearer to imitating the majority of practical tests of hardness; indeed, the author's tests seem to show this, since the indentations with his wedge remained continuously proportional to the pressure.—Ed.]

however, when the water contents sinks below normal air-dryness (15%), hardness increases only slowly, and sometimes decreases even, owing to a loss of shearing strength or increase of cleavability. (? Ed.) An interesting reference is here made to the recognition of this fact by Duhamel de Monceau, who in his *Traité de la conservation et de la force,* published in 1780, says: "Dry wood is to be employed; but it must still contain some moisture, in order to be hard, from which I conclude that too dry wood is not able to do good service." Hence hardness tests, like all other tests, should be made with normal moisture contents (15%). [Or, much better on green or watersoaked material, when this disturbing factor is eliminated , the relabivity ceasing beyond 32%.—Ed.]

Incidentally the difference in hardness of excentrically-grown conifers was tested. The excentricity, due to one-sided wind pressure, consists not only in increased ring width, but in increased production of fibres (red wood); the wide-ringed side is the harder, yet, according to Schwappach, in this wood formation, although heavier, the compression strength is smaller.

The influence of impregnation with heavy oils (creosote) was made a special study, using pavement blocks, some treated, some untreated, some kept in a room, some for two and a half years exposed to the weather. A slight decrease in hardness was generally observed, with the exception of spruce and larch, two species difficult to treat and hence not thoroughly impregnated, which showed slight increase. This decreasing of hardness due to the oil is, however, offset by an increase due to drying, for while shortly after the impregnation the treated wood showed smaller strength than the untreated, after 2 1/2 years of drying the reverse relation was observed. The untreated wood, left in the weather lost hardness, however, even though no fungus was as yet visible, while the treated wood retained its hardness. Untreated beech wood, especially, exposed for 2 1/2 years, lost more than 70 per cent of hardness and strength, being thoroughly rotten; while the loss in treated wood was only 20% of that of the loss in hardness and 30 % of that of the loss in the compression strength of untreated wood.

The range of hardness within the species tested was 1.4 for palm and 15.6 for ebony, these figures expressing kilogram per 1 square milligram.

It is also proposed to base a scale of hardness on the quotient $\frac{\text{hardness (Kg.)}}{\text{specific weight (x100)}}$ that wood being the most resistent and most desirable which contains the greatest hardness with lowest weight.

The "hardness quotients" for the woods lie between 3.5 (palm) and 13.7 (ebony). Comparing these quotients with the "relative quantity quotients", i. e., $\frac{\text{Compression strength}}{\text{Specific weight}}$, a very considerable difference appears. In conifers the hardness quotient is smaller than the quantity quotient, the reverse in broadleaved wood; for instance, for spruce the two quotients are 6.7 and 9.1 respectively; for oak, 9.8 and 5.1. Hence the latter are better where resistance to shock and wear is required, the conifers better for building purposes, where the relation of strength to weight is to be most favorable.

From this consideration it follows that influences other than hardness determine compressive strength, hardness probably depending on coherence of fibres sideways, compressive strength on stiffness, or resistance to binding of fibres. From the specific weight of different species of woods no final conclusion as to their hardness or strength is possible.

Lastly, the author brings forward as germane to the hardness tests, a series of tests on the resistance to the penetration of an axe, made with an axe-like wedge of 6 cm. width, made to penetrate 2 cm., on bolts free from knots 10 cm. thick and 50 cm. long, which are tested green and dry in two directions. The lengthwise test could be made only on green wood, since on dry specimens the wood would invariably split.

It was shown that here again moisture produces a considerable diminution of resistance; that is to say, wet wood splits easier, 35 per cent. in coniferous wood and in length direction of broadleaf, 26 per cent. in the cross grain direction of the latter.

The relation to specific strength was not clearly shown by the tests. To drive the axe across the fibre into coniferous wood required about double the force needed for doing so lengthwise, for the tested broadleaf wood somewhat less than double. The soft conifer wood, spruce, fir, pine, showed pretty nearly the same resistance radially or tangentially, but the broadleaved woods showed radially much less resistance than tangentially. The failure of the tests on the cross-section of the latter by splitting called attention to the ease with which the latter split radially, i. e., in the direction of the pith rays, and also to the toughness (in these tests) of the conifers.

A large number of tables and diagrams bring out the detail of this instructive series of tests.

Die Härte des Holzes. Centralblatt für das gesammte Forstwesen. May, June, 1906, pp. 193-202, 241-260.

MISCELLANEOUS.

Virgin Timber Reservations.

The intensity of the practice of forestry in Europe threatens to do away with every bit of original or virgin timber growth. The desirability of preserving some remnants of natural conditions for the study of plant geography and ecology, as well as for sentimental interest, is argued by Glutz before the Swiss Forestry Association with a view to secure such reservations. Our national parks and those of Canada are cited as attempting such preservation of original conditions. As other examples of virgin forest reservations are cited: Brandlehaw Park in Cumberland, England, of 125 acres; several parks in France, especially at Fontainebleu (4,000 acres), at Compiègne (1,800 acres), at Grande-Chartreuse (360 acres); in Austria, Count Schwarzenberg's at Kubany, Bohemia (125 acres, see description in FORESTRY QUARTERLY, Vol. II, p. 274); and Count von Liechtenstein's park, set aside two years ago in Silesia (over 400 acres). A few small areas in Oldenburg, in Prussia, and in Bavaria are still virgin woods, as well as in Switzerland, the reservation of which is demanded.

Motion betreffend Schaffung von Urwald-Reservationen. Schweizerische Zeitschrift für Forstwesen. June, 1906, pp. 184 ff.

Forestry on Dominion Lands.

It is estimated by E. Stewart, Dominion Superintendent of Forestry, that of the 2,656,200 acres of land in Canada under the control of the Dominion Government, 1,406,200 acres are more or less wooded. Supposing only one-fifth of this wooded area to be commercial forest, containing an average stand of 2,000 feet per acre, with a stumpage of $1 per thousand, the value of its timber to the government is not less than $359,987,200. This sum, however, represents but a small percentage of the actual worth, since the value of the smaller growing timber is disregarded, as is the importance of the forest in conserving the lakes and streams and in furnishing shelter for game and fur-bearing animals.

Fire is the greatest source of damage to the forest. The system of forest patrol started in 1901 on Dominion lands has proved very effective, particularly in the railway belt of British Columbia.

A systematic examination of forest reserves has been begun. Government forestry in Canada is particularly applicable, since most of the valuable timberlands are still held by the Crown.

Forestry on Dominion Lands. Canadian Forestry Journal. February, 1906, pp. 35-40.

Water-Powers and Forests in Canada

That part of Canada lying between New Brunswick and the eastern foothills of the Rockies is practically lacking in coal measures. Coal is imported from the United States for purposes of heating and power. The decrease in wood supplies and the increased use of electricity for various forms of manufacturing, transportation, and illumination render this economic condition an increasingly unfortunate one. The feasibility of transmitting electric power for long distances makes practicable a very considerable amelioration of this condition through the increased use of water powers instead of coal.

"At the present time there has been developed in Canada about 350,000 H. P. of water-power, which probably, including transmission lines, represents an investment of $25,000,000 or $30,000,000, and considered only on a 10-hour basis, means a saving of at least 5 tons of coal per horse-power per year, or 1,750,000 tons of coal per year as compared with about 4,500,000 tons annually imported. The near future will easily see this amount doubled or trebled if intelligent and comprehensive plans are adopted for development and distribution."

Since water-powers are valuable in proportion to the amount of water available at periods of low water, and since forests are instrumental in regulating and sustaining the flow of streams, it follows that for the future commercial development of Canada it is essential that upon the headwaters of its streams forest conditions be perpetuated on such lands as are of a non-agricultural character.

The Relation Between Water-Powers and Forests. Canadian Forestry Journal. February, 1906, pp. 49-53.

NEWS AND NOTES.

E. A. Sterling, *In Charge.*

The recently created position of State Forester of Maryland was filled on July 1 by the appointment of Fred W. Besley, with headquarters at John Hopkins University, Baltimore. Mr. Besley, who is a graduate of the Maryland Agricultural College and the Yale Forest School, takes to his new work a varied experience of several years as Student and Forest Assistant in the Forest Service.

During the last session of the California legislature laws commended by the Forest Service were enacted which extended and improved the fire laws upon the statute books of the State, and created the new office of State Forester.

The first of last July marked the close of the first year for this California forest organization and was attended by a change of administration in the office. E. T. Allen, the first State Forester, resigned his position to take up other work, and was immediately succeeded by G. B. Lull, of the Forest Service.

Mr. Allen's administration has been a most successful one, and in the year during which he held office there has been a striking advance made in the appreciation and practice of forestry in California. Convinced that the future of forestry in any region is founded upon protection from forest fire, Mr. Allen's first step was a campaign to arouse public sentiment to a realization of the damage caused by the spread of unchecked annual fires, and to organize an efficient corps of fire wardens throughout the state, as permitted under the new law.

The people of the State were not slow to perceive the advantages offered them by the new forest administration, and the prestige of the Forester's office has been firmly established. Besides the organization of the fire-warden system, cooperation with private owners in forest work has been undertaken, and calls upon the office for technical advice have been frequent from lumbermen, stockmen, and others interested in the forest resources of the State. With such success in interesting the people of the State attained in its first year, the future of the Forester's office in California is very bright, opening perhaps a better field of work than exists in any other State in the country.

Mr. Allen was notably equipped for taking up the difficult work of the organization of a new office, by years of varied experience as an Inspector in the Forest Service, his work having taken him through most of the forested country and forest reserves of the western states. He left the California work, to which he has given such vigorous impetus, to re-enter the Service as resident inspector of the forest reserves in the states of Oregon and Washington.

His successor in the position of State Forester, Mr. Lull, is a graduate of the New York State College of Forestry and has for some years been a member of the Forest Service, active in important work undertaken in several sections of the country. While a member of the Service he was identified with the office of Forest Extension and ranked as an Assistant Inspector in the work of that section. His experience in California has given him a wide acquaintance with the people of the State and with California conditions, which will be an especial advantage to him in his new position. The State is fortunate in so promptly securing, as successor to Mr. Allen, a man so able and so well equipped to maintain the high standard of the Forester's office.

Under the laws providing for the office of State Forester, the appointment of two assistants to him is authorized. Mr. Allen during his term of office had secured the services of Raymond Tyler, formerly a member of the Forest Service connected with the administration of the Sierra and Tahoe forest reserves in the State. Since Mr. Lull's advent a second Assistant State Forester has been appointed in the person of Charles H. Sellers. Mr. Sellers was also for some years a member of the Forest Service, having varied experience in the field work in many of the forest regions of the country and especially in the State of California.

California's Forest Service, now entering upon its second year, has a personnel which promises rapid progress for forestry in a State notable for enlightened interest in this profession.

S. J. F.

Another State forest service to have a change in its administration is that of Massachusetts. Alfred Akerman, who has been State Forester since the creation of the office in 1904, has gone to the University of Georgia, where he will have charge of the courses in forestry.

Ralph C. Hawley, who was Assistant State Forester of Massachusetts, also takes up teaching, having accepted a position as instructor in the Yale Forest School.

Further changes affecting education in forestry are the resignation of J. Fred Baker from the Pennsylvania State Forest Academy, at Mont Alto, and his appointment as instructor in Colorado College, at Colorado Springs.

The faculty at Mont Alto is now composed of State Forester Wirt and John P. Wentling and Edwin A. Ziegler, the two latter having been Forest Assistants in the Forest Service. Messrs. Wentling and Ziegler are graduates of Franklin and Marshall College, and acquired an extended acquaintance with the forest conditions and problems throughout the country while in the Government service.

A third Forest Assistant to recently leave the Forest Service and take up teaching is Benton MacKaye, who has been appointed an instructor in forestry at Harvard University. Mr. MacKaye graduated from Harvard in 1905 and saw his Government service in New Hampshire.

Messrs. Chapman and Rothkugel, whose employment by the E. P. Burton Company was noted in FORESTRY QUARTERLY, Vol. III, No. 2, p. 222, have given up their work in South Carolina on account of ill health induced by conditions there. Mr. Chapman re-entered the Forest Service and will continue to direct the execution of the working plan he made for the Cooper River Holdings. Mr. Rothkugel is now with George Craig & Sons, manufacturers of Hemlock, Spruce and hardwood lumber at Winterburn, West Virginia.

W. B. Piper, Yale, 1905, a Forest Assistant in the Forest Service, has been detailed as Forester to the Delaware and Hudson Railroad Company. The Forest Service prepared a working plan for the holdings of the above company in the Northern Adirondacks, New York, during 1905 and Mr. Piper will put into effect the recommendations made in the plan. During the present year the company are cutting fire-killed timber, but later the tract will be placed under more intensive management and green timber will be removed under the direction of the forester.

Thomas Elmer Will, former Professor of Economics at the Kansas State Agricultural College and later President of the same institution, has been appointed Secretary of the American Forestry Association. Prof. Will assumed the duties of his new office on September 1. His appointment to this important position has been received with much satisfaction by the members of the Association and it is confidently felt that the Association will be greatly strengthened through the efforts of the new Secretary.

Wm. M. Maule, a forester in the Philippine Bureau of Forestry, is enroute to the United States, via Europe, on leave of absence. Mr. Maule has been in the Philippine Islands since the early part of 1902 and is coming home to enjoy a well-earned vacation.

By the passage on June 11, 1906, of "An Act to provide for the entry of agricultural lands within forest reserves," Congress has removed the only justifiable cause for complaint against the establishment of federal reserves.

This act authorizes the Secretary of Agriculture to classify and list all lands within reserves (except certain counties in California and the Black Hills Reserve) which are chiefly valuable for agriculture and are not needed for public purposes. He may then request the Secretary of the Interior to open these lands to entry under the homestead laws.

Any person who wishes to homestead land within a reserve may now apply to the Forester of the Forest Service for an examination of the desired tract. If this tract is found to be agricultural land and is not needed for administrative purposes by the Forest Service, it will be classified and listed under this act and settlement upon it will be allowed.

The first lands to be examined will be those occupied by actual settlers prior to January 1, 1906, so that if the lands are found to be agricultural in character the occupant may make his entry under this act. Mere occupancy of the land will not, however, influence the decision with respect to its suitability for agricultural purposes.

Any settlement later than December 31, 1905, upon an area not yet declared open to entry by the Department of the Interior will be considered as trespass, and the trespasser will be ejected. Land which is now covered with merchantable timber will be opened for settlement only if is is shown to be exceptionally well adapted for agricultural purposes.

As soon as the income derived from timber sales and grazing fees is sufficient to place the federal forest reserves on a self-supporting basis, the number of rangers will be increased until each reserve is fully officered. This will mean a forest officer for approximately every township, and it is intended that each man shall have his permanent station and be provided with suitable quarters. These stations will be located on mountain meadows, parks, and bottoms, so that the rangers may raise their vegetables, grain and hay. In order that suitable lands for these stations may be chosen, the agricultural bill provides that only such lands within the reserves be opened for settlement as "are not needed for public purposes."

Every forest officer in charge of a reserve has therefore been ordered by the forester to prepare a list of all tracts of land in his reserve desirable for this purpose. Each tract is to be withdrawn by the Secretary of the Interior from "appropriation and use of all kinds under all of the public land laws, subject to all prior valid adverse claims, for use as a Ranger Station by the Forest Service in the administration of the Reserve."

These stations will probably be not farther apart than two to six miles, according to the roughness of the country. They will be located where there is enough agricultural land for a small field and suitable pasture for a few head of saddle stock and cows, in order that the ranger may have a comfortable home and can raise his vegetables and winter feed for his stock. The amount of agricultural land necessary will vary from ten to perhaps forty acres in different localities.

In addition to these small tracts, each ranger will be entitled to a pasture varying in size according to the quality of the feed from forty to two hundred acres. Non-agricultural land will be chosen for these pastures wherever possible and in no case will a site be selected which may prove desirable as a mineral location, or upon which there is a claim pending.

If there is any difficulty to be met in establishing permanent headquarters throughout the reserves it will be lack of water on lands owned by the Government. In the reserves of the southwest where water is especially scarce, nearly all the springs have long been owned by stockmen.

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THE HIGH SIERRA MAESTRA.

I. A SURVEY IN THE TROPICS.

The Sierra Maestra is the highest, as well as the wildest mountain range in Cuba, a part of the "master range" of the Antilles, paralleling the Southeastern shore, East and West of Santiago. The part to the East as far as Cape Maisi (also called Sierra del Cobre) and for some forty miles to the West of Santiago, is known as the low Maestra, attaining a general altitude of 1800 feet. Beyond, a sudden rise in the crest of some 2000 feet announces the "high" Maestra, an unexplored country of most rugged structure, and virgin as to forest conditions with the exception of the immediate sea-front.

It was this, practically unknown forest country, which the writer had an opportunity to explore in part, with a view to commercial development. Since details of tropical forest conditions in our hemisphere, and especially of Cuba, have so far been rarely or never discussed in literature, a description of the results of the forest survey of a tropical mountain range may prove of interest.

To talk about unexplored country in Cuba sounds strange, yet it is true that not even a botanist had collected over this high mountain range before Mr. Norman Taylor from the N. Y. Botanical Gardens, who had accompanied the writer, first trod the main ridge at the headwaters of the Sevilla River. There had been white men at the shores, and, indeed, a large and luxurious mining development had been conducted for two years on the Guama River and had engulfed a large capital of good American money in absolute loss, but neither geographer, geologist, nor naturalist has visited and described this region except from outward appearances along the shore. According to our native guides none but the native hunters had traveled the maze of ridges and canyons as we did.

Topography and Climate.

Geologically, erroneous notions regarding the high Maestra prevail in literature. It is not, like the Eastern extension, mainly a limestone formation, but, as far as explored, namely for over 40 miles of shoreline, and probably beyond it represents a solid granite mountain, a tremendous uplift of syenites, diorites, diabase and other granitic varieties, exposing the original base of the island, which elsewhere is mostly covered up by the limestone deposits. Only in two very confined localities close to the shore was a limestone deposit of small extent found, and conglomerates and shales which are also credited as occurring here were seen nowhere. It is for this reason that the contours, although bold, are so much smoother and rounder than those of the eastward slopes, which are terraced, frequently with vertical sides, a difference which has been observed by those who have described the shores from passing them by steamer. The soils are, therefore, also of different composition from those of most other parts of the island, namely lacking in lime, and, as far as edaphic factors influence it, the character of the flora must differ. Moreover, this range lies with its crest mostly above the 3500 foot level which it attains within fifteen to twenty miles of the shore, many of its peaks reaching above 4000 feet. The highest peak of the island, El Turquino, which, however, does not lie in the main crest but on a forward spur toward the sea, is supposed to reach an altitude of between 8300 and 8600 feet; the latter figures being noted on the general chart of the coast by our Hydrographic Office. This altitude, also, not only must influence the flora of the alpine region directly, but modifies the climate of the lower levels, and hence must have an influence on the distribution of species.

The *climate,* is, of course, in the main similar to that of the rest of the island, namely warm and moist, but the mountain range modifies it perceptibly, especially on the Southern slope, since the prevailing wind,—the North Eastern Trade—is not only tempered but deprived of its humidity by precipitation on the windward side of the higher ranges. As a result, aided by the Southeasterly seawinds in early spring, the rainy season which on the North side is described as only one, from May to October, becomes here distinctly two, namely March, April, May, as a result of the Southeasterly winds, and again in October, an overflow of the Northern rains, the three months intervening having only occasional short showers, such as are experienced during the rest of the year.

The temperature, which on the island in general is characterized by a high average and small range—77° for the mean, and 10° for the range at Habana, and as far as records go, rarely above 28 degrees in any part of the year, namely from 50° to 78°, except on higher elevations—here naturally shows much greater daily range and still greater annual range. From conversations with various natives it was learned that August, the month when the writer arrived, was the hottest in the year, and comparatively dry. The nights, however, were always delightfully cool, even at the seashore, a mountain wind setting in at night, and a seawind in the morning tempering the hot rays of the sun, which only during the middle of the day became really oppressive; otherwise not much difference from Northern hot summer days was noticed. In September, this weather continued, except that occasional rains became more frequent; usually in the middle of the day a brisk thunderstorm and shower in one valley or the other would occur, lasting from one-half to two hours. Towards the end of the month a temporal—a seawind blowing into the moisture-laden over-fall wind—increased the humidity so as to give rise to a heavy downpour continuing for hours, and lasting several days. October brings the climax of this secondary rainy season with cold weather, and gives way in November to a cool and dry season continuing pleasant—often too cool, as the natives complain, when the Northers blow—until March, when the Southeastern winds usher in the principal rainy season which, with increasing heat, reaches its maximum in May. This month, hot and wet, the real springtide of vegetation, stops all travel and work, and by June the rivers are rampant, but by July the water is gone, the skies have become clear and the sun beats down upon the dry ground. Although during the rainy seasons, large amounts of water fall and showers occur all through the year, all Southern exposures especially in the front ranges are really relatively dry country, due to rapid drainage and evaporation, bearing a different vegetation and exhibiting different development from the canyons and northern slopes. In the higher altitudes also considerable variation exists on the different slopes according whether they lie open to the moist winds or are located in the rain shadow of some higher windward peak or range.

To complete the *topographic description,* it may be said that the backbone of the main ridge, running almost due East and West, is not a continuous ridge but is from time to time, namely wherever a river basin starts, interrupted by superior eminences or peaks, a pair of them with a much depressed saddle below the general level of the crest indicating the source of the river. Long continuous ridges, similarly interrupted by peaks, run from this back bone more or less due South to the sea, dividing the river basins in a most pronounced manner, and secondary ridges branch off from these, themselves again divided by lateral ridges into a number of canyons of the third, fourth, etc. order. A most striking feature is that noted in other mountains of the island and perhaps in all tropical mountains more or less, namely the very narrow, often almost knife-edge salients or "cuchillas;" even those forming main watersheds show this character of the ridges. Thus the watershed between the Rio Sevilla to the South and the Barracoa to the North is formed by a saddle hardly 20 feet wide, with steep descents. All the canyons start with such steep descents, sometimes almost precipitously, without any terraces, changing into gentler slopes as the main river is reached, which may be in half a mile with 1000 feet descent. There is rarely a broader mountain back or more extensive sink found on the ridges.

The rivers are wild, treacherous mountain streams with magnificent, clear and limpid waters running to the sea, winding between more or less steep, sometimes precipitous banks, over boulders and rarely over short falls. Towards their mouths they broaden into deltas, forming more or less broad flood plains filled with sand and rubble. During the flood tide—which may come after a single days' rain, as the writer experienced—they spread over their banks and make new channels, but during the dry season, they are mostly lost in the sand and rocks, leaving dry rocky beds, within a mile or so from their mouth. A sea wall of rubble, more or less high, usually closes the latter, possibly leaving a pool behind it.

There is little flat land to be found anywhere, except in these river deltas and along the seashore, reaching rarely more than a mile inland. The slopes of the main river basins divide the country more or less systematically into valleys, separated by higher or lower hills. The top of the ridges furnish the best and altogether smooth travel, indeed they afford the only practicable approach to the interior and to the crest, the rivers being impassable, and the slopes mostly too steep and cut up with innumerable canyons, to be comfortable.

One good harbor and a few less desirable ones furnish an outlet for this otherwise practically inaccessible country, the veritable Switzerland of Cuba.

Tree Species.

The whole range from base to top is densely covered with arborescent vegetation. From the Royal Palms at the shore to the Manaca Palms at the top a variety of tree species most bewildering in number and in lawless sporadic distribution, as is the rule in tropic forest, calls for identification, classification and valuation.

Over 100 species were found, more or less, of commercial size and value, although not more than a dozen perhaps are known to the market. There is no handy Silva by the aid of which to become acquainted with these, even if the exigencies of a commercial inspection permitted the time to make a botanical study. We have, therefore, to reverse the order; first learn what different things are in existence and then try to find out what they are. With the aid of some native woodsmen, "practicos," as they proudly called themselves, not only the Spanish names but the signs of recognition in the woods, and, for the most important species, their real botanical character and identity could be determined, yet many of the species are still known to the writer only by their local Spanish name and by the appearance of their bark in the tree. Only one-third of the number has been identified from specimens collected by Mr. Taylor, another third has been more or less surely or doubtfully identified by the study of check lists. The difficulties in determining them are, first, the usual difficulty of securing material for identification from trees, and especially at a season when flowers and fruit are scarce, for the statement that flowers and fruit are found in the tropics all the year round is in this locality at least and, we believe, elsewhere only very partially true. Identification by foliage is well-nigh hopeless, because so many of the species belong to the same families and hence vary little in their foliage. (Recognition in the woods from the foliage is moreover impeded by the foliage of parasitic plants which intermingles with that of the host so as to obscure the latter). Finally, the floras which treat of the trees are so imperfect, that, even with good material, one may be left at sea. Unfortunately, too, there is no uniformity in the use of the Spanish names, so that the identifications by name from check lists made by some Spanish authors, are to be used only with caution. There is also little doubt that, although the native guides were remarkably observant and precise in their distinction of species, often more than one botanical species figures under the same name, and again, differences in the character of the wood, would lead as with us to differentiation in name for the same species. A more careful search would probably increase our list to more than 150 species as representing the arborescent flora of the High Maestra. Leaving the enumeration of all the discovered species to a separate list, we can single out and discuss as to their value and characteristics those which are both most frequent and at the same time commercially important.

The two most important and valuable species are the Cedar and Mahogany. The first, CEDRO, *Cedrela odorata L.*—so called from the smell of the wood—not at all a cedar, but belonging with the Mahogany and the well-known Umbrella Tree to the family of *Meliaceae,* is here for certain territory the most frequent, and attains magnificent size, diameters of 3 to 4 and even 5 feet, heights of 150 to 160 feet, and log contents of over 3000 feet, the average run, when only 15 inch logs are included, being somewhat over 700 feet to the tree. It is ubiquitous, making little choice of situations, and even on dry ridges, which are usually empty of commercial values, trees of large size will occasionally be found, the accident of location over a rock-fissure probably accounting for such favorable development. Its wood, now higher in price than Mahogany, namely in New York up to 15 cents per foot in the log and in Habana $100 to $125 for lumber, is well-known in the shape of cigar boxes, and is also fit for fine finishing, while culls ($30 to $40) are used in Habana for rafters. One of its peculiarities is that upon exposure to the sun it very rapidly darkens in tone. There are other woods resembling it in texture and other trees resembling it in foliage and bark, and the only final test is the unmistakable smell. Those concerned in log rules may be interested to learn that this and similar woods are sold in the New York market by the One-fifth rule, (an addition to Prof. Graves' collection), which divides the circumference in inches by 5 and squares the result to give the board foot contents of a 12 foot log. Since this gives invariably less than most other rules and since waste is reduced to a minimum by the use of fine saws or veneer knives, this high price for logs is relatively to that paid for our woods not as high as it appears.

Mahogany (CAOBA), *Swietenia Mahogany L.,* is the most readily recognizable species by its unique, dark bark, and its sickle-shaped foliage arranged in peculiarly rounded outlines on a straggling crown, which permits it to be readily singled out from among other trees and to be counted on a slope.

It is a tree of the dry slopes and ridges and rarely finds its way into the moister woods. Its size approaches that of the Cedar, although growing rarely to the same height, for it has a spreading habit, yet 4-foot trees with 2000 feet of logs were met, and the average ran over 600 to the tree. Cuban Mahogany, like Cuban Cedar is considered better than Mexican and that of most other sources of supply, bringing from 8 to 12 cents per foot in the log. Both these species have an exceedingly durable heart, and unless damaged by borers, the old dead and fallen trees, whose wood has weathered and darkened similar to our Walnut, are even more valuable than the living.

