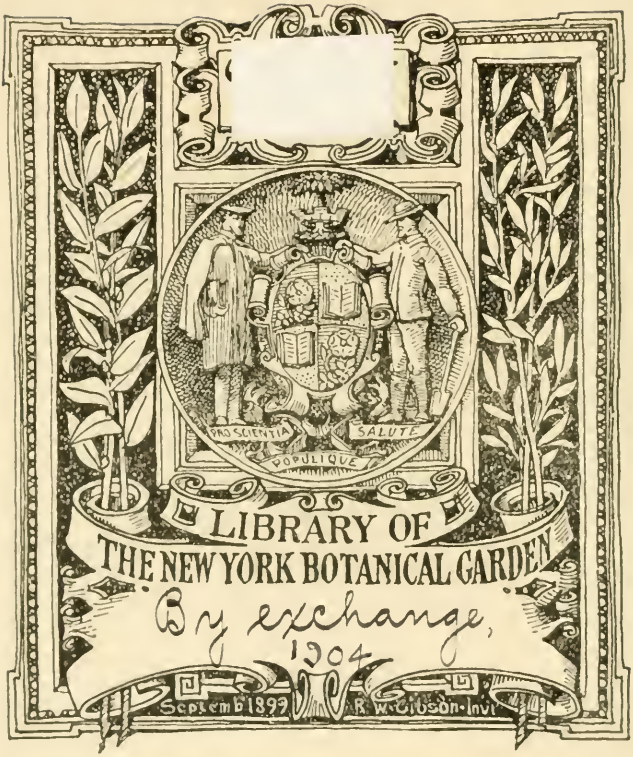
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Forestry Quarterly

VOLUME I

PUBLISHED UNDER THE DIRECTION OF A

Board of Advisers of the Faculty and Alumni

OF

The New York State College of Forestry

CORNELL UNIVERSITY
ITHACA, NEW YORK
1902-1903

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TABLE OF CONTENTS.

APPENDIX.

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FORESTRY QUARTERLY

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

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

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

Single numbers, twenty-five cents. — *Yearly subscriptions, $1.00.*

PRESS OF ANDRUS & CHURCH, ITHACA, N. Y.

FORESTRY QUARTERLY.

VOL. I. OCTOBER, 1902. NO. 1.

ANNOUNCEMENT.

Although there are a number of publications in the United States and Canada, wholly or in part devoted to the propagandism of forestry, there are at the present time none which are mainly or entirely devoted to the professional or technical interests of the subject.

With the establishment, within the last four years, of two fully-equipped special schools of forestry, whose graduates have begun work in the field; with the rapid expansion of the field work of the Federal Forestry Bureau, and of other agencies in technical direction, professional foresters have multiplied, and the time for means of communication among those who are building up the science and art of forestry in the United States seems to have arrived.

The FORESTRY QUARTERLY is intended to meet this need.

Besides publishing original articles on subjects of interest to the profession, and translations of such articles from foreign sources, it is intended to bring reviews and references to the current literature, and also, in brief notes, the news of the forestry world, personal and otherwise, with a view of keeping the readers in touch with the development of their art in all its branches.

While this journal, in its inception and management, is a child of the New York State College of Forestry, it is hoped that, as time passes on, its pages may be used by all or any workers in the field for the discussion of their problems and record of their experiences.

The FORESTRY QUARTERLY opens its pages for the freest discussion of all forestry problems ; it welcomes advice and invites criticism which may tend to promote our professional knowledge.

Since no past masters of the art, but only a young generation of foresters, just beginning their work, are, for the time being, to be the contributors and editors of this journal, it must step forth with due modesty and with the expectation of deficiencies, which only experience, as the time goes on, can correct.

It is in the main a student publication, designed for students, both in the field and school. The supervision, by an Advisory Board of older men, will, however, assure as high a standard as is possible under such circumstances.

We hope that in the conduct of this journal the spirit of one of the fathers of modern forestry, Cotta, so simply breathed forth in the preface of his first work on Silviculture, will be always present. To impress this spirit of modesty and yet of critical candor upon ourselves and upon our readers, we introduce this first issue with a translation of Cotta's words, which, written nearly a century ago, are still largely true and come home to us with peculiar force at this time, when the light of forestry is just dawning in our country.

COTTA'S PREFACE.

If the inhabitants of Germany should leave their country it would be all grown up with woods within a century. Since there would be nobody to use them, the soil would be enriched and the woods would not only increase in size, but in productive power. If, however, the people returned again and made just as large drafts as before for wood, litter and pasturage, the woodlands, even with the best forest management, would again not only be reduced in size, but also become less fertile.

Forests form and thrive best where there are no people—and hence no forestry, and those are perfectly justified who say: Formerly we had no forestry science and enough wood; now we have that science, but no wood.

One could say with the same justice: Those people are healthier who do not need a physician than those who do. But it would not follow that the physicians are to be blamed for the diseases. There would be no physicians if there were no diseases, and no forestry science without deficiency in wood supplies. This science is only a child of necessity or need, and need is therefore its natural concomitant; hence the phrase should be: We have now a forestry science because we have a dearth of wood.

Forestry, however, does not offer any nostrums and can do nothing against the course of nature. The celebrated physician Verdey said: "The good physician lets people die; the poor one kills them." With the same right one can say the good forester allows the most perfect forests to become less so; the poor one spoils them. That is to say, just as the good physician cannot hinder that men die because that is the course of nature, so the best forester cannot hinder that the forests, which came to us from past times, become less now they are being utilized.

Germany formerly contained immense, perfect, most fertile forests. But the large forests have become small, the fertile have become sterile. Each generation of man has seen a smaller generation of wood. Here and there we admire still the giant oaks and firs, which grew up without any care, while we are perfectly persuaded that we shall never in the same places be able, with any art or care, to reproduce similar trees. The grand-

sons of those giant trees show the signs of threatening death before they have attained one quarter of the volume which the old ones contained, and no art nor science can produce on the forest soil which has become less fertile, such forests as are here and there still being cut down.

The good forester then, also, allows the forest to become less, but only where it cannot be helped ; the poor forester, on the other hand, spoils them everywhere.

Without utilization, the forest soil improves constantly ; if used in orderly manner it remains in a natural equilibrium ; if used faultily it becomes poorer. The good forester takes the highest yield from the forest without deteriorating the soil, the poor one neither obtains this yield nor preserves the fertility of the soil.

It is hardly credible how much one can benefit or damage by the kind of management ; the true forestry science contains, therefore, much more than those think, who know only its generalities.

Thirty years ago, I prided myself on knowing forestry science well. Had I not grown up with it and in addition had learned it in the universities ! Since then I have not lacked the opportunity for increasing my knowledge in many directions, but during this long period I have come to see very clearly how little I know of the depths of the science, and to learn that this science has by no means reached that point which many believe to have been passed.

Many perhaps may be in the condition in which I was thirty years ago ; may they in the same manner be cured of their conceit ! Forestry is based on the knowledge of nature ; the deeper we penetrate its secrets, the deeper the depths before us. What the light of an oil lamp makes visible is easily overlooked ; many more things we can see by torch light, but infinitely more in the sun light. The lighter it grows around us, the more unknown things become apparent, and it is a sure sign of shallowness, if anybody believes he knows it all.

Our foresters can still be divided into empiricists and scientists, rarely are both united.

What the former considers sufficient in a forest management is easily learned, and the systematic teachings of the other are soon memorized. But in practice the art of the first stands to a

thorough forestry science in the same relation as the quack medicine to the true pharmacopia ; and the other often does not know the forest for the many trees. Things look very differently in the forest from what they do in books ; the learned man stands therefore, frequently, left by his learning and at the same time without the bold decision of the empiricist.

Three principal causes exist why forestry is still so backward ; first, the long time which wood needs for its development ; second, the great variety of sites on which it grows ; thirdly, the fact that the forester who practices much writes but little, and he who writes much practices but little.

The long development period causes that something is considered good and prescribed as such which is good only for a time, and later becomes detrimental to the forest management. The second fact causes that what many declare good or bad, proves, good or bad only in certain places. The third fact brings it about that the best experiences die with the man who made them, and that many entirely one-sided experiences are copied by the merely literary forester so often that they finally stand as articles of faith which nobody dares to gainsay, no matter how one-sided or in error they may be.

HEINRICH COTTA.

Tharandt, Dec. 21, 1816.

Heinrich Cotta, born in 1763 in Thuringia, said of himself : "I am a child of the forest ; no roof covers the spot where I was born. Old oaks and beeches shade its solitude and grass grows upon it. The first song I heard was of the birds of the forest, my first surroundings were trees. Thus my birth determined my calling !" He became the grandmaster of his profession. His "Anweisung zum Waldbau," from which this preface is taken, first published in 1817, experienced many editions, the last one in 1865 edited by his grandson Heinrich von Cotta.

VOLUME TABLES AND THE BASES ON WHICH THEY MAY BE BUILT.

Ever since the sustained annual yield became a factor in forest management every method of reducing the labor involved in taking an inventory of the stock on hand has been welcomed by the forest manager. One of the greatest of these labor savers is the volume table by means of which it is possible, with a minimum of measurement and calculation, to obtain the cubic content of a stand in a very satisfactory manner.

The first suggestion of the volume table was that of Cotta in his "Systematische Anleitung zur Taxation der Waldungen," published in 1804. Forest mensuration, like all other branches of forestry in the early decades of the nineteenth century, suffered from a lack of exact investigation, and Cotta's splendid idea was first developed on a scale large enough to be of practical value when the Bavarian government, in 1846, instituted a very extended study in the form and content of the stems of the more important forest trees of that country.

The volume tables which resulted from this study, which involved a complete analytical measurement of over forty thousand trees, were based on Cotta's idea that on the average, where considerable numbers were involved, trees of the same diameter and height contained equal volumes of wood. These tables were later translated from the old Bavarian foot and inch measure into the metric system by Ganghofer. Ganghofer also improved the opportunity to introduce age classes as a third basic factor in his classification.

The latter half of the nineteenth century witnessed a very great activity in research along forest mensuration lines, the greater part of which was directed towards the improvement and extension of the volume tables. With some minor exceptions, the work followed closely the lines of the Bavarian tables as improved by Ganghofer, and with the exception of the last decade, no original ideas of any great value were developed.

The preparation of tables that are to be of wide application and permanent value involves the measurement of a very large number of trees selected from various localities and, as

may be supposed, is a very laborious and time-consuming work. This can perhaps be best appreciated by glancing at the labor involved in the preparation of Baur's volume tables for the Norway or European Spruce, published in Munich in 1891. 55,-874 stems of Norway Spruce were carefully measured and their volumes separately calculated. This involved over six million measurements and as many calculations. Then came the great labor of digesting, classifying and preparing the results for publication, which required an additional eighteen months of labor. The great value of such tables, however, has been a sufficient inspiration to lead to the preparation of such tables for all the commercially important species of Europe. These tables are widely used to-day wherever the species for which they were prepared are under careful forest management.

Volume tables, as already mentioned, are based on a classification of the stems measured into height, diameter and age classes. The height and diameter measurements are of course fundamental and must be used as factors for classification in any volume table. A classification based on these two factors alone, however, was early found to be insufficient, for great variations in cubic content constantly occur in trees of the same diameter and height. Various factors cause this variation in the form of the stem, among which might be mentioned age, exposure, soil and climatic conditions, altitude and variations in the light conditions obtaining during the growth of the individual trees.

The exigencies of table-making limit the factors to be used in a classification of data for a single table to two. This may be increased to three if the tables are to be a combination of the simpler tables, as many tables being necessary as the third factor is given divisions. To introduce a fourth factor as a base of classification would make the tables so large and complicated that they would be impracticable.

Recognizing that the two factors, height and diameter, while fundamental, were not sufficient for practical purposes, age classes were chosen as a third factor by all except the most recent workers, and the volume tables for height and diameter classes were computed for each age class (age classes of forty years were usually used). Age was selected from among the various factors as being at once one of the most important factors in influencing

the form of the stem, and being a factor easily determined with tolerable accuracy.

When used with judgment these tables have proved of very great value in practical forestry operations greatly lessening the labor of determining the volume of stands inasmuch as they do away entirely with the necessity of sample trees, the volumes of the trees in the various diameter and height classes being read directly from the table. They are of course not used and not intended for use in the determination of volume in single trees, for trees of the same age, height and breast-high diameter growing side by side in the same stand sometimes vary in cubic content by 20 % or even more. In a stand that is *approximately an average stand*, however, these individual variations compensate, and a very satisfactory average result may be obtained.

Unfortunately, even in Germany with its intensive management, variations of a very marked character occur in the form of the average stem due to other causes than age. Where, as in America, the forests have developed without care and the silvicultural conditions are merely a result of natural forces and where great variations in age occur even on very limited areas making age classes impossible, these variations are of much more frequent occurrence. The weakness of a table founded on height, diameter, and age classes is shown in that it is incapable of adapting itself to any variation in the average form of the stem aside from that caused by age.

In an effort to overcome this difficulty Schuberg[1] in 1891 prepared "correction tables" by means of which it was possible to take into consideration the changes in the form of stems due to the various and often varying factors of site and silvicultural conditions. These tables prescribed that a percentage be added to or deducted from the amount read in his volume tables for the Silver Fir according as the stems proved of more or less cylindrical in form than normal. This variation in the form was determined by comparing the relation between the breast-high diameter (d) and the diameter at the middle of the stem (δ). The proposition that any variation in the cubic content of the boles of trees of equal height and diameter, must show itself in a more or less cylindrical form of these boles, seems impregnable. That this

[1] Formzahlen und Massentafeln fur die Weistanne, Berlin, 1891.

variation in form from or towards the cylindrical would be well expressed by the relation between two diameters properly chosen at different points on the stem is equally evident. The breast-high diameter has been universally chosen as the most practical point at which to measure the diameter of standing trees. Schuberg found from a very careful study of 1352 trees that the middle point was the most critical point on the stem for a second measurement. This relationship then between d and δ (or $\frac{\delta}{d} \times 100$ to express it as a per cent.) is capable of expressing any variation in form due to any factor or combination of factors, such as site, age, or silvicultural conditions.

In the same year Kunze[1] published the results of a very thorough study of the form of the stems of the Norway Spruce and Scotch Pine with regard to this relationship of d to δ. Some 10,000 spruce and over 8,000 pines were carefully measured, but aside from demonstrating the entire practibility of utilizing this factor in determining the form factor (f) of stems, Kunze failed to suggest any important practical application.

It remained for Schiffel[2] to develop this idea further, and in 1899 he published his volume tables for the Norway Spruce based on height and diameter classes and the $\frac{\delta}{d}$ relationship. His tables were developed from data obtained by the careful sectioning of 2,529 trees, in all of which he made a special note of the relationship between the diameter at breast-high and that at ¼ and ¾ height as well as that at ½ height (δ). He finally concluded that while the ¼ height diameter could be safely utilized when from any cause the diameter at ½ height could not be measured (obscured by branches, etc.), but that, on the whole, the diameter at ½ height was the most generally satisfactory. In this his work is in entire accord with that of Schuberg already noted.

Schiffel has termed the factor which expresses the percentage relationship between the diameter at breast-high and that at ½ height $\left(\frac{\delta}{d} \times 100\right)$ the *form quotient*, and as the expression

[1] Neue Methode z. raschen Berechnung d. unächten Schaftformzahlen d. Fichte u. Kiefer, Dresden, 1891.

[2] Form und Inhalt der Fichte. Mittheilungen a. d. Forstversuchswesen Oesterreichs, Wien, 1899.

aptly expresses the idea of a quotient which is an index to the form of the bole of the tree I have adopted it, and for short we shall call it $q_{\frac{1}{2}}$ to distinguish it from $q_{\frac{1}{4}}$ or $q_{\frac{3}{4}}$ which would represent the form quotient obtained by using the diameter at ¼ or ¾ height, respectively, as the upper diameter.

The form factor and the form quotient of any tree being mutually dependent for their magnitude on the shape of the bole of that tree, it follows that they must bear a very close relation to each other. Schiffel found that this relationship varied somewhat with varying heights of the trees but that in stands of comparatively even height, such as mature stands, the variation was very slight and when the f and the $q_{\frac{1}{2}}$ were expressed in per cents, the difference averaged about 21 which we may term a constant (C) for that species. This constant, it will be noted, is not appreciably affected by variations in the form of the stem due to age, site, or silvicultural conditions, the form factor and the form quotient being both similarly influenced by such variations.

This then gives us the simplest method that has yet been suggested for the determination of the approximate form factor of a tree, *viz.*, divide the breast-high diameter into the diameter at middle height, multiply by 100 and substract the constant, or to express it as a formula,

$$\left(\frac{\delta}{d} \times 100\right) - c = f$$

The accuracy of the result will vary from tree to tree, but the maximum variation in any coniferous tree that would be nearly enough normal in development to be selected for a sample tree in measuring a stand would not exceed 6 per cent. Where a number of sample trees are taken, the error would be compensating and could be wholly neglected, provided the c had been carefully determined for the species.

That the constant should vary in different species was to be anticipated. Unfortunately very little exact work has yet been done in testing this point in different species. What has been done, however, seems to indicate that the variation may after all be confined to relatively narrow limits. The Scotch Pine has been found to give a C of about 20, while that of the European beech is between 22 and 23.[1] The similarity in value of the constant here between the species varying so widely in habit of stem growth,

and the closeness of the figure found for the Scotch Pine to that given for the Norway Spruce suggests the possibility of using the same volume tables with slight correction factors for species which do not vary all to widely in habit of stem growth.[2]

The point which will strike the practical man in this connection is that this method of developing and using volume tables necessitates the measuring of trees at a point where standing trees cannot be directly measured. So far as the measurements for the construction of the volume tables are concerned, they must in any case be made on felled trees, which involves no difficulty. The same, of course, applies to the measuring of stands where it is possible to cut the sample trees. Where, however, it is impossible or undesirable to cut the sample trees, a real difficulty, but by no means a great one, is met.

Modern improvements in the instruments at the disposal of the forester has given him several by means of which it is possible to measure the diameter of a standing tree at any desired point with accuracy and considerable despatch, provided the point can be plainly seen. Wimmenauer's Baummesser[3] is perhaps the most satisfactory of the cheaper instruments that are at the same time thoroughly practical. It is a combination of a telescopic diameter measure with a splendid form of Weisse's height measure. For use in the woods I attached it to a stout camera tripod and found that with an assistant one could easily take all needed measurements on one hundred sample trees in a day of ten hours.

Very little has yet been done in the way of developing volume tables for the American species; indeed, aside from the Adirondack Spruce and the White Pine, we know but little of the average form and content of the stems of our varied silva. This is a field for almost endless research, and it may be that this recent improvement in methods may be used to advantage in the study.

JUDSON F. CLARK.

[1] See Müller's Holzmesskunde. p. 221.

[2] In another paper I shall give the results of some measurements on the Adirondack Balsam-Fir which indicated a constant of between 21.5 and 22 for that species.

[3] For full description see Allgem. Forst- und Jagd-Zeitung, 1896. p. 222. It is made by W. Spörhase in Giessen for 63 mark ($16.00). See also Müller's Holzmesskunde. p. 182.

DIFFICULTIES AND ERRORS IN STEM ANALYSIS.

Stem analysis includes two separate series of measurements, namely the determination of increments and of volume.

The exact procedure and sequence of operations, as carried on under the instructions of the U. S. Bureau of Forestry, differs, depending on the chief of the party, the individuals employed, the kind of timber, and several other variables. The data to be obtained is, however, the same, and the method employed is in general as follows :

The tree when felled is sawed up into sections. These sections, if the tree is cut solely for the measurements to be taken, should be made short enough to permit a true reading of the growth history of the tree, yet they should not be too short to increase the expense for it makes considerable difference in the cost of investigations if a man spend thirty minutes measuring up a tree or forty-five. The sections must be of equal length, of even feet, preferably even fives in order to facilitate working up of data.

It will readily be seen that the required length of section should be in relation to the height of the tree. It would be unnecessary finesse to take two foot sections of a 150 foot pine ; again ten foot sections of a 15 foot sapling would be insufficient.

The Bureau practice is as follows : Seedlings three feet, or under are sectioned every foot above root juncture, saplings between three and ten feet are sectioned every two feet, trees over ten feet in height are sectioned every ten feet, intermediate taper measurements being made every five feet.

Generally however, merchantable trees are not cut purposely by the Bureau, but measurements are taken on trees as felled and cut in varying lengths by lumberman.

According to market requirements, these logs may run 10.3, 10.4, 10.6, 12.4, 12.5, 16.5, 16.6, 16.7 feet, etc., the choice being with the sawyer, who varies the length so as to get the largest amount of timber out of the tree. The fractions of feet vary with the personal equation of the sawyers', a knot in the

log, the roughness of the river drive through which the log must pass, and other similar causes. This variability of log length gives considerable trouble in working up the data, but is of course unavoidable.

The object of the sectioning is in general merely to obtain the area and height increments, and the thickness of bark, often the width and age of the sapwood is also taken. The volume of the stem is computed separately from a second series of measurements.

To obtain the rate of height growth from the cut sections is of course simple ; the difference between the number of rings on two adjoining cuts gives the length of time during which the tree grew in height the length of the intercepted section.

To obtain the diameter growth correctly is neither simple nor easy. Considerable error is here involved even with care and experience. This error will be greater on the stump section and decreases on the upper sections. Ideally a tree is a paraboloid, its cross section a circle ; really it is an extremely variable form. Were the cross section a circle, and the annual growth concentric layers of even thickness all around, the operation would be simple, the measurements easy. One would merely have to lay the rule across the section from pith to perimeter and count and measure the ten year periods.

In reality the outline of the cross section is extremely irregular, especially so on the stump cut. The rate of growth desired is finally that of the area of each section it must therefore be obtained from an average radius.

At first sight this would seem a simple matter, and so it is on the upper sections, but the stump presents some difficulty. This average radius may in general be obtained from the largest and smallest diameters inside bark, but perhaps the largest diameter is caused by a sudden prominent root swelling ; it is evident that a radius derived from this diameter would be two large, a deduction should be made from the diameter, preferably by the eye with the calipers on the stump.

The average radius having been determined, it is necessary to lay it off on the stump. The number of places on which this radius can be laid off will vary from two in an ellipse to an infinite number in the circle. Assuming a case in which two only can be found, would it make any difference which was taken ?

The following example, taken from actual measurements of a White Pine section, shows the variability of results and the necessity of judgment in choosing the proper diameter :

Rad. A.	.35	.65	1	1.80	3	4.60	6.60	8.50	10.30	11.65
Rad. B.	.20	.80	1.20	2.10	3.30	4.90	7	8.35	9 70	10.85
Diam. A.	.70	1.30	2	3.60	6	9.20	13.20	17	20.60	23.30
Diam. B.	.40	1.60	2.40	4.20	6.60	9.80	14	16.70	19.40	21.70
Growth.										
Area % A	----	----	137	324	223	125	106	65	45	28
Area % B	----	----	121	207	146	120	104	42	35	25
Rad. A	13.10	14.75	16.20	17	17.60	18.20	18.60	19	19.30	19.60
Rad. B.	12.30	14.20	15.15	15.75	16.35	16.75	17.60	18.40	19	19.60
Diam. A.	26.20	29.5	32.4	34.	35.2	36.4	37.2	38	38.6	39.2
Diam. B.	24-60	28.4	30.3	31.5	32.7	33.5	35.2	36.8	38	39.2
Growth.										
Area % A	26.4	26.7	20.6	10.1	7.1	6.9	4 4	4.3	3.2	3.7
Area % B	28.3	33.2	14.5	07.9	8.0	4.9	5.1	9.3	6.6	6.5

The choice of the radius should be made with the eye ; choosing the one where the annual rings show the greatest regularity in width and curve.

It sometimes happens that the average radius can not be exactly found on the stump of trees felled in regular logging operations. The tree has been notched in such a way that the place where the radius should be located is in the rough slanting surface of the notch ; or it may be that a spot of rot appears in the place where the required radius should be drawn. As a general rule, and preferably, such a tree should be thrown out of consideration ; nevertheless in practice there arise cases when it should be taken. It may be of a diameter especially needed for completeness or in large timber the necessity of fully employing the measuring crew when following the sawyers closely, without interruption will make it expedient to use each tree without distinction. In such cases the measurements can be obtained with sufficient accuracy as follows :

a. Find an available radius as nearly equal to the average radius as possible ; count off the decades on this.

b. Draw a line from the pith, at 90° or less from the radius on which the decades were counted, make it the length of the average radius.

c. Connect the ends of these two lines already drawn by a third. Lines drawn parallel to this third line from the decades marked off on the radius will cut the real radius giving the required decade lengths. The lines are easily drawn parallel by means of the rule and a tally sheet for a triangle.