Closely resembling the Mahogany in texture, color and quality of wood is a monster tree of the *Leguminosae,* with a bright red pod, called Sabicu, a name applied elsewhere to a cogener of smaller size. This Sabicu, *Pithecolobium arboreum* (L.) Urb. reaches sizes of over 6 feet in diameter and 175 feet in height. Being rather branchy, its log contents measure hardly over 2500 feet at best, and 1000 feet to the average. It is almost as common as the Cedar itself, but apparently more confined to valleys, canyons and moister slopes. Attempts to introduce its wood in the New York market have so far had small success, but in Habana it is fully appreciated, and brings from $80 to $200 according to grades. It is evidently a fast growing tree and hence of more open grain than mahogany, otherwise hardly less fit for fine furniture. It is also used in wagon work.

There are a number of these leguminous trees whose wood differs very little and which have equal rights for consideration, being only less common and of smaller size. Of these there should be mentioned Sabicu Moruro—*Peltophorum adnatum Grieseb;* easily recognized by its peculiar closely packed mimosaceous foliage with golden hues. It grows to three feet diameter and is not unfrequent. Its wood resembles that of the Mahogany even more closely than that of the simple Sabicu.

Another one of this group, ubiquitous and more frequent than the preceding, is the Sabicu of the Bahamas, here called Jiqui or Jique—*Lysiloma Sabicu* Benth., resembling in the bark our Shagbark Hickory so that by similarity of name and features it was soonest remembered. It seems to replace the Sabicu on the drier slopes and attains good sizes even here, up to 4 feet diameter. Its wood is darker and harder than Sabicu.

A third species, usually smaller, hence with less of the dark heart wood, found mostly on dry slopes and rather frequent, is the smooth-barked TENGUE, *Poeppigia procera* Presb., which resembles in its foliage our Black Locust most closely.

In Europe Sabicu wood, probably supplied from any of these species, has long been known and appreciated in the markets, and is especially prized because of its soundness and absence of defects.

Another undetermined Acacia-like species, growing to only one or two feet diameter, YAMAQUEY, furnishes a black wood resembling Ebony.

Like all the Acacia tribe, these species have an almost indestructible heartwood and hence are most valuable for railroad ties. The only objection to the use of these hard woods for that purpose lies in their very hardness which renders spikes an undesirable means of fastening the rail. The substitution of bolts which are superior as it is, should give a ready market to this tie supply, which besides the species mentioned is increased by the following of our list: *Acana, Ajite, Caguani, Carbonero, Guama, Guamaca, Jucaro, Mahagua de Cuba, Miji, Quiebra-hacha, Yaba, Yaya,* and others.

In certain parts of the territory another leguminous species, the GUAMA, just mentioned, *Lonchocarpus sericeus* H. B. K. (not the Guama of Porto Rico) comes next in frequency of the more valuable species to the Sabicu, with large, glossy, otherwise Black Locust-like foliage and a bark resembling White Oak, reaching diameters up to five feet, but generally smaller, averaging 400 feet to the tree. Its black heartwood, as hard as iron, should be too valuable for railroad ties, but its value does not seem to be established in the market. Its bark is used for tanning.

Better known in the market for wagon work and construction is another leguminous tree, as frequent and more ubiquitous than the preceding and somewhat larger, with diameters up to 5 feet, namely YABA, the Angeleen tree—*Andira jamaicensis* (W.) Urb. Its hard yellow heartwood is indestructible and is specially prized for felloes in wagon work and for wharf timbers, bringing from $50 to $80 in Habana.

A half dozen other leguminous species occur only rarely.

The Linden and Malva families furnish two species of highest value, although unknown outside the island, which vie for beauty of color and texture with those mentioned, namely, MAJAGUA DE CUBA, *Carpodipterus Cubensis* Griseb., and MAJAGUA AZUL, *Paritium elatum* G. Don. The former with a cordate deltoid leaf, conspicuous on the slopes by its clusters of rose-colored flowers, forms a tree of 2 to 3 feet diameter averaging 400 feet to the tree, quite frequent especially on dry slopes, and furnishing a most durable hard, yellowish to dark-red wood. This valuable and quite common tree was first collected about 1866 by Wright on the northern slope of the Sierra, and seems since then to have escaped notice by botanists. The latter species with large yellow flowers turning red, and a broad basswood-like leaf is also frequently met and is of somewhat larger size than the former, averaging more especially in moist woods, 500 feet to the tree. It is a species most highly prized in Cuban markets not only for the unusual bluish-green color of its heartwood, but on account of its toughness and elasticity which fits it for spokes and axles and as a substitute for our Hickory where these qualities are required. Its price in Habana ranges from $100 to $150.

A shrub or low tree of the same genus, *Paritium tiliaceum* A. Juss., the *Emmagua* of Porto Rico, is found near the shore, very much resembling its congener.

Another species, used also for spokes, but with white wood, GUARANO (*Cupania macrophylla* Rich?) of the Soapberry family, is a rare tree of the same size as the former. .Spoke billets, 2 x 4 x 40, bring 25 to 30 cents a piece in Habana.

Still one of the very generally distributed and rather common trees,of established commercial value is the ROBLE BLANCO. The name usually denotes in Spanish an Oak, but this is a relative of the Catalpa and Trumpet Vine,*Tecoma pentaphylla* D. C., a large tree with diameters up to 4 and 5 feet, the light brown, black oak-like fissured bark resembling somewhat the Cedar. Its yellowish hard wood is especially prized for wagon work, ox yokes, tables, etc., bringing from $40 to $80, or, for ox yoke billets, $1 apiece.

Three more excellent timber trees may be mentioned as of established value and frequent enough to be a comercial factor, namely the JUCARO—*Bucida Buceras* L.of the *Combretaceae.* It is mostly found near the shore, reaches diameters of 3 and 4 feet, and furnishes a very hard, yellow or black wood fit for spokes and other wagon work, but is especially prized for its resistance to the teredo as wharf timber; the JATIA whose botanical identity is still in doubt, quite a common and ubiquitous tree of similar size as the former and prized for the same use; the CAGUANI (Mastic) *Sideroxylon Mastichodendron* Jacq., a ubiquitous, large tree with up to five feet diameter, furnishing a maroon red to yellow wood, hard and durable.

Since it is necessary to know also the weeds, that is the trees which are useless or whose use has not been found out, we must mention as the most common tree of all, the most striking by its foliage and apparently the most useless—although it may be in spite of its hollow stem and pithy white wood prove to be material for paper pulp—namely, the Moraceous YAGROMA (Trumpet tree), *Cecropia peltata,* a medium-sized tree, common through the Carribean Islands. With its large (sometimes over 1 foot) palmate leaves, silvery-white underneath, it continually calls attention to its uselessness. The well-known Silk Cotton Tree, *Ceiba pentandra* (L) Gaertn. is another as useless and very common, ponderous tree, doubtfully supposed to be an introduction from the East Indies, striking by its peculiar immense flukes or buttresses enlarging the base of the smooth-barked trunk, which defies any established conceptions of form factors. Its lightness and ease of working makes the wood desirable for the dug-outs of the natives, and it may have some value for paper pulp or boxboards.

The most ubiquitous and most common large-sized tree, vying with the Sabicu in development, is the well-known West Indian or Hog Plum, called JOBO, *Spondias lutea* L., which in bark and foliage immitates the Cedar, but it has a white soft wood which if one did not look to Cuba only for fine cabinet woods, would long ago have been utilized for common lumber and especially boxboards and crate material. Its prolific fruit production covering the ground with yellow plums which furnish the mast for the wild boars is the most ready means of distinguishing it from the Cedar.

Similar in its wood, similarly ubiquitous and almost as frequent and only slightly less ponderous is the ALMACIGO—*the Gumbolimbo* of the Bahamas, *Bursera Simaruba* (L) Sarg. of the *Burseraceae* (formerly *Anacardiaceae*) striking by its finely flaked papery rusty-red bark. Although not choice as to its location, it occurs most frequently on the dry slopes and ridges and here makes the best diameters, up to 4 feet, although remaining rather short in stature. Its wood is white and light without heartwood formation, and like the Jobo may be used for boxboards and other cheap lumber.

This exhausts the list of the species of commercial size which are relatively common, but by no means the valuable species. For there are to be found the well-known Ligumvitae or GUAYACAN, *Guaiacum officinale* L., a small (20 inch) tree of the dry slopes, said elsewhere to grow to 5 feet; the highly prized GRANADILLO *Brya ebenus* D. C. also a small tree of the dry slopes (a substitute for Ebony, 18 inch seen, said to grow to 3 feet); the Ebony itself, or at least a tree called EBANO, with specimens up to to 2 feet diameter; the OCUJE, *Calophyllum Calaba* Jacq., of the *Clusiaceae,* a large (3 to 4 foot) tree of the higher altitudes, resembling the butternut in its bark, the reddish brown wood of which brings $160 in Habana; Fustic (FUSTETE) *Chlorophora* (*Maclura*) *tinctoria* (L.) Gaud., a dyewood growing to 4 feet diameters, and ubiquitous; another dyewood, SANGRETORO, *Maytenus ovifolia* Rich. and AYUA (Ironwood), *Zantoxylum marticinense* (Lam) D. C., with its peculiar pyramidal thorns which beset the trunk even of old trees.

These and a number of undoubtedly valuable species occur, however, only in small numbers. Some of those of goodly size, the value of which is either locally known or is suspected, need only to be properly introduced to the market to find ready employment.

Of these we may mention ALMENDRO. *Laplacea Wrightii?* Griseb, which occurs rather frequently, a large tree (3 feet), with black bark resembling as also its foliage our Black Cherry, with a soft yellowish wood emitting a strong almond smell; BARIA—*Cordia nitida* Vahl? also quite frequent, resembling the Basswood in bark, and our Elm in character of wood; CUARIDURO—*Cassia emarginata* L., with a white, hard wood, used for wagon parts. YAMAGUEY, *Belairia* spec., a smaller tree (1 to 2 feet) of the dry slopes, with ebony-black heart. There are a number of these dry-slope trees which can, no doubt, properly be substituted for Lignum vitae, Ebony, Box and other hard species that are accepted in this market.

Of the smaller trees of value there is also to be mentioned DAGAME, *Rondeletia, arborescens* Griseb., occasionally growing beyond 2 feet diameter, of wide distribution, and especially adapted for spars.

As mainly botanically of interest, we should mention first of all the two curious parasitic trees, which have the habit of engulfing the trunk of other trees, or, as the case may be, of each other, finally smothering the victim, namely the well-known COPEY—*Clusia rosea* L., found all through the tropics, and JAGUEY (*Jabe or Avey*), probably represented by several species of *Ficus.* They grow also to self-supporting trees of considerable diameter (3 to 4 feet) and the wood of the Copey at least is found valuable for posts. Two other trees of large size, not at all infrequent, with a copious milky sap, MABOA, *Cameroria latifolia* L.?, and LECHERO, suggest the possibility of rubber production.

A number of palms appear in single specimens and groups all through the woods from the seashore to the very tops of the mountains, but have none or little commercial value, being too few in number.

A delightful surprise are the wild lemon trees, with excellent fruit, which are found everywhere in cool situations. Coffee trees also have run wild occasionally from the various cafetieras established in the woods by the insurgents of 1868.

The two small trees, most common and numerous of all, which have an established commercial value for canes, posts, poles and railroad ties are the MIJI, one of the several species of *Calypthranthes* (*Myrtaceae*), and YAGUA, the well-known Lancewood, *Oxandra virgata*, A. Rich., which sometimes reaches 2 feet diameters and over 50 feet in height. These two trees, almost to the exclusion of anything else, form the undergrowth throughout the woods, up to 2500 feet elevation at least. Indeed, one may almost say that the forest is composed of these two low species in all stages of development, with sporadic intermixture of the larger species.

Forest Conditions.

Aside from the difference in composition, the outer aspect of the tropical mountain forest, at least here, is not so very different from the more northern deciduous forest, and at a distance, if it were not for the palms which stick out here and there, especially near shore, we would not recognize any characteristic difference. Only on coming closer when we scan the forms of crowns and foliage, a somewhat different physiognomy may become apparent, due to the large number of species with pinnatifid leaves, and again with such of leathery texture. On entering we find further differences, not so great, however, as our fancy may have made us expect.

We are accustomed to take our conception of a tropical forest from the descriptions of low land forests, with a dense gloomy vegetation, almost impossible to penetrate, of mighty giants, dense underbrush and a jungle of vines, lianas, etc. But there are as varied conditions in the tropics, mainly due to variation in moisture conditions, as are experienced in our northern forests, and on this range neither on the shore nor in the narrow river valleys is any truly lowland forest to be found, excepting the mangrove swamps.

The first and most striking difference which will attract a forester's attention is the character of the forest floor, namely an almost total absence of a surface of undecomposed litter, and of a lower vegetation. Only the season's fall of leaves—and they fall more or less all the year—seems to cover the ground, without transitional stages of decay and humification; at least in the month of September, the mineral soil, humus-stained, to be sure, is everywhere visible. The herbaceous cover is also scanty, almost absent; no mossy carpet or grassy blanks are to be seen, and the botanical collector finds little to do. Again in the underbrush the absence of bushlike forms is noticeable; it is rather an open thicket of small trees than a dense entangled mass of shrubbery as we are apt to picture. There are, to be sure, varieties of conditions especially in the bottom, where lumbering has been done, and again on the highest ridges, but we speak of the more general aspect of the well-wooded slopes, canyons, and ridges.

Again, the addition of epihytic life distinguishes the tropic from the northern forest. Orchids and Bromelias abound, and llianas and vines hang from almost every large tree in long strands of varying thickness. These are perhaps the most striking feature. There is also a trailing grass, Divisi, *Arthrostylidium,* with long wire-like, tough strands (used for fishline) which adds to the danger of experiencing Absalon's fate. These more than the density of the undergrowth or the occasional rather effective thorns, make needful the use of the sabre-like machete—by the way, the ideal weapon for a forester, far superior to the axe—in order to expedite progress.

Next, our attention may be arrested by the form of some trees, like the *Ceiba,* and the *Yagroma,* although most of them do not vary from those of our trees, and the curious pyramidal spines of the *Ayua,* or the red papery bark of the *Almacigo,* will remind us that we are not at home; otherwise the bark of many suggest our own species, only the variety of smooth-barked trees is greater and confusing.

Finally, the density of the forest is different. Contrary to the usual conception of a dark gloomy tropical forest interior, we find here a pleasant half-shade and, indeed, when the vertical rays of the noonday sun pour down, a little more shade would be welcome. This is due to the manner of distribution of sizes.

While the whole country makes the appearance of being covered by a dense stand of timber, closer investigation shows that the trees of size are, indeed, relatively few, mostly broad-crowned and branchy, while the bulk is undergrowth or a second low tier. This underbrush, made up mainly of the two tree species mentioned is, however, as stated, not very dense, except in spots.

The openness of the main stand may be judged from the statement that, as developed by some 1200 acres of sample area, less than 1.4 tree of commercial size per acre was found. When it is considered that over 100 species participate in making up this stand, the difficulty of a commercial or even botanical survey will be realized.

Nothing is more puzzling than to discover a law of distribution. After many days of cruising over canyon, slope and ridge, one finds in identically the same kind of location a new species, a single tree or group, never to be seen again in further cruisings. Nearly 400 miles had been traveled before the first group of Ebony was met. Under such conditions it is almost futile to attempt to formulate a law of distribution or to determine the frequency of occurrence of any one species, and still less its part in the commercial composition. Nevertheless some approximation to these questions was necessary, and the results of 1200 acres of sample areas will, at least, be better than a mere guess, for the region in which this sampling was done.

The sampling was done by the old-fashioned, newly-named chain method, substituting for the chain a pedometer, checked by time for the distance traveled, and estimating all trees within 50 feet on each side, when a mile will represent 12 1-2 acres. For such rough surveying the use of the pedometer in knowing hands, after having adjusted it for personal equation and character of ground, has proved itself a useful instrument, of course only for establishing large averages of distances. Especially when frequently checked by time and making judiciously allowances for change of conditions, it will be found far better than the cruiser's mere opinion on the matter of distance at the end of a day's run. The accompanying map was largely based on these measurements, and the checking of points by plane-table method proved them remarkably satisfactory.

This sampling gave on about half the acreage, or over 50 miles run, which represented a fair proportion of the various topographic types, the following results as regards participation of the various species in the make-up of the forest.

	No. of Trees.	M. feet.
Cedar	191	121
Jobo	183	140
Sabicu	120	124
Guama	53	23
Yaba	52	30
Almacigo	52	38
Majagua de Cuba	51	20
Jique	40	21
Caoba (Mahogany)	24	17
Roble	23	9
Juba	8	1.7
Júcaro	7	4.3
Majagua azul	6	3.4

The rest of 170 trees of commercial size were distributed among 28 species with from 8 to 1 specimen each. From what has been said regarding the very uneven distribution of species, it will be understood that, if any other run of the same extent were figured up, a very different distribution might be found, although quantities would probably remain the same.

As would naturally suggest itself, a classification of topographic types, namely canyons, slopes, and ridges, was possible, which corresponded to some degree also to forest types, both as to distribution, density and development, the canyons and adjoining slopes being the best timbered, the ridges almost empty, the slope requiring a further subdivision, according to exposure, the southern exposures being dry, and bearing a different flora from the moister north slopes.

Among the tree species a division into three classes was possible, namely those decidedly xerophil, those decidely mesophil and those apparently indifferent to moisture conditions, occurring ubiquitously in all situations, some more frequent on moist, others on dry slopes.

The latter class of ubiquitous trees is by all means the largest, and includes the Cedar and pretty nearly all the more important timber trees. On the dry slopes the MAHOGANY, LIGNUMVITAE, MAJAGUA DE CUBA, GRANADILLO and several others of the heaviest woods are at home. Only a few, some 10 or 12, were found decidedly mesophil. In addition, there must be recognized those which hug the seashore, the decidedly hydrophil, *MANGLE, the Mangrove, Rhizophora Mangle* L. forming with some others swamps along the seafront, and

UVERO, the Sea Grape—*Cocoloba uvifera* Jacq., and perhaps some other species of this genus, occupying the sandy shores.

Finally an entire new set of trees appears on the high elevations somewhere above 2500 feet, a dozen or fifteen species, whose botanical identity has not yet been determined. Here the ponderous BARRIL, a *Caesalpinia,* with trunks up to 3 and 4 feet diameter, and 80 to 100 feet in height, and the not less developed MULATO and RETAMA (24 inch) are the most prominent timber trees. Several smaller melastomaceous species, especially a magnificent golden-leaved one, AGUACATE CIMARRON, add here to the wealth of foliage. Some of the lower level species, unless they be varieties, extend their field of distribution into these higher regions. Stray Cedars are found, ROBLE and OCUJE are present, the ubiquitous YAGROMA makes its silvery show, besides BUNIATO, COPAL, CUDYA, BADANO, GUAYABA, GUADIO, CUARIDURO, JAGUEY, LECHERO, SANGRETORO, and even the JUCARO, which usually and preferably frequents the seashore was represented by a 30-inch specimen. A number of the lower-level species are recognized here as varieties, thus COPEYSILLO, SABICU DE LA MAESTRA, AYUA AMARILLO, MAJAGUA DE LA MAESTRA, ALMENDRILLO.

The ubiquitous MIJI, which, as we have seen, forms generally the undergrowth, has, however, vanished with the 2500 foot level. Instead, tree ferns—AUREL—two species, and palms (MANACA and the spiny JUTA), have become quite general, as also scrubby thorns, among which the ubiquitous SARSA, *Pisonia aculeata* L., combining spikes and hooks in most effective manner is especially prominent and annoying. Small trees of YAMAGUA, JUCARO, MULATO, and some *Melastomaceous* species form the undergrowth of the moister slopes, and a number of un-named shrubs make a dense tangle on the drier ridges. Ferns, mosses, grasses (especially the sticky *Pharus latifolius*) and other mesophil or xerophil herbage according to location, cover the ground. On the whole, however, it is notable that outside of the openings in the river valleys and seafront, the lower vegetation is extremely scanty.

There is one feature of distribution not yet mentioned which is of peculiar interest, namely the occurrence of just one conifer, a Pine (*Pinus occidentalis* Sw.) of the Yellow Pine series, and very pitchy indeed. This Pine is ranged by botanists with the five-needled (*quinae*) ones, also varying to four and three needles; here, however, it varies even to two, and has mostly three and two needles.

This is found only on some rugged peaks of the front range above the 1800 foot level, where it grows to considerable size in almost pure stand, COPAL, LECHERO, JUBA, AZULEJO of the lower levels and two species nowhere else found, CALOMO SIELAGO (?) and JELECHO (JILATIO?) accompanying the Pines. Diameters of 24 inches, 130 feet in height and 50 to 60 feet log lengths are not uncommon, and an average of 10 M. feet to the acre was estimated on a 45-acre location, there being several hundred acres located on the very tops of a number of craggy peaks, evidently the most xerophytic locations.

How did this Pine, which is apparently not found to the East nearer than Hayti, with a sea of evergreen broad-leaf forest intervening, ever come to establish itself here? As a curiosity may be mentioned the occurrence of a single stray, young, (30 years) thrifty specimen of this Pine on a densely wooded river slope, almost near sea level.

Perhaps a few words in regard to the distribution of the Palms should be added. Some six indigenous species besides the planted Coco Palm were recognized, none of them of sufficient numerical development to become a comercial factor, unless the fan-leafed PALMA DE CANA, *Sabal umbraculifera* Mart., be excepted, which occurs in goodly sizes and numbers on the slopes and crests in the Western section. While these Palms in the lower elevations occur in single individuals, near the top of the Maestra and on the higher elevations they become grouped; especially the spineless MANACA, *Geonoma dulcis* Wr., occurs in groups and shady groves. Here, at the very top, also the very spiny JUTA, *Bacteris Plumeriana* Mart., and several species of Tree ferns add to the feeling of being in tropical surroundings.

COMMERCIAL ASPECTS.

Turning now to the commercial aspects of this forestgrowth, we are at once aware that, outside of the difficulty of exploiting it on account of the rugged topography, which is local and can eventually be overcome, there are two conditions, to be taken into consideration, which pertain probably to nearly all tropical forest, namely the small amount of commercial material per acre, and its distribution over so many species.

Here, in a truly virgin forest, rarely as many as ten trees of commercial size furnishing 15-inch logs or more, are found in canyons; from two to three on slopes, and still less on ridges, so that the average comes hardly up to 1.4 trees per acre. While in the bottoms the ponderous Sabicu in one case developed a stumpage of 17 M. feet on one acre, and acres of 1 to 3 M. feet are more frequently found, the average for the whole country, slopes, ridges and canyons, remains below 1 M.; and, if only the species, now established in the market are included, about one-half that amount. To be sure, values place a very different face upon the stumpage conditions. If only one Cedar can be found on every 3 or 4 acres, or say 200 to 250 feet to the acre, as in the case here, there is a log value of $25 to $30 represented, and even less valuable woods, as we have seen, bring, transformed into lumber, $80 and more, so that on the whole satisfactory enough margins can be worked out of such stumpage.

The worst feature is, however, the uneven distribution of the species and the lack of market for a large number, which are probably not only as valuable as those marketed, but could be readily substituted for them without damage to anybody. As a matter of fact it is well known that a number of the fancy woods from tropical countries are not at all true to name or, in other words, are derived under the same trade name from different species and even different genera, and it is likely not even known with certainty from which they come.

Ebony, for instance, denotes a class of woods which comes not only from various species of *Diospyros,* distributed through Ceylon, Bengal, Madagascar, Coromandel, but also from the leguminous *Brya,* which in Cuba is called GRANADILLO, and from several tree species of Guiana. Similarly are the sources of Brazilwood various, and, while perhaps the Cedar and Mahogany wood of various countries comes from the same species, it is well known that the Mexican or Cuban supplies are really very different in quality. Indeed, the African is known to be a different species.

By classifying the woods as regards color and qualities, and grading them as to these rather than as to name, just as is done with our Southern Pines, the difficulty of logging and marketing the infinite variety of tropical woods may be greatly reduced. Most of them are fancy cabinet woods, and to make a market for them, it is needful to create a fancy for variety instead of uniformity in taste. The millmen and commission merchants who handle this trade can hardly be expected to do much to bring about such a change, but the exploiters of tropical woods may very well make an effort, through architects and furniture manufacturers to introduce their various woods, instead of merely extracting, as is usual, the two most valuable, or better, the two that are established in the market, Cedar and Mahogany.

To speak of forestry in connection with such undeveloped conditions would be like putting on a dress coat in camp. There is a large portion of this country, although mountainous and rough, which is fit for pasture, and change into that useful employment of the soil, besides for raising of tropical fruits, cocoa, coffee, etc., is more likely to prove profitable. Indeed, almost any crop of the South or the North could be successfully grown in the bottoms and depressions, but the hillsides are best turned into grass, as some are now, covered with that most nutritious and most prolific of all grasses, the Guinea grass *Panicum maximum* Jacq., which has found its way from more Southern climes unto the burnt areas, made by the insurgents of 1868, when retiring into these mountain fastnesses from the Spaniards.

Naturally for mere protective purposes, certain parts should be kept under forest cover, and this will require nothing but keeping out the fire, for as the commercial trees are removed, MIJI and YAYA will take care to provide the cover. Fire, it seems, does not spread easily, for, although in the annual firing of the pastures to burn off the dead grass, fires must run into the adjoining woods, the extension of open ground appears to be but slow.

A few notes on animal life may prove of interest. In the month of September, if not at other times, nature is here sadly silent; except for the chatter of a most loquacious crow (*Corvus gundlachi*) near the seashore, and the most unharmonious screechings of a long-tailed rusty-brown jay, and the piping of some shorebirds, there is little birdlife in the lower levels. But the solitude of the high range is deliciously made melodious by the morning song of the Solitaire (*Myiadeste spec.*), a veritable nightingale; or was it the song of the equally melodious blue or brown thrush? In the spring, it is said, the woods are teeming with pigeons, of which now but little was seen. There is, however, noise enough at night, when the Crickets and Katydids begin their concert, apparently more sonorous than our own. At night, too, most striking is the Cucuyo, the electric light bug, emitting from his eyes enough light to read by.

Mosquitoes and gnats were in existence, but, especially in the higher altitudes, by no means the pests as which we know them in Northern woods. At the shore a tiny black gnat, almost invisible, is rather persistent and annoying, and near the stables or houses fleas are said to be plentiful. Altogether there were no extraordinary pests found. A single scorpion was seen, dug out of decaying wood, and the total absence of flies was notable. Perhaps the large number of lizards and chameleons accounts for this absence of annoying insect life. Snakes of various descriptions were frequently seen. None of them are poisonous, and the natives never bothered to kill them. Ants, forming curious, brown, large nests, kept themselves singularly unobtrusive, while bees fill their wabs full of the finest flavored honey, and apparently give it up willingly to the natives, who handle them without circumstance.

Of larger game, deer with black horns, not of large size, was seen, and wild boar, that is of the same wildness as our razor backs, were evidenced by many trails and wallows.

Bear is said to be in existence, but no traces were seen.

The most curious feature of low life in the woods are the land crabs, living in larger or smaller colonies, burrowing in the ground mostly near the seashore, but also on the slopes.

The game, the honey, the medicinal resins, etc., lead the hunter and the collector into these vast woods, and since travel on the ridges is easiest, we find trails even on the high Maestra, made by boar or men, which need only small work of the machete to render them passable.

There would be no unsurmountable obstacles to explore the entire range up to the highest peak, El Turquino, and interesting botanical discoveries would be assured. Iron, copper, and argentiferous lead have been found, and scenically, this range deserves the name of the Switzerland of Cuba.