In determining the width and age of the sap wood, a very important measurement in some species, it will be found that the average radius seldom crosses the sap at its average width. It is necessary, therefore, that the width of sap appearing on that radius be disregarded, and the average width be laid off at the end of the average radius ; the number of rings to be found in the space thus laid off will give the true age of sap wood.

The first operation in the series of form measurements is to measure the height of the stump. This is necessary for two reasons ; first, that the full volume may be calculated ; secondly, that the "breast high" point on the butt log may be properly located.

Stumps are measured in height to the nearest half foot ; this operation would, therefore, at first sight seem simple, yet trees do not grow regularly, as one would wish ; they grow on side hills, on boulders, on logs, against one another. Three out of four times there is no trouble in "declaring" a stump, but the third time one might throw it into one class or another. The error here involved might appear to be compensating ; it is not ; involving the personal equation it is accumulating. One man will invariably throw the doubtful stump in the upper height class, another man would throw it in the lower.

The following typical example will show the result of the error involved.

A stump whose diameter is 41.4″ was called two and a half feet high instead of two feet ; by so doing it was credited with a larger volume than it really possessed ; by calling the stump a half foot higher than it really was, the breast high point was lowered one half a foot on the log, thus occasioning a change in the breast

high diameter of 1.2 inches ; or in other words calling a tree 37″ in diameter when it really was only 35.8. The use of this tree for a volume curve would therefore throw the curve out to the amount that a 36″ tree should differ from a 37″ tree, less the partial compensation introduced by the extra one half foot in the stump. The following figures will show the amount of error in the case cited :

Stump Height.	Stump Diameter	D. bh.	Difference in Volume of Stump.	Difference in Tree Volume.	Error.
2 2.5	41.4 41.4	35.8 37	4.6 cu. feet.	16.9 cu. ft. that should exist.	16.9–4.6 12.3 cu. ft.

Or in words a 37″ tree is used which contains 12.3 cubic feet less than such a tree should contain.

"Tapering" a tree offers little other difficulty, and is subject to the same rules regarding regularity of distance as the sectioning of the stem, in fact it would be simpler to take the taper measurements at the same places as the section cuts, were it not that the length of the log is usually too great to give the true form of the tree if only measured at the log ends. The practice of the Bureau, therefore, is to take taper measurements on large trees at every five feet.

The simple operation of "tapering" affords little opportunity for error to creep in except by improper use of the calipers or by their inaccurateness.

Error due to the first cause is exceedingly common in varying degree. It is seldom that two men can taper a tree independently and get the same results. One will neglect to take the two readings at each place directly at right angles to one another ; the other may pinch the calipers too hard. With the calipers ordinarily in use, if great care is not used a loss of half an inch in diameter is easily the result.

Error resulting from inaccurate calipers is, of course, quite inexcusable, and as it is accumulating, very serious. It is caused by not having the caliper arms parallel. It will be greatest on the large diameters, for they are measured usually nearer the ends of the arms.

Example showing the error from "squeezing" calipers ½″ or having the arms not parallel to the same amount.

True D. bh. = 35.8 True vol. = 347.66 cu. ft. Error of vol. = 12.50 cu. ft.
False D. bh. = 35.3 False vol. = 335.16 cu. ft. Per cent. of Error = 3.6.

The error in amount grows with the size of the tree while the percentage error decreases.

Measurements in general are considered to be free of the element of judgment, but it will appear from these considerations that in forest work this is not so. There is a tendency on the part of many, especially over zealous new men, to stretch for useless and uncalled for accuracy. Such men will be found running the tape over the bumps and crooks of a hundred and fifty foot pine and then reading the tape at the end of a very irregular crown to the tenth of a foot. Such work is not accurate but merely a show on paper. Discretion as to the degree of accuracy attempted is as needful as discretion in the manner of measuring.

Other difficulties than those which have been mentioned occur; for instance the counting of the rings. They are present, however, only with certain species, or conditions and are to be overcome by special individual methods.

A. S. Williams.

ADIRONDACK BIRDS IN THEIR RELATION TO FORESTRY.

We have all learned, it is to be hoped, to look at a forest not as a mere collection of trees, but as an organic whole, the result of actions and reactions of all the factors found within its limits.

Technically speaking, there is required a forest canopy of certain density and a forest floor, both of which conditions must be produced by a stand of timber trees, not fruit trees ; yet this does not, by any means, include all of the component factors of the actual forest. The shade-enduring herbs and shrubs on the ground, the mosses and lichens on tree trunks and branches, and a host of other vegetable forms are likewise a part of the forest whole, since they are products of and entirely dependent upon natural forest conditions for their maintenance. Going a step further, the worms of the soil, the diptera in the air, the myriads of insects on leaves and bark, the mammals, and lastly, the birds in the branches may likewise be included. Whether or not an actual part, it is at any rate true that all of these animal and vegetable forms do exist and play their important rôle in the economy of the forest.

The nitrifying bacteria in the soil are constantly replacing the nitrogenous elements absorbed by the trees in their process of growth. Other minute organisms and certain fungi are reducing by decomposition the fallen leaves and twigs and dead trees into available plant food, and so on each individual is doing its share towards the perpetuation of the forest. The larger animate things are likewise doing their part, but in a totally different, yet equally efficient way; their work being found in the extermination of smaller forms detrimental to tree growth.

No living thing can long exist without a food supply of some sort, thus it has come about that many of the higher forms of life find their source of supply in other forms smaller or weaker than themselves. When this food supply is found in an animal or plant which is of value to man, the organism which feeds thereon is termed "injurious." Thus when an insect lays its eggs under

the bark of a valuable tree and the larvæ which hatch therefrom find this tree a source of food and protection, man designates this an "injurious insect." Fortunately there are usually other creatures which feed upon these so-called injurious ones and keep them in check, and it is in this capacity that the birds find their field of usefulness.

In the perfect forest there is an exact balance between all these combating elements, and the proper proportions exist so that the beneficial factors control and check the injurious agencies. When this balance is disturbed either way the general equilibrium of the forest is upset. If the insect-eating inhabitants are removed an "insect calamity" is inevitable, or it may occur that an animal, which under restraint is beneficial, becomes a pest when unrestrained.

In nature the ideal balanced condition never actually exists, yet in an undisturbed forest the combating forces are so nearly balanced that marked disturbances are unknown. It is only when man enters with his axe, gun and tinder box that serious difficulties arise. In keeping with the growth of scientific woodcraft, it should then be the aim of every forester to carry on his work with the minimum disturbance of natural conditions. Possessed of the knowledge that all things in a forest have a relation to it, either for good or bad, the forester should know well and study carefully all these influencing elements so that he may assist the good in overcoming the bad.

It is to the credit of scientific workers that many of these factors, especially fungi and insects, have been studied with the aim of finding means for their control, but it is to their discredit that the important work which birds do in the protection of the forests has been largely overlooked, and that these feathered friends of forestry have received little aid from man, and inefficient protection from their host of enemies.

It is as consumers of injurious forest insects that the birds find their chief commercial function in the forest, yet the æsthetic benefits accruing from their presence and cheering song should not be overlooked.

Available figures on the bird consumption of forest insects are not obtainable, but a few figures given by Mr. E. H. Forbush, Ornithologist of the Massachusetts Board of Agriculture, will give some idea of the insect capacity of one of our smaller Adiron-

dack birds. According to his authority an examination of the stomachs of four chickadees revealed the presence of 1,028 eggs of the canker worm. The stomachs of four other birds of the same species contained about 600 eggs and 105 female moths of the canker worm, the average number of eggs in each of the moths being 185. Since it is estimated that a chickadee will eat at least 30 female canker worms per day, it follows that 5,550 of these noxious insects would be destroyed per bird every twenty-four hours.

Dr. A. D. Hopkins, authority on forest insects, states in his report on "Insect Enemies of the Spruce in the Northeast," that "in hundreds of infested trees examined at least one half of the beetles and their young had been destroyed by birds and in many cases it was evident that even a greater proportion had perished from this cause alone." The woodpeckers were foremost in this good work. He estimates also that 100 beetles exist per square foot of the bark on an average infested tree, and as each tree is covered by some 60 square feet of infested bark, it is possible for each tree to support 6,000 individual beetles, 100 trees 600,000, and so on. If the present number of birds is able to destroy one half of these beetles, it is apparent that legislation or any scheme of protection which will increase their number in even a slight degree, will materially decrease the number of ravaging insects. This becomes the more important when we recall that the beetles are able to overcome the resistance of a healthy living tree only when present in large numbers. These figures, while only approximations, go to show something of the enormous influence the birds exert in keeping in check the myriad of injurious insects which abound in field as well as forest. The money value they represent is beyond computation, yet it certainly runs far into the millions annually. Indeed, the statement so often made that without birds as insect destroyers the earth would not long be habitable, is not beyond belief when we consider mathematically the rate at which insects multiply when unrestrained.

The matter appears in even a stronger light when we realize that about nine-tenths of all animal forms are insects, and that the disproportionally small number of birds is the only power which keeps them in check. The capabilities of the birds in a definite region acquire also a greater significance if the following somewhat hypothetical case be considered. At a low estimate each

bird will consume daily 30 insects. The total Adirondack region comprises some 4,000,000 acres, with a bird population per acre in summer of not less than four individuals. The total daily consumption on this area would then be 480,000,000 insects, or estimating 200,000 insects to the bushel, some 2,400 bushels. The disastrous result of these 2,400 bushels of insects if they were allowed to exist and multiply daily is only too evident.

In the forest the work of the birds is of even greater importance than in agricultural communities because here they are the only direct means of destroying injurious insects, barring possibly the work of the so-called "beneficial insects," like the clerid (*Thanasimus nubilus*), which is the enemy of the spruce borers of the genus *Dendroctonus*.

In the woods, spraying, poisoning and the various other methods of destroying eggs and larvæ cannot be practised, and the forester must stand a helpless onlooker in the event of an extended insect attack. Something can be done to protect a grove of park trees, but with an infested forest area of several hundred thousand acres in which are millions of trees, nothing can be done. Fortunately wide-spread devastation of timber, such as occurred in West Virginia from 1880 to 1893, and in the Northeast some twenty years ago, is rare, which fact is due, no doubt, to quiet, yet efficient work which the birds are doing day by day the year round.

During the summer months the swallows and swifts are busy by day darting through the air in pursuit of the aerial insects which constitute their sole food supply. When night comes their places are taken by the whippoorwills and nighthawks to whom the night-flying moths and millers are legal prey. In open spots on dead stubs or projecting limbs the various flycatchers sit like sentinels, leaving their posts only to dart after passing insects, which they secure by a series of lightning-like thrusts and darts. Less prominent but equally efficient in their work are the thrushes, sparrows and other ground birds, who explore among the grass and fallen leaves for ants and bugs. In the foliage of the trees the search is continued by the warblers and vireos, while the creepers, nuthatches and chickadees wind up and down the limbs and trunk, minutely investigating every inch of bark for eggs and larvæ. The woodpeckers complete the hunt by drilling through the bark to obtain the ants and borers they hear at work

within. With such a division of labor in a body of such indefatigable workers, it is plainly evident that it is necessary only to have the proper-sized working force to insure complete protection.

The casual observer in the Adirondacks would affirm that the number of species of birds, as well as the sum total, is small. Careful observation, however, indicates that the bird population is greater than is evidenced at first sight. From notes kept in the vicinity of Upper Saranac Lake for two seasons, the writer found that the total number of resident bird species exceeded seventy. Of these the greater number are insect eaters, wholly or in part, and were present in sufficient numbers to be designated as "tolerably common." The birds which did not feed on insects, added their quota of good by destroying noxious weed seeds.

This list of birds may be roughly grouped as follows:

Woodpeckers.—In our north woods country, the woodpeckers deserve first place in the category of beneficial birds. Their chisel-like bill, sharp, distensible tongue, and acute hearing enable them to locate tree borers, and remove them at a stage when they are doing the most harm. These birds are often accused of injuring trees, but with the exception of a single species (Yellow-bellied sapsucker) they scarcely leave a mark on a healthy tree. On a sickly tree, which is full of adult beetles and larvæ, they naturally make many holes in order to extract the borers, but the injury done by the birds is much less serious than that of the borers if undestroyed, and their removal not only gives the tree its only chance for life, but prevents the spread of the infection to neighboring trees. Then, too, their peculiar bodily structure is especially adapted for capturing many wood and bark borers, caterpillars and ants which would be inaccessible to other birds. Since their food supply consists of insect forms thus obtained, the number annually destroyed per bird is enormous.

Mr. Frank M. Chapman, the well known ornithologist, says: "It is evident that woodpeckers are great conservators of forests. To them, more than to any other agency we owe the preservation of timber from hordes of destructive insects." Dr. Hopkins, before mentioned, says: "Woodpeckers are the most important enemy of the bark beetle, and appear to be of inestimable value to the spruce timber interests of the Northeast."

Seven species of woodpeckers are found in the Adirondacks, *viz.* :—The Hairy, Downy, Artic Three-toed, Banded Three-toed and Pileated Woodpeckers, and the Flicker and Yellow-bellied Sapsucker. The first two mentioned remain in their northern range throughout the year.

Creepers, Nuthatches and Tits.—The arboreal birds most closely related to the woodpeckers in habit are the above three groups. They resemble them in their ability to climb readily upon vertical tree trunks, but differ in that their bills are not adapted for drilling through bark. The nuthatches and tits do not use their tails as a support, and climb with head downward or upward, as it happens, in contrast to the creepers and woodpeckers, who always climb head upward.

The Brown Creeper is the only one of the genus in America. Of the nuthatches two species, the Red-breasted and White-breasted are common. Of the tits the Black-capped Titmouse or Chickadee, is the species common in northern New York.

The food of these climbers consists of eggs and larvæ which they find in crevices of the bark, varied occasionally by seeds and small nuts.

Wood Warblers, Kinglets, etc.—In the family of warblers is included a large number of species which are more frequently seen than heard. They are small birds which inhabit dense thickets and the leafy branches of trees, and are for the amateur the most difficult birds to study. A few are vocalists of rare ability, but most of them reveal their presence only by a faint twitter or a flitting glance as they dart from limb to limb. They winter far south in Central America, but in summer come into the extreme temperate north to breed, and hence are common in the Adirondacks. Their food supply is almost exclusively insects, which they capture in the air or glean from the dense foliage which is their habitat. A large part of the insects they consume are harmless in nature, yet many of the smaller leaf-eating insects fall prey to their diligence. The following species have been recorded from the Adirondacks: Those bearing the name of warblers are the Golden-crowned, Yellow-rumped, Black-throated Blue, Chestnut-sided, Black and white, Black Poll, Red Poll, Nashville and Parula. Belonging to the same group is the Oven bird, American Redstart and Ruby-crowned Kinglet.

Vireos.—A group of birds very similar to the warblers in habits

and habitat, yet slower in their movements and more musical. Strictly arboreal in habit, they find their food in crevices of the bark and on under side of leaves. They are not plentiful, yet per individual are great consumers of eggs and small insects. The Adirondack region supports four species, viz., the Red-eyed, White-eyed, Yellow-throated and Warbling Vireos.

Sparrows and Finches.—A large group of terrestrial birds with short conical bills which are specially adapted for crushing seeds. Although subsisting largely on a vegetable diet, they, nevertheless, vary it with many insect forms, especially the ants, bugs and spiders found on or near the ground. In a farming country or near forest nurseries this family of birds deserves protection because of the vast quantity of noxious weed seeds they destroy. (But also of tree seeds, so that their usefulness is questionable. —[ED.) Many of them, too, are in the first rank as song birds. The species seen in the woods and clearings of the Adirondacks are as follows: Of the sparrows proper the Song, Fox, White-throated, White-crowned, Chipping and Vesper were noted. In addition the Junco, Goldfinch, Purple Finch, Rose-breasted Grosbeak, Indian Bunting and Scarlet Tanager were seen.

Thrushes and Blue Birds.—A family of woodland birds whose sweet voices and expressive song have made them known and beloved by all who appreciate bird melody. Usually few in numbers and subsisting on a combined insect and vegetable diet their greatest value lies in the restful, uplifting influence of their song. The species recorded were the Wilson, Wood and Hermit Thrush and the Robin and Bluebird.

Blackbirds, Orioles, etc.—We now come to a group whose direct value to the forest is seemingly wanting, as their haunts are the open fields and marshes, and their food a varied collection in which insects form an unimportant part. The representative species are the Red-winged Blackbird, Rusty Grackle, Bob-o-link and Baltimore Oriole. Seemingly rather an incongruous combination, but scientifically all one family.

Fly-catchers.—A more important group than several of the preceding. Living almost exclusively on an insect diet and existing in considerable numbers, they destroy large numbers of the light-winged insects, especially diptera. The Adirondack species are the Kingbird, Wood Pewee, Phoëbe and Least Fly-catcher.

Thrashers and Wrens.—Seldom inhabitants of dense forests,

yet commonly found in scrubby growth on the edge of woodlands. Several members of the family, which includes the mocking birds, rank high as vocalists. They are insectivorous birds, but are too few in number to be of great economic value. The Brown Thrasher, Catbird and Winter Wren constitute the Adirondack contingent.

Swallows, Swifts, etc.—A group of birds quite abundant in the Adirondacks, the Swallows being frequently seen in large flocks over lakes, streams and open fields. They live entirely on insects which they catch while on the wing. Few birds are more deserving of protection. The Cliff, Tree and Barn Swallows are common in the North Woods. Although of another family the Chimney Swift is here included. Likewise the Ruby-throated Humming Bird, which is a common Adirondack bird, whose favorite perch is a roadside telephone wire.

Game Birds.—While of no especial value to a forest, the northern game birds deserve protection because of their value as food, and for the hunt. The red fox is the worst enemy of the Grouse. Ruffled Grouse is the only common game bird, although the Canada Grouse and Woodcock are occasionally seen.

Nocturnal Birds.—The Whippoorwill and Night Hawk are the two strictly insectivorous, nocturnal birds of the Adirondacks. The night-flying moths and millers are their chief prey. Several species of Owls also occur, but they subsist mainly on rodents.

Crows and Jays.—"Saucy, impudent and worthless," describes the Crows and Jays of the woods. By destroying cutworms the Crow makes himself useful to the farmer, but in the woods he is a noisy, thieving rascal. The Jays are no better. The common Crow, Canada Jay (Whiskey Jack) and Blue Jay are the representative species.

An exhaustive study of the food supply of the forest birds has never been attempted, but their value in the forest seems so undisputable that all possible protection and encouragement should be given them, unquestionably. If, in addition, steps be taken to destroy the natural enemies of the birds, to curb the bloodthirsty spirit of the small boy with his first gun, and to discourage the useless egg collecting mania of the amateur ornithologist, the mutually beneficial relations which now exist between the birds and the forest will be perpetually maintained.

E. A. Sterling.

Forest Reserve Manual for the Information and Use of Forest Officers. Department of the Interior. General Land Office. pp. 90. By application at General Land Office.

During the past three years a strong movement has been made toward improvement in the management and forest conditions in the National Forest Reserves. The first step of importance gained was the appointment last year of Mr. Filibert Roth as Chief of the Division of Forestry, General Land Office. Mr. Roth was formerly Professor of Forestry in the New York State College of Forestry and a Special Agent in the Bureau of Forestry, Department of Agriculture. As Special Agent he spent considerable time in the Western Reserves and is thoroughly acquainted with the existing conditions.

Since Mr. Roth's appointment he has attempted a gradual change in existing management by introducing technically educated men. The position of Head Ranger has been established.

The Head Ranger is to act as the technical assistant to the Forest Supervisor. He is appointed after having passed an examination tending to show his qualifications, experience and efficiency in forest work, especially in forest surveying, timber estimating, scaling, logging methods and the principles of general forestry.

Two Head Rangers have already been appointed, also two technically educated men to the office forces.

The Forest Reserve Manual contains full instructions to all Forest Officers in the service; also copies of the rules and regulations to which the reserves are subject, and of all the blanks used in the administration, such as: Public Timber Sale, Free Use of Timber and Stone, Report on Mining Claim, Report on Grazing of Sheep.

The manual is intended solely as a handbook for the Reserve officers, but will prove instructive to all interested in the reserves and forest management problems in general.

Sixth Annual Report of the Forest, Fish and Game Commission of the State of New York. pp. 532. Numerous colored plates and half-tones. (By application to a senator.)

The Commission, in its summary in this report, makes the following important recommendations to the Legislature:

"That the State Constitution be so amended as to provide for the practice of conservative forestry on the State lands (referring to a clause in the Amended Constitution, which forbids the cutting of any timber whatsoever on State lands), and for the sale of dead, dying and mature timber under proper safeguards.

"That the excellent work done by the United States government in connection with our foresters, as shown by the report of the United States Forestry Department herewith submitted, be continued and an appropriation of $3,500, as requested, be made for that purpose. (See Working Plan for Township 40, T. and C. P. Bulletin No. 30, Bureau of Forestry). That a force of rangers be appointed for the prevention of forest fires, timber stealing and poaching on State land. That all town fire wardens be allowed a moiety of the fine in criminal actions in cases where they can secure evidence that will lead to conviction for setting forest fires."

The wisdom of one or two of these recommendations can perhaps be questioned.

There seems to be no reason why the Bureau of Forestry should do forestry work for this State. The Commission has in its employ men fully capable to conduct any forestry work; if it has not enough of them it is in a position to employ more.

Doubt may also be expressed as to the wisdom of the moiety system. It is little less than a system of bribery to do duty. By many, money thus given is looked upon as blood money. The system certainly lacks moral tone. If the State makes laws it should provide a service, competent and well paid, to enforce them.

The introduction of a ranger system again in this State, as it formerly existed, would be folly. The rangers were in general what the game wardens are to-day, local officials, bound by the ties of kin, of friendship, of neighborliness, to nearly every man in their districts. The game wardens are prompt against a stranger, but the local offenders who go unpunished are numberless. A ranger service composed of men neither born nor bred in the locality of their service, a body of men with some instruction in the aims and significance of forestry, well paid, allowed to have no other occupation, so that they regard their position as one of dignity, instead of a mere pick up on which a few spare

moments were to be spent, such a body of men would prove of great value and honor to the State.

Barring these exceptions, we believe that the recommendations of the Forest, Fish and Game Commission are good, and if acted on favorably and extensively by the Legislature, will cause the culmination of the series of recent movements for the economic use of our forest wealth. New York will be the first to have established rational forest management, as it has been the first in all movements toward that end.

The body of this year's report contains the most valuable matter of any ever published.

Bulletin 30. Bureau of Forestry. A Working Plan for Township 40, T. and C. P., is reprinted.

A History of the Lumber Industry in the State of New York. (See Bureau Bulletin 34, Bureau of Forestry), is of interest to the lumberman and industrial student.

Mr. A. Knechtel, B. S., F. E., Forester to the Commission, contributes a clear, concise article on Methods of Estimating and Measuring Standing Timber.

A Study in Practical Re-foresting. By J. Y. McClintock, C. E. Assistant Superintendent of Forests, is an account of a small plantation on the Girard Estate, Schuylkill County, Pennsylvania.

The following interesting data also appears. The amount of timber, log measure, taken from the Adirondack forests in 1899 was as follows:

	Feet.
Spruce, saw stuff	148,203,491
Spruce, pulp	195,568,623
Hemlock	46,545,772
Pine	33,132,807
Total,	423,450,693
Hardwood	24,296,654
Grand total,	447,747,241

Ninety-five per cent. of the lumber removed from the Adirondacks, it appears, was of coniferous trees, while the original stand speaking of the average is given by the same authority to have been 65% hardwoods. Speaking generally, therefore, it will be but a short time before the cut over lands of the region will be virtually pure hardwoods.

A History of the Lumber Industry in the State of New York. By William F. Fox, Bulletin No. 34; Bureau of Forestry, Department of Agriculture; pp. 59, Pl. 30.

This recent bulletin cannot fail to be of interest to all connected with lumber and lumbering in this State. To the student of economics, of industrial history, it will also be of value in portraying the growth of one of the greatest industries of the country.