B. E. Fernow.

II. LIST OF TREES ON THE SIERRA MAESTRA.

[The vernacular names are those locally used, and may not in all cases correspond to those used for the same species in other parts of the island. The spelling of the vernacular names has been found to vary often, and the phonetic interpretation of the sounds may not always be correct, hence various cross references were necessary.

The botanical identity of those followed by ? is still in doubt, having been based on the names in various check lists, principally F. A. Sauvalle's *Flora Cubana,* and Comb's *Plants of Cienfuegos.* The unquestioned botanical names were determined from collected material in the New York Botanical Garden.

Of some minor species nothing but the name and locality where found could be noted. The names of the important species and especially those found in the home market are underscored.]

ABEY, see Jaguéy.

ACANA—*Mimusops dissecta,* R. Br.?
Ubiquitous, rare. Small tree. Wood similar to Sabicu. Used for piling, railroad ties, etc.

ACANA DE COSTA—*Mimusops globosa* Gaertn?
Ubiquitous. Small tree.

AGUACATE—*Persea silvestris* Rich., or *alpigena?*
Ubiquitous, rare. Soft wood.

AGUACATE CIMARRON—A golden-leafed *Melastoma.*
High Maestra above 2500 level. Diameters up to 3 feet.

AJITE—*Gymnanthes lucida.* Sw.
On dry slopes. 30-inch specimen seen. Used for piling, railroad ties.

ALBEYOTA—
High Maestra above 2,500 level.

ALMACIGO—*Bursera Simaruba* (L) Sarg. (Gumbo-limbo of the Bahamas.)
Ubiquitous, frequent specially on dry slopes. Diameters 2 to 4 feet. Wood light colored, soft, no heart. Used for cheap furniture, boxboards. Medicinal resin.

ALMENDRO DE CUBA—*Laplacea Wrightii* Griseb ?
Ubiquitous, frequent. Diameters 3 feet. Wood yellowish, soft, of almond smell.

ALMENDRILLO—*Rhamnidium reticulatum Griseb?*
High Maestra above 2,500 level.

ALMORRANA—
In fresh woods, rare. Diameters to 3 feet. Wood yellowish.

ATEJE—*Cordia* spec.
Ubiquitous, rare. Diameters up to 5 feet. Wood white, no heartwood, soft.

AYUA—*Zanthoxylum martinicensis* (Lam) D. C.
Ubiquitous, frequent. Diameters up to 2 and 3 feet. White to yellow wood, fine-grained, somewhat like satinwood. Used for trimmings.

AYUA AMARILLO—*Zanthoxylum* spec. ?
High Maestra, above 2500 level.

AYUDA, see AYUA.

AZULEJO—*Styrax obtusifolium.* Griseb?
Moist woods, rare. Up to 3 feet in diameter. Hard, reddish heartwood.

BADANO—
Moist woods, rare. Up to High Maestra, here more freuent. Diameter to 3 feet. Wood white, soft.

BARIA—*Cordia nitida.* Vahl., or C. *gerascanthus* Jacq.?
Ubiquitous, frequent. Diameters 2 to 3 feet. Wood light reddish, similar to American Elm. Used for rafts, joists, axe handles.

BARRIL (or BRAZIL?)—*Caesalpinia?*
Top of Maestra. Diameters to 4 feet, and 100 feet in height.

BOTIJA—*Cochlospermum hibiscoides.* Kunt.?
Dry woods, rare. Diameter 2 to 5 feet. Wood hard, yellow to chocolate.

BRUJE—
Dry slopes, rare. Small tree. Wood like lignum-vitae.

BUNIATO—*Strychnodaphne floribunda,* Griseb?
Ubiquitous, up to the crest. Small tree. Used for packing cases.

CAGUANI—*Sideroxylon mastichodendron* Jacq. *Mastic* "(Ausubo" of Porto Rico.)
Ubiquitous, frequent. Diameters to 4 and 5 feet. Heartwood very hard, yellow to maroon red, durable. Used for railroad ties, construction timber. (Iu Porto Rico $16 for 4x6x163.)

CAIMITILLO—*Chrysophyllum glabrum..* Jacq.?
Ubiquitous, mostly moist woods, rare. Diameters to 4 and 5 feet. Hard, reddish wood.

CALOMOSIELAGO—
Large tree found only in pinery.

CAOBA—*Swietenia Mahagoni L.*
Dry slopes, frequent. Diameters up to 4 feet. Wood well known. Use well known. Price 7 to 10 cents per foot.

CARBONERO—
Dry woods. Diameters 2 feet. Heartwood medium hard, yellow. Used for railroad ties.

CAREY DE COSTA—*Cordia angiocarpa*? A. Rich.—Spanish Elm?
Dry slopes. Diameters 2 feet. Wood greenish brown, hard, (substitute for Lignum Vitae?).

CEDRO—*Cedrela odorata L.*
Ubiquitous below 2500 feet, frequent. Diameters to 5 feet. Wood yellowish, well known in market. Used for cigar boxes and finishing. Price, 10 to 15 cents per foot.

CEIBA—*Ceiba pentandra* (L.) Gaertn. (*Eriodendron anfrac-..tuosum* D. C.)
Ubiquitous, frequent. Diameters up to 8 feet. Wood soft, white. Used for dugout canoes and boats, may be suitable for paper pulp, and wool for stuffing cushions.

CHICHARRON—*Terminalia chicharronia* Wr.?
Dry woods, rare. Diameters to 3 feet. Wood hard, white.

COCUYO—*Bumelia nigra* Sw., or *Sideroxylon confertum* Wr.?
Moist woods, frequent. Diameters 3 to 4 feet. Wood yellow. Use, construction timber.

COPAL—*Icica copal.* Rich.? *Hedwigia balsamifera* Sw.? (*Masa* of Porto Rico?)
Ubiquitous, up to the crest, quite frequent. Diameters 4 to 5 feet. Wood hard, reddish heartwood. Use, resin, medicinal.

COPEY (CUPEY)—*Clusia rosea L.*
Ubiquitous, up to the crest, frequent. Diameters 3 to 4 feet. Hard wood, good for posts.

COPEYSILLO—
Probably a form of the foregoing. Found only on the high Maestra.

CORDOBAN (COROVAN)—
Only on high Maestra.

CUARIDURO—*Cassia emarginata L.*
Ubiquitous, up to the crest, frequent. Diameters 2 to 4 feet. Wood white, hard. Use, wagon work, tannin.

CUYA (or CUDIA, or CRUDYA?)
Ubiquitous, up to the crest. Diameters to 3 feet. Wood like Mahogany.

CUPEY, see COPEY.

DAGAME—*Rondeletia arborescens Griseb.* .

Ubiquitous, frequent. Diameters 2 to 4 feet. Wood, use for spars, etc.

EBANO—*Sideroxylon?* With light gray bark, hence probably not *D. Ebenum.*
Ubiquitous, mostly in moist woods, rare. Diameters 2 to 3 feet. Wood dark black.

FORCAJIGA—
In dry situations, rare. Diameters to one foot. Used for piles.

FUSTETE—*Chlorophora tinctoria* (L) Gaud.

Ubiquitous, frequent. Diameters up to 4 and 5 feet. Wood yellow, turning red. Use, dyewood. By the ton.

GRANADILLO—*Brya ebenus D. C.*

Dry woods, rare. Diameters 2 to 3 feet. Wood dark brown, mottled. Used for canes and carvings.

GUABANO—*Cupania macrophylla* A. Rich.?

Ubiquitous, rare. Diameters 2 to 3 feet. Wood white, hard. Spokes, billets at 25 to 30 cents.

GUABIGA—*Xylopia obtusifolia* A. Rich.?

Diameters 1 to 2 feet. No use.

GUACACOA—*Daphnopsis Guacacoa,* Wr.?

On the top of the Maestra. Trees 20-inch and 100 feet seen.

GUADIO—

Ubiquitous up to the crest, rare. Diameters up to 5 feet; 26-inch tree seen. Heartwood blackish, very hard.

GUAGUACI—*Guarea trichilioides L.*

Ubiquitous, rare. Diameters 4 to 5 feet. Wood white, medium hard. Used for boards and furniture; cathartic bark.

GUAMA—*Lonchorcarpus sericeus* H. B. K. (Not the Guamà of Porto Rico, *Inga laurina.*)

Ubiquitous, frequent. Diameters up to 5 feet. Wood blackish, hard as iron. Used for beams, bark for tannin.

GUAMA BOBO—

Probably a form of the foregoing.

GUAMACA (Very large leaflets, four.)

General, but mostly dry woods, frequent. Wood yellow, hard. Used for railroad ties, general construction; tanbark.

GUARIGA—

Dry woods, rare. Diameters 2 to 3 feet. Wood very hard. Used for mallets.

GUASIMA—*Guazuma ulmifolia* MacF.

Bottom lands, frequent. Diameters up to 4 feet, but short (50 feet). Wood white, light. Leaves medicinal.

GUASIMILLA—*Trema micranthum* (L.) Blume.
Dry woods, rare. Diameters 2 to 3 feet. Wood white.

GUAYABA—*Psidium Guava* Radd. Guava. (Not the Guava of Porto Rico. *Inga vera.*).
Ubiquitous, up to the crest, rare. Small tree. Wood yellowish white, fine smelling. Used for posts.

GUAYACAN—*Guaiacum officinale* L. Lignum Vitae.
Dry woods, rare. Diameters 4 to 5 feet. Wood dark brown. Use well known.

GUAYACAN NEJO—
Dry woods, rare. Diameters 2 to 3 feet. Wood like the foregoing, brownish black.

GUELLA—*Crescentia Cujete L.* Calabash.
Ubiquitous, frequent. Small tree to 30 feet. Wood tough. Used for railroad ties.

GUESIJO—*Celtis trinervia* LaM.
Small tree.

JUBABAN—(*Trichilla spondioides* Sw.?)
Ubiquitous, rare. Diameters 3 to 4 feet. Wood soft, white.

JABONCILLO—*Melicocca bijuga* L.
Dry woods. Diameters 2 feet, height to 150 feet. Wood yellowish. Used for furniture.

JAGUA, see YAGUA.

JAGUEY (*Jave* or *Avey*)—*Ficus spec.*?
Ubiquitous, up to the crest, frequent. Parasite. Diameters up to 4 feet. Wood white, soft.

JATIA—
Ubiquitous, frequent. Diameters up to 4 feet. Wood whitish-yellow, hard. For piles in seawater.

JELECHO—(Jilatio?)
Large tree in the pineries.

JIQUI—*Lysiloma Sabicu* Benth. Sabicu of the Bahamas.
Ubiquitous, frequent. Diameters up to 4 feet. Wood browner and harder than Sabicu. Railroad ties, furniture.

JILATIO—(Jelecho?)
High Maestra, above 2500 feet. A small tree (8 inches diameter seen.)

JOBO—*Spondias lutea* L. West Indian Plum.
Ubiquitous, most frequent. Diameters up to 5 feet. Wood white, soft.

JORCAJIGUARO—
Small tree, to 1 foot. For piles, stands sea water.

JUBA—(Uva?) *Cordia* spec.?

JUBA BLANCA—
On high Maestra. Large (4 foot) trees.

JUBA PRIETA—

JUCARILLO—
Ubiquitous, rare. Diameters 3 to 4 feet. Wood very hard, yellow to black. Furniture, tanbark.

JUCARO—*Bucida Buceras* L. (Ucar blanco of Porto Rico, "wild olive" of Jamaica.)
Ubiquitous, mostly along shore, but up to the crest, unless this is another species; frequent. Diameters 3 to 4 feet. Wood black to yellow, very hard. Wharf timbers, wagon spokes.

LANERO—*Ochroma Lagopus* L.
Moist woods, frequent. Diameters 3 to 4 feet. Wood white, soft.

LECHERO—*Euphorbia* spec?
Ubiquitous, up to high crest. Diameter 2 feet, height 120 feet seen.

LIRIO DE COSTA—*Rauwolfia Cubana* A. D. C.

LIMONCILLO CIMARRON—*Zanthoxylum* (spec.?)
High Maestra, above 2500 feet level.

MABOA—*Cameraria latifolia* L.?
Ubiquitous, frequent. Diameters 3 to 4 feet. Black heart, very hard. Milky sap.

MACAGUA—*Pseudolmedia spuria. Griseb?*
Ubiquitous, rare.

MACABEY—
Ubiquitous, rare. Diameters 3 to 4 feet. Wood white like Jaguey, and soft.

MAJAGUA AZUL—*Paritium elatum* G. Don.
Ubiquitous, mostly in moist woods, frequent. Diameters 2 to 3 feet. Wood hard, bluish-green, turning yellow; very tough and elastic. Furniture, spokes, axles. Price $100 to $150.

MAJAGUA DE CUBA, (de costa)—*Corpodiptera Cubensis* Griseb.
Ubiquitous, mostly in dry woods, frequent. This species is a re-discovery and found here quite frequent. Diameters 2 to 3 feet. Dark red. Construction, planks, boards, posts.

MAJAGUA DE LA MAESTRA—
Only on high Maestra.

MANGLE—*Rhizophora Mangle* L.
Along sea shore, frequent. Small tree, diameter up to 1 to 2 feet. Leaves and bark for tan.

MANGLE NEGRO—*Avicennia nitida* Jacq.?
Ubiquitous, rare. Large trees. Black heart like Lignum Vitae.

MARIQUITA—
Only on high Maestra above 3000 feet. Specimen of 20-inch diameter seen.

MANAJU—*Rheedia aristata* Gris.?
Moist woods, rare. Diameters 2 to 3 feet. Wood reddish.

MIJI—*Calypthranthes rigida* Sw. and other species?
Ubiquitous, frequent. The prevailing undergrowth, especially in dry woods. Diameters 1 to 2 feet at most. Wood yellow, tough, not easily split. Railroad ties.

MULATO—
On high Maestra only.

NEGRO CUBA (Tri-foliate).
Dry woods, rare. Diameters 1 to 2 feet. Wood yellowish.

OCUJE—*Calophyllum Calaba* Jacq.?
Moist woods, rare, larger number above 2500 feet. Diameters 3 to 4 feet (32-inch seen). Wood white to reddish brown. Furniture, etc. Price, $160.

PINION DE COSTA—*Erythrina corallodendron* L.?
Dry woods, rare. Diameters 2 to 3 feet. Wood hard, light black, similar to Jiqui and Lignum Vitae.

PINO—*Pinus occidentalis* Sw.
On dry, craggy peaks over 1800 feet. Diameters 3 feet. Height 130 feet. Pitdry, yellow-pine wood. First time collected in Cuba.

PURIO—*Bocagea laurifolia.* Benth & Hook.?
Moist woods, rare. Inditator of coffee lands. Small tree.

QUIEBRA-HACHA—*Copaifera hymenaefolia.* R.?
Ubiquitous, frequent. Diameters up to 4 feet; fluted bole. Wood white, hard as name implies. Specially for piles; stands sea water.

RASPA—LENGUA—*Casearia hirsuta.* Sw.?
Dry woods, rare. Small tree. Wood hard, lark, like Lignum Vitae.

RETAMA—*Senecio plumbeus.* Griseb.?
Only on high Maestra. Specimen seen 2 feet by 100 feet.

ROBLE BLANCO—*Tecoma pentaphylla.* D. C.
Ubiquitous, frequent, 9th in frequency. Diameters up to 4 and 5 feet. Wood hard yellowish. Wagon work, etc. Price, $40 to $80. Ox yokes, $1 a billet.

SABICU—*Pithecolobium arboreum* (L) Urb.
Ubiquitous, frequent, 7th in frequency. Diameters 5 to 7 feet. Wood fine brown, resembling mahogany, more wavy open grain, longer curly pithrays. Furniture and wagon hubs. Price, $50 to $200 for wide planks. Hub billets, 18 to 10 in. by 3 feet, $3 to $4.

SABICU MORURO—*Peltophorum adnatum.* Griseb.
Ubiquitous, frequent. Sizes smaller than Sabicu. Wood said to be of finer grade than preceding, otherwise same. Like the preceding. Tan bark.

SABICU DE LA MAESTRA—A form on the high Maestra.

SANGRETORO—*Maytenus buxifolius* (Rich) Griseb.
Ubiquitous, up to the crest, mostly in dry woods, rather rare. Diameters 3 to 4 feet. Wood hard, light blood-red.

SEIBA, see CEIBA.

SUCHIL (Suche)—*Plumieria rubra.* L.?
Dry woods, rare. Diameters 1 to 2 feet. Wood white, soft.

TAMARINDO—
Dry woods, rare. Small tree, 6-inch seen.

TENGUE—*Poeppigia procera.* Presb.
Ubiquitous, mostly in dry woods, rather frequent. Diameters 2 to 3 feet. Wood hard, brown, like Sabicu. Posts, beams, railroad ties. Medicinal bark.

UVERIGO (Uverillo?)—*Coccoloba* spec.?
Moist woods, rare. Diameters 3 to 4 feet, seen 15 in. Wood yellowish-red.

UVERO—*Coccoloba uvifera.* Jacq. Sea Grape.
Along sea shore, common. Diameters up to 1 foot.

VARIA, see BARIA.

YABA—*Andira Jamaicensis* (Wr.) Urb.
Ubiquitous, frequent. Diameters 4 to 5 feet. Wood hard, yellow. Beams, felloes, wharf timbers, indestructible. Price, $80.

YAGROMA—*Cecropia peltata* L., and *palmata* W.
Ubiquitous, up to the crest, most frequent. Diameters 3 feet. Wood light, white, stems hollow.

YAGUA—*Genipa americana* L.?
Moist woods. Diameters to 2 feet. Brownish heart.

YAMAGUEY—*Belairia* spec.
Dry woods, frequent. Diameters 1 to 2 feet. Wood hard, black heart, ebony-like. Building.

YAMAGUA—*Guarea trichilioides* L.? (see Guaguaci).
Ubiquitous, mostly in moist woods, rather rare. Diameters 4 to 5 feet. Wood medium hard, reddish between cedro and sangretoro.

YAYA COMMUN—*Oxandra virgata.* A. Rich. Lancewood.
Ubiquitous, most frequent, forming the undergroth. Diameters to 2 feet. Spars, shafts, poles, railroad ties. Price, per spar, 60 cents.

YAYA BLANCA—*Drypetes lateriflora* (Sw.) Kr. and Urb.
Ubiquitous, rare. Tall tree.

PALMS.

JUTA—*Bactris Plumierana* Mart.
A spiny tree palm on the very crest.

MANACA—*Geonomis dulcis* Wr.
On higher elevations to the very top.

PALMA DE CANA—*Sabal umbraculifera* Mart.
Large tree on front range.

PALMA REAL—*Roystonia regia* (L) Cook.
At seashore. Large tree.

YAREY—*Inodes causiarum.* Cook.
At shore. Hat palm.

YURAGUANO—*Thrinax radiata.* Lodd.?
Small tree at shore.

III. BOTANICAL NOTES ON THE VEGETATION OF THE HIGH MAESTRA.

The following brief notes are presented by permission of Dr. N. L. Britton, Director of the New York Botanical Garden, without whose help many of the determinations in this paper would have been impossible.

The varying moisture conditions on the southern side of the High Maestra predicate at least two groups of plant formations, namely, those which come under the influence of the moisture-laden Northeast trade winds (the plants of the high elevations and north exposures) and those which do not. Some species are distributed generally without reference to moisture conditions, but it is to differences in moisture conditions, rather than to those of temperature or altitude, that we must look for the reason of the great variation in the plants of these opposite situations.

Of those that occur only in the lee of the Maestra, there are some that must be considered typical strand or sea-beach plants, plants of wide distribution along the coasts of the West Indies. Of these *Coccoloba uvifera, Ipomoea Pes-Caprae, Canavalia obtusifolia, Guilandina crista,* and one or two wiry grasses were the commonest. Much of the coast, however, is not sandy, but consists of granite pebbles of all sizes. In such places all the above species are found, as well as independent plants of *Clusia rosea,* which is usually parasitic farther from the sea, and also *Bursera Simaruba, Cyperus ligularis,* and a species of *Conocarpus,* which is a particularly common shrub along the beach. These and the usual tree species of the Mangrove swamps found along the wetter portions of the coast are joined by the common herbaceous weeds of the West Indies.

Going back from the shore one finds the usual profusion of tropical weeds and littoral trees and shrubs, which being found everywhere in the West Indies, it is unnecessary to discuss, except to note that they appear to be more luxuriant at the eastern than at the western end of the region examined. Down the coast towards the west, where the country is well within the lee of the higher part of the Maestra, the lack of Piperaceae, Araceae and other moisture-loving plants; and the occurrence of at least two species of *Cereus* and of colonies of *Opuntia* are suggestive of the effects of the wind shield.

One of the typical features of this country is its river system. At the time of our visit all the rivers flowed under ground for the last one or two miles, the delta spreading out so that a river valley, a mile or more across at its mouth, would be formed. The various branches of the stream had cut out what, during the rains, would be islands, but at this season were only patches of land intersected by the stony river-beds. From the lack of shade or from the sterility of the soil, or from both causes, these restricted areas were almost truly xerophytic in character. Here about the only trees are one or two species of *Plumiera,* interspersed among a considerable variety of prostrate shrubs and low herbs.

In an attempted ascent of the Guama river many interesting species were found. As soon as the river narrows down and the banks become very steep, the country takes on an entirely different aspect. Although the slopes are well wooded, the trees are mostly of smaller size than on the bottoms in front, the predominating species being the small *Oxandra virgata,* a *Calyptranthes, Spondias lutea,* a *Cecropia,* and a fair sprinkling of *Swietenia Mahagoni* and *Cedrela odorata,* and many other tree species are found, but the most interesting is *Carpodiptera cubensis,* this being a re-discovery since its first collection during the explorations of Wright about 1866.

The lack of any considerable shrubbery and herbaceous undergrowth on the slopes was very marked at this point, as at nearly all places we visited that were in the lee of the Maestra. At this time (September) the ground was covered with a carpet of dried leaves, and this dryness, together with the dense shade, must be held accountable for the lack of herbaceous plants. About the commonest were the two grasses *Pharus latifolius* and *Oplismenus hirtellus,** and also numerous clumps of *Renealmea occidentalis.* At this point large numbers of the thorny *Pisonia aculeata* and the grass *Arthrostylidium* were seen and they were found subsequently throughout the region, the former being very noticeable on account of the obstruction that its armature makes to all who are trying to get through the "bush."

*For the determination of these and other grasses mentioned in this paper I am indebted to Mr. G. V. Nash of the New York Botanical Garden.

In climbing one of the mountains in the upper Guama the balanophoraceous parasite, *Scybalium jamaicense* was frequently found growing on the roots of *Cassia emarginata.*

Our first real canyon was visited here and the great change from the dry slopes to the moist gorge was very marked and most interesting. Epiphytes of all kinds abound, chief among them being *Tillandsia, Guzmania, Rhipsalis,* together with numerous Piperaceae, Orchidaceae and Araceae; and also many ferns, particularly of the genus *Campyloneuron.* Vines are festooned in the trees, noteworthy among them species of *Rajania, Prestonia* and *Mucuna.* These, with hundreds of others, make the views up these gorges very beautiful. The suddenness of the change from the dry slopes is a very pronounced example of the ecological relation that all plants must bear to their soil-environment. The climatic conditions are of course the same in both situations, but there is water in the bottom of these canyons and it is to this edaphic factor that we must look to account for the support of such a luxuriant vegetation.

On the mountains in this vicinity numerous colonies of *Pinus occidentalis* were noted. This was originally described by Swartz from the island of Hispaniola (Santo Domingo), and it is interesting on account of the variation that it shows in the number of needles. Haytian and Domingan specimens have usually four or five leaves in a sheath, while the Cuban tree has mostly three.

About the end of our stay in the lowland parts there was a shower almost every day. These are not showers in our northern sense, but terrific downpours, and, in consequence, throughout the forest a large number of Bromeliads were dislodged from their hosts and strewn over the ground. In the case of *Tillandsia fasciculata* particularly the cup at the base of the rosette of leaves becomes filled with water in a few moments and the epiphyte is torn from its support by its own weight. Thousands were found in this condition after a week of such showers.

After leaving the lowland for the Maestra the change in the flora is not very marked until one comes up to the top. Very few of the species found at lower levels are lost and still fewer new ones are found, so that the character of the vegetation is very like that of the lower altitudes. One or two terrestrial orchids and a few ferns are exceptions to this statement, but the really marked change does not occur until the top ridge is reached and for the first time the direct influence of the moisture-laden trade wind is experienced.

Then the change is, indeed, very great, and a number of plants that were not found in the low country are common. There are forests of tree-ferns, palms and tree species that are not found in other parts. Of the ferns generally it is impossible to give an enumeration, but their great number, particularly epiphytic and filmy ferns, make them, with the mosses, very striking features of the landscape. The atmosphere up here is very near the precipitation point, and it is thus an ideal environment for moisture-loving plants of all kinds, and, as might be expected, they occur in extravagant profusion. Almost every tree is covered completely with epiphytes, mostly ferns, orchids and *Peperomias,* while on the ground are large quantities of the grasses *Oplismenus* and *Arthrostylidium,* the latter often running up into the trees.

Of the orchids, a beautiful little *Pleurothallis* was one of the most common, some of the plants being scarcely more than two inches high, and having the most wonderful tiny flowers of dark red or white, or yellow-green. The genus *Stelis* was also well represented. The family *Melastomaceae,* represented by numerous shrubs and trees, was found here, but nowhere in the lowland, except in one canyon. It would not be possible in a paper of this length to give a detailed account of the plants of this ridge, as the number of species is very great and the time spent in the area was not at all proportionate to the richness of the flora.

On the slopes of this range occur three palms, the most common being of course the Royal Palm, *Roystonea regia.* The other two are not so plentiful, *Bactris Plumieriana* being local in its distribution, and *Geonoma dulcis* only common in altitudes of 2,000 feet or more. Besides these there are one or two others reported, and of course the Cocoa nut, *Cocos nucifera,* which has been introduced and planted at the shore.

One very interesting botanical feature of the region is the great size of the trees of *Ceiba pentandra* that are everywhere common except on the topmost ridge of the Maestra. To those who are interested in the probable New World origin of this species this discovery will be of interest, as it is (next to *Pithecolobium*) the largest tree that was found, and some of the trees may possibly antedate the discovery of the island. The occurrence of *Citrus,* however, in many shady nooks of this virgin forest—certainly an Old World genus—strengthens the questioned theory of the introduction of the former from the East.

Norman Taylor.

METHODS IN DETERMINING RESERVE BOUNDARIES.

The Section of Reserve Boundaries in the Forest Service, occupies itself with the examination of lands for new forest reserves, for additions to and eliminations from existing reserves, and for the classification of agricultural land in accordance with the Act of Congress of June 11, 1906. The importance of this work has increased enormously, and there has been a steady evolution in the methods employed. The first reserves were created upon petition of persons interested, without detailed examination by representatives of the Government. Now, there is a force of specially trained men who devote their whole time to this branch of activity.

In all branches of boundary work, three distinct steps are essential: (1) The preliminary collection of topographic and alienated land data; (2) Field examination; (3) Preparation of maps and reports.

Topography of surveyed areas within or adjoining the limits designated for examination is copied on township plats, on a scale of one inch to the mile; on these plats the sections are divided by dotted lines into 40-acre tracts. This data is secured from the official plats on file at the office of the U. S. Surveyor General for the State or Territory, or at the U. S. Land Office for the district within which the area to be examined is located. Frequently, as in the mountains of the Southwest, large areas are unsurveyed, and the missing topography must be sketched in the field. Where mountain lands are in demand for summer stock ranches, as is the case in Colorado and Utah, the surveys are nearly complete.