The author, Col. William F. Fox, from a boyhood on the rafts and in the woods of the Alleghanies, to Superintendent of Forests in New York State, has been intimately connected with lumbering interests in the State.

The history takes up the industry from its infancy, the pioneer with his ax hewing rough timbers and hauling them to town with his ox yoke; and carries it through its growth to its splendid maturity, reaching its supreme excellence in the logging railroad, the steam skidder and the band saw.

The intimate knowledge with which the author tells of the old rafting days, of the river driving with their attendant romance, excitement, danger, render the reading more like that of a novel than a prosaic bulletin or industrial history.

Excellent chapters on the pulp industry, log works, tan bark and finally, a roll of the pioneer lumbermen are included.

The Western Hemlock. By Edward T. Allen. Field Assistant, Bureau of Forestry. Bulletin No. 33, Bureau of Forestry, U. S. Department of Agriculture. Pp. 55, Pl. 23, Figs. 5.

This bulletin is one of a series being prepared by the Bureau of Forestry treating of the individual tree species of commercial importance throughout the United States. It was especially undertaken for the direct economic purpose of overcoming the false prejudice existing in the lumber trade against the Western Hemlock, *T. heterophylla.*

This magnificent timber tree is at present unrecognized in the trade because of the taint cast upon it by the reputation of the eastern species, and is only saleable by mixing small quantities of the best grades with the Red Fir and Spruce.

In this valuable bulletin Mr. Allen treats of the methods of exploitation, sale and utilization of the hemlock, also gives tables of growth and notes on its silvicultural characteristics. He summarizes:

1. The wood of the Western Hemlock is far superior to that of the eastern tree. It is suitable for use in all ordinary building work ; it furnishes good paper pulp ; it is sufficiently strong and light to make excellent hardware stock, and is particularly valuable for indoor finishing. The bark is half again as rich in tannin as that of the eastern species.

2. The Western Hemlock has now to contend mainly with a prejudice based on a knowledge of the eastern tree alone. Its qualities entitle it to rank among the valuable timber trees of the continent.

3. Under favorable conditions the Western Hemlock reproduces abundantly and grows very rapidly. Since these conditions are usually disadvantageous to Red Fir, Hemlock may often be counted upon to reforest cut over lands where Red Fir would probably fail to establish itself.

A Working Plan for Forest Lands Near Pine Bluff, Arkansas. By Frederick E. Olmsted. Bulletin No. 32. Bureau of Forestry. Pp. 49, Pl. 9, Figs. 9.

This working plan was made by the Bureau of Forestry at the request of the Sawyer and Austin Lumber Co. The object of the working plan was to determine whether the present tract of the company is large enough to furnish a sustained yield equal to the yearly capacity of the mill, and if not, to estimate the additional area necessary to secure such a result.

The holdings of the company consist of 105,000 acres, about 5% of which is bare of merchantable timber. The land in the average is covered with a mixed forest of Loblolly and Shortleaf Pines and hardwoods, the pines forming something over 50% of the stand.

Passing over the silvicultural descriptions and deductions we come to Part III, Forest Management, in which several yield tables and interest calculations are given.

Table No. 15, Page 44, Annual Interest represented by future cuts on the capital invested in cut over lands, does not seem deducible from the stumpage values and statement of yearly increment per cent. as given.

On the same page the following statement is made: "Cutting to the advised diameter limit of 12 inches, breast high, or about 14 inches on the stump, with stumpage reckoned at $2.00 per

1,000 board feet, and the value of cut over lands at $1.00 per acre, the average annual interest represented by the future crop on cut over lands is, for a period of 40 years, nearly 9%."

Working out the example on the basis given we come to a very different result. Entering in the well-known formula for compound interest accumulation $[C_n = C_0 \times (1.op^n - 1)]$ the given values, $C = \$1.00$, $n = 40$ *years*, $p = 9$, we get as interest charge for the land $\$1.00 \times (1.09^{40} - 1) = \$30.41$; for taxes and cost of protection, which are figured (on p. 43) at 5 cents per acre per annum, an accumulation at the end of 40 years

$$\left[C_n = \frac{r}{.op}(1.op^n - 1) = \frac{.05}{.09} \times 30.41\right]$$

of $16.89 accrues, or a total cost of product at 40 years of $47.30.

On the other hand table No. 13 gives the yield per acre at the end of 42 years cutting to a 12 inch D. bh. limit as 6,067 board feet. Multiplying 6,067 board feet by $2.00, the stated stumpage value, we get $12.13 as the value of the cut per acre at the end of 42 years, *i. e.*, the return is $35.17 less than it should be to yield a 9% interest.

The real interest which the above quoted example will give is about 5½%; this is considerably different from 9%. Yet, even so, if a 5% return can be secured from a forestry investment it is a remarkably good investment, and the statement still remains true (Page 44), "that the application of practical forestry to the tract of the Sawyer and Austin Lumber Company would be a sound business measure."

The Hardy Catalpa.—Bulletin No. 108; pp. 114, Pl. 40. Kansas Agricultural College, Manhattan, Kansas. (Obtainable by application.)

This bulletin contains a discussion of the methods of making catalpa plantations, and the probable profits resulting, also a collection of letters from the engineers of a number of railroads giving their opinions of the catalpa as a tie producer. To the western tree planter this publication should prove of interest and value.

Seventh Annual Report of the Chief Fire Warden of Minnesota. By C. C. Andrews; pp. 135; Pl. 16. (By application Chief Fire Warden.)

The Chief Fire Warden of Minnesota not only attends to the

duties concerning fire service, but in addition to those of a Forest Superintendent.

In his report for 1901 Gen. Andrews has included, besides the matter directly relating to the State Fire Service, a series of descriptions of the forestry conditions in European countries. This matter will be found of value and interest, at least to the general reader.

The number of reported fires in Minnesota during 1901 was fifty-five; burning over 58,400 acres and doing estimated damage of $42,000.

Proceedings of the Iowa Park and Forestry Association. First Annual Meeting, Ames, Iowa; pp. 80, Pl. 25. Price, 25 cents.

The first publication from a newly organized society, it is an indication of the continued interest that is being taken throughout the country in forestry and allied subjects.

American Public Health Association. Report of the Committee on the Relation of Forestry to the Public Health. By Prof. W. H. Brower; pp. 15. The Berlin Printing Co., Columbus, Ohio.

This pamphlet contains the most concise and accurate statement of the truths regarding the effects of forests on the public health that has yet been printed.

Sierra Club Bulletin. Vol. IV, No. 2. Merchants Exchange Building, San Francisco.

Contains a useful recapitulation of Conifers of the Pacific Slope: How to Distinguish Them. By John G. Lemmon.

Science. Friday, September 12, 1902.

This number of Science contains an article, "On Some Recent Advances in the Fireproofing Treatment of Wood," by Samuel P. Staller, which is a general review of the various processes of wood fireproofing, the qualities requisite in a satisfactory substance and method of impregnation, and finally a discussion of the Ferrill process.

The White Ant. By C. L. Marlott. Circular No. 50; Second Series; Division of Entomology; Department of Agriculture; Pp. 8.

A short account of the white ant, its damage and the means of prevention.

The Indian Forester. Calcutta, India.

July.

The Influence of Forests on Cultivation in the Hills. By Ram Swarup, D. D. R.

White Ants as a Pest of Trees.

Forest Administration in British India during 1899-1900.

We find here complete figures of the Indian administration, from which we take the following :

Total area of reserved forests, 86,970 square miles, yielding a gross revenue of $6,370,000, and a net revenue of $2,661,640.

Danger of Wood Pulp Paper. Publishers' Weekly.

August.

Fire Protection in Teak Forests in Lower Burma. By H. C. Walker.

The Timber Resources of the Australian Commonwealth. By E. T. Scammell.

In which the following figures are given :

	Total Area, Acres.	Forested Area, Acres.
Queensland	427,838,000	40,000,000
N. S. Wales	198,638,000	20,000,000
Victoria	56,245,700	11,797,000
S. Australia	578,361,600	3,840,000
W. Australia	624,588,800	97,920;000
Tasmania	16,778,000	11,000,000
Total	1,902,450,100	184,557,000

Dr. W. Schlich, C. I. E., writes of these figures that " only about 10% of the area of Australia is under timber forest, and enough has been said and written to show that these are on the highway to ruin.

September. This number contains matter of home interest solely.

Lesnoj Journal. Published bi-monthly by the Forestry Association in St. Petersburg.

March–April.

Square Plantations in Steppe Forests. By D. K. Domoslevsky.

The Pine in the Chulym Basin in the Tomsk Province ; its usual growth and some peculiar ones ; based on the last researches in Siberian forests. By I. G. Frinden.

A Basis for Regulating the Forests bordering the Amour. By P. Delle and V. Korsch.

Rate of Growth of Oaks in the Krapevense Forest. By V. Kluchneseov.

A Conference for Revising Freight Rates on Forest Materials. By V. Sobichevsky.

Appraising Forests for the Purpose of Taxation. By E. Damberg.

Insufficiency of the World's Timber Supply.—A criticism of the famous French article of 1900.

May–June. Manufacture of Charcoal in Maltzew's Forests. By R. Behdevsky.

Observations on the Life and Development of the Bark-eating Spruce-beetle (Bostrichus). By A. Voronzov.

Annual Report of the Public Forests.

Silviculture in the Forests of Osum. By N. Regisbevsky.

Schweizerische Zeitschrift für Forstwesen.

July. Forstliche Reiseskizzen aus den Dünen und Landes der Gascogne. By A. Engler. (mit Abbildungen.) (Schluss.)

A paper on the naval-stores industry, as carried on in Gascony, in the extensive forests of the Maritime Pine. The two methods of obtaining the resin, by protracted but not intensive working of the trees through a number of years, and by rapid intensive "chipping" of the trees, which, under this management, give large amounts of resin for a few years, and the methods of separating and purifying the products are treated.

August–September has little of general interest.

Centralblatt für das Gesammte Forstwesen. The July number contains:—

Vorbeugung gegen Ueberschwemmungen. By Oberförster Franz Pollak in Hainburg-an-der-Donau.

The old question of the influence of a forest cover upon precipitation and on the run-off is reopened and the conclusion is reached, mostly from a perfect knowledge of local conditions, that this is of considerable importance in relation to the run-off, tending in many ways to retard it and so lessen its ability to do serious damage.

Uebereinkunft zum Schutze der für die Landwirtschaft nützlichen Vögel.

Sets forth the articles of agreement and concludes with two lists of the useful and injurious species of birds found in the part of Europe covered.

Die Holzverkohlung in Nord-Amerika.

A brief review of the charcoal industry in the United States, the methods and the growth of the industry into the earlier primitive modern wood alcohol and acetic acid factories with their iron retorts for utilizing the wood most economically.

Zeitschrift für Forst- und Jagdwesen.

Forstliche Reisebilder aus Nord-Amerika. By von der Heyde, Kgl. Preuss. Forstassessor.

Notes of a railway journey across the continent from San Francisco to New York and Washington. The Yosemite and Yellowstone National Parks were visited but elsewhere few stops were made in this apparently hurried tour. One of the most striking scenes and one that left the deepest impression on the author's mind was the desolate country in the track of forest fires through Washington, Idaho and Montana, the very regions in which he had expected to find heavy virgin forests.

Revue des Eaux et Forêts.

August 15th. Le Déboisement des Pyrénées. By S. Guénot.

September 1st. La Lutte Contre Le Champignon des Maisons. By E. Henry.

La Vannerie et L'osier. By G. de la Barre.

September 15th. Le Sapin Tend à Supplanter le Hêtre en Montagne. By Joly de Sailly.

Bulletin de la Société Centrale Forestière de Belgique.

July. Le Nitrate de Soude en Sylviculture. By J. Huberty. An extensive article with examples.

La Dessoucheuse Bennett. A paper on an American stump-puller.
tion.

August. Les Engrais Chemiques en Culture Forestière dans la Région Ardennaise. By C. Delville.

September. The conclusion of the article mentioned in the previous month.

Les Forêts de l'Alaska, translated from *The Forester.*

Revista de Montes.

July 1st. Empleo de la Madera en la Fabricación de Papel. By Juan A. de Madariaga. A short paper on the various methods of making paper and the various substances used.

September 1st. Algunas Observaciones al Proyecto de las Obras de Defensa de Sevilla contra las Inundaciones. By H. del Campo.

NEWS AND NOTES.

THE FIELD SEASON OF THE BUREAU OF FORESTRY.

This year has been the most active and fruitful one in the history of the Bureau, one division alone, that of Forest Management, having had 104 men in the field exclusive of guides, packmen, choppers, etc. The chiefs, number of aids, and objects of work being as follows:

	No. of aids.	*Subject.*
Henry Grinnell,	7	Sugar Pine.
G. E. Tower,	5	Lodgepole Pine.
C. S. Chapman,	18	Working Plan Great N. Paper Co.
W. C. Hodge, Jr.,	12	" " " " " "
R. P. Imes,	10	White Pine and Hemlock.
Alfred Gaskell,	4	Southern Hardwoods.
G. S. Cleveland,	3	" "
John E. Keach,	6	" "
Franklin W. Reed,	3	Working Plan for Linville Imp. Co.
R. G. Zon,	3	Balsam in Adirondacks.
G. E. Clement,	3	Forest Conditions of Otsego Co., N. Y.
Covert DuBois,	–	Log Scales in Black Hills.
H. D. Tiemann,	2	Northern Log Scales.
H. H. Chapman,	4	Red Pine.
R. S. Hosmer,	9	Maine Cut-Over Spruce Lands.

The following undergraduates of the New York State College of Forestry were in the field with the Bureau of Forestry during the past field season: Frederick Dunlap, W. P. Harris, S. McP. Higgins, J. M. Keeler, G. B. Lull, H. O. Stabler, R. E. Sheldon, A. C. Weed, K. W. Woodward, A. S. Williams, I. T. Worthley, W. J. Ward.

The Appalachian National Park Association has called a convention to be held in the Auditorium, Asheville, N. C., October 25th, 5 P. M., in the interest of the proposed National Park.

Arrangements have been made with the Southern Railway Company for reduced rates. Invitations have been extended to the Boards of Trade of all the southeastern cities and a general one to all interested parties.

THE NEW YORK STATE COLLEGE OF FORESTRY.

The College of Forestry, now four years old, has each year made a gradual but sure growth in the number of students, the number of registrations having been in the first four years 4, 17, 25, 44 respectively, and 72 in 1902.

The requirements for admission were more strictly enforced this year, the number of applications having been greater than the faculty thought it desirable to admit. Ten graduates of other collegiate institutions were among the new men, some being obliged to take two years work and others three and four years for graduation. The following is a list of the men who have studied at the college, giving their present occupation :

Philip Ayres, 1 year Sp., Forester to the Society for the Protection of New Hampshire Forests.

T. F. Borst, '01, Forester for the Metropolitan Water Board of Massachusetts.

R. C. Bryant, '00, Forester, Bureau of Forestry, Manila, P. I.

A. E. Cohoon, 1 year Sp., Assistant, Bureau of Forestry, Washington, D.C.

R. H. Charleton, 1 year Sp., Assistant, Division of Forestry, General Land Office, Washington, D. C.

W. W. Clark, '02, Forester, Bureau of Forestry, Manila, P. I.

H. M. Curran, 1 year Sp., Field Assistant, Bureau of Forestry, Washington, D. C.

Prof. C. H. Davis, Sp., Instructor in Forestry, University of Michigan.

F. W. Fassett, Sp., Lumberman, Wellsville, N. Y.

Alfred Haines, 1 term Sp., Instructor in Forestry, Westtown Boarding School, Pa.

Wm. B. Howard, 1 year Sp., Assistant, Bureau of Forestry, Washington, D. C.

Abraham Knechtel, '01, Forester, Forest Commission, State of New York.

Wm. Klemme, Sp., Inspector, Bureau of Forestry, Manila, P. I.

J. M. Keeler, ex-'04, Student Assistant, Bureau of Forestry, Washington, D. C.

C. F. Littlejohn, 1 year Sp., Lumber Firm, Michigan.

L. Mazzanovitch, 1 term Sp., U. S. Ranger, Jackson, Wyoming.

W. M. Maule, ex-'03, Inspector, Bureau of Forestry, Manila, P. I.

Walter Mulford, '01, Forester, State of Conneticut.

C. R. Pettis, '01, Forester, Forest Commission, State of New York.

E. P. Sandsten, Sp., Horticulturist, University of Madison, Wisconsin.

E. A. Sterling, '02, Field Assistant, Bureau of Forestry, Washington, D. C.

A. V. Stubenrauch, Sp., Assistant in Horticulture, University of California.

H. J. Tompkins, 1 year Sp., Field Assistant, Bureau of Forestry, Washington, D. C.

G. S. Van Wickle, ex-'03, Inspector, Bureau of Forestry, Manila, P. I.

I. T. Worthley, ex-'03, Brooklyn, N. Y.

R. Zon, '01, Special Agent, Bureau of Forestry, Washington, D. C.

The Keuffel-Esser Company of New York have just put an excellent compass upon the market. It has a needle three inches in length, mounted in a brass box, with upright hinged sights. It is the ordinary surveyor's compass in miniature, and is provided with a ball and socket joint for mounting on a Jacob's staff. The instrument seems admirably suited for forest work. It is light enough to be carried in the pocket and used for valuation survey work, and accurate enough for running interior lines, mapping trails, roads, etc. Price, $10.

CAMP, 100 MILES BEYOND ALL SIGNS OF CIVILIZATION, NEAR BOLES PRINCIPE. P. I.
August 30, 1902.

My Dear ———

Sitting here in my tent and waiting for the rain to stop so that we can go out on a valuation survey, I will write a line to you who certainly think I have forgotten all my old friends.

The last three months have been full of haste and hurry for me. I left Hagger and the Camarines at two hours' notice, went a few days with Bryant, a little while in Manila, and then had to start for this forlorn part of the world. In my party are two American boys and one Philippino botanist. It took us fifteen days to make the trip from Manila.

This is the wildest part of the islands; a few huts and soldiers' barracks are all the signs of civilization in the region, and they are so far from the woods that we have to stay in camp near the place of our work. Our present camp is situated on the very rocky sea coast, near a small river. The river has three waterfalls, one of them 100 feet high. The region is all very nice and picturesque, but rather rough for work. There are no trails, and every step we take has to be first cut out. The work is, therefore, very difficult and slow; we never can finish more than six to eight acres per day. Frequent rains keep us often in camp; that means in a leaky tent. This week we could get out only three days.

I had to take all our provisions from Manila; canned food is all we have.

Captain Ahern will send VanWickle out here as soon as he arrives from the States. I will be very glad of that. It will make my work much easier, having another forester here.

Last week we made a long trip up the water shed. Having no trail we had to follow the bed of the river. In one day we had to cross the river or some of its tributaries exactly fifty times. The water in some places was four feet deep, and the current so strong that we had to form a chain to resist the current. Another trip brought us to the mountains inhabited by the Glougates, the so-called head hunters. Here we had an escort of six soldiers and came out safely. WILLIAM KLEMME.

At the Yale Forest School thirty-eight students are registered, twenty-five of them being new.

The school at Biltmore also shows a marked increase, eighteen students having already arrived. It is probable that this year as formerly more will enter later.

The University of Nebraska, the University of Michigan and the Michigan Agricultural College are offering short courses in forestry branches.

The University of California is seriously considering the establishment of a forest school. President Wheeler recently issued a statement calling for endowment funds.

CONTENTS.

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FORESTRY QUARTERLY

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

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

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

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FORESTRY QUARTERLY.

VOL. I. JANUARY, 1903. NO. 2.

OUTLOOK OF THE TIMBER SUPPLY IN THE UNITED STATES.[1]

I.

As Cotta pointed out a hundred years ago, forestry is a child of necessity. It is only when the wood supplies grown by unaided Nature are exhausted or near exhaustion, and when it becomes apparent that reproduction is not replacing the harvested virgin crop as rapidly as required, that forestry—systematic utilization and reproduction of wood supplies—becomes necessary.

While much has been said and written regarding the influence of forest cover on climate and waterflow as calling for the application of forestry, it should be understood that these considerations apply mainly to specified localities, that some of the claimed beneficial influences are often questionable or at least unproven, and that moreover, the forest effects may be secured incidentally; the supply question remains uppermost, and is the more important.

It behooves, then, every forester to find justification for his art and for his own existence in the answer to the inquiry which will bring out the fact that natural supplies are waning, and are not being replaced as fast as consumed.

Such inquiry involves knowledge on one hand, of the consumption of wood products in the given country, the possibility and probability of substituting other materials, and the opportunity of supplying it wholly or in part, by importations and, on the other hand, knowledge of the amount of standing timber ready for use, the condition of the forest areas, as far as promise of reproduction is concerned, and the rapidity with which such new growth may become available.

[1] Presented before Section I, American Association for the Advancement of Science, Washington, D. C., 1902.

Ten years ago, the Chief Geographer of the United States Geological Survey came out in print[1] refuting the writer's contention that a more conservative and rational forestry policy in the United States was needed, because, he asserted, the relations of forest growth to climatic, soil and water conditions are presumably of no practical significance, and because, in his opinion, the timber growth in the United States is certainly renewing itself much faster than it is being consumed.

This year, by a peculiar irony of fate, the Chief Geographer, now also in charge of the survey of the Federal forest reservations, furnishes as compiler of the Statistics of the Lumber Industry, in the Twelfth Census,[2] the most satisfactory data upon which to discuss the supply question, and to prove his position of ten years ago wrong.

As I have pointed out elsewhere,[3] both the gathering and the interpretation of statistics of forest industries are beset with more difficulties than are encountered in most other industries, largely because of their very diversified character and the very scattered and inaccessible locations of their sources. All census statistics have the tendency to remain below the truth—"some little pigs will not let themselves be counted"—and the statistics of forest products are probably more subject to this defect than others.

The final object of census statistics is, of course, to furnish basis not only for comparison between the various industries, bringing out their relative importance, but also to record the progress of development from decade to decade.

Unfortunately, for this last object especially, the absence of a uniform method of enumeration from Census to Census, added to the variable success of enumerators in securing information, render the data of uneven value; a direct comparison would lead to erroneous conclusions; proper allowances must be made for defects, variable from Census to Census, and only very general deductions as to tendencies are admissible.

With this warning against the mathematical use and interpretation of available forest statistics, we propose to present the data of

[1] Washington Evening News, April 1, 1893, and other places.

[2] Vol. IX, XII Census, Selected Industries, pp. 805, 1902.

[3] Quarterly Publication of the American Statistical Association, December, 1898.

the last Census and draw our conclusions as to the *probable* status of the timber supply question in the United States.

The census of 1900 for the first time seems to have secured tolerably full, although still incomplete, statistics of the lumber industry of the United States, which show that the estimate of the writer, made a few years ago, of 40 billion feet B. M. annual consumption, including all material requiring log and bolt size, is as near the truth as it can possibly be stated, for the saw mill product is placed by the Census as 35 billion feet, precisely the amount which the writer deduced from the reported saw mill capacity in 1898,[1] and the allowance of five billion feet for unenumerated amounts, staves and headings, railroad ties, round and hewn timber used locally, telegraph poles, etc., is, indeed, hardly sufficient. Since, however, in the census statistics there are undoubtedly duplications, we may perhaps still adhere, for all purposes of economic discussion, to our round figure of forty billion as representing fairly the present annual consumption. The summary of the Census (1900) of the saw mills, planing mills and timber camps stands as follows, saw mill product, output of planing mills, custom work, etc., and product of timber camps being mixed together :

Number of establishments (reporting or existing?)		33,035
Capital invested		$611,611,524
Salaried officials, 12,530		11,260,608
Wage earners, 283,260		104,640,591
Miscellaneous expenses		17,731,519
Cost of materials used		317,923,548
Value of products, total		566,832,984
Saw mill	$422,812,061	
Planing mill	107,622,519	
Timber camps	36,398,404	
Quantity of sawed lumber, M. ft. B. M		35,084,166
Value of same		$390,489,873

The figure of $318,000,000 represents the cost of the logs and all other materials at the various mills which produced the 35 billion feet of lumber and whatever other products were produced in the mills. Discrepancies between the total reported output of the logging camps (26 billion feet) and that of the saw mills amounting to nearly 40 per cent. (!), are explained by the com-

[1] H. Doc. 181, 55th Cong., 3d Sess., p. 119.

piler as due to failure of small concerns reporting on the former and to increase in the scale at the mill. There is enough confusion in the various tabulations to also produce various differences in other aggregates.

The saw mills alone seem to have produced from materials valued at $226,000,000 a product valued at $423,000,000. In addition to the 35 billion feet of lumber valued at $342,000,000,[1] representing 81 per cent. of the whole, the following materials were produced at the mills :

Material.	*Quantity.*	*Value, Million Dollars.*
Shingles M.	12,102,007	18.9
Hoops, M.	441,327	2.7
Staves, M.	1,664,792	13.7
Headings, M.	124,089	4.3
Bobbin and spool stock, M. ft.	40,037	.5
Furniture stock, M. ft.	105,305	1.9
Agricultural implement stock, M. ft.	33,250	.6
Carriage and wagon stock, M. ft.	82,686	1.8
Pickets and paling, M.	35,804	.3
Laths, M.	2,523,998	4.7
All other sawed products	———	19.6

The mill product outside the lumber value was therefore round $70,000,000.

While these represent reported amounts from regular mills and logging camps connected with them, the independent lumber camps added 3383 million feet of logs cut for mills, valued at $20,600,000, and other materials, like logs for export, hewn timber, railway ties, posts, poles, masts, spars, handle and cooperage stock, etc., aggregating about $15,000,000.

One very important item which apparently is not included in the above statements, the pulpwood, forms the subject of a special census, and adds over two and one-half million cords of log or bolt size material to the above. The consumption of this manufacture alone has more than trebled in the last decade.

In addition to these enumerated amounts, there must be allowance made, not only for what has escaped the enumerator in the regular wood consuming establishments, but also the very large

[1] In another table this is reported as $385,298,304, and the value of materials also figures differently.

amount of fuel wood consumption and other wood cut on farmers' wood-lots for home use, which in some other part of the Census is valued at round $110,000,000. According to the Tenth Census, our consumption of fuel wood was at that time 146 million cords, or 2.9 cords per capita. Assuming a substantial per capita reduction of this item, owing to increased use of coal, we may still place the present fuel-wood consumption at not less than 180 million cords.

Now, in order to place all these items in a form which makes them comparable to statements of wood production, it becomes necessary to translate them into a unit measure, the cubic foot.

Such reduction brings the consumption of material for which log and bolt sizes are indispensable conservatively to about 7 billion cubic feet, (probably nearer 8 billion,) and since most of our fuelwood is cut from similar material, we are perfectly safe in placing our total consumption of "timberwood" (over 3 in. diameter) for this general discussion at not less than 25 billion cubic feet, an average figure which the writer has used before as sufficiently near for an average of the last decade.

The next question is, are we increasing or decreasing our wood consumption? That, as the population increases, our total consumption increases, will appear natural, but that the per capita consumption has also constantly increased in spite of the enormously increased production of coal, iron, steel, and the use of other substitutes, will not so easily be admitted. For such an investigation, the defects in the gathering of census statistics above cited become fatal. Nevertheless, if the disproportionate difference between the increase of population and of the consumption is very large, we are safe at least to recognize a tendency.

Taking the census figures as reported for the lumber industry for the last five decades, the increases from decade to decade show the following percents:

	1860.	*1870.*	*1880.*	*1890.*	*1900.*
Cost of raw materials	57	132	41	66	31
Value of lumber product	60	117	11	88	29
Increase in population	36	23	30	25	22

Or, if we compare conditions at the beginning of the period (1850) and at the end (1900), in the 50 years the population

grew by 4.6% [1] per annum in the average, namely from 23.2 to 76.3 million, the value of lumber product by 17%, namely from 60.4 to 566.8 million dollars, and the cost of materials by 20%, namely from 28 to 317.9 million dollars. Making every allowance for defects in the statistics and for advance in prices, the difference is so large that a great increase in wood consumption per capita can be confidently deduced.

If we compare only the figures for the last 20 years, which are more reliable, we find the Tenth Census recording the value of products at 233 million dollars, with a saw product of 18 billion feet, as against the last Census, reporting 567 million dollars and 35 billion feet saw product. In other words, the quantity has doubled, its value nearly trebled, in these 20 years, indicating a change in value of 7 per cent annually in the average (or 4½ per cent compounding) and an increase in material of 5 per cent in the average (or 3½ per cent compounding). The population during this period increased by 2.5 per cent in the average, or, compounding, at 2 per cent, so that it appears that our per capita consumption of lumber alone has increased at a compound rate of 1½ per cent, or an average rate per annum of 2½ per cent during the 20 years, not including exports, imports or much other material not reported.

To assure us that this increase in per capita consumption is a feature of modern industrial activity and higher civilization, not confined to the United States, but pertaining to all civilized nations, we may look at the import statistics of other nations, which give quantities as well as values.

Great Britain, which is practically dependent on importations, has large resources of coal, iron and stone and hence uses wood probably, most economically, has increased its imports during the last forty years at the rate of over 5% in the average (or compounding at the rate of nearly 3%) while the population increased by less than 1% per annum.

[1] These figurings are at simple interest on the basis of the figures at the beginning of the period. If a compound interest calculation is made the increase in consumption will be found at the rate of somewhat more than 5 per cent. in cost of materials, while the population increased at somewhat less than 2½ per cent., making the annual per capita increase in consumption nearly 3 per cent. compounding, in which allowance for increase in price is to be made.

France, which is also relying upon imports to a very large extent shows a still more striking increase of importations namely 10% per annum for the last 70 years, while the population during the whole period increased only 20%; here progressive deforestation may account for the great increase of imports.

But in Germany we know the cut at home has constantly increased during the last 40 years or more, and yet the importations have also increased. While in 1863 her exports of forest products still exceeded her imports by 125,000 tons, after that year a remarkable change has taken place, and today Germany is next to England the largest wood importer in the world, with over 4500 thousand tons excess over exports, worth over 75 million dollars, an increase of 10% per annum in the average for the last 40 years, (or, compounding, at the rate of over 4%) while the population increased only 38% during the whole period. Even the fuel wood consumption in Germany has not decreased in proportion to the coal consumption, for from 1872 to 1896 the latter increased 103%, while the fuel wood consumption decreased only 18%.

All of which goes to show that a higher civilization and increased industrial activity make more demand for such a serviceable material as wood. In spite of substitutions, new uses arise to keep up the demand. And we in the United States who in the sight of plenty are not wont to save, will probably continue to increase our per capita consumption for some time at least at the rate of Germany.

How are these increasing demands to be supplied? When we have used up our own stores, are there any others to draw on?

Here we must first of all make a sharp distinction between the kinds of wood that are needed for use in the arts.

Some years ago the writer was taken to task by one of the lumber trade journals for asserting that the consumption of coniferous 'softwood' material represented ¾ of the total lumber wood consumption, to which the pines contributed to the extent of 50%. The present Census brings out precisely this proportion, except that if the pulpwood is added, the importance of the coniferous material is still further accentuated.

The relative importance of the different species is for the first time more fully and very satisfactorily brought out by the Census, permitting the following tabulation:

	Quantity. Million feet B. M.		Value. Thousands dollars.	Stumpage. Average values. Dollars per M ft.
Conifers.				
White Pine	7483		94,980	3.66
Southern Pine (several species)	9580		80,726	1.20
Hemlock	1860		17,832	2.56
Spruce (and Balsam?)	1448		16,323	2.26
Cypress	496		6,604	1.58
Norway Pine	259		3,022	2.88
Cedar	115		1,283	1.32
Tamarack	9		104	1.00
Eastern section	——	21,250		
Red (Douglas) Fir	1736		15,050	.77
Hemlock	1560		16,305	----
Yellow Pine (western)	1000		9,235	1.12
Redwood	360		3,646	1.00
Cedar	118		1,260	----
Sugar Pine	54		659	1.96
Tamarack	42		338	----
Western section	——	4,870		
All others		33	1,114	
Total		26,153	268,481	
Hardwoods (broad-leaved).				
Oak (various species)	4438		61,174	3.18
Poplar (Tulip)	1115		15,646	2.81
Maple	633		7,495	2.66
Elm	456		5,240	3.30
Cottonwood	415		4,304	1.45
Basswood	308		3,955	1.50
Gum (Red)	285		2,748	1.68
Ash	269		4,264	3.03
Chestnut	207		2,764	2.71
Birch	133		1,658	----
Hickory	97		1,815	----
Black Walnut	39		1,412	5.00
Sycamore	30		328	----
All others	208		4,015	----
	——	8,633		
Totals		34,786	116,818	

The White Pine still leads the list, although the three or four southern species of pines aggregated, exceed it in quantity, though not in value. The relative accessibility to large quantities of supplies predetermines, of course, largely the relative position, especially of the coniferous species, which can be readily substituted by each other. The stumpage prices given in the table, which are based on lumbermen's statements of the values of their holdings, are, in most cases, considerably below the actual prices now paid.

To the statement for spruce, at least 1000 million feet must be added for wood pulp, and for other species contributing to the same industry, 300 million ; the cut on farms, which is placed at nearly 110 million dollars in value, in part log and bolt size material, not brought to mill, will have to be considered, probably, for the most part, in the hardwood cut.

The hardwoods, to be sure, furnish the bulk of the fuel-wood, and when it comes to a mere statement of wood volume, represent, probably, the larger requirement of the total consumption, at least in the United States. Nevertheless, in the arts and industries, the softwoods are the important. These are to be found in quantity only in the north temperate zone, precisely that part of the world where the wood consuming civilization is most highly developed. The southern countries produce mainly the highly ornamental but exceedingly hard woods, which are only of limited application, hence relatively less important.

The densely populated, highly developed European countries satisfy their requirements in excess of home production from the less developed, thinly populated countries to the north and east, Russia, Norway, Sweden. Austria-Hungary, as well as from Canada and the United States.

The United States must rely upon its own resources and whatever her neighbor, Canada, can spare from its trans-Atlantic trade with the mother country.

In the next paper, it is proposed, to discuss the conditions of supply to meet our requirements.

B. E. Fernow.

NATURAL REPRODUCTION IN THE ADIRONDACK FORESTS.

During the summer of 1901, the writer was employed in making a study of the reproduction of the commercial trees of the Adirondack mountains. The work was done on Township 5, Hamilton County, in connection with a forest survey of the township, made at that time for the Forest, Fish and Game Commission by the U. S. Bureau of Forestry.

A proper policy for the treatment of our forests depends, of course, upon a knowledge of the reproduction of the trees. Such knowledge is the more important because forests grow slowly. With annual crops, a year or two may suffice to demonstrate the truth or falsity of a theory ; but with forest crops it may require a century for such demonstration. A proper forest policy has in view a perpetual forest of desirable species, and if any species is to be kept in the forest by natural generation, the degree of cutting must depend upon the facility with which it reproduces itself in comparison with the reproduction of other species on the same ground.

General impressions of the manner in which reproduction goes on in the forest, or in fact, of any phenomenon of the forest, are of little value. Conclusions should be drawn only from definite and thorough study of the subject. The method followed in making my study was about as follows :—Quarter-acre circles were chosen here and there over the township referred to, but were selected so as to give variety of conditions. Two young boys assisted me. The radius of the circle was actually measured, the boys running out from the center a tape line to the distance of 59 feet. The trees just outside the circumference were blazed, not only for the sake of accuracy, but so that I might be able at any future time to find any one of the circles, in case such might become important. The boys then measured off within this blazed circumference eight squares, each 10 feet on a side, marking the corners with small stakes. These squares were taken upon the forest floor proper, evading old decaying trees that had fallen upon the quarter-acre plot. From each of these squares the boys pulled up all the little growth of the commercial species. This was done in order to get an actual and accurate count.

The plants were separated into their different species, and each species was divided into three classes which were called germinated, seedlings, and juveniles. In the softwoods, or evergreens, plants so young that they had not yet begun to branch, were called germinated. Plants that had branched, but were not more than six inches high, were called seedlings, and plants more than six inches high but not more than one inch in diameter, were called juveniles. In the opposite-leaved hardwoods, the ash and the maple, a plant was not called a seedling until it had three sets of leaves above the cotyledons or seed leaves; and in the alternate-leaved hardwoods not until it had four leaves above the seed leaves. The seedlings and juveniles were classified as in the softwoods. A count and record were made of the number of each class of each species. The counts on the eight squares were added together, and the sum was multiplied by 13.61 to determine the growth upon the quarter-acre at the same rate.

Attention was then given to the old, rotting trunks that had fallen upon the quarter-acre plot. The boys pulled up all the little trees growing upon them, and these were classified and counted as already described.

All the trees above one inch in diameter found on the quarter-acre were then calipered. Measurements were read to tenths of an inch. These larger trees were also divided into three classes for each species, called polewood, small timber, and large timber. Polewood consisted of trees from 1 to 6 inches in diameter, the latter inclusive. Trees from 7 to 10 inches were called small timber, and trees above 10 inches, large timber.

It was thought that other species of plants found upon the circle might have a bearing of some importance upon the question. A list was made of all these as far as the species could be determined. Record was also made of the location of the circle, of the degree of slope, and of the exposure of the plot. The degree of light admitted through the crown cover was stated in numerals from 1 to 10. Note was made of habit of growth, habit of branching, form of bole, and, in fact, anything that would furnish a useful record.

It was intensely interesting to note the manner in which the reproduction was going on. The pine, spruce, and hemlock were, of course, regenerating only from seed. Under the conditions prevailing on that township—virgin forest, dense shade, much duff on

the forest floor—these species were reproducing almost entirely on the old, decaying tree trunks lying in the forest, and these trunks were themselves pine, spruce, and hemlock. They were not reproducing on old, decaying beech, birch, or maple trees. Occasionally an old hemlock was found literally covered with little spruces and hemlocks, while on the forest floor not a small tree of these species was to be found upon the quarter-acre. Patches of young spruces, from one to five or six feet high, were found apparently as if they had germinated on the forest floor, but upon close examination these were generally seen to be arranged in rows, which would indicate that they had come from some such seed bed as old logs. Frequently, too, the undecayed knots of an old hemlock could be kicked up along the row.

It is true that these species were also found germinating and growing on the forest floor. It was only, however, where the mineral soil was exposed, and this is of rare occurrence in the virgin forest; usually it occurs only on steep slopes and at the roots of upturned trees. Even in forests where lumbering has been carried on, unless fire has burned off the humus, the mineral soil is not much exposed. Skidding tears up the soil to only a slight extent, not enough to warrant the assumption that a seed bed will thus be furnished to reproduce the softwoods in sufficient numbers to keep up a forest lumbered periodically.

When fire goes through a softwood forest, leaving here and there a seed tree, the young growth comes up in abundance, for the reason that the fire not only burns off the humus, exposing the mineral soil, but it leaves a covering of ashes just suitable, when leached into the soil, for encouraging the growth of the trees; in fact, just the mineral matter that the burned trees took from the soil, the fire driving off into the air only the elements obtained from the air. Along the line of the Canada Atlantic Railway from Ottawa to Parry Sound can be seen miles of young White Pine as dense as it can stand, where the fire has left only here and there a tall pine with foliage, among the many dead, desolate remains of the once flourishing forest.

Until spruce began to be lumbered for pulp, many large, defective trees were left in the woods by the lumberman, and even now where pine is lumbered not all the trees are taken. It is well known that defective trees often produce more fruit than those that

are sound. It is a common practice among orchardists, when wishing to remove an old orchard, to girdle the trees a year before removal in order first to secure a large crop. Yet, where lumbering in the mixed forest has been carried on periodically, if a forest is left at all, it is bound to be a hardwood forest.

In the great pine forests of Canada, which the lumberman has cut over even only the second time, the scarcity of young pines is remarkable. If a fire runs over these lumbered forests leaving a sufficient number of seed trees, a larger number of young pines will appear. If, however, this young growth is again soon destroyed by fire it will not reappear in the same abundance, as many of the seed trees will be killed.

In a forest lumbered periodically, the regeneration of White Pine, spruce, and hemlock is, then, largely dependent upon the existence of a good mineral seed bed. In the virgin forest they reproduce on old fallen, rotting pine, spruce, and hemlock trunks, and are found very rarely on the forest floor. The balsam and cedar in the dense forest reproduce somewhat more freely. In places where the light is abundant they do fairly well on the forest floor. The cedar reproduces abundantly from seed in old pasture fields. In the swamps it is frequently regenerated from root suckers.

The hardwoods, especially the maple, birch, and beech, reproduce freely everywhere. The abundant regeneration of these as compared with that of the softwoods is everywhere noticeable. Almost any kind of a seed bed seems to be sufficient for them.

The softwoods are more exacting than the hardwoods in regard to light requirements and are more easily injured by frost. Nurserymen are careful in raising conifer seedlings to see that the plants are shaded from the hot glare of the sun, and that the screens are removed in continued cloudy or wet weather. In the winter the beds are well covered with leaves to protect the plants against the frost. No such careful treatment of hardwoods is necessary. In the forest, then, it is only where the light conditions are good, and sufficient protection is afforded in the winter that the conifers can be reproduced.

But it is not only in the matter of seed bed and light conditions that the hardwoods have the advantage, for they also sprout from the root. Beech roots run frequently above the surface of the soil, and these when wounded, as by the skidding of logs, send

up bunches of suckers. Groups of from two to ten trees of maple, birch, basswood, or in fact nearly any species of hardwoods, can be frequently found growing from the same root. It is common in the woods to see four or five basswood trees thus situated, each more than a foot in diameter. To be sure, such shoots from stumps or root are generally short lived, but they take up the light space, and live long enough to produce seed. To replace a softwood tree that is taken from the forest, another must be grown from the seed ; but when a hardwood tree is removed, many may spring from the root.

In case of fire, the hardwoods, as is well known, have the advantage. The softwoods are more open in structure of wood, have thin bark, especially when young, and are resinous and hence more easily burned. The hardwoods are not easily burned. They are so resistant that a belt of hardwoods is often planted as a protection to the softwood forest.

Since the hardwoods have the natural advantages mentioned, it is evident that if the softwoods are to be maintained or increased in the forest, they must receive artificial advantages. In a mixed forest such advantage might be given by the removal of the hardwoods, leaving the softwoods. This could be done only gradually, for with a rapid removal of hardwoods the softwoods would be overturned by the wind. It is well known, however, that trees adapt themselves to changed conditions when these are brought about gradually, and with a gradual removal of the hardwoods the softwoods would send their roots deeper and become wind firm.

Hardwoods, however, are difficult to remove. They are heavy to handle, and since they float only with difficulty they cannot be sent down the streams. It is only near large cities where firewood is in great demand that the market is strong. Even if they were removed, as the softwoods are very choice of seed bed, the latter would not be reproduced sufficiently without special preparation of the soil. With such preparation of the soil it would not be necessary to depend entirely upon the seed trees upon the ground, but seed might be collected from other trees and sown in the forest.

Perhaps the best artifical advantage that can be given to the softwoods is to raise them in nurseries from the seed, and trans-

plant them into the forest. That this is practicable and can be done at little expense is shown by a plantation of half a million trees, made last spring, in the Adirondack mountains, near Lake Clear Junction, by the New York State Forest, Fish and Game Commission. Over seven hundred acres of land was planted. The total cost, including the purchase of the plant material, was only $2,500, or half a cent a tree.

It is difficult to give a definite statement of cost per acre. The area planted contains marshy places, ledges of rock, logs, stumps, and large bowlders. The more of these, the less, of course, was the cost per acre, as such places had to be skipped in the planting. No two large areas will have the same topography. Any other area of 700 acres would differ considerably from the tract planted, and hence would differ in cost per acre of planting. Perhaps the fairest way to treat the matter is to give the cost per tree, which, as stated above, was half a cent.

It should be stated, however, that this exceedingly low cost is largely due to the fact that the College of Forestry furnished the plant material at less than cost price. Credit is also due the College for being the first to attempt such planting into the brush and to demonstrate its silvicultural success. At Axton, where it planted four years ago in the slash, and at Foresters where, three years ago, a plantation was made in the lumbered forest, it is estimated that 80 per cent. of the plants are still alive.

The choice of land made by the Commission evades the difficulty of removing the hardwoods, as their planting is done on burned lands, of which there are 60,000 acres in the Adirondack Park. Every state has, no doubt, similar areas which afford an excellent opportunity for planting.

A. Knechtel.

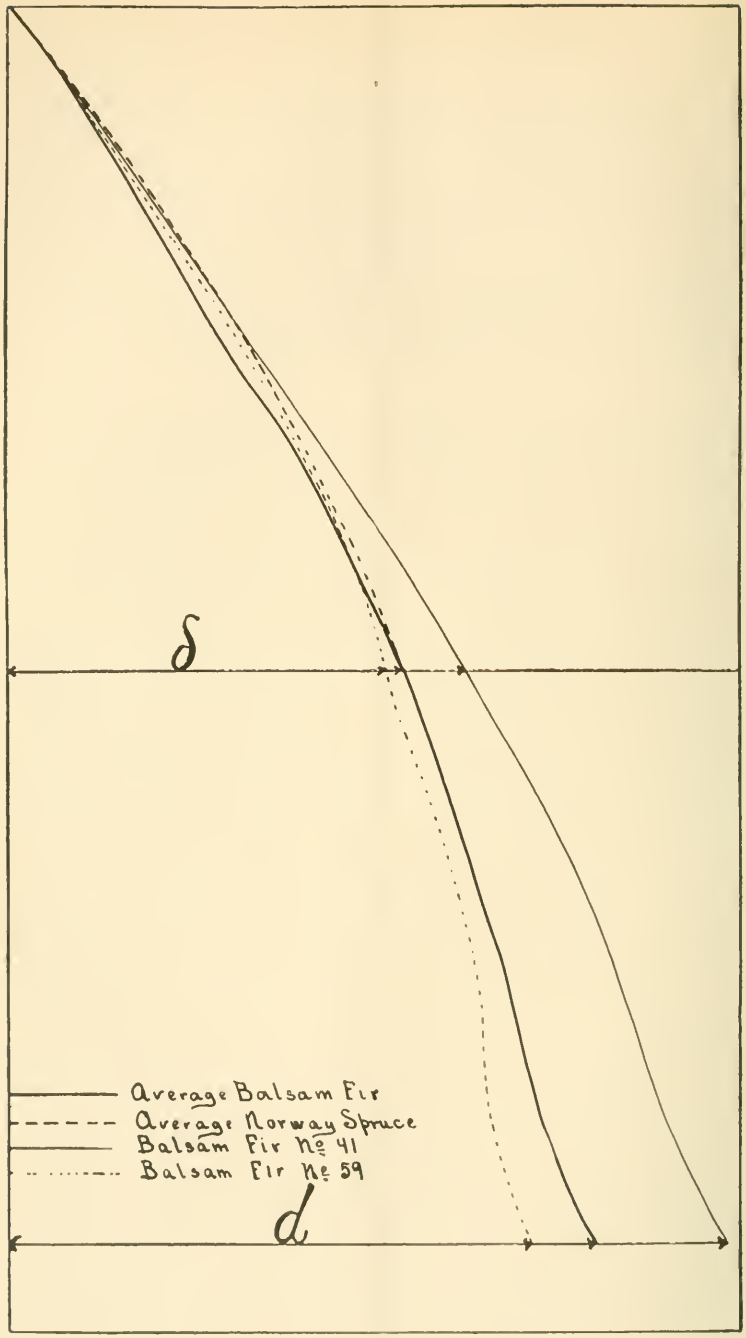
ON THE FORM OF THE BOLE OF THE BALSAM FIR.

Two days leisure on the banks of the Raquette River in the Adirondacks where pulpwood was being cut gave opportunity for measuring the boles of ninety-four Balsam Fir trees. The number is far too small for a satisfactory study, but the results were so suggestive that they are presented here in the hope that someone who has leisure and opportunity may be inspired to take up the task of determining more accurately the constant for this species.

The trees measured grew on a sandy loam of somewhat swampy tendencies on the east bank of the Raquette River, Township 23, Franklin County, New York, at an elevation of about 1600 feet. The trees varied in diameter from 6 to 14 inches, and in height from 50 to 76 feet. A majority were approximately 60 years old, while a minority varied from 45 to 160 years. They were almost all quite sound and of thrifty growth. The measurements were taken in the metric system to facilitate computation, and comparison with the volumes given in Baur's and Schiffel's volume tables of the Norway Spruce. For the purposes of this note the more important measurements have been translated into feet and inches. The stems were measured sectionwise, the sections being two meters long. The diameter was measured at the center of each section by calipering twice at right angles, the average of the two readings correct to the millimeter being taken. The diameter was similarly measured at ¼ and ½ height. Wherever irregularities were met the diameter was taken above and below the point and the mean taken. The total length of stem was noted, also the length of top above a diameter of 4 inches.