Where available, the topographic sheets prepared by the U. S. Geological Survey are used in supplying data as to topography of unsurveyed mountain areas and in supplementing the information given by the plats of the Land Office surveys. The latter give little or no idea as to relative altitudes in mountain regions.

Data concerning alienated lands are secured at the local U. S. Land Office and are marked on the township plats above mentioned, by means of rubber stamps especially prepared for that purpose. Each stamp makes a distinctive mark or character, to denote, by legal subdivisions of 40 acres, one of the different kinds of entries at the Land Office. Thus are distinguished Homestead Entry, Patented Land, Railroad Land, Timber and Stone Entry, Desert Entry, Approved State Selection, Unapproved State Selection, Patented Coal Land, Coal Entry, Mineral Claims, Lieu Selection and School Land.

Where the proportion of alienated land is very large, such areas are not generally considered suitable for reserve purposes. The exception to this statement is in the case of railroad land, where, within certain limits, every odd-numbered section was granted to a railroad. Some of the reserves contain a very large amount of land of this character. Where the land is otherwise desirable for reserve purposes, it may be included, if only 10 per cent. remains in the hands of the Government. The repeal of the lieu selection law puts a stop to the immense fraud by which the railroad companies, or the lumber companies to which they sold, were able to exchange the worthless portion of their holdings for valuable timber lands elsewhere.

Methods of field examination and report vary greatly with the size of the area to be examined and with the comparative necessity of securing exact results in the determination of boundaries. These points will be discussed in connection with the various classes of work.

EXAMINATION OF LANDS FOR NEW RESERVES.

This branch of work at first occupied practically the entire attention of the force of the Section of Reserve Boundaries. The large areas of special importance have, however, for the most part, been examined, and with the increasing demand for new lands for settlement, there will be an added amount of attention paid to readjusting the boundaries of reserves already existing or recommended for creation.

The considerations justifying the creation of new reserves are the protection of important watersheds and the production of timber for commercial use. Local demands for the regulation of grazing are of course to be considered, but can never be allowed to govern on large areas where there is no question of waterflow or reproduction. The Forest Service does not attempt a general solution of the problem of grazing on public lands; this can be brought about only by action on the part of Congress. As a matter of fact, however, the Forest

Service does exercise a very considerable influence upon the stock business of the country, since nearly all the available summer range is in forest reserves. Similarly, the fact that the regulation of grazing upon summer range in the mountains is essential to the continued utilization of the desert or prairie winter range, is an argument in favor of the reservation of the former. While the latter greatly exceeds the former in extent, still it cannot be utilized unless the former is so managed as to furnish sustenance for stock during that portion of the year in which the deserts or prairies can not be grazed on account of the absence of water.

The reservation of woodland areas is frequently justifiable, as in portions of Nevada, where such areas form important watersheds, or where the question of fuel supply or mining timbers is of great importance. On the other hand, the reservation of small or inaccessible forest areas is unjustifiable unless these areas are of sufficient present or prospective economic importance to justify the expense, considered from the point of view of timber production or watershed protection.

In the field, the first question to be answered is "Should this area, or a part of it, be reserved?"

The next step is the collection of field data for topographic and forest maps, and for the report. If the area is surveyed by either the Land Office or Geological Survey, the question of topography is practically eliminated. If not, the deficiency must be made up by sketching in the unsurveyed portions from the highest points accessible. Since it is expected that an average of about one township per day will be examined, these maps can not pretend to great accuracy. On these rough field maps are designated the distribution of the various types of forest cover, as Commercial Forest, Timberland, Non-Commercial Forest, Woodland, Cut-Over Land, Burn, Chapparal, Sagebrush, Open Grass Land, Cultivated Land, Cultivable Land, and Barren Land.

While in the field, tentative boundaries are determined and marked in on the township plats above mentioned. These lines are run almost invariably upon section or quarter-section lines, seldom upon forty lines. Natural boundaries are seldom used, even on unsurveyed land. Portions of the boundaries of the Priest River reserve, in Idaho and Washington, and of the Bitterroot reserve, in Idaho and Montana, are exceptions to this rule.

The examiner does not survey or mark the proposed boundaries;

he merely recommends what they shall be, on paper, leaving the later marking on the ground to be done by the Geological Survey or by the executive force of the reserve.

Usually, in the field, the examiner makes but little use of section lines and corners, locating his boundaries to a very large extent with reference to streams, peaks, buildings, roads, trails, patented lands, base of mountain ranges, or the line between surveyed and unsurveyed areas, as shown upon his plats.

After the completion of field work comes the preparation of maps and reports. This is usually done at the Washington office during the winter months. The forest map, showing distribution of forest cover, has already been described. In addition, a title map is prepared, showing location, extent and character of all alienated lands, compiled from data secured in the land office.

The report covers fully the points of location, area, topography, climate, silvicultural types, estimate of stand of merchantable timber, forest as a protective cover (including acreage and value of irrigated and irrigable lands dependent on proposed reserve), settlements, roads, railroads, lumbering, grazing (including amount and character of stock, conflicting interests and merits of controversy, and recommendations as to season and amount of stock to be allowed on reserve), damage from fire, public sentiment, and necessary administration.

ADDITIONS TO EXISTING RESERVES.

These are comprised chiefly in two classes:

(1) Timberlands left out at the time of creating the reserve because of uncertainty, in large unsurveyed areas, as to exact location of boundary recommended.

(2) Woodland areas excluded because of uncertainty as to exact location of lines, or because, as in some of the older reserves, it was not considered worth while, from an economic point of view, to reserve them. With increasing settlement of the country has come an increased demand for fuel, fencing and mining timbers, and the woodland areas have become recognized as of the very considerable economic importance.

In addition to these classes, there may sometimes be justified the inclusion of grazing lands, comparatively small in extent, without even a woodland growth, but of peculiar importance because of the relationship they sustain to local stock interests and the difficulty of properly regulating grazing were they excluded. Such, for instance, might be a narrow strip of foothill or bench land, just outside the reserve, adjacent to the cultivated valley lands, and the protection of which from over-grazing by transient stock is essential to the proper handling of local stock. This protection of local interests is particularly desirable where, upon the ability of local stockmen to secure proper summer range depends their ability to secure a market for the agricultural products of their ranches, in the form of winter feed for their cattle, sheep or horses.

Field work and reports are similar to those above described.

ELIMINATIONS FROM EXISTING RESERVES.

These consist principally of two classes:

(1) Strictly agricultural or grazing lands on the exterior boundaries of forest reserves. These cases occur chiefly in the older reserves, or where the imaginary boundary was established in a large unsurveyed area. Following the survey, readjustment is sometimes necessary.

(2) Agricultural lands within the exterior boundaries of reserves. The examination and listing for entry of these lands is authorized by the Agricultural Homestead Act, passed June 11, 1906. Under this Act, upon application to the Forester, agricultural lands in forest reserves are being examined and described either by legal subdivisions or by metes and bounds. Unsurveyed lands can be taken as readily as those which are surveyed. After examination, the Forest Service recommends to the General Land Office the descriptions to be listed for entry in the local land offices.

Only lands chiefly valuable for agriculture and not needed for administrative purposes by the Forest Service or for some other public use will be classified under this Act. The officer in charge of each reserve is required to send in for reservation a list of the lands needed for administrative purposes, and the examiner is also instructed to consider this question at the time of his examination. The reserve business is still in its infancy, and it is expected that before many years the administrative force will be increased to such an extent that there will be a ranger to every township, and this ranger will be permanent, and need a headquarters cabin, a small piece of agricultural land, and a horse pasture. The future rather than the present needs of the service must therefore be considered in making selections for ranger quarters, and this action is sure to result in more or less criticism of forest officers by persons wishing to secure these locations for their own use.

It has been definitely decided that forest reserve lands bearing a good stand of merchantable timber are not necessarily agricultural, even though, when cleared, they would produce a valuable crop. In other words, this Act will not be allowed to so operate as to permit the securing of timber land for speculative purposes. As a general rule, lands of this character will not be listed until the timber on them has been sold by the Forest Service.

The first field work under this act has been in the Priest River, Washington, and Bitter Root forest reserves, in Idaho, Washington and Montana. In the Priest River reserve, the lands in greatest demand are the open meadows and alder and willow bottoms along the streams. These areas are usually more or less swampy because of numerous beaver dams, to which, in fact, their original formation is largely due. They can, however, be readily drained, and the soil is well adapted to the growing of hay.

Experience has shown that the homesteading of timber lands in areas now reserved as a rule has not resulted in actual settlement and development of the country. Residence was frequently only perfunctory, and final proof a fraud. Title once secured, the timber was sold to lumber companies, ruthlessly slashed over, and the ground left a menace to the surrounding region.

The Act of June 11 promises to reverse all this, and bids fair to remove the last vestige of ground for effective opposition to the reserve policy. Actual residence will be required, and commutation not permitted. Instead of timber speculators, a class of home-makers will be attracted. Settlers will be interested in keeping the reserves free from fire, and will form a body of men who can be called upon quickly when occasion requires. Narrow meadows or valleys can be utilized, and the full 160 acres of agricultural land secured. In many cases this would be impossible under the old law, where descriptions must be by legal subdivisions of 40 acres. In many cases, of course, agricultural products in isolated sections can be marketed only by feeding during the winter to stock ranging through the summer on the reserves. The sale of reserve timber, and the assurance of future crops through fire protection and replanting will guarantee the permanence of the lumbering industry and of the market for agricultural products.

Field examinations of lands applied for under this act cover, as a rule, only small, isolated areas. The topographic maps of the Geological Survey are on too small a scale and are not sufficiently accurate to give more than a very general idea of the boundaries of agricultural lands. Nor can the plats of the land office surveys be relied upon for details. The field notes of the surveys show only distances along section lines, and the topograpry of the interior of the sections is necessarily only sketched in by draftsmen in the office. The courses of the roads, streams, etc., are therefore shown only in a general way, and can never be used as starting points from which to determine limits of agricultural lands. The only safe way, on surveyed lands, is to start at section or quarter-section corners, and measure along the section lines and, at stated intervals, at right angles to them, using the compass, and noting distances and platting results on the map immediately. Experience has shown that this measuring can be done very satisfactorily by pacing, after the manner adopted by timber cruisers. From 110 to 113 paces representing 20 rods or a tally. Four tallies carry one across one side of a 40-acre square, and eight tallies make a half mile. This is as great a distance as it is safe to depend upon pacing, without checking up on an established corner. This work must be done very carefully, and the compass used continually.

Mapping is done on the scale of four inches to the mile. Types of forest cover are mapped in by the use of colored pencils. The usual types in the Priest River reserve, Idaho and Washington, are Commercial Forest, Non-Commercial Forest, Woodland, Brushland, Open Meadow, Alder Bottom, Burn, and Cultivated Land.

Except in the very narrow meadows or valleys, it is most satisfactory to run the boundaries upon the rectangular system. A very convenient way, on surveyed land, is to consider each 40-acre square as being sub-divided into sixteen little squares, each 20 rods on a side and containing 2 1-2 acres. By mapping in the boundaries of the different types of cover very carefully, the boundaries to be recommended may readily be run upon these imaginary lines, making 20-rod jogs, so as to give the applicant almost exactly the agricultural land desired, and excluding the balance.

Where the agricultural land is in a very narrow strip, it is sometimes necessary to make jogs of less than 20 rods, and occasionally to run the boundaries in directions other than north, south, east and west. On unsurveyed lands, the descriptions must, of course, be by metes and bounds, with reference to some object which can be located with certainty.

Before final proof, if the description is other than by legal subdivisions, the applicant is required to secure at his own expense a survey approved by the Surveyor General, and to have the corners plainly marked by monuments on the ground. The Commissioner of the General Land Office has recommended that for the purposes of this act, on lands covered by the land office survey, 2 1-2 acres be made a legal subdivision. This would relieve the settlers of an unnecessary hardship, and would be no more than an act of justice.

The final report deals fully with location and description of the land, area, topography, formation (soil, rock and water), climate, cover, conflicting claims, use in the past, and economic possibilities, together with recommendations for or against listing. If listed, the first applicant for each piece of land is given a preferential right of sixty days in which to make entry in the local land office.

Clyde Leavitt.

THE HOLDING AND RECLAMATION OF SAND DUNES AND SAND WASTES.

Along both sea coasts of this country, near large interior lakes, and on or about lake or sea bottoms now dry, there often occur more or less extensive belts or low hills of drifting sand. Along the sea coast these are formed in large part by the unequal movement of the tide, whose flow tends to carry sand beyond the action of the waves, where it is caught by strong prevailing winds and carried up the beach, to be piled into low dunes and hills. As long as the sand is moist as a result of spray or capillary movement it is not easily moved by the wind, but as soon as the tide ebbs and the sand dries out it is carried up the beach or shore until stones, vegetation, or irregularities in topography cause it to be deposited. Gradually these accumulations to the leeward of obstructions are built up by fresh supplies of sand until the dune may reach a height of thirty to one hundred or more feet. After the dunes are formed they are held in place through gravity or cohesion of particles.

Hills originating from deposits of sand left by inland seas or lakes now dry are built up in the same manner as the dunes along our coasts. As the sand is looser and drier they are not as easily held in place as sea dunes. There is less moisture present, though the action of capillarity is probably as great as in coast dunes. The sand hills of Western Nebraska and the dune areas along the Columbia River in Washington and Oregon always show moisture a short distance below the surface, the amount depending somewhat upon the elevation of the dune or hill and the size and shape of the particles of sand. The presence of moisture in the sand does not prevent it from being carried further inland by strong winds to aid in the formation of other rows of dunes, which may gradually form a belt or range of hills often very wide and many miles in length, as is illustrated by the dune areas along the east shore of Lake Michigan, from Michigan City to the Straits of Mackinaw.

DUNE MOVEMENT.

Studies have been prosecuted to a sufficient extent in this country to allow of definite statements as to the rapidity with which dunes along our sea coasts or in the interior are moving. Observations made during several average seasons lead us to believe that, depending upon the severity of the wind and location, our dunes have about the same rate of movement as those in France and South Africa. The rapidity of movement will vary from a few inches to a number of feet annually, depending most largely upon the force of the wind. Along the Bay of Biscay, in Gascony, France, there is a belt of sand dunes which vary in width from one-quarter to five miles and cover an area of about two hundred and fifty thousand square miles. Where these dunes are not fixed by grass or groups of trees they advance eastward at a given rate of about sixteen feet per year. Marsh, in his "Earth as Modified by Human Action," says of these dunes:

"It is not known historically when the dunes began to drift, but if we suppose their motion to have been always the same as at present they would have passed over the space between the sea coast and their present eastern border and covered the area of two hundred and fifty thousand square miles in fourteen hundred years."

EXTENT AND INJURY FROM DUNE MOVEMENT.

In various parts of the world dunes in their movement have buried extensive forests, fields, and even villages and cities, and have changed the course of rivers. The lighter portions of the sand carried from these dunes by winds have turned lands formerly fertile into worthless barrens. Along the coast of Denmark the dunes in the course of two or three centuries have moved several miles inland, covering forests and villages.

In our own country the movement and injury from dunes has been extensive, yet, with a few exceptions, has not caused the loss of valuable lands or forests. Upon Cape Cod, in the southern half of Long Island, on the coast of New Jersey, and southward along the Carolina coasts, and along the Pacific coast, from the mouth of the Columbia River southward to Golden Gate Park in California, there exist areas of more or less active dunes, which, unless held, will probably do much damage in the future. Along the eastern shore of Lake Michigan, and along the Columbia River in Washington and Oregon, moving dunes have caused much damage by covering railroad tracks and encroaching upon fields and cities. Along the Snake River Division of the Oregon Railroad and Navigation Company's line, from five to eight thousand dollars per year have been spent in keeping the tracks free from sand. At Riparia, on the above division, large railroad shops, hotels, and other buildings were moved away to prevent their being covered by rapidly moving dunes. Six years ago, near the Dalles, Oregon, a wreck occurred on this railroad as a result of the covering of the tracks with drifting sand, which caused loss of life and property. Several forts along the Atlantic Coast are in danger of being injured from moving dunes.

SAND AREAS FORMERLY COVERED WITH VEGETATION.

That these extensive areas of sand plains and coastal dunes have been covered with vegetation in the more or less remote past has been proven by scientific investigation. The French engineers, Baron de Villers, Chambrelent and Bremontier, who were sent to study and reclaim the sand dunes and waste areas in Gascony, reported that there was evidence that the dune areas were formerly covered with vegetation. Dr. Dwight, an early president of Yale College, who traveled extensively through New England in 1880, writes that his investigation of the sands of Cape Cod led him to believe that they were formerly almost completely covered by natural vegetation. In accounts of investigations in the Nebraska sand hills Dr. C. E. Bessey states that at one time these hills were partially, if not entirely, covered with forest growth, and gives evidence to prove his statements.

The unfertile and waste conditions of these sand dunes and plains to-day has many different causes. Annual fires, resulting naturally or through man have probably had most to do in bringing about these conditions. The fact that our dunes and plains have been covered with a forest growth, and are in part now so covered, is strong evidence that the problem of holding and reclaiming them is not a difficult one, even though it may take years of patient labor and great expense.

EARLY EFFORTS TO HOLD DUNES BY PLANTING OF GRASS AND TREES.

Running back for centuries we find accounts of attempts to hold drifting dunes and to prevent the destruction of fertile lands back of them. In Egypt, before the Christian era, the Pharaohs built great walls along the edge of the plains on either side of the Nile valley to prevent sand from blowing down and covering fertile fields and orchards. For many centuries the people of Holland have planted and cared for the dunes along their coasts, and have influenced the formation of others, because these dunes keep back the sea from their homes and fields. The first authentic accounts of the successful holding of dunes is that of the French engineers who reclaimed the dunes and extensive sand plains along the southwest coast of France. As early as 1778 the French government sent an engineer, Baron de Villers, to Gascony to study conditions and prepare plans for the work of reclamation. The system which he proposed and partially put into execution is with a few exceptions much the same as that in use in Europe to-day, and the same that we will probably use when extensive work begins in this country. The fact that climatic conditions are more favorable in France than in countries to the northward has made the final success of dune planting in the former country much more evident. The system proposed by de Villers, and later perfected by Engineers Chambrelent and Bremontier, was the formation of a litoral or protective dune just above high-water mark, followed by the planting of this with sand-binding grasses, and a final planting among the grass of the Maritime and other pines.

PLANTING OF TREES NECESSARY FOR THE HOLDING AND RECLAMATION OF DUNES.

After the formation of the protective dune and the planting with grass comes the work of planting trees over the dune and in its lee. In Europe the usual method of starting the grass is to set out plants of beach or marram grass (*Ammophila arenaria*) in groups or rows, the distance apart depending upon the severity of the wind and whether it is desired to build up the dune slowly or rapidly. The beach grass grows vigorously, putting out rootlets at the nodes as these become covered. Care and attention in preserving the required density, and the immediate replacement of the plants which have failed are the chief requisites in the preliminary holding of the dune. After the grass has become well established and the dune has reached the right size, seedlings of some coniferous tree are planted among the grass, or seeds of the Maritime or other pines are sown with those of hardy shrubs like the *Cytisus,* which shade the young pines for the first few years of their growth. On sand areas to the leeward of the dunes, where grass may or may not have been planted, the usual method is to cover the surface with brush arranged like slates on a roof and held down with a shovelfull of sand here and there. Seeds of the conifers desired are then sown among the brush.

On active dunes the planting of grass or other herbs is absolutely necessary for the tentative holding of the sand, but forest trees must be planted to bring about the fineal reclamation. In the Report of the Harbor and Land Commissioners of Massachusetts for 1896 the chairman of the commission, who made a thorough investigation of the Province Lands, says:

"It is obvious that the work of planting with beach grass must be done first, and that this must be followed up by planting shrubs and trees of rapid growth, interspersed with those of slow growth before the labor of planting shall be completed."

Mr. A. S. Hitchcock of the Division of Agrostology in Bulletin No. 57 of the Bureau of Plant Industry, entitled "Methods Used for Controlling and Reclaiming Sand Dunes," writes:

"The reclamation is most permanent when the dunes are covered with forest; hence forestation is the ultimate aim wherever possible."

The director of the Central Experiment Station at Ottawa, Canada, was sent abroad in 1901 to investigate dune planting, with a view of planting and reclaiming the shifting sands of Sable Island, off the eastern coast of Canada. After making thorough investigations in France, Holland and Denmark, he reports that trees must be used if permanent results are to be obtained.

DUNE RECLAMATION IN THE UNITED STATES.

The work of planting dunes and sand wastes in this country has been very limited and to a large extent is still in the experimental stage. At Cape Cod, from 1826 to 1838, numerous plantings of beach grass were made by the government and by the town of Provincetown at a cost of twenty-eight thousand dollars. Constant care was not given this planting, and fishermen and laborers cut sod and removed woody growth until the dune lands reverted to their original conditions. Only now, with renewed efforts, is the work beginning to be successful. Along the coast of Long Island, New Jersey and the Carolinas a few scattered attempts have been made to hold the dunes, but nothing of importance has been accomplished. A little planting of grasses was done at the mouth of the Kalamazoo River in Michigan, but the work was not continued, and now conditions are even worse than they were before this work was started. Here beach grass (*Ammophila arenaria*), sea-lime grass (*Calamovilfa longifolia*) were used, and would have been successful but for lack of care. Successful efforts have been made on the part of several cities along the lake shore in Southwestern Michigan to cover dune areas which were encroaching upon these cities. Perhaps the most successful results have been obtained in Golden Gate Park, in San Francisco. Here the dunes were extensive and were gradually moving toward the city. Experiments were made with planting barley and some of the lupines, but success came only when the beach grass was introduced. A large number of trees have been planted and the most satisfactory are the Monterey Pine and the Monterey Cypress, which are native to that immediate region. Some success has been obtained by the planting of several species of the Eucalyptus and the Australian wattles (*Acacia latifolia* and *Acacia laphantha*).

THE FUTURE OF DUNE RECLAMATION.

Wherever the Dunes exist in this country there are numerous grasses and other herbs which are well suited to preliminary plantings and there are also numerous native conifers and a few broadleafed trees which have a high value for planting on sand wastes. Investigations show that such conifers as the White Pine, Jack Pine, Loblolly Pine, Norway Spruce, and Austrian Pine, where not subjected to severe salt winds, are adapted for planting on dunes and sand plains of the Eastern States. Along the Pacific Coast and in the Columbia River country such conifers as the Bull Pine, Sand Pine, Monterey Pine and Monterey Cypress are valuable for planting.

On inland sandy lands, such as the sand hills of Nebraska, the experimental planting of forest trees has been much more extensive and more satisfactory, and there is now every reason to believe that all of the so-called absolute waste lands of the West can be reclaimed and made to grow forests of coniferous trees. The expenditure of considerable sums of money and years of patient, persistent work will be required, yet the outcome can not be other than a success, and that a financial one.

The injury which is resulting each year from the movement of the dunes of this country demands that we do something to hold them. So far in our national existence we have ignored the results of their encroachment upon forests and fertile fields, and have cften aided them in their destructive work. As lands along our Atlantic and

Pacific Coasts and along inland lakes and rivers now covered with dunes become more valuable, our government will of necessity pass laws and expend large sums for their holding and planting, as France, Germany, Holland, Denmark and other countries have been forced to do.

The great need at present is a definite knowledge of the dunes as they exist in different parts of the country. There must be more accurate data as to the origin of the sand, which is forming a certain group of dunes, of the process by which the dunes are being formed, of the amount of plant food which the sand contains, of the moisture in the sand and its source, and lastly, and of most importance, of the flora of the dunes. From this knowledge it will be comparatively easy to plan as to where the sand shall be held, whether in the form of a protective dune or at the place of its origin, and what methods of work will be most practical.

H.P.BAKER.

SLASH BURNING IN THE LAKE STATES.

The first steps towards the establishment of scientific forestry methods in the Lake States, as in every other region, are measures of protection. The two enemies which demand particular attention are the high rate of forest taxation and fire. For the amelioration of the first of the evils no satisfactory solution has as yet been reached, and none will be reached till the state, county, town and forest owners submit the question to some disinterested party for arbitration. The advantage heretofore has always been on the side of the tax collectors, but some concessions must be made to the private owners if any thing is to be accomplished in the way of reform. In the matter of fire protection considerable results have already been accomplished and a great deal more is well within the reach of all far-sighted owners or states if the way is but pointed out to them.

The experience of the Government Forest Reserve at Cass Lake, and elsewhere in the region where the experiment has been tried, has proved conclusively that the burning of the slashings on cut-over land is a wonderful help if not an absolute prevention in keeping out fire. Every logger knows, and no one is better qualified to judge, that nine-tenths of the fires in the woods start in the debris left by the lumbermen. When the slashings are burned and the forest floor kept clean there is little chance for a dangerours fire, and all such as start are easily controlled on account of the scarcity of fuel.

The lumberman has but one objection to this process of brush burning, it costs too much money. He would rather run the chances of completing his logging operations and getting out of the country before the fire gets in. The principal benefit derived from the slash burning, namely, the almost complete restocking of the land by natural regeneration, has no influence with him because of a false observation—that White and Norway Pine will not follow themselves. A trip through the Cass Lake Reserve, where slash burning has been carried on for the last three or four years, or through portions of the Fond Du Lac Indian Reservation, where the fire does not happen to have swept over the ground, cannot help but convince anyone that the White and Norway Pine reproduce themselves very readily if given half a chance. It is only where a severe fire has gone over the land, killing all the White and Norway Pine seed that the Jack Pine has taken possession of the soil. This state of affairs has, however, been so universal that the lumbermen have come to think of it as inevitable.

A little careful examination would show that the reputed high cost of slash burning is largely a bogey held out by the contractors who burn the brush, or used by the lumbermen who know better as an argument for lower stumpage prices on reserve lands. The actual cost of the labor used in the burning is small—rarely exceeding twenty-five cents per M. feet of timber cut, if the burners know their business. However, twenty-five cents per M. on a cut of ten millions means an extra expense of $2,500, which is more than the average lumberman cares to put into it unless forced to it by reserve laws. Is there not some way of reducing this cost so that the scheme may be practicable for all private owners?

The solution of the problem would seem to be in the cordwood market, and especially is this true in the regions of Minnesota where most of the lumbering of today is being done. When the lumberman has finished with the forest there are—including tops, broken logs, defective trees, popple, birch, and sometimes some other hardwoods of good fuel value—from ten to twenty cords of fire wood left on the ground to waste. No study of the subject has been made in this region, the rough estimate is based on the figures obtained in the Black Hills Forest Reserve, and the guesses of the lumberjacks and rangers, and is therefore only approximate. Is there no market for this cordwood? For a very large per cent. of it—especially that located in the portion of Minnesota abutting on the treeless prairies—there certainly is a market, and a good one. The prairie states are calling for fuel and offering good prices for it not so very far to the westward. Even the lumberjacks and brush-burners on the reserve recognize this and sigh for an opportunity to ship out cordwood instead of burning it up. Rough calculations and approximate figures show that much of it could even be taken to other markets than the plains at a small profit.

What would be the result of this marketing of cordwood? The woods would be cleaned of eight-tenths of the material that supplies the fire of the cut-over land and the other two-tenths would be so disposed that it could be burned at a very small expense. Wood choppers could be hired—are hired in the Black Hills Reserve—to chop wood and pile brush for little more than the cost of chopping alone. When the wood is cut out to a diameter of two inches, very little brush is left. The chopper is obliged to handle the brush once to get it out of his road and it is little more trouble for him to throw it in a pile than to scatter it all over the woods. Once piled on a clean forest floor it can be burned under favorable weather conditions for almost nothing. It would without question pay good returns in those regions where the high wood prices of the prairies are obtainable and a market could be worked up for it throughout a great portion of the more eastern territory. It is not necessary that a big profit be obtained. If the cordwood must be sold at cost, or even at a very slight loss, the benefit obtained by the cleaning up of the ground, the great stride made toward fire protection, the assurance of good regeneration—hence the increased value of the cut-over land—and the employment of that much more labor, are sufficient profit. The slash is disposed for practically nothing. Why would it not be a good proposition for the owners of the timber land or even the fire wardens of the different states? It would furnish to the fire warden a cheap means of fire protection and in many instances a revenue to help out the deficiencies in other places.