The accompanying figure represents graphically the form of the stem of two average and two individual trees. The height of the figure vertically representing the tree height of 65 feet. The diameters are represented on a somewhat larger scale horizontally. The line at the center of the figure represents the middle point of the boles. The curved lines representing the outline of the boles terminate at breast-height which was the lowest point measured.

The heavy full line represents the average form of 14 trees of 65 feet in height. The influence of the enlarged base of the bole (root-swelling) is appreciable at the breast-high point, and gives


δ
d
Average Balsam Fir
Average Norway Spruce
Balsam Fir No. 41
Balsam Fir No. 59

the stem a neiloid form. At a height of about 11 feet this neiloid form changes over to that of the paraboloid which obtains to the top of the tree, becoming to be sure more and more conical as we near the top, but never quite assuming the form of a true cone. Similar average diameter measurements of stems of other heights indicated in each case the same essential features, viz., that the bole above the neiloid portion at the base is fairly cylindrical up to the middle point, and that beyond this it falls rapidly away to a conical form which terminates in a very long slender conical top, averaging, in the 65-foot trees, 16 feet above the 4 inch diameter point.

The heavy broken line of the figure represents the average bole of a Norway Spruce of the same height and the same diameters at breast-high and the middle point.[1] It will be noticed that up to the middle point the variation was so slight that it could not be represented in the figure, but that in the upper half of the bole the Balsam Fir is markedly more conical than the Norway Spruce.

The volume of the bole above the 4 inch point (the unmerchantable portion when cut for pulp) proved to be about 3% of the whole stem in the trees measured. This is noticeably larger than that of the Red Spruce of similar dimensions. As intimated in a previous paper[2] the form factors of all the stems were calculated from the sectional measurements and were compared with the form quotient obtained by dividing the breast-high diameter (d) into the middle diameter (δ) multiplied by 100. The results for the individual trees were classified according to breast-high diameter, height, form factor, form quotient, and age. The facts brought out by this classification will be indicated briefly in the following paragraphs, and while the small number of trees examined must not be overlooked, the results as far as the data went were sufficiently uniform to induce the belief that they are in the main correct.

Form Factor: The average form factor for the 94 trees was 45.7. That it fell with increasing height, as all form factors based on the diameter at breast-high must fall, goes without say-

[1] Form und Inhalt der Fichte : Adalbert Schiffel. Mittheil. a. d. Forstl. Versuchsw. Österreichs. Heft 24. 1899.

[2] Forestry Quarterly, Vol. I., No. 1., p. 11.

ing It also fell with constant heights but increasing diameters, indicating that the more thrifty trees were relatively more conical. This fall in the f was approximately one point for every increase of .8 inch in diameter.

Form Quotient: The average form quotient ($q_{1/2}$) was 67.57. The form quotient was found to be influenced in character and amount in an almost entirely similar manner as the form factor. This will be fully shown by a study of

The Constant: The constant (c), *i.e.* the difference between the form factor and the form quotient, was found to be 21.87 on an average of the 94 trees. Variations in height were without influence upon it as is shown by the following summary :

Height.	*Constant*	*Number of trees.*
Trees under 54 feet.	21.6	3
" 54 to 61 "	21.8	21
" 61 to 67 "	22.	43
" 67 to 74 "	21.3	17
" over 74 "	22.1	10

Variations in diameter were also without appreciable effect. The diameters and their constants are as follows :

Diameter.	*Constant.*	*Number of trees.*
8 to 9 inches	22.2	18
9 to 10 "	22.2	23
10 to 11 "	21.6	23
11 to 12 "	21.0	16
Over 12 "	21.6	8

Variations in age were without effect. The data are as follows :

Age.	*Constant.*	*Number of trees.*
Under 50 years	22.1	10
Between 50 and 60 years	21.2	43
" 60 and 70 "	21.5	9
" 70 and 100 "	21.8	15
Over 100 years	21.8	8

The only consistent variation observed in the c was a gradual rise with the rise of the form quotient and form factor, the former rising slightly more rapidly than the latter, due, apparently, to a relatively more sudden tapering off above the middle point in trees which are more cylindrical in the lower half of the bole. This variation is of practical importance in volume determinations

where the form factors of the sample trees are taken from standing trees by the formula $f = \left(\frac{\delta}{d} \times 100\right) - c$. According to the measurements on these trees, however, the error due to this variation would be less than $\pm$ 2.5%. The figures are as follows :

Form quotient.	*Constant.*	*Number of trees.*
58–60	20.9	2
61–63	21.0	6
64–66	21.3	27
67–69	22.1	32
70–72	22.3	22
73–75	22.9	5

The average constant for the Balsam Fir as shown by this study proves to be practically 21.9 as compared with 21 for the Norway Spruce and 20 for the Scotch Pine. The variation of individual trees from the average was considerable but in no case excessive. The largest c for a single tree was 24.1, the smallest 19.7, indicating a maximum error in volume determinations from form factors derived by formula of less than $\pm$ 6% for individual trees. This error would be greater for the individual trees where the middle diameter is measured in standing trees, but as it is a compensating error it would certainly be inconsiderable where a fair number of sample trees are used.

The two trees of 65 feet height showing maximum variation from the average of the 14 of that height are shown in the figure by a light broken line (No. 59, $c = 23$), and a light full line (No. 41, $c = 20.3$) respectively. It will be seen that No. 41 is a very conical tree (form quotient, 63.6) while with No. 59 (form quotient, 72.4) quite the reverse is the case. This illustrates what has already been said of the c rising somewhat with the rise of the form quotient. I was interested to compare the volume obtained by sectional measuring of 54 of the trees ranging in height from 59 to 69 feet with that obtained by using volume tables built on the older and newer bases. The only tables available for such a comparison are those prepared for the European or Norway Spruce by Baur and Schiffel. Measurement by sections gave a volume of 874.7 cubic feet. Schiffel's tables (based on height, and diameter classes, and the $\frac{\delta}{d}$ relationship) gave 898.7 cubic feet, or an error

of + 2.8%. Baur's tables (based on height, diameter and age classes) gave 1009.8 cubic feet or an error of + 15.4%. The result with Schiffel's tables inspires the suggestion that, where volume tables are wanting these volume tables may be used for any coniferous species without any considerable error where the constant for the species is known.

A partial difficulty was met, however, in that different species may be essentially different in their relative height and diameter dimensions. I found no great difficulty in using Schiffel's tables for the Balsam Fir, but in an attempt to do the same with the Red Spruce I was constantly finding combinations of dimensions for which there was no corresponding volumes worked out in the tables, due to the fact that such combinations do not occur in the Norway Spruce. For example, a Red Spruce cut on Moose Mt. gave the following measurements: height, 21 meters; diameter, 41 *cm*; $q_{1/2}$, 74. On referring to Schiffel's table (p. 111) I found that he gave volumes for trees of 21 meters height and a form quotient of 74 but only for diameters from 17 to 27 *cm*!

JUDSON F. CLARK.

Since the above article was sent to the printer a kind friend has expressed the opinion that the reader has not had a sufficient explanation of the character of Schiffel's volume tables to appreciate my suggestion that they might be used for our species, provided the constant for the different species were determined. I shall therefore review and add a few words to the explanation given in my previous paper.

The data for these tables were obtained by very careful section-wise measurement of 2529 stems of Norway Spruce. These measurements were classified according to height, diameter at the middle point, and diameter breast-high. From these data curves were drawn enabling the investigator to correctly average his results and to interpolate for dimensions which were not met in the preliminary taking of the data. From these curves a series of tables were constructed from which the volume of any tree of known height, form quotient, and breast-high diameter might be readily read off without calculation.

The individual trees of any species vary greatly in form, but it stands to reason that if two trees of the same species measure the

same at breast-high and at the middle point of the bole, and are of the same height *they cannot vary greatly in volume.* This third factor, the relative diameter at the middle point, is the basic principle which separates these tables from all others. It is this which makes the same table applicable to stands of all ages and grown under all silvicultural conditions, notwithstanding the fact that changes in environment and development may produce changes in the form of the bole which result in variations of over 20% in the cubic content of stems having the same height and breast-high diameter, and grown side by side in the same stand. Some of the trees from various causes or combinations of causes are in any stand much more cylindrical than their neighbors. If, however, we look for the volumes of two trees, varying essentially in form of bole in Schiffel's tables the larger diameter at the middle point places the more cylindrical tree in a very different table from that used for its conical neighbor.

Another point in this connection might bear repeating and addition. So far as the constant has been determined for the different species it has been shown to be remarkably uniform. That for the Scotch Pine in Europe is 20, Norway Spruce 21, European Beech 22 to 23, Balsam Fir, so far as examined, 21.9. I have also examined a few trees of Hemlock, Tamarack, Red Spruce, White Cedar, and Pitch Pine (*P. rigida*) all of which indicated a constant not greatly differing from that of the Norway Spruce. 37 trees of White Pine, averaging 260 years old and about 143 ft. in height gave by far the highest result, viz., 24. This high constant in this case was due to the excessive enlargement at the base of the boles shown by the trees studied, and is probably an extreme case. In any event, *the constant being known*, it is a simple matter to determine the per cent. which must be added to or subtracted from the volume read from the tables for any given species to get the correct content.

The enlargement of the tables so as to provide for all combinations of dimensions which may be met in field work with our eastern conifers is a large task. My studies in interpolation by means of curves where necessary has led me to believe that it is possible that a solution of the problem lies in this direction, very satisfactory results having been obtained in interpolating for the Red Spruce and the White Pine.

J. F. C.

CURRENT LITERATURE AND REVIEWS.

Annual Report of the Commissioner of the General Land Office. Pp. 120.

Much information of interest and value regarding the forest reserves is contained in this report.

Complete lists of the forest reserves are given, together with their areas, the state or territory in which they are situated, and the per cent of its total area which they cover.

The area* of sixty million acres comprised in the fifty-four reserves is entirely in the region west of the 95th meridian; it is distributed through a great variety of conditions; in climate, from the excessive humidity of the Pacific slope to the aridity of the southwestern deserts; in timber, from the magnificent volume of the firs and spruces of Washington to the dwarf cacti of Arizona. These reserved areas should, both directly and indirectly, prove of great value to the nation.

The great step of making these reserves having been taken, there must follow two greater ones: that of maintaining them and that of properly utilizing them.

The force of rangers employed in protecting the reserves varied during the past year from 425 to 124. To expect such a force to protect 60,000,000 acres is nothing less than hopeless.

Concerning the utilization of the reserves, with little exaggeration it may be said that the government receives no direct profit from them; only sixty-six million feet, board measure, and sixty-six thousand cords of wood having been sold, or in all less than one-quarter the amount yearly taken from the Adirondack region. On only one reserve, that of the Black Hills does an established system of timber sales exist. Indirect profit ensues from the utilization of the reserves for grazing; yet the people as a whole should not be expected to maintain, at their expense, grazing grounds for the free use of a few.

* Since the publication of this report the following additional reserves have been created:

St. Mary Forest Reserve, Montana	1,800,000 acres
Chippewa Forest Reserve, Minnesota	200,000 acres
Kootenai Forest Reserve, Montana-Idaho	1,276,000 acres

The government policy of donating public lands to wagon road and railroad companies is still being actively pursued ; on page 53 the following statement is made :

"There have been certified and patented during the fiscal year ended June 30, 1902, under the several land grants made by Congress to aid the construction of railroads and wagon roads 5,008,-132 acres of land, an increase as compared with the preceding year of 2,371,780 acres."

The Hon. Binger Hermann, Commissioner of the General Land Office, in summary makes a number of recommendations, of which the following have special interest :

4. Renews recommendation of a repeal of existing laws with regard to timber on the unreserved public lands, and the passage in their stead of a general law which will provide ample protection for the forests and at the same time furnish a means by which monopolies, settlers, miners, and others may secure a sufficient supply of timber for their legitimate needs.

5. Recommends larger appropriation for an increased number of special agents for the prevention of depredations upon public timber and protection of the public lands from unlawful entry or appropriation.

6. Renews recommendation of a change in the law providing for an exchange of lands embraced in forest reserves held by private owners for public lands not in reservation, so as to secure an approximation in value of the lands relinquished with those selected in lieu thereof.

Message from the President of the United States: transmitting A Report of the Secretary of Agriculture in Relation to the Forests, Rivers, and Mountains of the Southern Appalachian Region. Pp. 208 ; Pl. 78.

This report is the result of extensive investigations authorized by the last Congress. It includes the following subordinate reports of independent investigators: Forests and Forest Conditions in the Southern Appalachians, by H. B. Ayers and W. W. Ashe ; Lumbering in the Southern Appalachians, by Overton W. Price ; Description of the Southern Appalachian Forests by River Basins, by H. B. Ayers and W. W. Ashe ; Trees of the Southern Appalachians, by W. W. Ashe and H. B. Ayers ; List of Shrubs of the Southern Appalachians, by W. W. Ashe ;

Topography and Geology of the Southern Appalachians, by Arthur Keith ; Hydrography of the Southern Appalachians, by H. A. Pressey and E. W. Myers ; Climate of the Southern Appalachians, by Alfred J. Henry.

The Conclusions of the Secretary of Agriculture are summarized as follows in his report :

"1. The Southern Appalachian region embraces the highest peaks and largest mountain masses east of the Rockies. It is the great physiographic feature of the eastern half of the continent, and no such lofty mountains are covered with hard-wood forests in all North America.

"2. Upon these mountains descends the heaviest rainfall of the United States, except that of the Pacific Coast. It is often of extreme violence, as much as 8 inches having fallen in eleven hours, 31 inches in one month, and 105 inches in a year.

"3. The soil, once denuded of its forests and swept by torrential rains, rapidly loses first its humus, then its rich upper strata, and finally is washed in enormous volume into the streams, to bury such of the fertile lowlands as are not eroded by the floods, to obstruct the rivers, and to fill up the harbors on the coast. More good soil is now washed from these cleared mountain-side fields during a single heavy rain than during centuries under forest cover.

"4. The rivers which originate in the Southern Appalachians flow into or along the edges of every State from Ohio to the Gulf and from the Atlantic to the Mississippi. Along their courses are agricultural, water-power, and navigation interests whose preservation is absolutely essential to the well-being of the nation.

"5. The regulation of the flow of these rivers can be accomplished only by the conservation of the forests.

"6. These are the heaviest and most beautiful hard-wood forests of the Continent. In them species from east and west, from north and south, mingle in a growth of unparalled richness and variety. They contain many species of the first commercial value, and furnish important supplies which can not be obtained from any other region.

"7. For economic reasons the preservation of these forests is imperative. Their existence in good condition is essential to the prosperity of the lowlands through which their waters run.

Maintained in productive condition they will supply indispensable materials, which must fail without them. Their management under practical and conservative forestry will sustain and increase the resources of this region and of the nation at large, will serve as an invaluable object lesson in the advantages and practicability of forest preservation by use, and will soon be self-supporting from the sale of timber.

"8. The agricultural resources of the Southern Appalachian region must be protected and preserved. To that end the preservation of the forests is an indispensable condition, which will lead not to the reduction but to the increase of the yield of agricultural products.

"9. The floods in these mountain-born streams, if this forest destruction continues, will increase in frequency and violence and in the extent of their damages, both within this region and across the bordering states. The extent of these damages, like those from the washing of the mountain fields and roads, can not be estimated with perfect accuracy, but during the present year alone the total has approximated $10,000,000, a sum sufficient to purchase the entire area recommended for the proposed reserve. But this loss can not be estimated in money value alone. Its continuance means the early destruction of conditions most valuable to the nation and which neither skill nor wealth can restore.

"10. The preservation of the forests, of the streams, and of the agricultural interests here described can be successfully accomplished only by the purchase and creation of a national forest reserve. The States of the Southern Appalachian region own little or no land, and their revenues are inadequate to carry out this plan. Federal action is obviously necessary, is fully justified by reasons of public necessity, and may be expected to have most fortunate results."

The bill for the founding of the Appalachian Reserve which was so strongly pushed in Washington last year will undoubtedly be passed this winter. The founding of the proposed Reserve will mark a new epoch in the forestry history of this country. Rational forest management inaugurated here will undoubtedly react favorably on the management of the Western Reserves.

Economics of Forestry. By B. E. Fernow. Thos. Y. Crowell & Co., New York, 1902. Pp. 520. 8°. Price, $1.50.

This "reference book for students of political economy and professional and lay students of forestry," one of a series in the publishers' Library of Economics and Politics, comes just from the press as the *Quarterly* goes to the printer. We can, therefore, only give this brief notice of its appearance and of its contents.

The subject is discussed in 12 chapters: First comes an introductory chapter: The Relation of the State to Natural Resources. The second chapter: The Forest as a Resource sums up the character of this national asset "which is second only to agriculture in its importance." The other chapters are: The Forest as a Condition; Forest and Forestry Defined; Factors of Forest Production and Business Aspects; Natural History of the Forest; Methods of Forest Crop Production: Silviculture; Methods of Business Conduct: Forest Economy; Principles and Methods of Forest Policy; Forest Policies of Foreign Nations; Forest Conditions of the United States; The Forestry Movement in the United States.

An appendix of 78 pages adds a large amount of statistical information, in which the whole book abounds; and 17 pages of bibliography, with special reference to American literature, with a full index, completes the book.

The publishers introduce the volume with a reference to President Roosevelt's expressions regarding the vital importance of forest supplies, and with the statement that Dr. Fernow "has here gathered together more facts on this great subject than were ever before presented within the covers of a single volume," which the author in the preface claims to be the first of its kind in the English language. In this claim the publisher and author have perhaps not given full credit to H. Doc. 181, by the same author, which hitherto could claim that position.

The author having been for twelve years in charge of the Federal Forestry Division in Washington during the period of its gradual development, which has made its present expansion into a Bureau possible, and as an active officer of the American Forestry Association during its entire history of existence, has had unusual opportunities to speak from personal observation and active participation in the development of these policies.

Monographia del Castagno.[1] By Lodovico Piccioli ; Chief Director of the Forests of Siena. Pp. 178, Fig. 60.

The most comprehensive work on chestnut culture for the fruit that has yet been published.

It is especially apropos and valuable in this country because of the increasing importance of chestnut culture and the work being done in New York and Pennsylvania on the subject.

It contains chapters on: The Structure of the Wood ; The Origin of the Cultivated Varieties ; Distribution ; Silvicultural Characteristics ; Its Requirements ; Collection and Keeping of the Fruit ; Coppiceing and Grafting ; Nursery Practice ; Sowing and Planting ; Mature Woods ; Utilization of the Fruit ; Diseases.

A Manual of Forest Engineering for India. By Charles Gilbert Rogers. Vol. II. Office of the Superintendent of Public Printing, Calcutta, India. Price, six shillings. Pp. 256. Fig. 118.

Volume II of the Manual of Forest Engineering for India contains an extensive treatise on road and bridge construction applicable in forest work. The subjects are treated in a practical as well as a theoretical way. The application of the principles given would in no way be confined to India.

The work is the best of its kind that has appeared in English. It will prove of great value to the managing forester.

Report of the Third Annual Meeting of the Canadian Forestry Association. 1902, Pp. 128.

The minutes and the papers read at the meeting are printed in this report. In the discussions a number of points of interest to Canadians were touched upon.

Thomas Southworth, Director of Forestry for Ontario, brings together much matter regarding the timber laws and the public forest lands.

Austin Cary, Forester to the Berlin Mills Company, in a paper[2] read before the meeting, gives some valuable information on conservative lumbering of spruce ; from which we make the following selections :

[1] Castanea sativa Mill.

[2] The Management of Pulpwood Forests.

"As for conservative cutting of spruce woods, I will say first and most emphatically that we find it a difficult and risky process, one that is likely to bring more loss than gain unless done with great care and considerable skill. It may be different in other countries, but that is the case here. Our timber is typically large and tall; much of it stands in exposed situations, on ridges and mountains; much is on extremely rocky land. The winds are constantly damaging our native uncut stands, and the thinning of woods in all such places as above is either entirely impracticable or must be done with the greatest caution to insure that what is left standing will not blow down."

"According to my observation a logging boss trained to hard cutting when told that we wish to cut conservatively is pretty sure to leave what he does leave not in the shape of small growth so much as in strips of scattering timber and odd corners on rough and difficult ground. This makes the logging show up cheaper, but it may be, on the other hand, that what is left standing is the very stuff that most needs cutting of any on the land. In other words as a first result instead of thinning or conservative cutting we are apt to get simply slack cutting.

When this has been corrected and the man gets a better notion of what we are about, his next move is to leave the small growth uniformly all over the land. This may do in some countries, but it means loss here. Tall and slender trees left too open, anything less than a full stand on divides and knolls, tall timber shoally rooted on rocky land, these items together may amount to a good deal in a logging job and all of them are such that sooner or later they are sure to blow down."

And, finally, this passage is worthy of note, not merely for its bearing on this particular problem but as a general opinion of one of our most successful practitioners:

"What has been lately written gives a clue to the motive for conservative cutting as we practice it. We have not settled down to the European idea of sustained yield, of running a business of a certain volume for ever from a given tract of land. Whatever has been said, I do not believe that any business concern in the United States, knowing what it means, has settled on that. The reason is that we have large tracts of timber that badly need cutting, and the sooner we can get over them, saving the dead and declining stuff and putting them in shape to grow, the better it will be. This is the chief motive, and, balanced by considerations of cost and practicability, is the key to our operations along this line. Of course, expected growth is a consideration as far as it is not offset by windfall. Then we believe that in the future better stumpage can be had on the smaller classes of timber."

Mr. Cary takes a radical stand, and, contrasted with that of other investigators under similar, almost identical conditions, it is a startling one. Undoubtedly what our woods now need is less theory and more practice, less poor measuring, more good silviculture.

Report of the Director of the Experiment Farms, Department of Agriculture, Canada, 1901.

In this report will be found a short account of the experiments in tree planting on Sable Island, an attempt at the fixation of shifting sands.

Report of the Connecticut Board of Agriculture 1901. Pp. 320.

In this report are reprinted two interesting addresses before the Agricultural Convention :

Forestry for the Farmer, by Walter Mulford, State Forester, and The Yale Forest School and Its Purposes, by Henry S. Graves, Director of the Yale Forest School.

Special Report of Capt. George P. Ahern, in Charge of Forestry Bureau Philippine Islands. Government Printing Office, Washington, D. C., 1901. Pp. 60, Pl. 33.

This report gives an excellent idea of the forest and lumbering conditions in the islands. The forest service consists of the officer in charge and the following assistants ; four Foresters at $200 per month, four Inspectors at $150, ten Assistant Foresters at $50, thirty Rangers at $30, a Chief Clerk at $100, a Botanist at $100 and a Translator.

All timber cut on public land is cut by license. Each shipment of forest products must be classified, measured, and orders of payment issued, all of which requires considerable training, inasmuch as one hundred and sixty varieties of native tree species are received in the market, not to mention many varieties of dyewoods, gums, resins, etc., with all of which the official must be thoroughly acquainted and able to promptly classify and appraise ; this in addition to his duties in charge of the forests of his district, running his office, and instructing ignorant native loggers in the rudiments of the forestry regulations.

Each shipment of forest products is inspected by a forestry official and each log stamped with the Bureau mark. A manifest

is made and a copy sent to Manila. The manifest shows the name of the licensee, location of cutting, dimensions and value of each log cut, and the name of the tree species. A glance at this copy in Manila shows whether the regulations are being followed.

Under the Spanish administration licensees cut what they pleased. Trees to be felled were not selected, no minimum size was prescribed, valuable rubber and gutta percha trees were felled, and the most valuable woods used as fire wood.

The Philippine Islands contain about seventy million acres, of which about fifty million are covered with forests. In the neighborhood of densely populated centers and along the main travelled routes timber is scarce. More distant from these sections "vast virgin forests are met with, rich in valuable hardwoods, dyewoods, gums and other products." In the southwestern islands the virgin forest extends from the water's edge to the topmost summits of the mountains.

The number of tree species in the islands is astonishing to the American and marvellous to the European; six hundred and sixty-five have already been listed, one hundred and sixty are in common use. The qualities and values of these woods vary greatly.