This has never been tried in this region because no one knows anything definite about the amount of wood that would be available on different types of land, the cost of transportation to the different markets or what the possibilities of the different markets are. The plan has been tried and worked in the Black Hills Reserve, but the conditions there are unique and so different from those existing in this region that results can not be predicted from experience there. Some study and investigation is necessary to get anything like an accurate estimate of the results. A comparatively small amount of work would furnish the data to settle the question of practicability; but who is to do that work? The Forest Service, which is best equipped to carry on the work and best able to bring the matter forcibly before the parties concerned, has not grasped the importance of the subject or given it any attention. It would seem to be up to the individual States to look up the matter for themselves, though the problem affects such a large area that it would seem to rightly belong to the National Service.

This question is in my opinion, the most important forestry problem in this region today, insuring, as it does, if a few seed trees are left, the restocking of the land with valuable species. Coupled with a lower rate of taxation on timber lands, which is bound to come, it would induce many owners to hold onto their forest lands and care for them with a view to their future value.

E. G. Cheney.

VOLUME TABLE FOR HEMLOCK ON THE EASTERN SANDSTONES OF NORTHWESTERN MICHIGAN.

RESULTS OF MEASUREMENTS OF 20 TREES OF EACH DIAMETER.

D. B. H. Inches	Cubic Feet	Board Feet (Doyle Rule)
6	2	
7	3	
8	5	
9	7	7
10	9	15
11	11	20
12	14	31
13	17	46
14	20	67
15	24	90
16	28	114
17	33	138
18	38	160
19	43	183
20	48	210
21	33	242
22	59	278
23	65	314
24	71	350
25	77	390
26	83	431
27	89	470
28	95	510
29	101	555
30	108	603
31	115	656
32	122	717
33	130	790
34	139	870
35	148	960
36	159	1075

L. M. Higgins, and T. B. Wyman.

CURRENT LITERATURE.

HENRY S. GRAVES, *In Charge.*

Forest Mensuration. By Henry Solon Graves, M. A. New York. John Wiley & Sons, 1906. Pp. 458.

This first American professional textbook on one branch of forestry treats the subject with a completeness which it has never received in the English language and places it at once on a level with such well known German works on forest mensuration as that of Udo Muller, Schwappach, Stoetzer, etc.

The distinctively American part consists in the chapters on log rules, in which Prof. Graves elaborates further the contents of his Woodman's Handbook. We cannot let the opportunity pass of expressing our regret that the author did not more strenuously point out the undesirability of these absurd units of measurement, forty-five in number. We admit that, as long as they are used in practice, we cannot help using them, but it would have helped the introduction of one proper standard of measurement, the cubic foot, or better still, the cubic meter, if it had been pointed out that by multiplication of the cubic contents of groups of logs which practically admit of no dispute, with simple factors of conversion, the miller can come to a *judgment* of board foot contents of his cut as close as the logscale; and after all a logrule is nothing but a *judgment* of what the cubic contents may produce in saw material.

The same completeness with which this part of the volume is treated and the same clearness and simplicity of statement characterize the rest of the manual, in which the needs of the American practitioners are constantly kept in mind. Several matters which are not found in European manuals, but are decidedly germane to the subject, are to be found. Such are the discussion of various methods of estimating standing timber and of short cuts to determine volumes of trees; volume tables with number of logs and merchantable lengths and graded volume tables, which in European practice are more removed from a forester's ken and interest; an elaboration of strip surveys, which, although originally used a century or so ago, have become obsolete in settled countries; and various references to the growth of tropical trees.

All parts of the subject are fully treated and we find only few omissions of minor import. In all chapters there is enough of original contribution to remove the idea of a mere adaptation from foreign sources. It is a thoroughly good American manual.

From the bookmaker's point of view we find little to criticize. In the matter of references and credits we observe several lapses, a number of misspellings of names, etc., all matters of minor detail, which may be overlooked in comparison with the general excellence of contents and make-up. B. E. F.

The Vegetation of the Lamao Forest Reserve.. By H. W. Whitford. Reprint from the Philippine Journal of Science, May and July, 1906. Manila.

This paper contains the results of an extended ecological study of the first regularly established forest reserve in the Philippine Islands. The reserve, located directly across the bay from Manila and in very easy access to it, comprises 4,426 hectares, and is covered for the most part with virgin forest. It was set aside to serve as an experimental ground for the study of growth, methods of silviculture, botanical research and as a preliminary training ground for foresters.

Mr. Whitford studies the vegetation from the standpoint of the "formation." He studies each formation, not by general inspection, but by actual counts of trees on sample plots. As the region is mountainous, he lays these off in the form of strips, like the strip surveys of the forester, up and down the slopes. His conclusions are thus based on actual field records and are accordingly accurate.

The Lamao reserve is divided into six general formations, and each of these in turn into subordinate formations due to local topographic influences, temporary clearings, or other causes.

The immediate coast is given the name "Strand" Formation. It comprises the sandy coast lying above high tide and the muddy shore between low and high tide. The former is divided into two subtypes, the "Pro-Casproe" formation, named from a typical creeper, and the other the "Barringtonia-Pandanus" formation.

The tidal section comprises the mangrove and the nipa palm soils. Both of these two plants are of interest, not only botanically but economically. In some parts of the Philippines the mangrove furnishes the chief supply of firewood; and the nipa palm is of great economic importance for its different products. Mr. Whitford's account of the formation is, therefore, valuable to the forester, though on the Lamao reserve the area is restricted in extent.

The region directly back of the shore, extending to the mountains proper and running up in some places 175 meters above sea level, is characterized by the presence of bamboos and by trees more or less deciduous, of which *Parkia Roxburghii* is a type. Mr. Whitford gives to this type the name of "Bambusa-Parkia" formation. It is exposed during the dry season to greater drying influences than at higher altitudes. The present forest is in large part second growth, resulting probably from clearings made for cultivation, so-called "caingins." The general term for such second growth forests is "parang." Mr. Whitford divides the general type into subordinate types like "Dinochloa Parang," "Mixed Parang," etc. Fully two-thirds of the whole formation is occupied by this parang type, including the open areas covered with cogon grass.

The region of the reserve lying back of the lowlands is of even greater interest to the forester because it is not likely to be used for any but forest purposes in the future. The region immediately back of the type just described is called by Mr. Whitford "The Anisoptera-Strombosia" formation, so named from the most distinctive trees in the upper and lower stories. The forest is characterized by a two-storied form, and the presence of many trees of great size. The most characteristic is the Mayapis, which reaches a height of 36 meters. This type, while containing many small straight trees so characteristic of the tropics, does not have the desity of the second growth parang, and, were it not for the numerous rattans, the aspect of the forest would not after all be so very different from that in many sections of our own country. The immense number of species growing in mixture is well shown in Mr. Whitford's sample plots, one of which on a single hectare shows 120 different species of trees. The upper story is composed principally of the *Dipterocarpaceae*. This family is an exceedingly interesting one because it occurs so generally throughout the tropical East and because its representatives are usually very large, tall trees, forming an important element of the commercial products of the forests. The Indian "Sal" and Burmese "Eng" are examples of this family. The forests of the Philippines with the heaviest yield are largely composed of this group, and, in the type under discussion, there are six species of the family, all of which are commercially valuable.

Mr. Whitford's description of the epiphytic plants, buttresses, fluted trunks and other characteristics of the forests of this type is exceedingly interesting and should be read even by those who are unable to follow with interest the detailed discussion of the species. As in the other types, variations in topography cause differences which enable a further division into sub-types.

A third type is that called the "Dipterocarpus-Shorea" formation, occurring on the slopes just above the preceding. Here over 30 per cent of the larger trees belong to the Dipterocarpaceae and 15 per cent of them are Dipterocarpus grandiflorus. In some places these trees form in the upper story practically a uniform stand. The type is further distinguished from the preceding by the smaller number of deciduous trees, that is, in the words of the ecologist, the formation is less xerophytic on account of the greater rainfall, smaller saturation deficit and heat.

The fourth type, still further up the slopes, is called the "Shorea-Plectronia" formation, lying between the contour lines 450 and 900 meters. In this type the proportion of the Dipterocarps falls to about 16 per cent. The general aspect of the forest, like that of the preceding type, reminds one of the forests of the temperate region because of the thin undergrowth and the relative scarcity of rattans and such forms of vegetation as ordinarily are associated with tropical forests.

The cap of the mountain, including everything above 900 meters, is named the "Eugenia-Vaccinium" formation. This area is distinguished by a relatively high humidity and strong winds. The latter give rise to the peculiar dwarf condition of tree growth, and the former to an abundance of epiphytic vegetation.

Mr. Whitford's description of the different ecological formations is illuminated by the large number of excellent photographs.

The report is of value to both the ecologist and to the forester. The division of the forest into types may be used as a foundation for the organization of the forest work later on. It is a great pity, however, that Mr. Whitford did not include in his study the economic aspects of the forest. He has a general classification of trees by height, but makes practically no mention of diameters. The forester misses in his descriptions the many points which accompany the usual forest description, such as the form of the stand, the character of the trees in the different types, the density, the reproduction of the commercially valuable trees, etc. These points are absolutely necessary for the silviculturist, even if he does not have an actual estimate of the conditions of the merchantable stand. At the beginning of his paper Mr. Whitford makes a statement that, "stripped of its business aspect, forestry is nothing more nor less than forest ecology." A botanical enumeration of tree species is interesting and valuable to the forester, but it is the form of the forest, its conditions, size and habits of the trees which are of special value to him as a foundation for his plans for silvicultural treatment.

All foresters will be glad to hear that Mr. Whitford has become a member of the Bureau of Forestry of the Philippine Islands and will continue his ecological studies. All look forward to future publications describing the conditions of the Philippines, and it is hoped that he will consider them not only from the purely botanical standpoint, but also from that of the forester. H. S. G.

The Forester. By John Nisbet, D. OEc., Edinburg and London, 1905. In two volumes, 642 pp.

American foresters have found Nisbet's "Studies in Forestry" one of the most helpful works on Silviculture in English. It is gratifying, therefore, that the author, John Nisbet, has published a much larger work on Forestry. "The Forester" is based on the sixth edition of the work under this name by James Brown and edited by John Nisbet. The author has, however, rewritten the entire subject and added so much that the new work resembles the old chiefly in general arrangement and form, and not in text.

Mr. Nisbet has covered the whole field of Forestry and designs his work as a text book for British foresters. His aim is to aid the private owners and foresters in Great Britain and he has written for their special requirements. Mr. Nisbet asserts that the average British forester does not need such an elaborate education as is given in the continental schools, but if he has a knowledge of Dendrology, Plant Physiology, and Agricultural Chemistry, the technical subjects, Sylviculture, Protection of Woodlands, and Utilization of Forest Produce may be taught, at least as far as the indoor work is concerned, in 100 to 120 lectures. He has in mind, of course, the practical forester, the woods foreman as we call him, and his book is planned to meet his special needs.

Fifth Annual Report of the Indiana State Board of Forestry for 1905. By W. H. Freman, Secretary. Indianapolis, 1906. 245 *pp.*

The efforts of the Board have been devoted to practical work on the State forest reserve of 2,000 acres. The work has consisted of road building, construction of reservoirs, cisterns, fishponds, an administration building and fences, and of tree planting. So far about 200 acres have been artificially stocked, chiefly by sowing.

The State Board is engaged also in educational work, through correspondence, public lectures, and the press. Co-operative work with private owners also constitutes an important part of the work of the Board.

The report contains a number of papers, including "The Trimming of Shade Trees," "Some Insect Pests of Indiana Trees," "Thirty Timber Trees of Indiana," and "The Insect Enemies of Native Forest Trees on the Reserve."

Forestry seems to be making distinctive advances in Indiana.

H. S. G.

Report of the Canadian Forestry Convention, Held at Ottawa in January, 1906. Ottawa, 1906. 208 pp.

This report contains much material of general interest. The gathering was notable as voicing a widespread interest in the improvement of the forest policy of the Dominion and Provinces, the chief feature of which is the extension of permanent forest reserves. The present well-known system of fire rangers is discussed for Ontario by Mr. Aubrey White, and for the Dominion by Mr. E. Stewart. An article by Mr. Thomas Southworth sets forth the present status of forest reserves in Ontario. The Convention urged the extension of the system, increased appropriations for fire rangers, and the examination of all public lands in advance of settlement, for the double purpose of preventing injudicious settlement on forest land, and securing such lands for permanent reserves. Many papers of considerable value are published, including such subjects as the tree planting work of the Government, forest education, and timber supplies for railroads and pulp mills. A useful feature of the report is the very complete subject index.

H. H. C.

Flora of the State of Washington. By Charles V. Piper. Volume 11. Contributions from the United States National Herbarium, Smithsonian Institute, 8, 636 pp. Washington, D. C. 1906.

In 1901 Dr. Charles Mohr published the Plant Life of Alabama, a work distinctly in advance of any State flora published up to that time. The excellency of this work was largely due to the full account of the distribution, modes of association and adaptations of the flora of the State. Professor Charles V. Piper's recent Flora of the State of Washington is in many respects an equally important contribution to our State floras.

Professor Piper has been for a period of twenty years a student of the vegetation of the State of Washington. From his long residence in the State he has acquired a most intimate acquaintance with its great diversity of plant life. In his preparation of the flora of the State he has had access to all the collections of plants made in the State which are in American herbaria. In the treatment of a number of families and genera, Professor Piper was assisted by specialists. The vascular plants are the only ones listed and discussed.

A brief account is given of the botanical explorations made in Washington from the time of Menzies to the present. The climatic factors which influence vegetation, viz., precipitation, sunshine, temperature, and winds, are discussed and data given. The data, however, are for the most part incomplete and can only apply to a few of the physiographic regions of the State.

The zonal distribution of Washington plants is discussed at some length and tests given of the more important plants of each zone. To the forester this is by far the most interesting and valuable part of the volume. An attempt is made to trace the origin of the flora of each of the important zones and comparisons are drawn between the vegetation of adjacent areas. A number of excellent plates illustrates some of the characteristic types of vegetation peculiar to the various physiographic regions of the State.

With a State so large as Washington and with such marked physiographic features, it is unfortunate that a more detailed account of the vegetation of the State from an ecological standpoint could not have been given. The greater portion of the volume, viz., 526 pages, is given to an annotated catalogue of the vascular plants.

An innovation in this catalogue, over most State texts, is in the excellent but simple keys to the genera and species. Professor Piper's list is far from being a bare catalogue of plant names. The full synonymy of each species is given, the type, locality, and the range. The list is replete with notes where uncertainty exists in relation to citations and the work abounds in notes giving added information to present published accounts of the plants of the State. Many new species are described and many others mentioned for the first time as occurring within the State.

The nomenclature aims to follow the recently proposed Philadelphia code. A fairly conservative attitude is taken regarding the limitation of species and the splitting of well established genera for the sake of new names. J. W. T.

Report of the Superintendent of Forestry, Part X, Annual Report, 1905, Department of Interior, Dominion of Canada, Ottawa. 28 pp., 8 plates.

This publication sets forth the work accomplished by the Forestry Branch of the Department of the Interior during 1905. Of special interest are the reports of the Assistant Superintendent and the Tree Planting Inspectors, in which the progress of tree planting among private landowners is discussed.

The distribution of seedlings and cuttings to farmers has now assumed large proportions, 1,860,000 seedlings and cuttings having been furnished during 1905. Seventy-five per cent of the above were maple and ash, the remainder consisting of Dakota cottonwoods, Russian poplars, willows and a few elms. The species of maple is not stated, but it is doubtless the one locally known as Manitoba maple (*Acer negundo*). If such is the case, it seems unfortunate that encouragement should be given to planting a tree of so little value when other trees of greater worth could readily be substituted. Large numbers of *Acer negundo* were planted on timber claims in the United States some years ago and the owners of these claims now regret that they did not plant trees producing more valuable timber. Canadian foresters cannot but profit by a study of the plantations made in the prairie regions of the United States, for thereby they could avoid many of the errors committed by tree planters in this country. The report states that the greatest interest in tree planting is manifested by settlers in the regions which are just opening up.

The methods employed by the Forest Service of the United States Department of Agriculture in aiding and advising tree planters residing on the new irrigation projects in the West might be followed to advantage in Canada.

The Forest Service makes a study of the regions where tree planting is to be done, and when the lands are thrown open for settlement the Forest Service is in a position to advise the owners just when and how to plant to secure the best results; the species best adapted for a given purpose and the care and cultivation a given species will require to insure success. Circulars are published in which detailed advice on the above subject is given. These are distributed to all parties who are interested in tree planting in the region to which the circular applies.

A large part of the nursery stock distributed by the Forestry branch of the Canadian Government is grown at the Government Nursery at Indian Head, where 16 acres were under nursery at the time the report was submitted. All nursery work will soon be transferred to this section, and when fully equipped and all contemplated improvements are made it should prove an excellent station for nursery work.

Thirteen thousand two-year-old Scotch pine seedlings were planted on the Spruce Woods Timber Reserve. No mention is made of the use of any native species. In undertaking experimental reforestation work in reserves, the fullest success can hardly be secured from planting only one species, and that a foreign one. Scotch pine is a rapid grower and adapted to many conditions, but the results secured from plantations in this country do not warrant its use on a large scale until more is known of its action in large plantations. White pine, although of slower growth in youth, will usually overtake Scotch pine in 40 years, and from that time on it grows at a more rapid rate and produces more valuable timber than the former. It is to be hoped that other species, especially conifers, will be planted experimentally on the reserves and given a full trial.

The report of the Crown Timber Agent deals chiefly with fires which occurred during 1905. After discussing in a brief way the cause of the various fires and damage resulting to the timber, he concludes as follows: "The past season has been by far the driest since the inauguration of the fire ranging system and in view of these circumstances, I consider that the system has once more proven a success in preventing fires, which, if once started, would have devastated the whole of the railway belt."

In the letter trasmitting the report to the Deputy Minister of the Interior, the Superintendent advises as the next step in industrial advancement the establishment of a forest school, where both theoretical and practical instruction shall be given. Mention is made of the inauguration of the work of examining the reserves and determining the character and amount of standing timber, etc.

The report, on the whole, shows that progress is being made in promoting the practice of forestry in the Dominion. R. C. B.

Practical Suggestions for the Massachusetts Tree Planter. By Ralph C. Hawley, Assistant State Forester. Bulletin No. 4, State Forester's Office, Boston, Mass. 23 pp.

This bulletin was published "to answer many of the numerous questions which are continually being received by the State Forester in relation to the planting of forest trees."

In dealing with the subject the author selected five trees, namely, white pine, chestnut, red oak, white ash, and sugar maple, which he considered the best adapted for planting in the State, and has given full instructions for the collection and sowing of forest tree seeds and the propagation and care of the seedlings in home nurseries. The methods and cost of planting are discussed and also the returns which may be expected from plantations of the above species. Stress is laid upon the necessity of protecting the plantations from fire, two methods being suggested; namely, construction of fire lanes and patroling the plantation during the season when danger from fire is greatest.

In discussing the collection and storage of white pine seed, the author states that from one pound of seed "the planter may expect to raise on the average about 10,000 seedlings." Such a large number of seedlings from one pound of seed is but seldom secured, except under very favorable circumstances, even by experienced persons, and the amateur may be somewhat discouraged when at the end of the season he finds perhaps but a few hundred seedlings. Many foresters may question the wisdom of advising the average tree planter to attempt to grow his own white pine stock, unless large numbers are required. They are rather difficult to raise, and two or three years' time must elapse before the seedlings are ready for planting on the permanent site. If they could be readily obtained from nurserymen, purchase of plants would be the simplest method. Commercial forest nurseries will soon be more plentiful and this problem will be solved.

The author states that "As the expense of establishing a plantation of chestnut or red oak is greatly lessened by planting the nuts or acorns, instead of the seedlings, it is advised that the former method be employed for these two species whenever the proposed planting site is fairly clean of bushes and sprout growth." The author might have mentioned the danger of loss of seed by squirrels and other animals, which often not only devour every seed planted, but have been known to attack the small seedlings just as they appear above the ground.

The discussion of the returns which may be expected from plantations is of much interest. From tables which are given it may be seen that plantations of white pine and white ash 40 years old will yield an income of more than 4 per cent compound interest. Chestnut plantations will give similar returns, on land with less than $20.00 per acre, and when less than $10.00 per acre is expended in planting. Plantations of red oak and sugar maple should not be cut at 40 years, since they will not produce saw logs within that time.

The author concludes that "On the whole, the assertion is warranted that plantations of the more valuable forest trees make excellent long-time investments."

The appendix contains a diagram of a small nursery and a statement of its capacity for the species recommended.

The report contains information of much value to tree planters in Massachusetts, and should prove of great assistance to them.

R. C. B.

Forest Fires. By Alfred Ackerman, State Forester. Bulletin No. 5, Massachusetts State Forest Service, Boston. 24 pp.

This bulletin discusses various phases of the forest fire question in Massachusetts. The subject matter is treated under four general headings, namely:

1. Introduction.
2. Causes.
3. Method of Extinguishment and Prevention.
4. Fire Suppression a Public Duty.

In the introduction the author describes the various ways in which fires injure forest growth, and points out that the reproduction, especially of white pine, is generally killed by fire. This destruction of young growth is usually not taken into account in summing up the damage done to the forest tract, although in the long run it is probably the greatest injury the forest suffers. From reports received it was learned that fires are prevalent all over the State, but are most abundant in Middlesex, Norfolk, Plymouth, Bristol and Barnstable counties. The soil here is sandy and during certain seasons of the year the conditions are very favorable for fires.

The present system of dealing with forest fires in Massachusetts is far less efficient than it should be. Comparison is made with Minnesota, in which State we are apt to think that forest fires are very prevalent. A comparison of the annual burned area to the total area of woodland in each State shows the conditions to be more favorable in Minnesota than in Massachusetts. The actual money loss in Massachusetts is also greater.

Forest fires in the State are attributed to the careless use of matches, to lighted cigar stumps, camp fires, bonfires, brush burning, and locomotives. The railroads are credited with being the most prolific source of fires, although spark arresters are in common use. A statement showing the damage claims paid by the railroads is given. This is interesting in that the damages paid by one railroad, the New York, New Haven and Hartford, have increased each year, due probably to a growing sentiment against forest fires, and to the fact that more claims are presented for settlement and higher damages are claimed than formerly. This shows an increasing appreciation of the value of the woodlots on the part of the owners.

Under methods of extinguishment and prevention, the author mentions backfiring, trenching, and the use of portable chemical extinguishers. The construction of fire lines around the most exposed portions of the woods is advised, also the posting of the lands with notices, placed in conspicuous places.

In a discussion of the present laws for the prevention of forest fires, the author points out the more serious defects and suggests changes in the present law which would make the system more effective.

The existing laws provide for the appointment of fire wardens by the towns, who have charge of the prevention and extinguishment of forest fires in their respective towns. The expense of the forest fire protection is borne entirely by the cities and towns. One serious defect of the existing laws is that the system lacks a head who has positive and active powers. Another serious defect is that the towns are too small geographically to have entire charge in the matter of forest fires, which often run from town to town, and the men fighting fire in one town refuse to cross over the line into another town for fear they may not be paid for their services.

The following changes are suggested: That the State have an officer with powers and duties similar to those of State Forest Fire Wardens in other States and that the commonwealth also should bear a portion of the expense involved in extinguishing and preventing forest fires.

An appendix contains portions of the forest fire laws of Connecticut, Massachusetts and Minnesota, which permit of ready comparison.

It is doubtful if the bulletin enters into sufficient detail, or is sufficiently specific to answer the purpose for which it was evidently written; namely, to arouse the interest of the people of the State in protecting the woodlands from fire, and prepare the way for needed reforms in existing forest fire laws. Although the defects of the present system are pointed out, the matter is not discussed at sufficient length nor in a definite enough manner to impress the average reader, unless he already is well acquainted with the forest fire question. R. C. B.

Chestnut in Connecticut and the Improvement of the Woodlot. Bulletin No. 154, Connecticut Agricultural Experiment Station. By A. F. Hawes, M. F. 1906. 41 pp. Illustrated.

This bulletin by the State Forester of Connecticut furnishes valuable information concerning chestnut in southern New England. The presentation of the subject is sufficiently technical to appeal to the professional forester, and at the same time is so clear as to be easily understood by the average woodlot owner.

"To furnish definite data on the character of chestnut" as a basis for forest management is the purpose of the bulletin, the data for which was collected recently in Connecticut through co-operation with the Forest Service. Problems of silvicultural treatment, of utilization, and of the profits to be derived from chestnut are considered. The volume tables showing contents and values obtainable from chestnut trees in cubic feet, cordwood, ties, piles, poles and lumber undoubtedly are the chief items of interest.

Chestnut is the leading commercial tree of Connecticut, being estimated to compose over one-half the timber in the State. The virgin forest was exhausted before the Revolutionary War and the present stands of chestnut are of sprout growth. Emphasis is laid on the need of caring for forest crops as well as for farm crops.

The benefits of thinning and methods of making them are briefly explained. In this connection should be mentioned the excellent diagrams and photographs of stands before and after thinning. They will prove highly instructive to inexperienced men who desire to make thinnings.

The harvesting of the crop is advised on a rotation of 50 years, to be varied according to market conditions; while a modification of the coppice system can be used in cutting, leaving occasional standards of long-lived species, like white oak and hickory. The author states that the trees should be left in groups to prevent damage through windfall or windshake. That this damage would result in the case of such well-rooted, tough species as white oak and hickory seems highly improbable.

Under the head "Timber Estimating" the fact is brought out that the average farmer is not able to estimate standing timber and that consequently in selling his wood he is at the mercy of the lumberman. The farmer can use to advantage a systematic method of estimating. As providing such a method, volume tables are defined and their application in estimating standing timber is explained. The usefulness of the volume tables here presented would have been increased had they been based on both diameter and height, instead of on diameter alone. If the average heights corresponding to each diameter were shown in the tables, this defect would be less noticeable. As it is, the use of the tables, even in southern New England, may often give widely inaccurate results.

Figures of cost for logging ties, piles, poles, cordwood and lumber are included, representing the average for the State of Connecticut. Average market prices also are quoted, which being substracted from the logging expenses show the profit on the different products.

Throughout the region small portable or water mills saw the timber. This is bought by the tract for a lump sum, rather than for a stumpage price per unit of volume. Owing to the farmer's ignorance of estimating, he loses by this arrangement. If the volume tables enable land owners to estimate more accurately and thus to obtain better sale values for their timber, the publication of this bulletin would be well worth while, even should it accomplish nothing else.

"With the data at hand as to the quantity of various products which can be secured from chestnut trees of different sizes and the cost of manufacturing the same, it is a simple matter to draw conclusions as to relative profit from ties, lumber, poles, piles and cordwood." This the author has done, showing the stumpage value for trees of different diameters. Poles, lumber, ties, piles, and cordwood, in the order named, are the most profitable products. The stumpage values range from $0.05 for an 8-inch tree cut into ties to $8.35 for a 30-inch tree cut into a pole. However, local conditions and prices may often change the relative value of the products. This is especially true of lumber and poles. Trees can in many places be cut into lumber more profitably than into poles.