For purposes of sale the government has classified these into six groups, the prices, in Mexican money per cubic foot, paid for state timber in these groups is as follows: Superior, 14 cents; First, 10 cents; Second, 8 cents; Third, 3 cents; Fourth, 2 cents; Fifth, 1 cent. Only groups three, four and five may be cut for fuel.

The present output of native timber is entirely inadequate to supply the home market, and large quantities are imported. The prices current in Manila for superior and first group woods are $1.50 to $6.00 Mexican per cubic foot. Rough lumber brings from 25 to 50 cents Mexican per running foot.

Timber: A Comprehensive Study of Wood in all its Aspects. By Paul Charpentier, translated from the French by Joseph Kennel. Scott, Greenwood & Co., London. 1902. 8°. Pp. 437.

The dearth of English books on forestry in general, and especially on specific branches, leads us to look with eager anticipation at the announcement of any such work.

"Timber: A Comprehensive Study of Wood in all its Aspects," is the ambitious and rather misleading title of a new book treating on various branches of forestry.

Part I is devoted to a brief study of the histology of woody stems, and also includes some notes on the chemical composition and physical properties of wood. Part II is a brief description of the timber trees of the world, partially illustrated, and with notes on their value from silvicultural standpoints. The taxonomy is very antiquated, and in many cases the specific and even generic name is omitted. The list of timber trees given is extremely incomplete; for example, only two American pines (Pinus rigida and Pinus strobus) are mentioned.

In Part IV is a chapter on silviculture, and one on exploitation, and a review of the forests and forest resources of all countries of the world. The forests of Europe and of the French colonies receive the most attention. In speaking of America the author announces that a discussion of the forests of the whole continent would carry him too far and therefore he limits his remarks to the forests of the State of Maine. One quotation is perhaps sufficient to indicate the general accuracy of this effort. "Planks about 100 feet long and 6½ feet broad without a single knot are current merchandise. The planks are obtained from giant fir trees. The forests producing these firs are so vast that, although saw mills of the neighborhood have sold 500,000,000 feet of lumber per year for the last ten years, the voids made by this vast consumption hardly seem to have left any trace beyond the formation of forest paths."

Part V devotes some sixty pages to the decay of wood and methods of prevention, and to the fireproofing of timber. On page 304 we are informed that the most essential cause of alteration in wood is found in the "great affinity of its carbon to oxygen, an affinity which is favored by alternations of dryness and dampness" and which finally results in "the conversion of the timber into a greyish or brownish powder"!

Part VI is devoted to the various applications of timber and other forest products. The chapters on gums, resins, tannin, dyes and similar products are by far the best in the book, and are the redeeming feature of a work that is chiefly characterized by vagueness, inaccuracy and abominable English.

Leitfaden für schweiz. Unterförster- u. Bannwartenkurse. By Dr. Franz Fankhauser. 1 Teil. Einleitung, Standortskunde, Forstbotanik und Waldbau. Pp. x+182. Ill. Bern, 1902.

A handy manual of practical forestry containing brief definitions and notes regarding the forests and forestry of Switzerland but with little of direct interest to us. It is practical forestry condensed for the use of Swiss underforesters.

The chapter on Site we find of more than local value and it is interesting to note the method of treatment. It is in the chapter on Forest Botany, however, that the author excites our envy. If only we had such descriptions of a half-hundred of our principal timber trees with such emphasis on their silvicultural requirements and possibilities as are here given in concisest form for the Swiss species how much better could the young forester orient himself in silviculture!

The chapter on Silviculture proper deals too much with details of practices which are as yet too expensive for our conditions.

Proceedings of the Academy of Natural Sciences of Philadelphia. Vol. LIV. Part II.

Contains a paper, Two Fungus Diseases of the White Cedar, by John W. Harshberger, Ph.D., which gives an extensive account of the injury done to the white cedar in the swamps of New Jersey by *Gymnosporangium biseptatum* and *G. Ellisii*.

The Woodsman's Handbook, Part I. By Henry Solon Graves. Bulletin No. 36, Bureau of Forestry. Pp. 148, Pl. 1, Figs 15.

The major part of this handy little volume is taken up by a comparison of the 43 different log rules in use in the United States and Canada. The tables give the log diameters in even inches from six to sixty, and the corresponding volumes for 12, 16, and 20 foot logs. A short history and description of the method of volume determination is given for each rule. The Scribner, Doyle, New Brunswick, Nineteen Inch Standard and the Twenty Four Inch Standard rules are given in full.

A number of handy tables for the reduction of logs to square timbers, for cubic contents of logs, for cordwood measurements etc., are included. The remainder of the volume is occupied by

more or less rough volume tables of the commoner Eastern species and short accounts of various field operations and instruments. If this handbook does nothing else than bring before the trade the incongruities existing in the log rules it will have served a worthy purpose.

Among Green Trees. By Julia Ellen Rogers, A. W. Mumford, 1902. Pp. 202, 8°, $3.00.

This elegant and beautifully illustrated volume does not pretend to be more than a popular book, we nevertheless give it a mention here because it is the first in the English language to dwell at length upon the physiology and phaenology of tree life.

Although written in a pleasing style and with a good general knowledge of tree life, there are unfortunately to be found in it many of the half-truths, inaccurate and even incorrect statements, which characterize most popular books quite unnecessarily.

The Lumber Trade Journal, of New Orleans.
December 1st.

The *Journal* makes the following comment on the departure of thirty-six men of the Bureau of Forestry to make a working plan for the Kirby Lumber Company of Texas.

"The Kirby interests include timber largely *en masse* and of a character, both in extent and physical aspect, to invite scientific manipulation and assure the very best attainable results.

Upon the part of the holders of less formidable tracts, there is no perceptible disposition to apply similar treatment, and the prospect for anything like a general adoption of the Kirby policy is accordingly unpromising. In ordinary or typical cases, the *Journal* hears of no similar action in the South and expects to hear of practically none in the future."

Allgemeine Forst- und Jagd-Zeitung, 1902.
Ueber Registrierkluppen. By Dr. U. Müller. Pp. 262–266.

A brief discussion of the development of self-registering calipers from the beginnings of Wolf in 1850, serves as introductory. The body of the paper is taken up with a comparison of the advantages and disadvantages of self-recording calipers in general, and of the three makes known as Hirschfeld's, Wimmenauer's and Hohenadl's.

Among the disadvantages of a general character may be noted the necessity of calipering the mixed stand once for each species, an objection which will for a long time preclude the introduction of such calipers into work in this country. The impossibility of checking the results obtained by the use of this instrument as well as the added weight the recording apparatus brings in are items to be considered.

Revue des Eaux et Forêts.
October 1st.

Une Invasion de Pissodes. By E. Henry. An account of an insect (*Pissodes notatus*), destructive to young pine plantations. Under the heading, Chronique Forestière, an account of the annual continental trip of the English Arboricultural Society is given.

November 15th.

Conservation des Bois par l'Électricité. By Raymond Brunet. A description of a process of wood preservation by means of an electrical injection of a saline solution in the wood tissue.

Lesnoy Journal.
July-August.

Statistical Investigations of the Administration of the Public Forests for the last thirty-three years (1868–98). By G. Daniel-Bekow. Pp. 675–770.

Observations on the Life and Activity of a new Bark Beetle (*Tomicus vorontzovi*). By A. Vorontzov.

NEWS AND NOTES.

THE PROPOSED APPALACHIAN RESERVE.

The *Lumber Trade Journal* of New Orleans in an editorial of November 15th, has the following to say regarding the project of the Appalachian Forest Reserve :

"A systematic campaign is on foot to induce the federal congress to provide a fund for the future national control of what is proposed to be called the Appalachian Forest Reserve, embracing portions of the Carolinas and Tennessee. In a report to the president of the United States by the Hon. James Wilson, sec etary of agriculture, covering a topographical description of the region in question and its physical aspects, the following conclusions are made :

"The preservation of the forests, of the streams and of the agricultural interests here described can be successfully accomplished only by the purchase and creation of a national forest reserve. The states of the Southern Appalachian region own little or no land, and their revenues are inadequate to carry out this plan. Federal action is obviously necessary, is fully justified by reason of public necessity, and may be expected to have most fortunate results.

"The 'public necessity' relied upon to procure the desired legislation has relation principally to the effect of such contemplated preservation upon the streams as a means of preventing further devastation of the adjacent slopes and valleys under cultivation by floods otherwise sure to afflict that region. The report under review estimates losses to farmers from floods along the streams traversing the Appalachian quarter as having approximated $10,000,000 in a single year. From this alleged circumstance it is inferred that the devastation thus wrought has accrued from the previous cutting off of timber from lands drained by these streams.

"Whether the exigency recited in the report is of a character to warrant the public expenditnre recommended or not, the positive facts in the premises do not appear upon the face of the document under review to be sufficient.

"If, as recited, the damage from floods during the "present year" has amounted to $10,000,000, how much of it is due to

previous denudation, or, in other words, how much would it have been had the forests never been disturbed at all? Is it a clearly demonstrated fact that the preservation of Appalachian forests would cure the streams of that or any other region of a habit of overflowing their banks and causing damage?

"The *Journal* is declaring no unfriendliness to the movement at all, but like others interested in it, this paper would like to see any hidden or weak or ambiguous or otherwise defective feature of the case made clear before it is sent to Congress for final legislative disposal."

The Appalachian Forest Reserve project is certainly a good one.

The floods which arise in the region damage the low-land country. The succeeding dry season threatens the prosperity of the industries dependent on water power. The deplorable condition of the inhabitants itself demands remedy. The misuse of the land as a timber producer calls for prevention. The timber famine, which the last census shows to be in the near future, all these are reasons which make it imperative that the region be in government possession.

It is, however, not only important that the government secures this region, but that when secured it be put under proper management.

It is the intention of the promoters of this new reserve project to have it put under the management of the Bureau of Forestry of the Department of Agriculture, under the implication that it is to be used as an experimental area.

If it is to be an experimental area it should come under the direction of the Department of Agriculture. Yet is not four million acres rather large to experiment on, when one hundred thousand would do as well?

As a forest reserve with similar functions to the other reserves precedent undoubtedly decrees that it be under the management of the Department of Interior. But since the General Land Office service is almost entirely composed of political appointees, and the Bureau of Forestry of the Department of Agriculture, as a scientific body, is of men with professional education, the likelihood is that the area would be best managed by the latter.

THE FORESTRY, WATER STORAGE, AND MANUFACTURING ASSOCIATION OF THE STATE OF NEW YORK.[1]

The membership of this new organization is worthy of notice; it is entirely composed of men with timber and mill interests in the Adirondacks, practically every lumber firm of any importance being represented. The effect that this associotion will have on future legislation remains to be seen.

An association with similar professed purposes already exists as the Association for the Protection of the Adirondacks; it on the other hand is composed of men interested in the region for its aesthetic value, owners of camps and sporting clubs. Between the two it should be possible to place the Adirondack interests upon a proper practical basis.

PHILIPPINE NOTES.

Mr. Gifford Pinchot and Capt. Geo. P. Ahern, in charge of the Bureau of Forestry, P. I., are making a tour of the archipelago on the Gen. Alava, put at their disposal by Governor Taft.

R. C. Bryant, Cornell '00, has been made Assistant Chief of the Bureau.

Wm. Klemme, Cornell Sp., has been advanced to the grade of Forester.

W. W. Clark, Cornell '02, in the absence (because of injury) of Mr. S. T. Neely, formerly of the U. S. Division of Forestry has had charge of the wood testing department.

Mr. S. M. Higgins a special student in the New York State College of Forestry has been appointed forester to the Cleveland Cliffs Iron Co. This is a very large and influential company in northern Michigan which owns in addition to large iron and railway interests, one million acres of woodland. It employs large number of Finnish wood choppers to supply the wood for the charcoal used in smelting the iron ore. Mr. Higgins will operate on Grand Island, a beautiful piece of land near the town of Munising and the famous Pictured Rocks. Although the island

[1] See Forestry and Irrigation. Vol. VIII. No. 2. November 1902.

is at present densely wooded and inhabited only by light-house keepers and employees of the company it is destined to become a resort of as much importance to the people of Chicago and other cities as the Adirondacks are to New York. He will have charge of the general forestry work, fish and game preservation, road construction and other works which will add to the value and attractions of the island.

"STUMP ANALYSIS."

A practice of doubtful utility which has recently been noticed in forest investigations under a term conveying an entirely erroneous impression is "stump analysis."[1] Compared with stem analysis, to which it would seem related, this process of ascertaining accretion on weathered stumps is entirely worthless. To be sure diameter and area accretion curves of single trees may be so obtained, but as these measurements are necessarily taken at varying heights, the heights of the stumps, they cannot be readily compared *inter se* and will not furnish curves for the stand.

But especially are the curves so obtained of little value as the data come from the very part of the tree least fitted for use as representative, for here irregularities due to accidental injuries—shading, etc.—as well as to normal root-swelling and fluting are most pronounced. These irregularities have been carefully worked out for the White Pine and very instructive comparisons of curves derived from the stump section (2½ ft. from ground) with curves from higher sections are made in the monograph on the White Pine.[2] Stumps may be of great value to the cruiser as indices of soundness, etc., for estimating adjacent stands, but plans for the future must rest on a firmer basis than such data can ever furnish.

[1] Duncan, T. L. Report on the Forest Conditions of the Pillsbury Donation. Pp. 23. Maps, Plates. St. Paul, Minn., 1902.

Hawes, A. F. A Plantation of European Larch. Forestry and Irrigation. Vol. VIII, Pp. 472. (Nov. 1902.)

[2] The White Pine. By V. M. Spaulding; revised and enlarged by B. E. Fernow. (Bull. No. 22. Div. of Forestry.) Washington, 1899.

See Appendix, Table V, Pp. 107–116.

SEED COLLECTING.

The Division of Forest Extension, Bureau of Forestry, during the past season, has been collecting seeds in various parts of the West. The work has been carried on to increase the knowledge of the subject, learning of available localities, of methods of picking the cones, extracting the seeds, etc., and primarily to obtain seed for use in the newly established nursery at Halsey, Neb., and in the San Gabriel and San Bernardino mountains. It is hoped that the details of the experiences will not be withheld from the profession.

The following table gives the quantities of seeds collected :

Species.	Quantity in pounds.	Region where procured.
Pinus lambertiana	45	California.
" ponderosa	30	California
" "	120	Rocky Mountains.
" "	84	Pine Ridge, Neb.
" "	11	Oregon.
" attenuata	135	California.
" edulis	28	Rocky Mountains.
" divaricata	18	Brainerd, Minn.
" "	20	Walton, Mich.
Libocedrus decurrens	50	California.
Juniperus virginiana	14	Rocky Mountains.
" "	190	N. Platte River, Neb.
Abies concolor	1	Rocky Mountains.
Picea parryana	32	Rocky Mountains.

The Forest, Fish, and Game Commission of New York this fall collected a large quantity of Red Spruce seed for use in the State nurseries in the Adirondacks and the Catskills. The collections were made at Fulton Chain, Hamilton Co,, from the fallen tops on the lumber jobs.

Three methods of gathering were pursued : namely, by picking the individual cones, by cutting the small twigs and whipping the cones off over the side of the collecting pail, and by stripping, the picker standing at the tip reaching back on the branch with one hand on each side, and stripping the cones off into the pail. The success of the different methods depends on the number of cones on the branches.

Two hundred bushels of cones were collected, they yielded 375 pounds of seed, or nearly 2 pounds of seed per bushel of cones; as there are about 120,000 seeds to a pound, in all 45,000,000 seeds were obtained. Fifty-eight bushels were collected by day labor at an average cost of $.87; 142 bushels were collected, payment being made by the bushel, at an average cost of $.75, giving an average cost for the 200 bushels of $.78.

The expense of cartage and drying of the cones and extraction of the seeds brought the final cost up to $1.78 per bushel, or $.95 per pound of seed. This is remarkably cheap, the price quoted by a large seed dealer being $3.00 per pound.

The results of an experimental planting made by the U. S. Division of Forestry in 1890 on the sandhills of Nebraska seems to have proved, that the Banksian Pine, *Pinus divaricata*, is one of the best adapted species for planting in arid conditions.

The *Forestry Quarterly* is in position to direct any intending purchasers of seed of this species to a reliable source of supply at reasonable prices.

CONTENTS.

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FORESTRY QUARTERLY

THE OBJECTS FOR WHICH THIS JOURNAL IS PUBLISHED ARE:

To aid in the establishment of rational forest management.

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

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

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FORESTRY QUARTERLY.

VOL. I. APRIL, 1903. No. 3.

FORESTRY AT AN AMERICAN AGRICULTURAL EXPERIMENT STATION.

"We are haveing trouble with our hens throats swoollen sneezeing have lost 4."

Such was an appeal for help addressed to the writer as forester of the Connecticut Agricultural Experiment Station. Perhaps it did not strike so much wider of the mark than such communications as these, which are very common: "Kindly send to my address full information regarding the forestry laws of the highway protecting shade trees against trolley companies"; and "Can you not give some of your attention to beautifying our rural school grounds?"

Hens' throats, shade trees and school grounds unquestionably are important. But their care is not forestry.

Connecticut's woodlands and idle lands are almost exclusively owned in relatively small tracts, ranging from ten to four hundred acres each.

The importance of the small wood-lot as a factor in American forestry is recognized. Woodlands held in small parcels form in their aggregate such a considerable proportion of the forest area of the country, and furnish materials of such great total value, that forestry for the farm cannot fail to play an important rôle in the future.

Every forester knows that these wood-lots are not yielding anything like what they would yield if a reasonable amount of care and skill were employed in their management. The complaint so commonly heard among farmers and other owners of small

timber lots, that this part of their property is a detriment to them, is undoubtedly often true. But they would make the same complaint of their gardens if they left them also to Nature's erratic care. In the latter case, no one would feel pity for the "shiftless" owners. It seems to be difficult for a layman to grasp the idea that Nature must be improved upon in the wood-lot as well as in the garden.

The problem involved in the management of a wood-lot located comparatively near market is essentially different from that of the remote and extensive mountain area. A Connecticut farmer would be justified in entering into a degree of *finesse* in his silvicultural operations which would probably be impracticable at present to the American forester at work in a mountain region, where the margin of profit in handling timber is relatively small. On the other hand, the carefully developed working-plan for the mountain area, necessitating perhaps many series of compartments for the proper execution of the ideas involved, requires to be radically changed when it is applied to the small forest of an agricultural region. Under exisiting American conditions the one appears to be largely the problem of extensive supervision ; the other, that of intensive detail. It is the Dakota wheat farm as contrasted with the New Jersey market-garden.

There is a great dearth of definite knowledge as to the best methods of procedure in this market-gardening forestry. Here as well as in other lines of forest work, we in this country are hampered at every turn by lack of definite American experience, of clear-cut American object-lessons, and of concrete, reliable American data. General principles we may take as our heritage from Old World toilings. Details of feasible methods of procedure adapted to our conditions we must learn for ourselves, and the work has barely begun.

It appears, then, that a large proportion of the general public still either misunderstands, or is entirely without any understanding of, what forestry really is, and what it aims to do. On the other hand, if a woodland owner does understand the forester's aim, and takes him to the wood-lot to ask, "What is best here?" or "Just what should be done there?" can that forester give clear-cut definiteness to his answers? Does he know of any actual ex-

periences under similar conditions on which to base his advice? Have his ideas been tested in practice? Probably the owner of that wood-lot cannot afford to conduct an experiment station. Is it not a serious thing to ask him to pursue any policy of which we are not sure, involving as it does an extended period of years? We tell the farmer that he should regard his timber as a regular crop and should care for it as such. Are we certain we can tell him how best to sow and cultivate and reap that crop?

Evidently here are two important lines of work requiring attention. To bring to people's minds, and by forceful object-lessons to impress upon them, what forestry really means; to work out the details of a practicable system of utilizing our local non-agricultural lands to the best advantage: these are two prime needs of the forestry movement in Connecticut.

It is to take part in trying to meet these needs that the Connecticut Agricultural Experiment Station of New Haven has added forestry to its other fields of activity. It would seem to be work eminently proper for an agricultural experiment station to undertake in a state where, as in Connecticut, the greater part of the forest area is owned by farmers.

The Station's work in forestry was commenced in the spring of 1901. Five lines of effort have developed:

1. A study of the forest conditions existing in the State, with a view especially to suggesting feasible methods of improving those conditions. A detailed forest survey of one of the typical regions of the State has been begun.

2. Experimental and demonstration work in afforestation. The Station owns two tracts of land in the Connecticut River valley in the northern part of the State. One, about 60 acres in extent, is an open sand-plain typical of considerable areas in the State. The other, of about 40 acres, is a wood-lot cut about six years ago and very severely burned in 1901. The former is to be used for experimental forest planting. Nurseries covering slightly over one acre and containing perhaps 250,000 seedlings and transplants have been established to supply stock. Upon the final forest site several acres have been seeded, and about 20,000 trees planted. The experiments include methods of nursery practice and care of seed; tests of species; methods and cost of planting, and of sowing seed on the final forest site.

3. Experimental and demonstration work in treatment of the wood-lot. A little work in cutting and in planting has been done on the burned-over tract mentioned above. Thinning and improvement cutting have been carried on in co-operation with a private owner in the central part of the State, and considerably more such work is planned for this winter.

4. Dissemination of information and practical assistance to woodland owners. Stress is laid upon the value of personal intercourse with farmers and other woodland owners throughout the State. Every opportunity is taken to become acquainted with such men and talk with them, on their wood-lots if possible. Addresses have been given at meetings held under various auspices, such as the Grange, the Farmers' Institute, the State Board of Agriculture, the State Forestry Association, and the Daughters of the American Revolution. Considerable correspondence has been carried on, and is encouraging in showing interest developed.

The Station makes an offer similar to that of the national Bureau of Forestry. The Station forester will visit any one owning woodland or idle land in Connecticut who gives reasonable assurance that he seriously intends to carry out some practical forestry work, and will prepare a planting plan for open land, or suggestions for treatment of woodland, as the case may be. The expense to the owner is that necessarily incurred by the forester in traveling to and from New Haven, there being no other fee.

Several parties have availed themselves of this offer, and some planting has already been executed as a result. A co-operative agreement with the Board of Water Commissioners of the city of Middletown has been signed, by which the Water Board agrees to expend not less than $1,000 in the execution of a planting plan to be prepared by the Station forester. The land to be planted comprises about one hundred and fifty acres of open land upon the watershed of one of the city reservoirs. The city also owns about nine hundred acres of woodland on the same watershed, on one portion of which the Station forester is this winter to begin thinning and improvement cutting.

The work outlined above may be termed the Station work proper, and is supported by a portion of the income of a bequest

recently made to the Station. There is, in addition, another line of forestry effort in charge of the Experiment Station, supported by State funds.

5. In June, 1901, the General Assembly of Connecticut passed "An Act concerning the Reforestation of Barren Lands." The Board of Control of the Experiment Station was directed to appoint a state forester, who was "to buy land in the State suitable for the growth of oak, pine or chestnut lumber at a price not exceeding $4.00 per acre." The forester was further "authorized to plant the lands so bought with seed or seedlings of oak, pine or chestnut, and such other trees as he may deem necessary or expedient, at a cost not exceeding two and one-half dollars an acre." Among other provisions the following may also be of interest: "and with the approval of the governor and the attorney general, [the forester] may sell portions of the same [the lands] when they shall command a greater price than the cost and interest thereon."

Two thousand dollars for a period of two years were appropriated for carrying out the provisions of the act.

No comments are necessary upon the imperfections and inadequacy of the bill. Nevertheless, it is a step in the right direction.

The Station forester was appointed State forester. A printed call for offers of land for this "State Park" was distributed, resulting in the offer of twenty-four tracts, aggregating something over seven thousand acres, and located in twenty towns scattered throughout the State. The various tracts have been carefully examined, and negotiations for purchase are now in progress.

The promoters of the act had in view the afforestation of idle land. But they now endorse what seems to be a better policy for the present, a policy to which it is hoped the State may soon give reasonable financial support. This policy is that the State purchase a limited area, making of it a demonstration and experimental tract: primarily, for showing and for experimenting with methods of treatment of land already wooded; secondarily, for showing and for experimenting with methods of afforestation. Realizing that the greatest immediate need of forestry in Connecticut is to bring about a better system of management of small wood-lots *by private owners*, it would seem to be the function of the State to, firstly, inaugurate a series of careful

investigations as to the best methods of treating the Connecticut wood-lot; and, secondly, to provide object-lessons. Such object-lessons should serve both as patterns for private owners of woodlands to follow more or less, and as incentives to induce such owners to give their lands better care, by showing them that their pocketbooks are favorably affected in so doing.

It is hoped that in the near future the State will go much further, and engage in forestry on a sufficiently liberal basis to accomplish something in the way of regulation of the flow of our smaller rivers, and to insure to future generations a home-grown supply of large sized timber. The regulation of stream-flow of the smaller rivers is of peculiar importance to Connecticut, because of the large number of manufactories depending upon water power.

Such is the beginning of one American agricultural experiment station's work for forestry.

WALTER MULFORD.

THE OUTLOOK OF THE TIMBER SUPPLY IN THE UNITED STATES.*

II.

In the first paper we have seen that the United States will have to rely for its timber supply upon its own resources and whatever its neighbor, Canada, can spare.

If, as we shall see further on, it is difficult to estimate our own home resources, is is still more difficult, with so vast and largely unsettled a country as Canada. Yet a mere knowledge of physical geography and of the relation of plant production to climate suffices to discredit the extravagant claims sometimes made regarding the natural timber supplies of that country.

The Statistician of the Department of Agriculture, at Ottawa, making a report on the "Forest Wealth of Canada," in 1895, sums up the conclusions based on a more or less exhaustive inquiry as follows:

1st. The first quality pine has nearly disappeared.

2nd. Of second quality pine there is a considerable supply.

3d. Of other timber woods there is a large supply.

4th. We are within measurable distance of the time when, with the exception of spruce, as to wood, and British Columbia, as to provinces, Canada shall cease to be a wood exporting country.

As the Statistician had, before the inquiry, held rather different views regarding the situation, it is not likely that these deductions are radical.

As to the spruce supply, it may be stated that an immense area to the northward and westward, as far as Alaska, contains this class of timber, but as is to be expected, from soil and climate, it occurs mostly in scattered open groves, of inferior development, and, while most important for home consumption, unfit for export and use in the arts, being in that respect largely on a par with our own Alaskan possessions.

In fact, in the Eastern Provinces, the true timber producing area is bounded towards the north by the Height of Land. Beyond this natural limit there are only along watercourses and

*Presented before Section I, American Association for the Advancement of Science, Washington, D. C., 1902.

in limited areas, stands, which are capable of furnishing lumber trees, the rest is possibly pulpwood, which as the drainage is northward, away from market, will for a long time remain unavailable.

While, with a scanty population, less than six million at present, a country whose climate and soil is largely fit only for timber growing, the round 300 million acres of actual or potential timber land in the eastern provinces could be made to supply a considerable amount for export beyond home consumption, the same inattention to caring systematically for the reproduction and protection of the timber crop, which is characteristic with us, prevails in Canada for the present.

Moreover, Canada can at any time close the door to further exports. Indeed there is now a movement in that direction. It has been ordered that all logs cut on Crown lands shall be sawed within the Dominion, and a strong effort will presently be made to stop the export of pulp logs from the Dominion. At present, this is mainly intended to prevent the raw materials from being exported, instead of the manufactured product; but if, at any time, the reduction of supplies makes it desirable, such restrictions can easily be further extended.

We must, therefore, rely mainly on our own stores, and on our own efforts at home to secure the supplies for the future.

We shall now have to find some answer to the other set of questions, which concern themselves with the chances for the supply of these demands from home sources.

First, as to the amount of virgin timber still untouched and ready for use, we have really no knowledge, and only conjectures are possible. Yet a not quite unreasonable guess as to the probabilities is possible, if we have some knowledge of the forest area in different sections of the country, and the usual average stand per acre, and gather other indications leading to a probability calculation.

The writer, a few years ago, ventured such a calculation, having canvassed the situation from many points of view, and came to a statement* of 2300 billion feet B. M. still available, of

*Senate Document, No. 40, 55th Cong., 1st Session, 1897.
H. R. Doc. No. 181, 55th Cong., 3d Session, 1898.
See also "Economics of Forestry," 1902.

which 1400 billion was supposed to be coniferous material. Although the census compiler is at great pains to show some of the details of this calculation wrong and below the truth, he comes finally to the conclusion that the reported total amount of timber held by lumbermen namely 215,550 million feet, is "probably somewhat more than one-tenth the amount now standing in the country," practically the writer's figure or less; and adding up the statements made regarding the standing timber of coniferous material, only 1100 billion feet are found by the census compiler, as the following tabulation of his statements shows:

Species.	Billion feet B. M. Standing.	Billion feet B. M. Owned by Lumbermen.
Southern Pine	300	46.5
White Pine	50	16.4
Hemlock	100	6.8
Spruce (Eastern)	50	8.6
Cypress	65	6.6
Red Fir	300	23.8
Western Pine	125	24.6
Redwood	75	14.3
Sugar Pine	25	3.9
Hardwoods (one-half oak)	?	30.

The difference of the two estimates would appear to lie mainly in the distribution of these supplies, the writer accrediting the Eastern States with less, the Pacific Coast with a larger supply.

The distribution of supplies is of considerable importance commercially, for it influences the location of manufacture, and the cost of transportation to market. With the decrease of supplies in one region, a shifting of centers of production takes place in another region.

The Census brings an interesting map showing the present distribution of the lumber industry. The most intense concentration of this manufacture is found in the northern section of Michigan, Wisconsin and Minnesota; in the middle west of New York and Pennsylvania, in Maine and New Hampshire and on the Pacific Coast in Washington, and on a small territory in Oregon along the Columbia River, while the centers of intensive production in the Southern states are more widely scattered with reference to shipping ports along the coast and Mississippi River.

There are also tabulations showing by geographical subdivisions the relative positions of the different territories as contribu-

tors to the timber product and the changes that have taken place in this relative position, as far as the defective Census figures indicate. At least, the general tendency of this change in the four principal sections may be seen in this tabulation of the percentage of total lumber production contributed by them :

Years.	Northeastern States.	Lake States.	Southern States.	Pacific States.
1850	54.5	6.4	13.8	3.9
1860	36.2	13.6	16.5	6.2
1870	36.8	24.4	9.4	3.6
1880	24.8	33.4	11.9	3.5
1890	18.4	36.3	15.9	7.3
1900	16.0	27.4	25.2	9.6

As supplies gave out, the Northeastern States reduced their cut ; as railroad development increased, the Lake States increased their cut, until, in 1890, the highest mark was reached and the decline began, the Southern States then increased their cut in proportion. These changes in location are interesting and significant, but, for our purpose of forecasting the future, we are concerned only with the supplies as a whole.

Since, owing to change in the standard of the commercial log, owing to closer utilization and to more careful exploitation and manufacture, supplies usually hold out longer than anticipated, it will be perfectly safe to accept the writer's higher estimate and yet find the situation unsatisfactory. For, even if we double this estimate, it is apparent that with a cut of forty billion feet, increasing at the rate of at least 5% per annum, we do not have 30 years' supply of old stock in sight, a serious enough situation to make desirable a more serious, statesmanlike and businesslike consideration of the forestry problem than it has received hitherto.

We admit that both the census compiler and the writer are mainly guessing at the amount of standing timber, but there are enough data at the basis of these guesses to render them worthy of consideration.

The Census brings the information that the stumpage on the lumberman's holdings averages 6,700 feet B.M. per acre, or in the Eastern States an average of somewhat less than 5,000 feet, and somewhat less than 25,000 feet in the Pacific States. The compiler comments correctly, that "the average stand of timber per acre, being that of selected tracts owned by lumbermen is, of course, higher than the average of the country or state."

For the purpose of a possibility—not any more probability—calculation we may assume that the entire forest area of the United States at one time, say only fifty years ago, contained this average stand. With such extravagant assumptions we may be justified in assuming the area involved as 500 million acres, the potential timber area determined by the writer, rather than the 700 million acres claimed by the U. S. Chief Geographer, in which all waste land is included ; we would then find a total original stand of 3350 billion feet. Assuming again that the consumption of 40 billion at present, has grown to that amount by only a 3 per cent. rate, (instead of the more likely 5 per cent.), from the original figure, then we would have had a total aggregate cut during the 50 years of round 1115 billion feet, and if the increasing rate of consumption continued, the balance would be used up in less than 35 years.

The 250 million acres of farms cut out from the forest, mostly wastefully logged and largely burned in log-rolling bees, may be assumed to have furnished the requirements of the preceding period.

These probability calculations merely show that our guesses at the amount of standing timber are not entirely unreasonable, and they certainly lend color to the assertion, that unless very radical changes in use and exploitation take place, our virgin supplies will certainly be used up within less than a generation. But, to be sure, according to the Chief Geographer, "timber growth in the United States is certainly renewing itself much faster than it is being consumed."

The certainty in this respect it would be even more difficult to establish, than regarding the standing timber, but a probability calculation is here also possible, by borrowing some figures from the experience of a country where timber production is a well-established business, and accurate statistics are available.

In German State forest administrations, comprising some 10 million acres under good management, the production of timber-wood (over 3 inch) has constantly increased in response to this management, until now it may be stated in the large average, with a rotation of about 100 years, as 43 cubic feet per acre per year, of which 50 per cent., or round 22 cubic feet are saw log and bolt size material ; these figures must be reduced by 15 to 25 per

cent. if private and corporation forests are also brought into consideration.

Hence, if we were to assume that in the unmanaged wild woods of the United States a production of 40 cubic feet of useful wood and 15 cubic feet, fit to supply saw material, takes place, we would, indeed, be beyond reasonable expectation, especially since fires ravage thousands of acres annually, and the young growth at least is destroyed on them.

Again ruling out the waste and brush lands, which either by nature or by ill-treatment have become incapable of producing any valuable timber growth, the area on which such growth might take place may be set down as not to exceed 500 million acres. With such assumption the new growth would represent 7.5 billion cubic feet of log material,—about our present annual consumption.

Any one who is at all familiar with the condition of the timbered forest areas of the United States will readily agree that not one-half the assumed production takes place over this vast area. In the untouched woods, the natural decay offsets the accretion, while on the culled area, both in the old and young growth, the larger portion of the after-growth is of weed trees,—not valuable timber.

Another way of approximating the possibilities—not probabilities—is to assume the reported stumpage on the lumberman's holdings, namely, round 5000 feet B M. per acre in the Eastern United States, as representing the average capacity over the whole forest area. Nature has taken hundreds of years to produce this, but, assuming the same stand left to nature could be secured in 100 years, then the average accretion per acre and year would be 50 feet B. M. This would not suffice to supply as much as three quarters of our present annual requirements of lumberwood, And how far are our premises below the probabilities?

Not that under good forestry practice even a better average could not be obtained, for the 50 feet B. M. represent about 10 cubic feet, forest grown material, while the German practice produces at least over 16 feet of saw material per acre per annum.*

But we have so far no forestry practice, no silviculture, no systematic reproduction. Not even protection of nature's crop against

*In exceptional cases on selected small areas as much as 90 cubic feet of saw material has been attained.

the annually recurring fires exists. And these fires, while they may not destroy or even seriously damage the old crop, as in many cases and conditions they do not, they kill with absolute certainty all the young crop, and there is so far but little hope that they will soon be stopped. What incentive can there be for private interest in spending money or foregoing immediate revenue for a crop, which is so readily lost?

We may as well wake up to the realization that our efforts to secure a more rational treatment of our forest resources and apply forestry in their management, are not too early but rather too late, that they are by no means sufficient, that serious trouble and inconvenience are in store for us in the not too distant future, that the blind indifference and the dallying or amateurish playing with the problem by legislatures and officials is fatal.

We can, then, summarize the situation, which justifies the urgent need of the foresters' art in the United States, from the point of view of supplies, as follows:

(1) The consumption of forest supplies, larger than in any other country in the world, promises not only to increase with the natural increase of the population, but in excess of this increase per capita, similar to that of other civilized, industrial nations, annually at a rate of not less than 3 to 5 per cent.

(2) The most sanguine estimate of timber standing predicates an exhaustion of supplies in less than 30 years if this rate of consumption continues, and of the most important coniferous supplies in a very much shorter time.

(3) The conditions for continued imports from our neighbor, Canada, practically the only country having accessible supplies such as we need, are not reassuring and may not be expected to lengthen the natural supplies appreciably.

(4) The reproduction of new supplies on the existing forest area could under proper management be made to supply the legitimate requirements for a long time; but fires destroy the young growth over large areas, and where production is allowed to develop, in the mixed forest at least, owing to the culling processes, which remove the valuable kinds and leave the weed trees, these latter reproduce in preference.

(5) The attempts at systematic silviculture, that is, the growing of new crops, are so far infinitesimal, compared with the needs.

B. E. Fernow.

FOREST ADVANCE OVER GLACIATED AREAS IN ALASKA AND BRITISH COLUMBIA.

A very interesting group of facts, involving problems of great import, is embraced in the rate which forests in Alaska and British Columbia have been and are yet following up glacial retreat. The rate of retreat of the one and of the advance of the other are recorded in two ways: 1st. By the growth and advance of trees, and 2d, by the increasing depth of forest litter and humus, due to the two, three, or more generations of trees which have grown since the morainic debris, or glaciated surface was left bare by retreating ice.

After observations upon mountains on which the glaciers were small remnants, the writer visited Alaska for the purpose of studying these phenomena where they are best marked in the northern hemisphere. After careful consideration of those glaciers which would give the most reliable types and at the same time would be accessible in the short period available for study *Mendenhall Glacier* and its former bed were selected for special study. The features herein described for this locality are in general true for immense areas which were observed but not closely studied. It is true that in some instances glacial advance has been recorded by the destruction of young and even full grown forests; but these instances evidently mark fluctuations in the general glacial retreat which is in progress. After a slight advance the retreat is again taken up, and for a limited period with greater rapidity than marks the retreat of neighboring glaciers.

Mendenhall Glacier, in Lat. 58° 25′ N., Long. 134° 30′ W., occupies the upper portion of a lateral channel jutting off northeasterly from the north end of Gastineau Channel. The glacier once occupied the whole of this lateral channel, but has retreated until its face is now some four miles from the junction of the two channels. This lower end is now entirely filled up with glacial debris and overgrown with alder, cottonwood and spruce, with shrubs, marsh growth, etc. The lower portion of the filled area is just above tide level; the upper is about 150 feet above tide level.

The front of the glacier is some three miles in length and of irregular and varying height; where long continued melting has

taken place the wall of ice is only twenty or thirty feet high, and where masses of ice have recently broken off it is several times these heights.

During the nine years preceding 1901 the retreat, as marked by a mining stake, has been at the rate of from 40 to 50 feet per year. But this rate of retreat is recorded for a far greater period by the forest and scrub growth which flourishes on the former bed of the glacier, and upon its enclosing slopes. At a distance of about three miles from the present face of the glacier quite a forest of spruce trees has grown, many of which have been cut for the mines on Douglas Island. Those now standing within two miles of the face of the glacier are nearly full grown and are evidently the only generation which has ever occupied the locality, as there are no aged or fallen trunks, and the forest litter and humus is thin and coarse. The size of one of these trees and its growth are as follows:

At	25	years	9	inches	in	diameter.
"	50	"	16	"	"	"
"	75	"	20.5	"	"	"
"	100	"	23	"	"	"
"	125	"	25.5	"	"	"
"	150	"	27.5	"	"	"
"	175	"	30.5	"	"	"
"	209	"	32.3	"	"	"

other trees not felled were as much as 8 or 10 inches larger in diameter, but the one measured was about an average.

Advancing from three-quarters to a mile toward the glacier few trees could be found over 20 inches in diameter, or about 70 to 80 years old; within the next one-half to one-quarter of a mile the trees had decreased in age to saplings 6 to 8 inches in diameter or about one-quarter of a century old. Beyond these were young and seedling spruce which soon gave out entirely, their places being taken by alder-brush, dwarf cottonwood, grasses and mosses. The surface between these and the glacier was composed of clean boulders, gravel and sand, showing but slight signs of disintegration and supporting no growth except mosses.

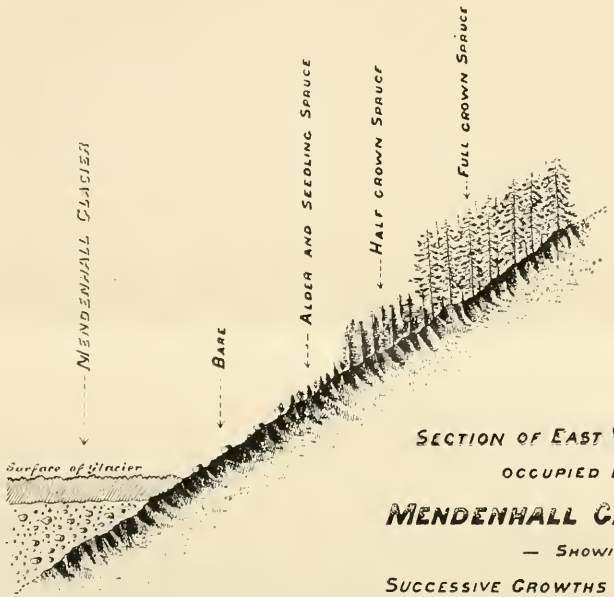
Standing at the base of the glacier and looking at the mountain slope to the eastward a similar record of the melting and thinning of the glacier and the advance of forest was observed. For the first 100 to 110 feet in elevation above the glacier bed the sides of

the mountain were quite bare, and marked by a few parched boulders; then a growth of alder brush, young and seedling spruce for about 60 feet; then a dense growth of spruce saplings and poles 15 to 20 inches in diameter. Above these stood a dense wall of well grown spruce trees between two and three centuries old. (See sketch.) (It was impossible to make a photograph of these interesting belts of growth owing to the fogs and rains, so that the sketch and notes were the best modes of making a record.)

The forest record and data available for study from the Puget Sound region to Yakutat Bay are highly instructive, not only to the students of forestry but to those of geology and climatology.* The writer has endeavored to show elsewhere the bearing which this forest advance has upon the problems of climatology, and to follow this data beyond the field of forest record into that in which the time since glacial retreat is estimated in many thousands of years and recorded by the subsequent retreat of cascades and falls. But the forester has the opportunity of reading the most recent and yet progressing record, and of laying its lessons before the scientific world. Perhaps there may be localities where the two records overlap, where both the number of generations of trees which have grown upon a given area, and the distance a certain fall has retreated since glacial uncovering took place, may be of record and reasonably legible.

MARSDEN MANSON.

* NOTE.—For an account of a similarly interesting progress of forestation of a moraine in Glacier Bay see "Forests of Alaska," by B. E. Fernow, in Harriman Expedition, Vol. I.—EDITOR.



Section of East Wall of Cañon

occupied by the

Mendenhall Glacier, Alaska,

— Showing —

Successive Growths as the Ice recedes.

— August 1901 —

CURRENT LITERATURE AND REVIEWS.

Report of the Forester for 1902. By Gifford Pinchot, Washington, D. C. 1902. Pp. 109–136. From Annual Reports, Department of Agriculture.

The work of the Bureau of Forestry has greatly increased in the past year. Applications were received for working plans for 4,700,000 acres, but for lack of men and money only about 8% of these applications could be acted upon. Planting plans were made for 3,400 acres. Extensive investigations of important timber trees were made. Various forest industries and conditions were studied. The personnel of the Bureau was also increased. Notice of the many excellent publications as they appeared, has previously been made in these pages.

The work of the Bureau not only has increased in quantity but in quality. Compare for instance, the Working Plan for Township 40, made two years ago with the similar report just appearing in the Maine Forest Commissioner's report. In the former the word reproduction hardly occurs and considerations for the future beyond a short period of years are dismissed almost with the single sentence: "a sufficient number of seed trees will be left to insure the reproduction of spruce;" compare this with the report from Maine where six pages are devoted to the considerations of reproduction, sexual maturity, influence of exposure and of light, of seed beds and of seedlings; surely there has been a creditable improvement.

Fourth Report of the Forest Commissioner of the State of Maine. Augusta, 1902. Pp. 152. Illustrated.

The act of the Maine legislature of 1891 which created the office of Forest Commissioner required that officer to make annual report of his inquiries and investigations. In pursuance of that act, the fourth report of the Commissioner has just been published as a well appearing volume of 150 pages with numerous plates illustrative of the forest conditions of the state.

Maine's great manufactures of pulp and paper render it natural that the current volume should deal largely with spruce. Further than that, it is perhaps inevitable that Commissioner Ring, with

long experience as a lumberman, should endeavor to present a summary of the standing spruce timber of the state. The results of his inquiry render him very sanguine. His estimate of standing timber is 21 billion feet B. M. of spruce alone, 9 inches and over breast diameter, and as he supposes the annual growth on this amount to be 3 per cent., he thinks the accretion is not exceeded by the cut. Such figures promise well for business prosperity in Maine, although Mr. Ring seems to believe that certain regions are in the way of being depleted. It appears that Maine has vast timber resources in the great wild region north of Moosehead Lake, a region which up to the present has been only lightly cut into, and that, for mills located on the St. John River in New Brunswick.

Wholesale timber estimates which do not seem to prove that dire and early calamity is upon us are so rare a thing that those interested will be likely to inquire carefully as to the basis on which they are founded. Mr. Ring has not had much money at his disposal and does not pretend to say that his figures are based to any large degree on original examinations, nor perhaps would they be any better for that. Until reliable and thorough-going surveys can be made the estimates of owners and others interested in tracts in question must be accepted as the best information of their stand that can be had. This information Mr. Ring professes to have gathered with care, and without positive proof to the contrary his figures cannot be discredited.

But it behooves us to bear in mind the limitation of accuracy in timber estimates and to recognize clearly on how uncertain a basis our anticipations whether roseate or the reverse are founded. It is well known that no man estimating in timber, with which he is thoroughly familiar, and in moderate sized and compact bodies can depend on coming nearer than 25% of the truth, and on timber as it stands in our woods and on large tracts he needs a much larger percentage of leeway. Furthermore it needs to be considered that the woods of Maine have not been explored by one man, but by a vast number with very various ideas and all kinds of experience, while a great number of townships cannot be said to have been explored at all. All this renders these wholesale timber estimates very uncertain indeed. If they convey abroad a contrary impression and delay the time when really

reliable surveys are inaugurated they will be likely to do more harm than good.

In addition to these statistics Mr. Ring describes briefly a few of the great fires and gales that have in times past ravaged the state, and Mr. Austin Cary contributes an article on the timber beetles that have killed spruce in large quantities in Maine. The same writer describes a system of topographical timber maps adapted to the needs of the lumber business, and Prof. W. M. Munson writes on the distribution of forest trees. Lastly we may mention a study of the spruce in Maine by Ralph S. Hosmer of the U. S. Bureau of Forestry containing recommendations for the management of a tract studied; and a report* by Austin Cary, forester of the Berlin Mills Company, of five years' experience, in the actual management of spruce land. These two articles are worthy of careful perusal by any Maine firms who are trying to introduce the principles of forestry into their lumbering business.

Mr. Hosmer's report is of the high type that we have learned to expect from agents of the forestry bureau, dealing thoroughly with the stand of timber, with waste in logging, with the conditions essential to growth and reproduction of desirable trees. His main conclusion is that on such land as he had studied "practical forestry may with advantage be introduced." This term "practical forestry" whether intentionally used or not is one admitting a great latitude of interpretation. Many acquainted with Maine lands, the financial returns from them and their present value and condition, might query if it had not already in many cases been secured. However with Mr. Hosmer it evidently means something more carefully regulated. Conservative cutting carefully adapted to the land and to the timber, and with marking as an essential point of the system is the practical forestry he refers to. There is furthermore to be noted in his report, what seems to be a distinct advance in the practical acquirements of the government foresters, namely a recognition of the necessity of a more generous allowance for wind throw, and of the fact that large portions of spruce woods must be cut clean.

Mr. Cary, on the other hand, after five years experience finds he has not been able as yet to accomplish some things laid out in

*The Management of Pulpwood Forests; See Forestry Quarterly Vol. I, No. 2, Page 67.

this program. In the first place he has found conservative cutting a risky business involving loss through wind. Next he has found that marking for the loggers was beset with such difficulty and aroused so much opposition that better results were gained by other means. The methods of the loggers under him do not seem to have been so modified as yet that young growth has been perceptibly favored. On the other hand genuine economy of merchantable lumber does seem to have been secured. Stumps are cut low, tops high, windfalls and dry timber picked up, and this on a large scale, throughout a big lumber business. We gather that in this direction alone there is in most large lumber businesses, enough to occupy trained men for some time.