Tables of growth in height and diameter are presented, as well as some specific examples of the growth that may be expected under forest management. The height growth is shown to be practically at a standstill for sprouts after the first 50 years, and for seedlings at 60 to 70 years. After the first decade the diameter growth of chestnut sprouts and seedlings is approximately the same. This, however, does not correspond to studies of diameter growth for chestnut in other sections of the country.

Applying the figures of growth, the author constructs a table showing among other things the percentage increase in volume and in value of chestnut trees. These percentages remain high until comparatively large sized trees are obtained. For example, a 24-inch tree is growing in volume at the rate of 3.1 per cent annually, and in value at the rate of 6.7 per cent annually. On the basis of the values in this table, interesting conclusions regarding the time for cutting single trees are developed. The age at which decay sets in and the sprouting capacity of chestnut, both as affecting the time of cutting, receive attention.

The author closes with a discussion of the possibilities of forest management for the different kinds of land owners.

R. C. H.

Ravages of the Gypsy and Brown Tail Moth. Published by The Medford Mercury, Medford, Mass. 1906.

Students of Forest Entomology will be interested in this illuminating work. There is, at the beginning, an interesting account of the ravages of the Gypsy and Brown Tail Moths, with particular reference to Medford conditions, where the Gypsy Moth originated in this country. Practical measures of combating the pest are given and the Massachusetts laws relating to them are summarized.

The bulk of the work is made up of a series of excellent photographs, comprising in all over one hundred and fifty. The book is of distinct educational value.

Report of Special Master, Southern District of Texas, Circuit Court of the United States. Intervention No. 393. Cause No. 54, Equity. Austin, Texas. 1906. 17 pp.

This is a report of the proceedings in the case of the Maryland Trust Co., Trustee, against the Kirby Lumber Co., in connection with the alleged waste of timber in logging. The report discusses in detail the use of log rules, particularly of the Herring, Doyle, Scribner and Orange rules. Those interested in log rules should read this paper.

Notes on a Visit to Some European Schools of Forestry. By E. P. Stebbing. Forest Bulletin No. 5, Calcutta, India, 1906. 54 pp.

This bulletin contains a condensed description of the principal forest schools of Europe. The author's object in visiting the schools was chiefly to study the museum collections and the methods of instruction in zoology. The report is, therefore, mainly an account of the equipment of the schools. A discussion of the courses of study and the requirements for admission for the dieffrent institutions would be of great interest to foresters, especially in this country, and would have given Mr. Stebbing's paper greater educational value.

Forsten, in Woerterbuch der Volkswirtschaft, Gustav Fischer, Jena, 1906. pp. 857-889.

Prof. Dr. Jentsch, who made such a thorough study of American forest conditions in the Zeitschrift für Forst und Jadgwesen (see p. 348 of this issue), furnishes the article on Forestry for the new edition of the excellent encyclopaedia named. He defines the word Forst as Mr. Fernow has insisted the English "forest" should be defined, namely, as woods which are treated according to economic principles.

Faulty in an article for publication, which, from the title, supposedly knows no territorial limits, is the lack of all information regarding other than European, or, indeed, German forests. As regards the latter, the information is as complete as 30 pages of closely printed matter can give it, and as regards forestry practice and forest politics as clear, concise and modern as can be expected from the author. The literature list is especially welcome.

The author also contributes the article Jagd.

In Forest Land. By Douglas Malloch. American Lumberman, Chicago, 1906.

This journal is strictly devoted to professional record, and hence it must be prosaic in the extreme, concerning itself only with facts, and at best with professional fancies; yet it may for a moment at least take cognizance of a poetic production which portrays with so much intimate understanding forest life and the incidents of a lumberman's existence as does the small volume before us, collected from the pages of, and republished by a supposedly still more prosaic trade journal.

To win a poetic side from the rough logger's and the uncouth mill hand's surroundings is no easy matter, but the author has succeeded in a marked degree in places, albeit most of it is mere rhyming.

A forester, with all his practical work, realizing that his work is for future unborn generations, must be a seer, a poet, to some extent, and hence should cultivate his poetic soul by relaxing occasionally from his prosaic attitude, and by seeing the beauty as well as the usefulness of his charges. For this purpose the book may be recommended. B. E. F.

OTHER RECENT LITERATURE.

Game Laws for 1906. *A Summary of the Provisions Relating to Seasons, Shipment, Sale, and Licenses.* By T. S. Palmer and R. W. Williams, Jr., U. S. Dept. of Agriculture. Farmer's Bulletin No. 265. 55 pp.

Special Report on the Decrease of Certain Birds, and Its Causes, With Suggestions for Bird Protection.. By Edward Howe Forbush. From the 52d Annual Report of the Massachusetts State Board of Agriculture. 113 pp.

Suggestions to Homesteaders and Persons Desiring to Make Homestead Entries. Approved August 4, 1906. General Land Office. 16 pp.

The Relation of Desert Plants to Soil Moisture and to Evaporation. By Burton Edward Livingston. Published by the Carnegie Institution of Washington, 1906. 78 pp.

The Forestry Work of the Ohio Experiment Station. By W. J. Green and C. W. Waid. Ohio Agricultural Experiment Station. Circular No. 50, 1906. 11 pp.

How to Prune Young Locust and Catalpa Trees. By W. J. Green and C. W. Waid. Ohio Agricultural Experiment Station. Circular No. 51, 1906. 6 pp.

Hearings Before Committee on Agriculture, House of Representatives, on Bills Having for Their Object the Establishment of Forest Reserves in the Southern Appalachian and White Mountains. 59th Congress, 1st Session, 1906. 52 pp.

Second Annual Report of the Shade Tree Commission, Newark, N. J., 1905. 16 pp.

The Genus Ptelea in the Western and Southwestern United States and Mexico. By Edward L. Greene. Contributions from the United States National Herbarium, vol. x, pt. 2. 1906. 30 pp.

Location and Area of the National Forest Reserves in the United States, Alaska and Porto Rico. Forest Service Leaflet, Sept. 1, 1906. 4 pp. This shows a total of 112 Forest Reserves, comprising a total area of 109,103,047 acres.

The Utilization of Tupelo. By H. B. Holroyd. Forest Service Circular No. 40. 16 pp.

Forest Planting on Coal Lands in Western Pennsylvania. By S. N. Spring. Forest Service Circular No. 41. 16 pp.

Consumption of Tanbark in 1905. By H. M. Hale. Forest Service Circular No. 42. 4 pp.

Cross-ties Purchased by the Steam Railroads of the United States in 1905. By H. M. Hale. Forest Service Circular No. 43. 6 pp.

Wood Used for Pulp, 1905. By H. M. Hale. Forest Service Circular No. 44. 11 pp.

Prolonging the Life of Telephone Poles. By Henry Grinnell. Reprint from Yearbook of the U. S. Dept. of Agriculture, 1905. 10 pp.

Waste in Logging Southern Yellow Pine. By J. Girvin Peters. Reprint from Yearbook of the U. S. Dept. of Agriculture, 1905. 11 pp.

How to Grow Young Trees for Forest Planting. By A. E. Sterling. Reprint from Yearbook of the U. S. Dept. of Agriculture, 1905. 10 pp.

Federal Game Protection.. A Five Years' Retrospect. By T. S. Palmer. Reprint from Yearbook of the U. S. Dept. of Agriculture. 1905. 20 pp.

Some Insects Injurious to Forests. The Western Pine-Destroying Barkbeetle. By J. L. Webb. Bull. No. 58, pt. 2, Bureau of Entomology, U. S. Dept. of Agriculture. 13 pp.

Annual Report of the State Geologist for the Year 1905, *with Map.* Geological Survey of New Jersey. MacCrellish & Quigley, State Printers, Trenton, N. J. 1906. 358 pp.

Contains interesting articles entitled "A Brief Sketch of Fossil Plants" and "The Flora of the Cliffwood Clays."

Alkali Soils of the United States. A Review of Literature and Summary of Present Information. By Clarence W. Dorsey. Bull. No. 35, Bureau of Soils, Washington, D. C. 1906.

The Brown-tail Moth and How to Control It. By L. O. Howard. Farmers' Bulletin No. 264, U. S. Dept. of Agriculture, Washington, 1906.

PERIODICAL LITERATURE.

IN CHARGE:

Botanical Journals ....R. T. FISHER
Foreign Journals............B. E. FERNOW, R. ZON F. DUNLAP
Propagandist Journals ....H. P. BAKER
Trade Journals ....F. ROTH, J. F. BOND

FOREST GEOGRAPHY AND DESCRIPTION.

Reboisement Policy in France.

For three-quarters of a century France has been making amends for the disastrous policy of disposing of public lands and forests adopted at the time of the first Revolution. Purchase at prices that savor of extortion for reforestation at an expense unwarranted unless we recognize that a forest cover is indispensable has only too widely prevailed. Those reforestation projects lying in southeastern France, in the Alps, have attracted most attention. The scale upon which they were undertaken was enormous, and it is estimated that another hundred years of work is necessary to complete present plans for protecting this miserable country from torrential floods, avalanches and landslips.

The technical excellence of these works compel admiration, says Schwappach, and they have long stood as models of their kind before engineers from all parts of the world.

The criticism has lately made itself heard in France that simple tree planting is alone sufficient to control those mountain streams, and that all the expense of dykes and drains may be spared. But a study of local conditions reveals to one who is somewhat acquainted with similar work in other parts of Europe that the forest cover really plays quite a minor part in the control. Only when the criticism goes farther and calls to question the *policy* of these improvements does it touch a vital point. The whole region is wretchedly poor and with all human effort soil and climate can be modified but little. For but a fraction of the contemplated expenditure every parcel of land could be bought outright and the whole population transferred to more favored regions.

Only a few miles westward of the Rhone lies the watershed between the Atlantic Ocean and the Mediterranean in the Cevennes. The southern and eastern slopes are very steep indeed and contain engineering difficulties hardly second to those in the Alps. But political and social conditions are vastly more favorable and the same expenditures here have brought results much more satisfactory. Oak and beech are planted in the lower altitudes, spruce, fir, larch and Mugho pine higher up.

In the Pyrenees control of torrents meets with much the same natural conditions as in the Alps, but the region has suffered less at the hand of man. Only a few of the streams need remedying and the outlook is more hopeful. Very great pains have been taken to protect certain mountain resorts from boulders falling from the cliffs above, both by forest planting and by masonry.

Of unusual interest was a swath cut through the forest by an avalanche. Everything went down in the ruin from timberline to the bottom of the narrow gorge, where the debris piled up. But on the opposite ascending slope there was a continuation of the swath; all the trees were blown down in the direction the avalanche moved, not only up to the crest of the next hill, but for a short way down the farther side.

The Landes of Gascony lie in southwestern France, forming a triangle between the ocean, the rivers Gironde, Midouze, and Adours. Little more than a century ago this was a wilderness that no owner claimed. The State appropriated to itself and improved immense areas by replanting to Maritime Pine, after fixing the dunes with sand-grasses. Entirely as a result of this improvement this region has become a large producer of naval stores.

Between the Loire and Cher, south of Orleans, lies another sand plain that has been greatly improved by forest planting and drainage. Here, too, in the Sologne, as it is known, was Maritime Pine planted at first. The winter of 1879 was too severe and killed this species everywhere, and since that time return has been made to broad-leaved species which are native, though some pine has been planted in the hope that such a severe winter may never again occur. The Scotch Pine seems best adapted to conditions in the Sologne, but always with broad-leaved trees in some sort of mixture, or as an underwood.

Forstliche Reisebilder aus den Aufforstungsgebieten Frankreichs. Zeitschrift für Forst- und Jagdwesen. May, 1906. Pp. 314-333.

Forestry in Hungary.

In setting down his impressions of Hungarian forestry after a four days' stop in the municipal and private forests of the Tatra Mountains, northeast of Vienna, Dr. Martin touches upon two widely separated aspects of his subject; technical forestry and forestry as affected by tariff duties.

The forests visited were beech and oak and other broad-leaved trees, which together make up 88 per cent of the wooded area of Hungary. For beech, soil and climate appear to leave nothing to be desired, but even favorable sites cannot remedy the apparent lack of care for the stand in its youth. Little attention to seed years in cutting for natural regeneration has rendered it necessary to fill fail spots with conifers (spruce and larch), and as a result the young thicket and pole wood stands are filled with "wolf" trees.

The oak in pure stand occupies 27 per cent of the forest area of Hungary. Frequent seed years and the mild climate and rich soil lend themselves well to natural regeneration. In sharp contrast to German and French practice is the *rapid* progress of removal cuttings; the mother stand is entirely removed in the second or third year. Frost and drought are factors which do not enter, but weeds come in and choke the young plants, retarding their development, and causing fail spots, which are then planted at considerable cost with conifers. Everything strengthened the opinion that unless kept free of weeds by cultivation oak seedlings thrive better for several years under partial shade, such as afforded by mother trees in natural regeneration.

Beech and oak mix well here, and what is lacking in these stands is clearly due to the little care they receive in their growth. As revealed in some localities in Germany, so here it is apparent that oak thrives in mixture with beech the better the milder and sunnier the site and the richer the soil. In higher altitudes and latitudes, and on harsher sites, the oak begins to require care and attention, or it gives up its place to beech. Thus, it becomes necessary to grow the oaks in groups instead of in even mixture.

Large areas in the Tatra hills are devoted to coppice forests, oak being grown for tanbark. Twenty years is the usual rotation and thinnings are made in the fifth and fifteenth years. These are required by law, though the material may not pay for its removal.

Coppice for tanbark is here beginning to fail to yield a profit, as it has failed in Germany. The indicated transition to high forest requires greater denial on the part of small owners than they can afford, and the problem is really a serious one for the State to consider if these areas are to continue to produce wealth.

Hungary is a timber exporting country and it is to be expected that the visit of a German whose country exacts a duty on the wood it must import to supply itself would call forth arguments for free trade. And reasons *pro* and *con* are set forth in their best light.

A protective tariff or free trade, each find their justification in economic conditions which change. Measures that are reasonable today may soon be very unjust.

Kritische Vergleichung der wichtigsten forsttechnischen und forstpolitischen Massnahmen deutscher und ausserdeutscher Forstverwaltungen. Zeitschrift für Forst- und Jagdwesen. March, 1906. Pp. 159-169.

FOREST BOTANY AND ZOOLOOY.

Length of Life of Trees.

The concluding article by Dr. Kanngiesser regarding the age of trees treats of Elm, Basswood and other deciduous trees.

An Elm planted about the year 1500 at Bisson, in Normandie, had a diameter of 5 1-2 feet, with an average growth rate of about 1 inch per decade. Another, in Switzerland, measured nearly 8 feet, and the growth of the last 50 years about 8 inches. An Elm in Hesse, the stoutest on record, has about 6 1-2 feet at 1 m. above ground. An age of 500 years or more for this species is deduced from these measurements.

Tilia may exceed this age by far, for a Basswood felled in Lithuania showed 817 annual rings. Three historically surely determined specimens exhibit striking variations in the rate of growth, namely, 1.6, 3.7 and 5.3 mm. annually, showing how unrelated age and diameter may be. The first specimen at Fribourg was planted in 1440 and is about 4 1-2 feet breast high; the second, planted at Jena in 1664, has a diameter of 6 feet, and the third, planted at

Munchenwyler in 1556, which was destroyed by a storm in 1890, measured over 11 feet. Two Linden, which are supposed to have been planted before the 13th century, namely, at Neustadt and Kasberg, in Bavaria, are over 10 and 14 feet, respectively. The former had already, in 1392, to be propped up with 62 posts. The stoutest Linden and the stoutest tree on record in Europe is the one at Staffelstein, with 15.6 feet, man-high. As a rule, however, the age of 400 years is probably rarely exceeded by this species.

Of other species there are found *Acer pseudoplatanus* at 1350 m altitude with 9 feet diameter. The celebrated Maple under which, in 1424, the Federation was founded, died in 1780, so that the possibility of 600 years of age is likely. A specimen of *Acer campestre* of two feet diameter is reported from England.

Sycamores grow to 12 and 15 feet diameter, but their age is uncertain.

Ash is supposed as long-lived as Beech, although diameters over 3 to 4 feet are rare.

The Olive, *Olea europaea,* is reputed to possess most remarkable longevity, but no authentic determinations exist.

Willows, due to their remarkable reproductive power, have a long life.

The estimate of 600 years for the best known *Populus alba,* near the Danube, at Leipheim, with a diameter of 11 feet, is reduced to one-half by the author.

Populus nigra of 100 to 150 years of age are recorded with 5.6 and 4.5 feet diameters.

Juglans regia with 5.3 feet, without age determination, is reported from Switzerland.

Ueber Lebensdauer und Dickenwachtum der Waldbäume. Allgemeine Forst und Jagdzeitung. Sept., 1906. pp. 289-291.

Forest Weeds.

Dr. J. F. Clark defines a forest weed as "a plant which is injurious to the reproduction, growth or quality of wood crops." These fall into two classes, the first consisting of herbaceous plants and shrubs, and the second of undesirable trees.

"The absolute necessity of light for plant development on the one hand, and the possibility of shading the forest soil on the other, at once suggests the remedy for herbaceous and shrubby forest weeds, which is to establish or maintain a crown cover of at least moderate density, where such weeds are troublesome or likely to be so. In the case of groves of trees having open crowns, such as the black walnut, or tulip, or old oak stands, underplanting with beech or hard maple is sometimes resorted to, to destroy the weeds and to protect the soil from sun and wind. By virtue of their ability to form part of the crown cover and thus insure their light supply, the weed trees constitute a special class requiring radically different treatment. No matter how varied the kind, age, or quality of the weed trees, the practical forester has but one remedy, and that remedy is the ax."

Seven illustrations of forest weeds accompany the article, together with descriptions and statement as to proper method of procedure in each case. The evil effects of grazing woodlots are especially well brought out.

Some Types of Forest Weeds. Canadian Forestry Journal, September, 1906. pp. 110-113.

Peculiar Beech.

Near Hamelin, in northwestern Prussia, according to Boden, is found a variety of the European Beech, the Süntel beech (*Fagus tortuosa*), distinguished by its peculiar habits. The axis early becomes nearly horizontal and there are two terminal buds on each shoot of unequal size. Whether the larger is directed outwards or sidewise makes a great difference in the subsequent growth. Placed in line with the axis of the shoot the crown is formed 4-6 meters to one side of the root; directed laterally the main axis assumes a shape like a corkscrew. Then when these two positions are occupied first by one, then by the other bud, an intricately intersprangling, wide-spreading crown is the result.

The Norway spruce has long been looked upon as the only species available for windbreaks and to fill accidental openings in broad-leaved stands. It is known to be but imperfectly hardy and to succeed but poorly in this position, failing in late middle life just as its protection is most necessary.

This rare variety of Beech, with the hardiness and dense foliage usual to the Beech, and its spreading crown, suggests itself as the proper tree for use as windbreaks and as a filler in mature forests, where it would supplant the spruce. The supply of seed is very limited and this will serve to prevent its wide use immediately.

Der wirtschaftliche Wert der Süntelbuche, Fagus tortuosa. Zeitschrift fûr Forst und Jagdwesen, February, 1906. Pp. 103-109.

Buds and Twigs in Winter.

An inquiry into a comparatively little considered field of tree biology is Mr. Karl M. Wiegand's article on buds and twigs in winter, with special reference to the functions of the bud scales. Among his conclusions perhaps the most significant is that bud scales are "not important to the plant as modifiers of temperature, (and)....have probably been evolved to prevent excessive transpiration, and to protect the delicate tissue from mechanical injury." While not of direct usefulness to the silviculturist, this article (like others of its sort) is distinctly of interest to any student of relations between trees and their environment.

Some Studies Regarding the Biology of Buds and Twigs in Winter. Botanical Gazette, June, 1906. p. 373.

Seeds in Liquid Air.

The effect of the intense cold of liquid air on seeds had been investigated by Woodland and Selby (Wooster, O.), with the result that no essential influence on the germination could be detected. Becquerel has repeated the experiment, having seeds for 130 hours in liquid air of — 185° to 192°. These experiments show that the resistance of seed to such temperatures depends on the amount of water and gases in their tissues. If these are present in sufficient quantity nucleus and protoplasm are hopelessly disorganized; but if sufficiently dried the seed retains its germinative power. This, according to Becquerel, contradicts the idea that reduction of temperature produces a temporary cessation of activities, preserving the protoplasm viable as long as it is kept frozen.

Der Einfluss flüssiger Luft auf Samen. From Comptes rendues t. 140, pp. 1652-1654. Centralblatt fûr das gesammte Forst wesen. Aug., Sept., 1905. p. 403.

Disease of Chestnut.

The disease described by W. A. Murrill has become epidemic in parts of New York City, and occurs also in New Jersey, Maryland, the District of Columbia, and Virginia. Although belonging to the genus *Diaporthe,* the species of which live usually on dead wood, this new species is parasitic. Its life history and effects are thus described:

"The fungus enters through a wound or dead limb and works beneath the cortex in the layers of the inner bark and cambium. The bark soon dies and changes color, and later becomes rough and warty from the presence of numerous yellowish-brown fruiting pustules, which appear in the lenticels and send out peculiar twisted spore-masses containing millions of minute summer spores. These spores are produced continuously throughout the summer and early autumn, and germinate without a period of rest, when they fall upon wounds in other chestnut trees. The winter spores mature in late autumn in the same pustules, and germinate the following spring, when the mycelium, which has passed the winter in the infested bark, also begins to grow again and continues to spread beneath the cortex, sending up fruiting pustules and distributing spores as in the previous season.

"The fungus attacks twigs, branches and trunks of Chestnut trees, irrespective of size or position, and usually proceeds in a circle about the affected portion until it is completely girdled. The death of the end of the branch necessarily causes loss of vitality and partial death to the remainder, and this enables the fungus to spread very rapidly through the tissues below until it reaches the main trunk, when the life of the tree is measured by a few years at best."

Treatment or restriction of this fungus, Mr. Murrill says, is very difficult. The mycelium cannot be reached by spraying solutions, and the only feasible measure seems to be to cut off infected portions and tar or paint the wound against further infection. This, however, is not likely to be effective except with young, vigorous trees, and Mr. Murrill is inclined to think that the disease, when well started, will have to run its course.

A New Chestnut Disease. Torreya, September, 1906. p. 186.

Peculiarities of Pine Moth.

In the year 1902 in certain provinces of Norway near the Swedish boundary the Pine Moth (*Lasiocampa pini L*) suddenly appeared in such great numbers as to be a serious pest, destroying considerable areas of pine forests, as reported by Mewes.

Anticipating a spread of the pest across the boundary the Swedish Department of Lands and Forests sent experts into Norway to familiarize themselves with the development of the insect and the effective methods of combating it. At the same time colored charts showing the insect in all stages of development and the nature of the damage it does were distributed through such localities as were liable to attack. In two places the pest was found to constitute a menace to the forest—one near the boundary and near infested areas in Norway, and one isolated 30 miles distant. This latter evidently stood in no relation to the area previously infested, but had arisen independently. Search for pupae in the autumn of 1903 showed that this area was seriously threatened, while the first mentioned required but little attention.

About 290 ha. (755 acres) were involved, lying in a narrow strip in the valley of the River Rottne. One-third of this area was covered with young growth (4-5 meters high), and observations in Norway had indicated that stands of such age were not destroyed the insects feeding here only early in the season, going later to older trees, if such are to be found.

During March and April, 1904, the large trees in this area were painted with a narrow ring of birdlime. A ring 2 cm. broad was entirely sufficient, and not a single caterpillar was known to cross and reach the crown. As anticipated, thickets and young polewood stands were not seriously damaged, and the measures adopted were thus effective in every respect.

In Sweden the Pine Moth requires two years for its development. The parasitic *Anomalon,* living in its larva, however, keeps the life period of one season normal to both insects in lower latitudes. Thus it is clear why the Pine Moth so rarely does great damage in Sweden and is so readily controlled.

Der Kiefernspinner in Schweden, 1903 *und* 1904. Zeitschrift für Forst und Jagdwesen. January, 1906. pp. 39-43.

SOIL, WATER, AND CLIMATE.

Water Contents in Forest Soils.

During the summer seasons of 1894 and 1895 series of soil-moisture determinations were made in the neighborhood of Eberswalde. These experiments, Ramann reports, were made to determine the average water content of different sorts of soils, and, secondly, the variations arising from different methods of regeneration. As always during the early stages of any study, unsuspected factors are discovered and new problems present themselves for solution. The purely local influences and the occurrence of wet and dry years contributed most toward rendering the results indecisive. Local factors obscure differences due to different degrees of thinning in growing stands, and dry years serve to emphasize difference in site, which wet seasons conceal.

The soil nearest the surface is not taken into account in drawing conclusions, for obviously this is too easily influenced by changes in the weather. The conclusions drawn are, for the sandy soil in question, as follows:

Unless decayed humus is present longer the effects of plowing disappear in the fourth year.

Whether, in reproducing by the strip method, the direction in which strips run (east and west, or north and south) makes any difference in the amount of water at the disposal of the young stand, the experiments failed to determine, but they did show that seedlings in openings have more soil moisture at their disposal than seedlings under a nurse stand. An extreme condition is noted in an old beech stand, which was considerably drier than a heavily sodded clearing, especially below 25 cm. "Other things being equal, the soil under a mature stand is drier than bare soil in almost every case, if we leave the surface out of the reckoning." Repeatedly during the work, Heyer's assertion that the quality of site is dependent solely on the amount of water available was shown to be untenable. Soils equally moist may bear very different stands and soils of widely differing water content may belong to the same site class.

Even moderate cultivation increases the amount of water available in the soil by preventing evaporation, and the intenser the cultivation the more marked the results. These results appear only directly under the cultivated area; the soil at the margin is not affected in the slightest.

The soil cover has immense influence; a compact layer of humus reducing soil moisture during the growing season.

Wassergehalt diluvialer Waldböden. Zeitschrift fûr Forst und Jagdwesen, Januar, 1906. Pp. 13-38.

Classification of Humus Formations.

The palaeobotanist Potoniè at Berlin, anticipating his great work on the origin of coal, has published a brief resumè regarding the different forms and stages of humification. Humus, generally speaking, are the solid (or dissolved) materials which remain as a result of the decomposition of plants. This decomposition can proceed under different conditions, the most important of which is presence or absence of air. Accordingly, there are four varieties of decomposition, namely, mere destruction or decay (Verwesung), putrefaction (Fäulniss), and between these two lie muck formation (Vermoderung) and turf or peat formation (Vertorfung).

The first process, destruction or decay, is a decomposition, in which everything is turned into gaseous form, carbon oxide and water, leaving no permanent, solid carbon products.

Muck formation occurs with presence of insufficient oxygen, so that a complete decomposition into water and gas cannot take place, and a solid carbonaceous material, muck, remains. It is that which we see in humid forests, and what makes the black soil in parks.

When the supply of oxygen is still further reduced, turf formation takes place, tending towards muck. The peat bogs in which this condition especially occurs exhibit plant growth in such a manner that new generations continue to form on top of the decomposed and decomposing ancestors, so that continuously increased exclusion of air takes place, which leads to the fourth process, putrefaction, decomposition under total exclusion of air.

In reality none of these processes occurs purely by itself, but they proceed side by side, and interchange. In the two intermediate processes of muck and turf formation an accumulation of carbonaceous matter takes place, the continuing decomposition leads to formation of coal.

Besides the solids the soluble carbonaceous materials are also designated as humus, namely, the humic acids. These are leeched out and carried away by waters, coloring creeks and rivers. These are mostly disintegrated in the first mentioned manner, and finally "nothing" remains of them.

Zur Humusbildung. Centralblatt für das gesammte Forstwesen Aug.-Sept., 1906. Pp. 401-403.

SILVICULTURE AND PROTECTION.

Mistaken Silvicultural Aspirations.

A bit of silvicultural history of interest to all engaged in converting mismanaged woods into good producers is told by F. H. When in the middle of the last century it became evident in some of the Swiss forests that coppice and coppice with standards did not satisfy the requirements, and a conversion into timber-forest was imperative, it was necessary to find means of continuing at least the supply of needed fuel wood, before the lengthened rotation would give new supplies. To meet this need it was proposed, after temporary agricultural use of the areas, to plant in rows the species which were to form the timber forest, namely oak, beech, blue beech, maple, ash, elm, and between these rows to introduce rows of the rapidly growing larch, pine, birch and black locust, with the expectation that after 35 years—the rotation of the coppice hitherto practiced—these would furnish as much wood as the coppice, and thus supply the needed requirements.

What really happened is related from the city forest of Lenzberg, with an area of 1500 acres, where in 1847 such conversion was begun. The newly installed forest manager, convinced of the propriety of this proceeding, was gratified to secure from 460 acres, devoted four years to agricultural use, a rent of over $17,000, while the planting cost was only $6,000. But, whatever the original condition of the plantations and the expectations may have been, the stands of later years do not justify the method. These, now 47 to 57 years old, show first of all that the "Vorwald" rows of rapid growing species were not removed, but on the contrary form the main stand, while what was to be the timber forest, mainly beech and blue beech, has become poor, crippled underbrush, which in 50 years has hardly grown 25 feet. The larch, on the contrary, shows excellent growth, fine form and large production, with trees of 70 cubic feet in the bole it forms the main stand, with pine, birch, ash, oak, elm, and maple as subordinate mixture in formal rows.

It is clear that the soil had lost more than gained by the agricultural use: the cultivation supposedly beneficial is offset by loss of humus and mineral constituents, and by the removal of stones. Probably at first the plantations were benefited, but the benefit did not last, the absence of the humus cover also causing absence of the angle worms and consequent loosening of the soil. An imperfectly decomposed humus from the leaf fall of the plantations covers the hardened mineral soil without mixing with it.

Chemically, also, the soil is unfavorable to deciduous trees, lacking in lime, which in addition to other factors, like frost, undue shade and the undesirable physical condition of soil has produced the remarkable deterioration of the beech—a warning to consider more carefully the biology of the species used in forming plantations!

Das Vorwaldsystem, seine Ziele und seine Erfolge. Schweizerische Zeitschrift für Forstwesen. Sept. 1906, pp. 273-278.

Variations of Strip System.

Very careful and very extensive investigations are recorded by Ogiewski in the Russian Lesnoj journal regarding the strip system with fellings in series, and in echelons. The factor of light and its influence is especially investigated in regard to duration and intensity. A point *a* in the open is fully lighted as long as the source of light lasts, a point *b* lying between two stands of timber is lighted only for a portion of the time, which may be expressed as a percentage of the duration of light on *a*. If *D* is the length of day, *S* the average intensity of light during the same, *d* the duration of light on an opening or cut, *s* its intensity, and *P* the product of duration and intensity, then $P:100 = ds:DS$, or $P = \frac{ds}{DS} 100$. D is known, *d* is found by observation on sunny days, *S* and *s* depend on direction of the sun's rays, and are expressed by the *sine* of the angle M, with which they strike the plane. A vertical from the point of observation forms with the rays the zenith angle (z), which complements M to a right angle, hence $M=90\text{-}z$, and the intensity of the light is expressed by $\sin\,(90\text{-}z)$. A formula well known to astronomers makes $\cos z = \sin y \sin \delta + \cos y.\ \cos \delta \cos t$, when y is the geographical latitude, t the sun's time in degrees, δ the inclination of the sun dependent on the season and, together with the sun's time, to be found for any moment in an astronomical calendar. The last two formulas give the intensity of the light, and the calendar its duration, beginning and end.

The light intensity and duration was then established for a number of sample plats of 1 qm located at varying distances from the standing timber, and 5 m distant from each other. The influence of the different intensities on the natural regeneration was determined by the average number of seedlings per ha.; the influence on sowings by counting germinated plants on 100 spots, computing the germination percent. and the percent. of successful spots; the influence on planting by determining the number of plants persisting after a given time.

From the large amount of observations recorded in 18 tabulations the following conclusions are drawn: The success of natural regeneration of pine depends on the degree of light. Side shade favors it and reduces loss in sowings and plantings. The explanation lies in the reduced temperature and reduced loss of moisture from the soil. To secure good reproduction the width of the strips should not exceed 60 m. The strips in echelons are very much better seeded than those in series.

Ueber Kulissen und aneinander gereihte Schläge. Allgemeine Forst- und Jagdzeitung. Sept., 1906, p. 306.

Tending the Crop.

A long and most suggestive article by Schiffel does not pretend to bring anything new but analyzes critically and exhaustively on the basis of empiric and scientific biological knowledge silvicultural questions on which opinions diverge. Such systematic presentation of the principles by such an authority, even though elementary, is worth while devoting space and time to brief fully.

Under "factors of the form of stands," the author discusses the differences in composition which in a given locality are produced by the influences of soil, species, density, age and habitus dependent on biological characteristics of the species. Climate must be considered as not capable of being influenced; other factors, like soil surface, air movement, water, chemical, physical and mechanical conditions of soil and soil cover, on the other hand, although mostly capable of being influenced only in a small degree, may become the cause of considerable differences in the form of stands.

Soil. The great topographic variation which is possible even on a limited area is pointed out as calling forth notable variations in soil quality. Differences in humus contents may produce considerable differences of development in the younger stages, while later mainly the light and the physical and chemical conditions of soil are important, and especially drainage conditions.

Species. The species influence form of stand by making different demands on the soil and at the same time influencing its physical condition by character of shade, density, and fall of litter. Again their biological characteristics are so different, that even though equally adapted to the soil their development in mixed stands change its form considerably.

Little is really precisely known as to adaptation of species to soils. Root systems and their variations in different soils give indications as to demand on depth and moisture. Just as in the crowns, there are physiolological peculiarities in the habitus of the root systems, like the well known taproot and tracing root habit.

Since broad-leaf trees make, generally speaking, greater demands on soil fertility and humidity than conifers, the locally varying contents of soil in sand, gravel, stones, may in the former produce greater variation of development. The surface conditions which favor or retard rapid surface drainage will have similar effect, and in a mixed forest difference of shade will also accentuate these variations.

Another factor not to be underestimated is the retention of water by the crowns, which varies with species, age, density, soil quality, etc., and similarly their influence on frost conditions.

Even-aged stands may in consequence of these variations become irregular in height and development. The judgment as to whether such irregularity is to be attributed to site or to species and density is not without influence on managerial measures for correction, possible in one case and not in the other.

Still more important in the tending of the crop is the manner of its original formation and the biological characteristics of the species, for they influence density and character of crown. Density is a function of the method of formation as well as species, site and age.

In even-aged stands, crown cover is greater in youth than later, reaching its maximum when the clearing process begins for lack of light. The beginning of this process is indicated by shorter shoots or cessation of shoot formation on the lower branches. In natural regeneration this maximum of density comes earlier, but lasts a shorter time than in open plantations. The stage of greatest density—in conifers indicated by a continuously green layer of litter on the ground, in broad-leaf trees less certainty in the crowning is of greatest import for determining the manner of tending the crop.

That light-needing and shade-enduring species show great differences in beginning, intensity, and duration of maximum density calls for difference in treatment. Perfect crown cover is a different thing with light-needing species and with shady ones. The better the site the sooner crown cover closes up, but also the shorter is the period of maximum density, due to vigorous growth. The cover formed by a smaller number of trees is often more perfect than that of a larger number, on account of better individual crown development. Hence density of stock is an important factor in determining degrees and forms of crown cover.

Tending the crop means regulating density, for on density depends form of bole and technical value, as well as quantity of production. The judgment as to whether and when with given species and given sites to make a thinning is the most important question in tending the crop.

Light. As branches die off for lack of light diameter growth is retarded until by the death of individuals crown development of the remaining trees is enlarged vertically and horizontally. It is not demonstrated, yet not entirely to be disregarded, that this retardation of diameter growth may be due to retention of meteoric water in the crowns and resulting dryness of soil. Since, however, the period of minimum rate of growth falls together with the end of the density period i. e. when the crowns are smallest and therefore retain least water, the main cause of the death of branches must be sought in withdrawal of light. The behavior of the dominant stems, which do not participate in the decrease of increment, are also a potent argument for this theory. Yet, we may assume, that the water conditions of the soil have an important influence in the change of density, i. e. loss of branches, at least where the soil humidity falls to a degree which corresponds to minimum requirements of the species in hand.

Since Heyer, the relative demands of different species for light have been the foremost basis for their treatment.

With light-needing species, irregular forms of stands as regards height and density are rare and are possible only on best sites. The reason is that the lower stand is soon eliminated. While no light-needing species can persist under the shade of its own mother trees, tolerant species can persist in the shade of their own mother trees, if only not overtopped. For these reasons selection forest with light needing species is possible only in very open stands and natural regeneration with them is more difficult, especially if as in pineries soil moisture approaches a minimum. Hence, also, the well-known rule, that in mixed plantations the light-needing species must be more rapid growers or that the "filler" must be tolerant. Practically, this rule is difficult of execution because light requirements are so much influenced by site, hence it is impossible to formulate rules for the tending of mixed forest in which the mixture is in single specimens; the general deduction may be made, that it is easier to tend stands mixed in groups, than those mixed as single individuals. Nor is it possible to readily formulate a scale for the requirement of species as regards density and form of crown cover.

Shaft Form. A maximum of value is the object of forestal operations, hence when quantity production cannot any more be stimulated, quality, i. e. timberwood percent or shaft form must be improved, to secure straight, clear, cylindrical logs of largest diameter. Species differ as to their capacity of securing this result. The conifers are physiologically predisposed to it, even without a dense stand. These are, therefore, least influenced by density. The characteristic of the broad-leaf trees dividing the shaft into a crown is differently developed in different species, influenced also by soil conditions, the better soil tending to develop a long undivided bole. Density of stand is the only means of forcing this development of long, straight, clear, cylindrical bole. But since quantity depends on open condition, the task is to regulate and even out these two requirements, which is the more difficult since besides site, age and species, its heightgrowth and character of crown must also be considered.

Height Growth. The most light-needing species are the most rapid growers (in their youth), the tolerant the slowest, a relation between height growth and tolerance exists to a degree. In each species a period of most rapid height growth can be found, which is largely independent of the site, but much more influenced by density. The inherent tendency of conifers to be monopodial makes it intelligible that density influences their height growth less than that of deciduous trees, which have the tendency of spreading. With these, therefore, the period of maximum height growth may be influenced to a degree. Site influences only the absolute measure of height growth; since on the same site at same age the tree in the open has less height than that grown in dense stand, we have means to increase the absolute height in a given time. Since with conifers this influence cannot be exercised, knowledge of the period of their maximum height growth rate is more important, for during this period any interruptions of crown cover are most readily filled up. Later, when height growth decreases, an opening in conifers is closed less readily than in broad-leaf trees; with these density produces more energetic, open stand slower height growth, and in older age an opening up may arrest height growth entirely. With conifers open stand rather stimulates height growth. In other words, the *variations of density have the opposite influence on height growth with conifers and with broad-leaf trees.* The optimum position has not yet been determined. While with conifers thinnings may be made during the period of maximum height growth without damage to shaft form, in length and with advantage for diameter development, clearness of bole alone requiring consideration, with broad-leaf species such openings must be avoided at that period, as detriment to form.

If a site does not fit two or several species in the same degree, as is usual, their behavior as to relative height growth cannot be surely predicted, and, since density also varies according to species, prescriptions of a general nature for manner, time and severity of thinnings cannot be given, each case requiring its own answer. For instance, if spruce in mixture with pine has not reached up to the latter in the polewood stage, then it will never do so, and it remains mere soil cover; the pine spreads into branches. If spruce ever reaches up to the beech, the latter is lost. If oak does not remain permanently ahead of beech, it cannot be preserved without costly individual tending. With the desire to make room for a species in mixture, the rest of the stand may experience such damage that it is questionable whether it pays to maintain the unsuited species.

On good sites the period of maximum height growth begins earlier and lasts a shorter time than on poor sites. On best sites with spruce the period may begin in the 5 to 10 year with one foot or more. On poor sites in the 40 to 50 year, with three inches as maximum average decennial rate. Hence, neither age nor rate permits judgment of the limits and duration of the maximum rate period, which must be always determined by special investigation.

More detailed account is made of reactions by the different species to various treatment in this respect.

Crown Form. Form and dimension of crown are among the best criteria for need and degree of thinnings. The structure of the crown is dependent on biological predisposition and density, besides age and site. Generally speaking, crowns in their youth are more elongated and open than in later age, with a tendency to broaden on better sites. With the same species and height the more compact and rounded form indicates poorer site. During the period of greatest height growth the side branches reach for light, the branches are at an acute angle with the shaft. Only in the open stand does a natural development take place, and here the light-needing species especially, spread out horizontally, for to secure light for the lower branches these must grow more sideways than the upper. With tolerant species this is not necessary, hence the crown is denser, does not lose lower branches as far down, and rounds off later in life.

The lack of ability to develop adventitious buds is the reason why conifers exhibit more regular crowns than broad-leaf trees, which possess this faculty. Hence, the compacting of the crown by shortening of internode in conifers gives an easier clue to judgment of height growth and site conditions. This shortening of the growth rate of the main axis is accompanied by increase of the form factor and hence also with same height and density poorer sites produce more cylindrical stems. The changes in crown form of the various species are described in detail.

The author then proceeds to the discussion of *Erziehungshiebe*, thinnings, the object of which, he repeats, is to secure in a given time the highest attainable values with due regard to expenses.

Thinning in the Subdominant (Niederdurchforstung), removing only dead and dying, neglects the time element and on poor sites fails to secure results altogether, because no dominant growth is developed.

Thinning in the Dominant (Hochdurchforstung) contemplates the growing of selected trees, which in number may be as many as can finally occupy the area with normal crown cover. Specially selected for their good form, this *élite* is to specially cared for from early youth by giving them light and room for development as needed, keeping the secondary growth for filler and nurse crop. The object of securing stout material in shorter time is attained only under certain conditions, for even this method may not claim general application, and the author proceeds at length to discuss its limitations.

The first difficulty is to determine upon a number of the *élite*, which must vary according to species, site, rotation, etc., and requires knowledge of the losses that must occur. This, however, is not so difficult since in time corrections and reductions can be made as they appear desirable. The individual care, however, must be costly and, while theoretically the proposition is tenable, practically and financially it may not be, and in large administrations almost certainly will not be.

Additional objections come from considerations, of characteristics of species in shaft form, height growth and of form of stand. It is prescribed to care for the *élite* by openings around their crowns suitable to their development. Now, as shown, in deciduous trees such openings tend to produce unfavorable effects in shaft form unless they are made very moderate. Such moderate openings, however, are only possible in younger years. The older the stand, the more difficult to open up around a dominant stem in a given, moderate degree. The removal of a neighbor is apt to make too big a hole, and the effect will be opposite from the desired. In a pole wood of even-aged, pure deciduous trees the execution of the principle will almost surely become impossible. Pruning would be too expensive. The tendency of such openings to retard height growth may give the advantage in that respect to the subordinate crop, which, there is danger, may overgrow the *élite*. At least, the method is questionable for deciduous species and pine.

It is otherwise with spruce, fir, larch, which do not spread nor are retarded in height growth as a result of opening,, the method is with these applicable without doubt, but it must have done its work and be discontinued by the time the period of maximum height growth is ended, so as to preserve the stems with clear cylindrical boles. But the difficulty in the choice of *élite* trees and the uncertainty of their fate make it appear simpler even with these species not to select a number, but treat all good dominant growth alike as final harvest crop. After several thinnings the best will, of course, remain.

In irregular pure stands, the final harvest crop is easily recognized but their treatment not as easily. Here not necessarily the stoutest, but the highest are to be chosen. These, however, in irregular pine or deciduous forest, should not be freed in early age, which would lead to spreading their crown. Indeed, they do usually not need any assistance. With spruce, larch, fir in irregular stand when in close position the freeing will be satisfactorily responded to.

The most favorable results come from this mode of thinning in mixed growths, the species of which are different in height growth and light requirement. Here, usually one species is to be favored, and the trees of this species are destined to be dominant growth. Indeed, here the light-needing species will necessarily have to be protected by giving it space according to the needs of its shaft development.

The method of thinning according to the principle of *equal standing room* for all sound and normal members of the stand in even distribution, does not share in the objections of the thinning in the dominant. This method does not require the maintenance of a filler, the dominant trees being made to maintain crown cover and natural clearing. Experience in the sample plats has shown, that with this method stands on good sites even severely opened during the period of maximum height growth close op rapidly, and satisfy as regards increment. The removal of the filler or secondary crop prevents formation of raw humus, light and rain reaching the soil move freely. Grass and weeds, come in, to be sure, but soon vanish again. General rules cannot be given for degree and time of this operation any more than for the other modes, all depending on species and form of stand. Some species must be forced from early youth to grow straight and clear shafts, others do not lose anything by delay. Each species makes different demands on degree of density for best shaft development. In this respect the author places in series larch, spruce, fir, birch, aspen, pine, alder, ash, oak, beech, the latter requiring the densest stand, while the larch even in open stand will develop good boles; one thousand trees to the acre medium site of the first, at least ten times for the last would be a desirable number. For fir two thousand trees would still insure straight bole and sufficient clearing. By starting plantations with the proper number according to characteristics in the shaft formation of the species, the necessity of thinnings may be avoided until a dominant growth is clearly developed, and indicated by the crown form. This time comes usually when the height growth begins to retard, and the earlier the less danger there is of detrimental reaction on shaft form. Hence, larch, spruce, fir should be kept open in youth, and later, when height growth is finished, dense; pine and broad-leaf trees the reverse.

Economy requires to avoid as much as possible the need of thinnings: *the growing of pure, even-aged stands, properly started, will under otherwise equal conditions produce the best financial results.*

The author then discusses in elaborate detail the methods of procedure under a variety of conditions for each of the principal German species.

To give a sample of the manner of treating the subject we select the pine, as probably most nearly representing similar conditions to our various yellow pines.

The pine is the only conifer which as regards its needs in early youth approaches the broad-leaved species: it must be kept dense. On better sites it may be planted in more open position than on poor sites, not over 1 m (3 1-4 feet) on the latter, 1.25 m (4 feet) on the former. Natural regenerations or sowings should be thinned early. During the clearing period it should be kept dense—the reverse of spruce and larch—clear bole at the expense of diameter growth requiring this. When the crown has decreased to one-third of shaft length a severe thinning is indicated, reducing numbers to one-half, which will rapidly close up. Then follows a longer or shorter period of rest and density until height growth begins to retard, when the shaft form is completed, and thinning for diameter is required. A secondary stand will then have formed, which is to be left at first to help the clearing process but, when the young timber period is reached, and the shaft form satisfactory, every laggard is to be removed, and in even groups standing room for each is to be provided. But decidedly dominant trees even then must not be freed, for it would require making larger holes in the crown cover than can now be closed, and the trees would grow into spreading crowns except on very good sites, and now the characteristic broad-leaved and rounded crown forms, strong branches develop umbrella-shape, and diameter growth proceeds with maximum rate. Thinning in the dominant is not fitted for the pine, it induces sprawling, branchy trees (Protzen).

It is understood that the density of the first period must not be continued so that the stand becomes stationary or the stems remain so slim as to be endangered by snow pressure, etc. Such stands must be gradually brought into more open position.

It is difficult to avoid under this treatment the formation of annual ring zones of varying width, less so, however, than with spruce and fir, and a loss in quality need not be feared.

On poorer sites the young growths can be kept more open, and they require earlier interference as regards time, but at about the same height. With pine the early education is decisive for shaft form, while larch, spruce, fir may even in later life be forced to clear their shafts. A pine growth grown up in open stand can not any more be made to grow into technically valuable wood, for knotty and rotten branch holes are too frequent.

An indication for the time of thinning in the polewood is the leaf fall. In the stage of densest cover the leaf fall, just as with the spruce, on account of the dying branches, is more abundant and ceases almost suddenly at the end of the clearing period, because the living crown has then sunk to a minimum. After the period of maximum height growth the pine thins out naturally, and permits a soil vegetation, yet even in old age it can spread its crown and make it denser, the accretion, however, does not react much to the increased light supply.

Just as the pine should be admixed to other species only in groups, other species do not succeeed very well in single admixture with it, except under very favorable site conditions. Spruce unless protected becomes usually secondary stand; not even fir can work itself through if once overtopped, and beech also rarely makes useful trees under the pine. Larch and oak do better. Where not absolute pine soils, but fresh, deep loose soils are involved mixture in groups is desirable.

Ueber Bestandserziehung, Centralblatt für das gesammte Forstwesen. Aug., Sept., Oct., 1906, pp. 333-335-405-425.

Chestnut Culture.

In a longer article Böhmerle discusses in detail the forestal characteristics and behavior of the European Chestnut (*Castanea vesca* Gaertn.) Natural Chestnut forests exist to a large extent in Krain (Austria), and the most northern stand is found near Komotau in Bohemia, where it was planted between 1625 and 1645, some of the trees now having diameters over 5 feet with heights over 50 feet. A very extensive account of the location of chestnut trees in Austria and of their measurements is given, which all show low stature with large diameters. Trees of 15 to 20 feet diameter and more are in existence (see page 211 of this volume). In nature this chestnut occurs only singly and in groups mixed in deciduous and conifer forest, although densely foliaged and partially shade-enduring. Otherwise it appears very much like the American Chestnut in wood and behavior, except that it requires higher temperatures and is liable to frost, hence best adapted to southern exposures. It is especially fit for coppice, and preserves its productivity into old age. Like the oak, it has a deep-going tap root, which makes it difficult to transplant, and to prune this root means to induce broad crown development. As to its shade endurance, this depends as with all species, very much on climate. In its native habitat it is half shade-enduring, but at a distance from the climatic optimum towards cooler situations, there is an increase of light requirement, while in the opposite direction shade-endurance increases. Soils influence light requirements in the same sense, good soils increasing tolerance. Detail investigations of the wood finish the article.

Die Edelkastanie in Niederoesterreich. Centralblatt für das gesammte Forstwesen. July, Aug., Sept., 1906, pp. 289-306-355-367.

Nursery Practice Root Pruning.

Intensive development of plant material is the order of the day in Germany, and planting of older stock with the ball of earth is becoming more general. Principally to secure good stock for such use, a new root pruning knife has been devised by Kaiser, a double-edge V-shaped knife, which can be attached with varying angle to a long handle. The object of the pruning is, of course, to secure a compact, fibrous root system, which especially in plants used with the ball of earth will keep the ball together. For spruce the pruning is to be done twice before transplanting, the first time in the spring, the second year in summer or fall (August, September). The intention is to secure only short, new fibrils, when the loss of roots in removing the plants will be minimum. Evidently, four-year-olds are to be grown. When plants in the nursery are set 6 inches apart men can prune easily 400 plants.

Das Kaiser 'sche Wurzelschneidemesser. Allgemeine Forst- and Jagdzeitung. Sept., 1906, p. 356.

Reforesting Farm Soils.

Two years ago the Pommeranian Foresters' Society discussed pretty fully the early thinning out and dying of the Scotch Pine on reforested farm land areas. Various views were expressed holding accountable such different agencies as fungus pests and soil conditions. Set to thinking by these different expressions of opinion, Froembling, the author of this article, believes he has found the true cause. This is two-fold. Directly it is due to a root-rot (*Polyporus annosus*), but one must look farther to account for the fact that this fungus confines its serious ravages to stands upon agricultural soil though it is found quite generally distributed through all pine stands, doing little damage.

The primary reason is the animal manure remaining in farm land when it is reforested. This manure forces the young trees into unnatural growth during the thicket age and leaves them overgrown and weakened as they enter the polewood stage. In this plight they fall easy prey to the root-rot.

Exhaustion of the soil by growing the last farm crops without applying animal manure, deep plowing to distribute the manure through deeper soil and thus make its influence less potent at first and more protracted, and finally, moderately thick planting instead of sowing are recommended to produce stands more resistent to the ro the rot. Where it can be done the Norway Spruce should, of course, be used in preference to the Pine, as this species does not suffer in the same way.

Die Kiefer auf ehmaligem Ackerlande. Zeitschrift für Forst- und Jagdwesen. March, 1906, pp. 169-176.

Protection against Pine Rot.

Inasmuch as a concerted movement has been instituted in Prussia against the pine rot, *Trametes pini,* according to a plan devised by Dr. Möller, it is of interest to have the record of recent experiences in putting this plan into practice. According to Kienitz, in Chorin forest near Eberswalde, this fungus has long been rather common, spreading slowly until now its eradication presents a typical problem.

The first move was to forbid the removal of branches from trees by faggot gatherers, for many living branches are always torn off with the dry, and an open door offered the fungus for its attack. Aggressive work commenced, however, in the removal of the bracket or shelf-like fruiting bodies and painting scars.

Three men working together first sought out the fruiting bodies in a strip of forest marking the trees found. After making a circuit at this work they took ladder, paint pot and brush and long-handled chisel and removed the fruiting bodies, covering the scars with antiseptic paint. The shelves sometimes sit as high as 5 meters from the ground and in the work of finding and removing them the frequent change of work is very desirable, as affording rest to the muscles in neck and shoulders.

Clearing 17 acres of the fungus was done at a cost of 78 cents per acre, not counting the cost of equipment. On a large scale and with the speed that would come with practice, this price should be reduced to 10 to 15 cents per acre.

Kampf gegen den Kiefernbaumschwamm. Zeitschrift für Forst- und Jagdwesen, February, 1906. Pp. 114-116.

Damage by Ice Storms.

A year ago on the 20th day of November an ice storm in the lower Vosges did heavy damage. In Alsace-Lorraine and in Baden a total of 32,000 festmeters of timber-wood was thrown and broken. Ice storms, says Ney, are rare phenomena fortunately, for the destruction wrought is always severe. Not only are the trees brought to the ground but limbs are torn away splitting the bole past all possibility of use except as fuel.

The atmospheric conditions under which ice storms occur are of unusual interest. Pure clean water may be cooled below the freezing point and remain in a liquid state. In this state the slightest jar or the introduction of a minute particle to serve as a nucleus for crystalization causes the liquid to congeal instantly. Before ice storms can occur the air must be free from dust and smoke, as protracted rains with no strong winds will cleanse it. Then a fall of temperature will cool the rain drops below freezing, but snow will not be formed for lack of a nucleus for crystallization. On striking the earth of any solid body the shock is great enough to freeze the drops. The result is a coating of translucent ice, covering everything in the landscape with a sheath, thicker above or in the direction from which the storm is driven. This sheath is very heavy and on broad leaves may increase the weight enormously.

Pine, spruce and fir suffer most, being evergreen, yet the larch and birch, too, are severely damaged by the ice that collects on the long slender branchlets.

Utilizing a forest damaged by an ice storm presents peculiar problems. Conifers never recover lost crowns, but broad leaved trees can very often put on new branches and continue their growth for a while at least. Pick up all the fallen trees first, then the splintered standing and then those conifers with crowns stripped from their shafts. Painstaking utilization will reduce the loss to a minimum.

Der Eisbruch in den unteren Vogesen vom 20. November, 1905. Zeitschrift für Forst- und Jagdwesen. March, 1906. Pp. 150-159.

MENSURATION AND FINANCE.

Hypsometers. A series of comparative measurements with different hypsometers by Flury on 542 trees which were afterwards felled, namely, with Weise's, Christen's, Hüni's, Klein's which latter are very expensive precision instruments, show that there is very little difference in accuracy. The differences from the true height in single tres vary between + 11 to 13 per cent; if height classes are formed this difference is reduced to + 2 to 5 per cent. Other investigations concern themselves with the various sources of error, like oblique position, wind, etc.

Mitteilungen der Schweizerischen Zentralanstalt fûr das forstliche Versuchswesen. VII Band, 3 Heft., 1906. Pp. 233-286.

Growth of Ash. The rarity of growth measurements of deciduous species may lend value to the tabulation of a few yield measurements of Ash (Europaean), published from time to time in various journals and compiled with an additional measurement by Lorey. The Europaean Ash, like ours, is a rapidly growing, light-needing tree.

The height curve of the sample trees in the last area ran as follows:

Height	1	3	5	7	9	11	13	15	17	19	21	m.
Age	6	15	20	23	25	28	31	35	39	43	52	years

A careful calculation of the bark per cent led to the conclusion that the usual allowance of 10 per cent is too low for older Ash in open stand. Other detail measurements add interest to the contribution.

Aufnahme Ergebnisse einer Eschenprobeflache. Allgemeine Forst- und Jagdzeitung. Oct., 1906. Pp. 357-360.

UTILIZATION, MARKET AND TECHNOLOGY.

Treating Telegraph Poles.

A scale of the conservative effect of different preservatives has not yet been established, although an attempt was made by Christiani to arrive at such a scale through statistics from the whole German Empire for 20 years, published in Archive fûr Post und Telegraphie, 1905.

This scale, according to the author to be taken with reserve, places tar oils (creosote) first, sublimate of mercury next, zinc chloride next, and copperas last.

With telegraph poles, says Havelik, it would be presumption to give general preference to one or the other material. All these adhere only superficially to the wood and can be leached out more or less easily, according to local conditions. A study of the statistics of those impregnated with the first and last mentioned materials of the scale lead to the conclusion that where conditions are unfavorable the creosoted poles stand longer than those treated with sulphate of copper, but in favorable locations the latter outlast the former. This would show that the greatest economy is secured by studying the behavior of the different materials under different conditions.

Untreated poles last from one to seven years, the rot making them break at the ground. Larch poles last usually longer than spruce and fir, and especially when set so as to avoid alternations of dryness and humidity of soil, they last long (over 15 years) and do not decay through rot fungi, but by a different process of disintegration, which makes them dangerous, because there are no outward signs of decay. Poles treated with copperas also last from one to seven years in unfavorable locations and here they rot through fungi, but in favorable situations, where they last eight to thirty years, they succumb to either of the two modes of decay. In other words, where only the character of the wood and not also the soil conditions would lead to decay the impregnation with copperas is effective. It is useless, on the other hand, to employ this material where soil conditions are the main cause of decay. Here, therefore, creosoted poles should be substituted. The first three years after their introduction the expense would appear greater, but after seven years the financial effect would be in their favor.

The author explains his conception as to the reason why creosoted poles last longer. A cubic meter of wood is treated with 5 kilogram sulphate of copper, or else with 150 to 200 kilogram creosote. The latter contain at least 8 per cent pheriols, the preservative element, hence there are 12 Kg. in the wood, or more than twice the quantity of preservative, which, moreover, may in itself be more effective. In addition, the oiliness of the creosote—objectionable to the repair men—keeps moisture away as long as the soil is not evaporated. Temperature will do this, while the copperas is merely leeched out.

Only wood of resistent species should be used, since even with the best impregnation the individual character of the wood has a bearing on its durability.

Ueber den Wert der Impraegnierung der Telepraphen-Stangen. Allgemeine Forst- und Jadgzeitung, Sept., 1906. Pp. 301-304.

Combustibility of Wood.

Recent Experiments by Hornberger and Selheim at the Münden Forest Academy on the combustibility of oak and beech wood have shown that the two are in this respect practically the same. Oak burns through slower than beech when it is of vigorous growth and heavy. Light wood grown on poor sites burns more rapidly than beech. Beech shows less variation in the tests in question than oak. Since it is not possible to distinguish between the different grades of oak in specifying for building purposes, it is purposeless to exclude beech where it is thus shown to be better than certain grades of oak which are not excluded.

Looking more closely into some of the comparative tables we note that in one test oak burned through in one-fifth longer time than beech and the extent of charring was one-third more on the beech. On exposing similar sticks to a certain heat, the oak broke into flame in two minutes and sixteen seconds, the beech in two twenty-six. On the whole, charring was about as extensive on the one as on the other and elaborate statistical methods are necessary to bring out what differences there are. The whole paper is a good example of the statistical method of investigating such problems.

Vergleichende Untersuchungen über die Feuergefährlickeit des Buchen- und des Eichenholzes. Zeitschrift für Forst- und Jagdwesen. June, 1906. Pp. 386-397.

Hardness and Weight.

Recent experiments by Büsgen show that while hardness of wood is not a function of specific gravity, it roughly approximates this when averages are considered. Placing a series of specimens in order of their specific gravity and averaging their hardness in groups of five gives an ascending series with no very great irregularities.

Hardness was determined by driving a needle into the wood a distance of one millimeter. The lack of perfect agreement may be inherent in the method used.

Holzhärte und Spezifisches Gewicht. Zeitschrift für Forst- und Jagdwesen. April, 1906. Pp. 251-254.

STATISTICS AND HISTORY.

German Statistics.

The forestry statistics of Germany have lately been more fully elaborated than ever before by action of the German Forstwirtschaftsrat in deputing Prof. Schwappach to collect them. The statistics of the State forests had before been quite complete, but of private forestry comparatively little got into print, and it is this portion which now has been greatly enlarged, at least twelve of the large owners, representing 9 per cent of this class of owners, have been willing to report the results of their management, and also some of the municipal forests have come forward, some 20 per cent of this class being represented. Still, only little over 44 per cent of the total forest area of Germany figures in the latest statistics, tabulated by Schwappach for 1904.

Altogether the area, cut, and financial results of 15,600,000 acres of managed forest land are reported in detail, of which 10,-800,000 are State lands.

The largest city forest reported is that of Görlitz, in Silesia, of around 65,000 acres; the largest private forest, of Prince Fürstenberg, is 78,000 acres, and all of those reporting are over 28,000 acres.

In wood production per acre the variation is very great and lies between 12.9 cubic feet in the Hanover communal forests (12,000 acres), and 111.5 cubic feet in the State forest (only 16,000 acres) of Saxe-Altenburg. This leaves out the unusual cuts in several cases, where windfall and insects had disturbed the usual rate. On large areas, over 50,000 acres (in order to include private holdings), the cut is usually above 40 and below 100 cubic feet. In the larger State administrations, Würtemberg and Baden lead with 94 cubic feet. In the communal forests Baden, where state management exists, stands first with 103 cubic feet, to be sure on only a 10,000-acre area. To all appearances the private owners do not cut much more than the State administrations, except that several of them were forced to overcut on account of windfall, which in the case of Prince of Pless meant 400 cubic feet to the acre.

The percent of saw timber varies in still greater range, namely, between 19 and 84 per cent, but usually it lies between 45 and 65 to 70 for the larger administrations.

The handsome revenue of over 45 million dollars, or nearly $3.50 per acre, results from these woodlands. The State forests average a little less than $3.40, but the best of the larger ones, Würtemberg nets $5.90, Bavaria only $2.50. The 560,000 acres of Crown forests earn less than $3.00, and 445,000 acres of private forest bring also less than $3.00, while the 91,000 acres of municipal forest earn $5.50.

Notable is the fact that Baden, with only 39 per cent saw timber, of which 64 per cent is conifer, and Saxony, with 53 per cent saw timber and 70 per cent of it conifer, work out only 50 cents difference per acre, in favor of Saxony, with exactly the same cut.

Statische Mitteilungen über die Erträge der deutschen Waldungen für die Jahre, 1900, *bis* 1904. Mitteilungen des Deutschen Forstverein in Zeitschrift fûr Forst- und Jagdwesen. Oct., 1906. Pp.688-694.

Prussian Statistics.

It appears from the statistics of 1904, the latest compiled, that the net results of the forest administration have been three times as large as they were in 1868 and 26 per cent better than in 1900, namely, $2.37 per acre. This latter increase is mainly accounted for by a larger cut, namely, 28 per cent above that of 1900, while prices in these two years of comparison seem not to have differed. Expenditures increased 21 per cent over 1900 and are nearly two and one-half times as large as they were in 1868. In educational direction the expenditures have grown during this period to nearly 3 1-3 those of the early times.

The average cut per acre of timber wood (over 3-inch) was 55 cubic feet, 54 per cent of which is saw timber.

The average price per cubic foot for wood of all description (over 3-inch), worked up in the forest, was 7 1-2 cents on a cut of about 380,000,000 cubic feet, the cost of felling and preparing for transport being 2 1-3 cents, so that the stumpage value is somewhat over 5 cents per cubic foot, or say $7 to $8 per M. feet. The best pine (II class) brought, however, 12 cents per cubic foot, equivalent to a stumpage of near $18 per M; spruce brought a little higher price, and oak (III class) of 16 to 20-inch diameter brought over 20 cents, or near $30 per M, cut to logs in the forest.

That these will soon be world prices admits of little doubt.

Amtliche Mitteilungen aus der Abteilung für Forsten. 1904. Berlin, 1906.

Canadian Forest Reserves.

The Establishment of forest reserves upon Dominion lands, in Canada, is the result of a movement which began about the year 1893. The first reserves made were Turtle Mountain Reserve, in southern Manitoba, and Riding Mountain and Lake Manitoba West Reserve, in northern Manitoba, which were set apart by order of the Minister of the Interior on the 13th of July, 1895. The advisability, however, of giving the reserves a more permanent character became apparent, and it was decided that they should be set apart by Act of Parliament. This is accomplished by the Dominion Forest Reserves Act, passed by the House of

Commons at its last session (1906). The boundaries of each reserve are specifically stated in the act, and can be changed only by special Act of Parliament.

The Superintendent of Forestry is charged with the control and management of the reserves, subject to the direction of the Minister of the Interior. The exchange of lands outside the reserves for private holdings inside is authorized. The appointment of forest rangers by the Minister of the Interior is provided for, such rangers to have all the powers of a justice of the peace. During the construction of any railway passing through Dominion lands, such railway is required to reimburse the Crown to the extent of one-half of the expense of fire-ranging along its line and for a distance of five miles on either side of its right of way.

The names and areas of the Dominion Forest Reserves set apart by this act are as follows:

Name of Reserve.	*Area, square miles.*	
Province of British Columbia—		
Long Lake	190	
Monte Hills	106	
Martin Mountain	18	
Niskonlith	124 1-2	
Tranquille	149	
Hat Creek	206	
Donald	72	
Larch Hills	25	
		890 1-2
Province of Manitoba—		
Riding Mountain	1,535	
Turtle Mountain	109 1-4	
Lake Manitoba West	248	
Spring Woods	110	
Duck Mountain	1,251	
Porcupine	322	
		3,575 1-2
Province of Saskatchewan—		
Beaver Hills	72	
Pines	145	
Moose Mountain	163	
Porcupine	360	
		740
Province of Alberta—		
Cooking Lake	114	
Cypress Hills	18	
Kootenay Lakes	54	
		186
Total		5,391 3-4

The Dominion Forest Reserves Act, and *An Act Respecting Forest Reserves.* Canadian Forestry Journal. September, 1906. Pp. 121-124 and 139-147.

The Timber Pirate.

That Canada, as well as the United States, suffers severely from the depredations of the timber pirate is shown in an article by Hon. W. C. Edwards. The desirability of *bona-fide* settlement on actual agricultural land in timbered areas is recognized. The mere pretense of settlement, however, as a means of plundering the public timber wealth of the country is severely condemned. The writer estimates that for every tree in Canada cut for commercial purposes at least twenty trees have been destroyed by fire. The majority of these fires are attributed to the carelessness of ostensible settlers upon forest lands, who desire to secure title only for speculative purposes. The fire ranger system adopted by the Provinces of Ontario and Quebec has greatly reduced the destruction caused by forest fires. On the other hand, the steady rise in stumpage values gives an added incentive to activity on the part of the schemer who sees an opportunity to secure control of valuable timber lands under the guise of agricultural settlement, either by himself or by others employed for the purpose.

In our own country the loss to the Government from this form of fraud has been almost incalculable. However, the possibility of its continuance is being eliminated by the rapid extension of the forest reserve area and by the increased efficiency in the enforcement of the law. The Act of June 11, 1906, permitting agricultural settlement in forest reserves will not operate to permit the securing of timberlands for speculative purposes, as has been anticipated in some quarters.

So-Called Settlement in Forest Areas. Canadian Forestry Journal. September, 1906. Pp. 106-109.

MISCELLANEOUS.

Forestry Exhibits at St. Louis.

Little, indeed, of interest to a forester has escaped our German friends who visited the St. Louis Fair. They have made a complete catalogue of forest exhibits, large and small, whether in the Forest, Fish and Game Building, or less prominently displayed in State or foreign buildings. The exhibits of Germany and German East Africa receive their due share of attention, while the exhibits made by Japan are detailed to great length, as is fit. Among the impressions left in the memory of a hurried visitor, that of the Japanese forestry exhibit stands high. As from few others, a definite picture of Japanese forestry practices, progress, aims and accomplishments came from a study of the exhibit made.

The criticism of the exhibit of the United States Government which Riebel makes, and especially of those of the various States, is of most interest and value to us. To anyone familiar with forest conditions in this country the display of forest products to the exclusion of nearly everything else would give the impression that this was a country producing timber far in excess of home needs, and expected to continue to do so. The sharp competition which led each State in its display to call attention to its productions has been wrongly interpreted by one who, with a wider view, has overlooked that this was an opportunity for each region to place its products before the public in their best light. The St. Louis Fair was a World's Fair, but the visitors were overwhelmingly American.

For the Federal exhibit it is enough to point out that in America we have had a struggle to compel the association of forestry with lumbering, and the St. Louis Fair bore eloquent witness to the success of this effort. Our next step will be in the direction the Germans indicate when they say that by charts and statistical material showing the exhaustion of supplies and by showing the profit in forestry as an investment the extension and care of our forests could be best brought home to our people.

Forstwirtschaft, Jagd und Fischerei auf der Weltausstellung zu St. Louis. Zeitscrift für Forst- und Jagdwesen. April, May, 1906. PP. 217-237, 387-314.

Telephones in Forest Reserves.

The installation of telephone service in the National forest reservations, where there is necessarily much isolation, is counted on not only to prove of great convenience to those engaged in the administration of these tracts, but also to save many thousands of dollars and perhaps even many lives. The advantages of the telephone in securing aid for fighting forest fires are described by Mr. Bristow, pointing out the helplessness in which the isolated forest ranger finds himself without it. The first line to be constructed by the Government is to be in the Big Horn Reserve in Wyoming. It is to be 109 miles in length, connecting the rangers' cabins with the Supervisor's headquarters. The cost of construction is estimated to average $30 per mile. The total cost of supplies for the line, exclusive of instruments, which are to be leased from the Bell Telephone Company, amounted to $2,400, delivered at Big Horn, the cost of the wire alone being $1,897.50, insulators, brackets, etc., requiring the balance. The use of trees for poles reduces the expense of construction. The saving of a single tract of moderate size is enough to pay for a telephone line. Private lines are also established in addition, upon permits from the Forester.

Wherever possible the line should be carried within reasonable distance of high places which may be made look-out points.

Telephones and the Forest Reserves. The American Telephone Journal. October, 1906. Pp. 218-221.

Railroad Planting.

The Canadian Pacific Railway Co. has begun tree planting on quite an extensive scale along its Western lines. A contract has been let for a small acreage of breaking near Wolseley, on which it is the intention to experiment with tamarack for ties. A piece of ground is also to be planted at Medicine Hat with Jack Pine and Tamarack for the same purpose. Over 100 miles of trees are to be planted between Winnipeg and Calgary for snow breaks, and at several stations trees are to be planted around the station grounds, and prizes are to be offered the section foremen who make the best showing. This work, if carried on successfully, ought to encourage tree planting among the farmers of the West.

Canadian Forestry Journal, September, 1906.

Educational Changes.

This year important changes have been made in the direction of two German Forest Academies. Oberforstmeister Weise resigned from the academy at Münden and was succeeded by Oberfortmeister Riebel from Eberswalde, in whose place Dr. Möller, well-known to pathologists, assumes direction of that academy.

In order to make better provisions for research work in forestry, and to secure a permanent staff of forest experts for scientific research, as well as for training candidates for the Government and State forestry service, the Imperial Forestry School at Dehra Dun, India, has been enlarged and hereafter will be known as the Imperial Forestry Research Institute and College. The college staff will include officers of the imperial service, holding the following position: (1) Silviculturist, who will make silviculture his special study. (2) Superintendent of forest working plans, who collects and collates statistics of the results of forestry management throughout India. (3) Forest zoologist, who will investigate the damages caused by insects and other pests. (4) Forest botanist, who will study the botany of forest plants, distribution of species, diseases of forest trees, etc. (5) Forest chemist, who will investigate the chemical properties of soils and forest produce. (6) Forest economist, who will study economic methods of commercial timber production and marketing. These officers, while engaged primarily in research work, will each deliver a course of lectures on his special subject in the college, and take part in the training of the students. The work of instruction, however, will for the most part be carried on by four assistant instructors.

NEWS AND NOTES.

E. A. Sterling, *In Charge.*

Rapid development of irrigation projects throughout the West greatly broadens the field of farm forestry, particularly planting. In all of the newly irrigated regions windbreaks and shelterbelts will be needed for the protection of crops and stock, and the only assurance of a cheap wood supply will be the farm woodlot. Unassisted, settlers will plant inferior species and use wrong methods, repeating the mistakes of the early settlers on the praisies of the Middle West. To assist the settlers in planting the best kinds of trees in the best way the Forest Service is making a study of the possibilities of planting, and has arranged for the withdrawal of land for experimental planting on six respective projects.

The field study has been completed in the Truckee-Carson and North Platte projects and in the South Platte Valley, and reports are in preparation covering the subject of tree planting by the settlers, and by the Government along canals and on waste lands which have been withdrawn by the Reclamation Service. Detailed plans have also been prepared for the experimental planting on these projects. The aim will be to place in the hands of every settler a circular telling him what and where to plant and how to care for his plantation when established. As a practical demonstration of the possibilities of forest planting in the region he will have the experimental tract on which trees of various species will be planted on different situations and by various methods.

Even with the great variety of trees growing naturally in the United States it is difficult to find species fully adapted for planting in many portions of the West, where tree growth is wanting and urgently needed. Several exotic trees have been tried in southern California and in southern New Mexico, but the one which gives greatest promise is the *Cedrus deodara.* The seeds are somewhat difficult to germinate in the nursery, but once started the seedlings are vigorous and easily handled. When transplanted into the mountains of southern California reserves they have withstood the drought with remarkable success, and promise to be an important factor in reforesting the watersheds of this region. Of the small number planted last year near Fort Bayard, N. Mex., 70 per cent have endured the season's drought.

The old question of whether seeds from stunted trees will produce trees of like character is still open to question, but it seems reasonable to assume that some such cause is at the bottom of the poor development of Scotch pine in parts of the United States, particularly in the Middle West. It is certainly true that much of the seed offered by dealers is obtained from trees growing in unfavorable situations on the continent of Europe, and that these trees have not reached normal development for many generations. To test hereditary influence of seed parentage, the Forest Service has arranged to secure Scotch pine seed from the large, well-developed trees near Darmstadt and in the Spessart, and plant them by the side of undescribed seed from American dealers and from the smaller trees of France. The development of the seedlings and of the trees in plantations will be carefully watched through a long period of years.

The plan of establishing small nurseries at all permanent rangers' headquarters on the forest reserves has been carried into effect during the summer. With few exceptions reserve officers are enthusiastic over this line of work, and it promises to bring about a rapid increase in the amount of reserve planting at a very slight expense. One of the main objects is the educational value of the work to the rangers concerned, and at the same time it will greatly increase the output of seedlings and give excellent opportunity for experimental plantations on all of the reserves. Two hundred and eighty sites suitable for such nurseries have been reported upon by the supervisors, and a number of the nurseries have been started under technical supervision.

The forest reserves in the West cover practically all of the important watersheds and naturally include many drainage basins on which cities are dependent for their domestic water supply. It is the intention of the Forest Service to improve these watersheds as fast as possible by protection, restricted cutting and grazing, and by planting. Nurseries have already been established to produce stock for planting on such watersheds in southern California, in the Pike's Peak region of Colorado, and on the Salt Lake Reserve, near Salt Lake City, Utah. During the summer three new city watershed projects have been reported upon favorably. One is in the Pocatello Reserve in southern Idaho, where a small nursery was established during the late summer. Another is in the Uinta Forest Reserve in Utah, where large areas are in need of planting for the benefit of the city water supply of Provo, Logan and Ogden. The third is in the Pecos Forest Reserve in northern New Mexico, the source of water supply of Las Vegas and Santa Fe. It is the intention to establish a planting station about five miles east of Santa Fe, on the edge of the reserve, next spring.

It is now the plan to enlarge forest reserves by taking in juniper and pinion land, which was formerly left out, but the unmerchantable timber is useful to the Forest Service as a protective cover and controls the grazing ground used as winter range by reserve permittees. Unless included it will be used as summer range by sheep owners who do not take out reserve permits, thus working hardship on reserve permittees. The value of pinion and juniper is increasing and causing indiscriminate cutting for use for ties, posts and firewood.

Condition on the Alaskan reserves make the ordinary form of reserve administration useless. No horses are required, but boats are necessary. No trail work is to be done or cabin sites selected at present. The supervisor was recently authorized to purchase a boat, which will be a traveling headquarters.

A planting plan for the Lehigh Coal & Navigation Co. was recently completed by A. S. Peck, of the Forest Service. The object of forest planting is watershed protection and the production of mine props. A year ago an investigation was made of forest planting on coal lands in Western Pennsylvania and the planting plan for this company extends the field of work to Eastern

Pennsylvania. The report provides a definite planting plan for a small typical area and includes a forest policy for the whole, which calls for the employment of a forester, whose duty shall be to organize a system of effective fire patrol, establish and maintain a forest nursery, superintend forest planting on waste lands and act as technical adviser to the superintendent of the timber tracts owned by this company.

Forest fires are the chief obstacle in forming successful forest plantations on the 9,000 acres where planting is now contemplated, and it seems reasonably certain that the forester can greatly improve the local sentiment regarding fires and be able to reforest the entire area.

Some of the species to be used are Scotch pine, European larch, chestnut and red oak.

Recent experiments at Escanaba, Mich., on the treatment of Arborvitae telephone poles, by co-operation between the Forest Service and the American Telephone and Telegraph Company, have brought to light the fact that the butts of Arborvitae poles can be treated in an open tank in a manner sufficient to add many years to the life of the pole. An average penetration of three-quarters of an inch, with a maximum of over an inch, has been secured. This series of experiments is to supplement experiments carried on in the same manner by the Forest Service last year on chestnut and white cedar poles. The excellent results obtained have been the means of the American Telephone and Telegraph Company sending out a circular letter requesting that all of its poles for heavy line construction be treated in this manner.

During the past few months the Forest Service has been conducting a series of experiments in co-operation with the Philadelphia and Reading Coal and Iron Company to ascertain the best method of handling and treating mine props. These are the first experiments which have been undertaken by the Forest Service in mine prop work. Timbers used as mine props decay very rapidly, the conditions in mines being extremely favorable to the growth of wood-decaying fungi. During a recent trip through the mines where the experimental timbers are located, it was found that after four months' trial results were already obtainable. While it is yet too early to discriminate between the different methods of treatment, all treated timbers are found to be free from attack, while the untreated timbers placed in the mines for comparison are showing signs of fungus growth.

The open tank method was used in treating some of the mine props and a penetration of 3 and 4 inches was secured on seasoned loblolly pine. The results are so satisfactory that plans are under way for the erection of a small commercial plant to further test the advisability of treating mine props by this method on a commercial scale. It has also been pretty well demonstrated that red oak can be treated by the open tank method.

A series of experiments are just being completed at the plant of the Chicago & North Western Railway Company at Escanaba, Mich., where the Forest Service has been investigating the method employed by the company in treating tamarack and hemlock ties. The company attempted to treat these timbers in a green condition and very poor results were obtained. The series of experiments has brought out that when the timbers are seasoned to a weight of 38 to 42 pounds per cubic foot, the timbers can be successfully treated by the Burnettizing or Wellhouse process. Formerly attempts were made to treat the timbers in a green condition, weighing 50 to 55 pounds per cubic foot. As a result of the experiments the company has signified its intention to issue orders that no ties be treated at the yard weighing over 43 pounds per cubic foot.

The Forest Service has under consideration experiments to determine the proper method of seasoning the tanbark oak in California. At present very little of the tree is utilized except the bark, which is used for tanning. The wood, although possessing many of the valuable qualities of the eastern oaks, is very apt to warp and check in seasoning, which ruins its utility for lumber. Therefore, unless a ready firewood market is near at hand the tree is stripped of its bark and abandoned to decay. In view of the meager stands of hardwood on the Pacific Coast, such a study as proposed is well in accord with the most economic use of forests.

During the summer and fall a careful examination has been made of the dead and mature timber on thirteen forest reserves in the Rocky Mountains. The purpose of the study is to determine the quantity and location of tracts of merchantable timber and to encourage the marketing of it where practicable. As a result of the investigations a market is already assured for a considerable quantity, and if the tests now in progress on this material bear out the theory that the strength has not been impaired a still greater demand should arise. Its greatest utility is for box boards, mine props, posts and poles. Winter precludes any further field work this year and the following months will be spent in preparing detailed reports covering each reserve studied. Stand and type maps accompany the report on each reserve.

The Forest Service proposes during the winter to begin the compilation of growth tables for the leading species of forest trees. The tables will show, as far as data is available, the volume, form, growth, and yield of each species. Western species will receive first attention.

Mechanical tests on Eucalyptus manufactured into vehicle stock will be made during the winter to determine the strength of this wood. Tests have already been made on hickory and will be used as a basis for comparison.

A new forest school has been established at Bottineau, N. Dak., known as the North Dakota School of Forestry. This is the result of a bill which passed the Legislature of that State at its last session making appropriation for instruction in forestry. Prof. R. R. Thompson is in charge.

Mr. Ralph C. Bryant, formerly Inspector in charge of Co-operative Planting in the Forest Service, has resigned to take a position in the new department of lumbering at the Yale Forest School. Mr. Bryant graduated from the New York State College of Forestry in 1900, being the first graduate from a technical forest school in America. He served for a time as forester with the New York Forest, Fish and Game Commission, and then went to the Philippines. During his three years in the Philippine Bureau of Forestry he attained the rank of Assistant Chief of the Bureau. Upon his return to the States in the summer of 1905 he entered the Forest Service, holding the above named position until his resignation.

Dr. C. A. Schenck, Forester of the Biltmore Estate and Director of the Biltmore Forest School, is at his home in Darmstadt, Germany, enjoying a well-earned rest during December and January.

While Dr. Schenck is away his assistant, Dr. C. D. Howe, is Acting Forester and Acting Director. In his instruction work Dr. Schenck is being substituted by John Foley, of the U. S. Forest Service, who lectures on Forest Mensuration from November 15th to December 22d, and Alfred Akerman, of the University of Georgia, who lectures on Forest Policy from January 7th to February 9th.

It appears from a notice in the Canadian Lumberman that Dr. J. F. Clark, the efficient Forester of the Province of Ontario, has abandoned his post to engage in a lumbering enterprise in British Columbia. We suspect that not only financial advantages were the motives for this change.

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