Altogether Maine is in a hopeful condition. There seems to be an awakening among the large owners of land and mills, and the ideas of forestry are getting hold upon them gradually but effectually.

First Annual Report of the Society for the Protection of New Hampshire Forests, 1901–1902. Concord, N. H. Pp. 75. Illustrated.

The Society for the Protection of New Hampshire Forests was founded in 1901, to study the forest situation in the state and to point out methods by which it may be improved. Its first activity was to place placards in public places calling attention to the need of preserving the forests. It inaugurated a lecture course under which a series of meetings were held in the mountain region. It now permanently employs a forester, Dr. Philip W. Ayers, to investigate timber growth, visit woodlands and advise upon them when requested, and to address various meetings throughout the state. The work of the Society has been excellent and deserving of the greatest praise.

Report of the New Hampshire Forestry Commission for the Years 1901–1902. Concord, N. H., 1902. Pp. 109.

The first forty pages of this report contain a rambling description of inspection trips taken through the state and of meetings with various friends and acquaintances. The second forty pages contain statistics, taken from the Twelfth Census, of the allied forest industries. Among various discussions in the remainder of

the report, appears an argument for the establishment of a national park in the White Mountains, the main point made being, that Congress is about to establish one in the Appalachians and the White Mountains are just as well suited for it. A map compiled by the U. S. Geological Survey of the White Mountain region is appended. In no part of this report can there be found a statement of any material accomplishment by the Commission.

This seems to be but another instance of the inefficiency of unsalaried Forestry Commissions.

How to Grow a Forest from Seed. By Prof. F. Wm. Rane. Bulletin 95, New Hampshire Experiment Station, Durham. Pp. 97–107. Fig. 11.

A leaflet of interest to the wood-lot owner.

Statement of Work Done by the Pennsylvania Department of Forestry. 1902. Pp. 158. Pl. xxxiii.

Pennsylvania is to-day, if we except New York, the foremost state in forest investigation and preservation. This result has been but recently obtained, and is due largely to the active guidance of Dr. J. T. Rothrock the present Forest Commissioner. The forestry commission exists probably in its best form in Pennsylvania. It consists of five unsalaried members and a president with a salary of $3,000 per year. The Commission is empowered "to purchase any suitable lands in the Commonwealth for purposes of forest preservation," "provided, that in no case shall the amount paid for any tract of land exceed the sum of $5 per acre." "The said Commission is also empowered to establish such rules and regulations with reference to control, management and protection of forestry reservations" "as in its judgment will conserve the interests of the Commonwealth; and whenever it shall appear that the welfare of the Commonwealth will be advanced by selling or disposing of any of the timber on forestry lands, the Commission is hereby empowered to sell such timber on terms most advantageous to the State."

The state forest reserve now consists of 572,722 acres, the major part of which has been purchased; no itemized statement is made in the report of the costs of these lands but of course they average less than five dollars per acre.

A forester has been engaged, Mr. George H. Wirt, trained by Dr. Schenck, a forest nursery established, and plans for a forest academy matured; in other words, Pennsylvania is now in a position to do something besides issue reports.

Several separate papers also appear in this report among them being, "The Chestnut Harvest" and "Manufacture of Chestnut Meal"; a selected translation from the "Monografia del Castagno," by Lodovico Piccioli, and the "Propagation of Forest Trees Having Commercial Value and Adapted to Pennsylvania," by George H. Wirt. It is an excellent little bulletin well fulfilling the intention of the author, "to present in a brief and clear way such facts and methods as will bring reasonable success to the inexperienced planter, without making necessary any large expenditure of money."

The Forests of Rhode Island. By Fred W. Card. Bulletin 88. Agricultural Experiment Station, Kingston, R. I. Pp. 39. Fig. 24.

The bulletin gives a good idea of the forest conditions of the state. "A surprisingly large part of Rhode Island, when the population of the state is considered, is covered with tree growth. A very large part of this growth possesses no real value for timber purposes." "Few states have less to expect from forests in the way of influence upon climate and water flow. Rhode Island has no mountains, and few high hills. Danger from floods is comparatively slight. Close proximity to the ocean insures a humid atmosphere. The wind-breaking effect of the forest is therefore of less consequence than in regions subject to drying winds, where this is often of the greatest importance. All these influences have some weight, even in Rhode Island, but the question is primarily an economic one. Will it pay in dollars and cents to foster the forests?"

Report of the New York State College of Forestry. 1903. Pp. 32.

This recent report of the College shows several gratifying conditions. The students now number seventy, and in addition quite a large number from other Colleges of the University have profited by its courses. Attention is called to the imperative need

of increased accommodations and equipment at Ithaca. The curriculum has remained about the same as in previous years with the exception of the addition of special meteorological work under Dr. Allen of the local Weather Bureau Station.

The College Forest and its policy is treated at some length. Of the silvicultural methods employed in converting the poor existing stand to one of value the Director has the following to say :

"There is one fact on the silvicultural side which the experiment has demonstrated to the satisfaction of the writer, namely, that in the hardwood forest of the Adirondacks, where the pine and spruce have been severely culled, the only practicable method, both from financial and silvicultural points of view of securing a desirable new crop, is a clear cutting system, followed by artificial regeneration of the conifers, leaving only enough of the hardwoods to produce an admixture by natural regeneration, and saving only so much of the promising volunteer growth of young hardwoods and conifers as is not liable to be thrown by the winds. Indeed, it may often be best to make a clean sweep—denude, though the word has been used to denote vandalism — and replace artificially without reference to existing volunteer growth. This planting, of course, costs; it is an investment for the future, but one that can be easily shown to be profitable in the long run. This method cannot be practiced without taking care of the rubbish resulting from the logging operation, and this, of course, again entails expense. But when the simple and efficient system of clearing, followed by planting, is practiced, the debris can be burned more cheaply, using the early spring season, before the snow is quite gone, and thus the fire danger, always attending logging operations, can be most readily reduced."

The Forests of Garrett County. By H. M. Curran. Special Publication from Garrett County Report of the Maryland Geological Survey. Pp. 303–329. Ill.

An excellent local report.

A First Book of Forestry. By Filibert Roth. Ginn & Co., Boston. Pp. 291. Illustrated.

This neat little book introduces the study of forestry to the sect of nature students, and the unmistakable marks of their style

are apparent in many parts of the volume, but nowhere more conspicuously than in the opening paragraphs. The subject matter is divided into three parts, The Woods, Forestry, and Related Topics; a more generous use of headings, some sort of arrangement into chapters, would greatly help the usefulness of this volume, the work of one of the first foresters of the country.

Although not intended for professional use, any forester will be delighted with the clear, animated descriptions of the various types of forest and woodland. But we might find fault with some of the details of the author's silviculture. As we write the soft maples and the elms are in flower, but the pods of the Black Locust still hang on the trees in abundance; accordingly we fear that he who waits for the pods to fall and hopes to gather them the same way as those of the Honey Locust will wait long. The unqualified recommendation of the use of natural regeneration under shelterwood for the Eastern spruce forests will certainly disturb him who knows how dubious this practice may become and sees its disadvantages growing into impossibilities.

Yet the book is a welcome addition to our as yet scant literature and the errors are all in unimportant directions or in minutiae. Among a mass of general readers throughout the country this volume will do a great good work, and it is for these that it is written.

How to Tell the Trees. By John Gill Lemmon. Oakland, Cal., 1902. Pp. 66. Illustrated. Price 50 cents.

A collection of notes on the Western coniferae, and not of the extensive scope that the title would suggest.

Hand-book of the Trees of New England. By Lorin L. Dame and Henry Brooks. Ginn & Co., Boston, 1902. Pp. 196. Pl. lxxxvii.

An excellent little manual, well illustrated, which meets the need of the student in the field. The trees are described systematically under the following sub-divisions: Habitat and Range, Habit, Bark, Winter Buds and Leaves, Inflorescence, Fruit, Horticultural Value. Mr. Warren H. Manning, under the sub-division of Horticultural Value, contributes much desirable information. In nomenclature the authors have followed Engler

and Prantl for order and names of families, the Berlin rule for genera, and under the genus the priority rule for species; all common names which are in use in New England are given. The Hand-book deserves no adverse criticism, the only addition that can be suggested is that of a key to the species.

The Hardy Catalpa. Bulletin No. 37, Bureau of Forestry. Pp. 58. Pl. xxx.

Considerable skepticism has always existed about forest planting on the plains,—first, as to whether plantations would thrive; second, as to whether they would prove financially successful. The doubts of the skeptics were not allayed by the deplorable failures under the various homestead acts.

Many plantations in the Middle West have been very successful, that the proportion of failures is large is not due to unfitness of conditions but to poor choice of species.

Mr. William L. Hall, in "The Hardy Catalpa," describes four of the largest and most successful of Western catalpa plantations. The descriptions are in detail and comprehensive; wood product and financial tables for timber actually grown and sold are given, and the methods of establishment and tending discussed. The four plantations together comprised an area of over 1200 acres; the crops were cut at ages varying from 12 to 21 years, the trees then being large enough to yield from one to three 6-foot posts. After deducting the costs of planting, of tending, of soil rent and all other expenditures, the net return on these plantations averaged from seven to fifteen dollars an acre per year.

Of the catalpa Mr. Hall has the following to say: Of the trees used for commercial planting none have been planted more extensively in the region of southern Iowa and Nebraska and eastern Kansas than the Hardy Catalpa. A few years' trial on the plains sufficed to prove its good qualities for that region. It was easily propagated, grew rapidly on prairie soil, had good form, was drought resistant, had few insect or fungus enemies, and above all was a lasting timber, adapted to many uses. As a post timber it has given excellent satisfaction. It ranks with Black Locust and Osage Orange in durability, while it surpasses them in rate of growth, form, and freedom from checking. Altogether, as a post timber suitable for growing in a large section of

the Middle West, it has no equal. For telegraph and telephone poles its only deficiency seems to be a tendency toward crookedness, but possibly this can be overcome by special treatment. As a railroad-tie timber the Hardy Catalpa has not had sufficient trial to demonstrate what its rank should be. Experiments have left no doubt as to its resistance to decay. The only question lies in its resistance to wear.

This bulletin also contains a paper on The Diseases of the Hardy Catalpa, by Dr. von Schrenk.

It is interesting to note that at the beginning of the 19th century, when fears of a timber famine were active in Germany, the rapid growth of the catalpa suggested it as a possible preventive, and its qualities and possibilities were set forth in a pamphlet, entitled: Der Bohnenbaum, ein sicheres Mittel den Holzmangel mit abzuhelfen, nebst einer allgem. Einleitung u. Bemerkungen über den Holzmangel, etc., von F. A. Resch. Erfurt, 1800. 78 pp.

Map of the State of California. By F. S. Kelsey. Published by the California Water and Forest Association.

An interesting map showing the three principal factors in the water supply; the areas of the principal water sheds, the mean annual distribution of rainfall, and the timber and brush covered areas. Lands covered by Redwood, by other timber and by brush are separately indicated by topographical signs. The data was obtained from the report of the California State Board of Forestry for 1886–1888 and of the U. S. Geological Survey. The scale of the map is 1 to 760,320.

Finland: Its Public and Private Economy. By N. C. Frederiksen. Edward Arnold, London. 1902. Pp. 306. 8°. Price 6 shillings.

In a chapter on Forestry the author gives by means of sufficient data and excellent deductions a clear description of the Finnish forests, their management and utilization.

Finland is one of the best wooded countries of Europe; more than half, about sixty-four per cent. or 57,500,000 acres is covered by forest; of these 36,500,000 acres are dry forest land, the remaining 21,000,000 acres being marsh land studded with trees.

The Crown still retains possession of all waste and forest lands, (35,000,000 acres) which have not been distributed among the peasants as "enclosures" of 750 to 2,000 acres, according to the laws of the 18th century. The public lands are divided into fifty districts, varying in size from 3,750,000 acres to 30,000 acres, each is in charge of a forester and a body of guards. In spite of the existence of a forestry school since 1863, little has been done besides protecting and selling the timber, "the use of seed and of planting is only beginning to be understood."

The forests have suffered severely from fire damage, due chiefly to burning for improvement of the pasturage. Numerous laws were passed to prevent the fires, one of import is rather curious as it forbids burning over very stony lands at all; or other lands covered by deciduous trees, more than once every thirty years; or if covered by coniferous trees, once every forty years. The damage done by fires has greatly decreased with the present laws and administration; during the period from 1891 to 1895 about 40,000 acres in the average per year were burnt over. Injudicious exploitation has been the cause of much damage, especially was this the case with the "enclosures," which as soon as they were handed over to the peasant were often stripped of timber, that he might gain a little capital with which to begin farming.

The forested area is very thinly stocked, the marsh lands often having but one or two trees per acre. The Scotch Pine (*Pinus sylvestris* var. *rigensis*) is the most valuable tree. It occurs scattered over marsh lands, and on the hills as the dominant tree in mixture with the spruce (*Picea excelsa*) and the birch (*Betula alba*). The spruce, the tree second in importance, is worth about 20% less than the pine and grows best in mixture with it. The birch and alder (*Alnus incana*) come in readily on burned lands.

Exploitation of the forests is rapidly increasing. Besides being used for lumber, large quantities of pine (over 10,000,000 cu. ft.) every year are consumed in the destructive distillation for tar, leading to denudation of the cut area or its reversion to pure spruce stands. The use of the spruce for paper pulp is rapidly increasing, at present about 10,000,000 cu. ft. are annually used in the export trade. The birch is extensively used for turnery, and the aspen for matches. With the exception of the above

minor uses, the bulk of the annual cut of 700,000,000 cubic feet goes to the mill to be manufactured for home consumption. Finland is to-day in the condition of the United States—just beginning to realize that the "inexhaustible timber supply" is a myth; prices are rapidly rising, have in fact doubled in the last fifteen years; more economic methods of exploitation and of manufacture are being introduced; the former large sized trees are no longer to be obtained: in 1887 it took 30 stems, as they run, to make a St. Petersburg standard, while in 1897 it took 42.

PERIODICAL LITERATURE.

Beginning with this year various changes in the issuance of forestry journals are to be noticed. Oberforstmeister Wilhelm Weise, Director of the Royal Prussian Forest Academy at Münden in Hanover, who edited the "*Mündener Forstliche Hefte*" until its discontinuance a year ago, now becomes joint editor with Oberforstmeister Paul Riebel, Director of the Royal Prussian Forest Academy at Eberswalde, of the "*Zeitschrift für Forst-und Jagdwesen.*" This affiliation should raise the influence of this already standard publication, and, both from the standpoint of the interest of the papers published and of the convenience to the reader, should be greeted with approval.

Among the journals of the last decade none stood higher than the "*Forstlich–Naturwissenschaftliche Zeitschrift*" established by von Tubeuf in 1892 and discontinued upon the editor being called to Berlin in 1898. This is now revived by Dr. von Tubeuf in association with Dr. Hiltner, Director of the School of Agricultural Botany in Munich, under the title of "*Naturwissenschaftliche Zeitschrift für Land- und Forstwirtschaft,*" and as organ of the botanical, zoological, soil chemistry and meteorological laboratories at Munich as well as of the School of Agricultural Botany. Special attention will be given to the diseases of cultivated crops induced by fungi and insects.

In France, Charles Broillard, Conservator of Forests, who during eleven years has conducted the "*Revue des Eaux et Forêts*" with such untiring energy and intimate acquaintance with his subject and with the practical requirements of his position has

laid aside his editorship on account of old age. This has been taken up by Mélard who has made somewhat of a name for himself since the International Forestry Congress at Paris in 1900 through his discussion of the insufficiency of the world's timber supply. In his first number Mélard has outlined a program, covering several pages, and, supported by The Board of Forest Management at Paris, and by the faculties of both the French forestry schools, at Nancy and Barres, he will be in position to maintain and advance the prestige of this journal.

Dr. Fankhauser, from whose "*Schweizerische Zeitschrift für Forstwesen*" we take the foregoing notes, devotes a fourth paragraph to an appreciation of the "*Forestry Quarterly.*"

Rod and Gun in Canada.
Feb.

"The Rocky Mountain Park," and "Ontario Forest Reserves" are both short descriptive articles of general interest.

March.

Estimating Timber Contents, by A. Knechtel is another of the short descriptions of well known timber mensuration methods which have been appearing from time to time in Rod and Gun.

Woodland and Roadside.
March 1st.

In an interesting article of a general nature Mr. T. F. Borst describes forest work in Massachusetts in general, and especially that of the Metropolitan Water Board in reforesting the Boston watershed.

Popular Science Monthly.
March.

Mr. Raphael G. Zon of the Bureau of Forestry writes on the Source of Nitrogen in Forest Soil. He reviews the work of recent investigators especially that of Prof. Henry.

Transactions of the English Arboricultural Society. Vol. V, Part II. G. & T. Fisher ; Carlisle.

Contains an interesting account of the annual excursion of the Society to France, and also several articles on English private estate management.

Queen's Quarterly.
Oct.

Some Recent Contributions to the Literature of Forestry. By W. H. Muldrew.

An attempt to give a brief general review of the publications relating to forestry in the United States and Canada from the earliest times to the publication of "Practical Forestry" in 1902. No unusual familiarity either with forestry or the literature thereon is revealed.

Revue des Eaux et Forêts.
Dec. 15th.

M. E. Henry discusses at length the influence of forest litter (couverture morte) on the conservation of moisture; the work of several German and French investigators is reviewed and several experience tables are given.

Feb. 15th.

The foreign commerce of paper pulp is reviewed for the past ten years. During that period the French importations of manufactured pulp have nearly doubled and of pulp wood have tripled.

Bulletin de la Société Centrale Forestière de Belgique.
Jan. and *Feb.*

"Au pays du pitch-pine," by M. E. Leplae, is a good description of Florida, its forests, forest industries, geology and general conditions. Turpentine orcharding and the exploitation and milling of the Longleaf Pine are taken up at length.

Centralblatt für das Gesammte Forstwesen. 1903.
Jan.

Die Forst- und Volkswirtschaftliche Bedeutung der Anbauversuche mit nordamerikanischen Holzarten für Deutschland und Nord-Amerika. By Dr. Harold Unwin. Pp. 8–20.

The first installment of this discussion deals with the early attempts at introducing exotic, especially American forest trees into German forests. These importations were treated with little regard to their silvicultural needs, and consequently the only specimens remaining are found in parks where they were, the author explains, better protected against injury by game.

It is of interest to note the relative importance of our species in the export trade, which is indicated in these statistics. Longleaf

pine heads the list with about 1,400,000 cubic feet. Red Cedar follows with a similar amount. Walnut takes third position with about 500,000 cubic feet, oak and tulip tree each with about 150,000 cubic feet, while cottonwood, maple, hickory, ash, cherry and small amounts of birch, dogwood, and persimmon bring the total to about four million cubic feet, representing perhaps thirty million feet B. M. in all.

Allgemeine Forst- und Jagd-Zeitung. 1902.

Beitrag zur Geschichte der Horizontalgräben. By Leo Anderlind. Pp. 333–35.

Horizontal furrows as a protection against excessive washing on steep slopes appear to have been first employed in northern Germany at Muppberg, near Neustadt on the Heide. Here in 1843, Schlich began the reforestation of the mountain by use of these furrows, and the plan has proven so practicable that it is still used by the present administration. The plan was taken up almost simultaneously in other parts of Germany and in France, where Eugène Chevandier discussed his work in this connection before the Academy at Paris as early as 1844.

Notable examples of the practice in various parts of Germany and cases of localities where the adoption of this protection seems advisable, are cited.

Forstliches und Anderes aus den Nordost-Karpathen. By Freiherr von der Goltz. Pp. 369–73.

These notes on Hungarian forests and forestry as seen during a brief excursion in August, 1898, with facts on the forest areas, practices, etc. of Hungary, fill the body of the journal.

Among things of interest is a description of a plant for the impregnation of beech ties. In the process here used each tie takes up about 35 kg. of the impregnating fluid, two kilograms of this being creosote oil and 1.8 kg.. zinc chloride ; the remainder is water. The output of this plant is given as 300,000 ties per year.

Die Durchlüftung des Bodens, ein Kulturmittel. By Forstmeister Eulefeld. Pp. 397–401.

The advantages of the ranging of hogs in the forest begin to appear now that, after a protracted struggle, the Germans have for the most part succeeded in shutting their woods entirely

against such cattle. The advantages are best seen in the middle life of the stand when the cover is dense enough to lead to the formation of raw humus, and are in the direction of an aeration of the soil by turning the humus under and opening up the deeper layers to the action of atmospheric agents. These arguments, however, seem to apply to peculiar conditions and limited areas rather than to be of general application.

Ueber ungünstige Einflüsse von Wind und Freilage auf unsere Bodenkultur. By Forstdirektor Emeis. Pp. 401–4.

From experience in Schleswig–Holstein the author tells of the influence of winds on the light sandy soil of that state. As in many places in our own country the soil, when once exposed to the wind action by the destruction of the cover of forest as in Wisconsin or of sod as in parts of New England, is blown by the wind and dunes are formed which can only be subdued by restoring the surface protection.

NEWS AND NOTES.

BUREAU WORK IN TEXAS.

Early last month the large field party which was in Texas during the winter returned to Washington. The work of making a working plan for the Kirby holdings has been about half completed.

The following notes on the conditions there existing have been kindly contributed by members of the party :

Practically the only tract of virgin Longleaf Pine (*Pinus palustris*) land of any considerable size left in the United States, except that in Western Louisiana, is the one controlled by the Kirby Lumber Company of Houston, Texas. These holdings include thousands of acres of Longleaf timber-land scaling from about 10,000 feet to 15,000 feet per acre, not allowing for cull. Many acres of pine and hardwood land, not so valuable for its timber occur ; here Shortleaf Pine (*Pinus echinata*), Loblolly Pine (*P. taeda*), and sometimes a little Longleaf are intermixed with various gums, oaks, magnolias, beech, and hickories. The cypress swamps, "where land and water meet," are occasionally found. By far the most valuable and largest in area are the pure Longleaf lands.

The thing which impresses one especially is the park-like appearance and exclusive character of the Longleaf Pine forest. Mile after mile the Longleaf Pine ranges along with occasional Black Jack Oak and Post Oak as undergrowth. This peculiar park-like appearance is undoubtedly due to the high light requirement of the species. After a Longleaf stand has started no younger generation can appear under the shade of the original stand. Gradually the stand thins itself, and when maturity is reached it is composed of comparatively uniform sized trees. The purity of the forest is largely due to the soil ; the highly silicious and porous soil so characteristic of the flat hills of southern southeastern Texas is able to support only Longleaf Pine.

In the northern woods, after an original stand is removed it is replanted by some other species ; thus in Michigan, the White Pine when removed is first replaced by birch, poplar and cherry ; later among these species again appears the White Pine, and eventually becomes the dominant species. Not so with the Long-

leaf Pine, after it is cut down the ground remains barren or comes up again in Longleaf, if conditions for reproduction are present.

The exclusive character of the soil, and light needing nature of the Longleaf Pine tending to make the trees of the stand of uniform size greatly complicates the problem of management. The mature pine is, as a rule, about fifteen inches or more in diameter on the stump, exactly the diameter to which the timber is cut here. This means practically clean cutting. If no provision is made for reproduction after the timber is cut, the land not able to support any other species and not fit for agriculture will become waste land.

The reproduction of the Longleaf Pine forest is complicated with many difficulties as fire and hog raising; that it cannot be obtained without sacrifices at present on the part of the owner is self-evident, and the question whether it will pay to make the sacrifices is beyond my ability to answer.

WM. B. HOWARD.

Lumbering methods vary only in details on the different parts of this tract, and a few of the most striking features of the operations as carried on at the Silsbee, Harden Co. works may be taken as representative of the whole. The woods where the cutting is being done is seven miles from the mill at Silsbee and is reached by a standard gauge train. The engine used is of fifty tons and similar to thirty-one others owned by the company. Two trips are made a day, one early in the morning taking the men to work, and the other in the afternoon; on the first return trip eight or nine loaded cars, and in the evening about eighteen loaded cars are drawn to the mill. A car will hold logs scaling about 2700 feet, thus the two trains will accommodate close to 70,000 feet the total day's cut. This cutting is for the Silsbee mill alone, and the company operates thirteen other mills, some larger some smaller; the present rate of cutting per year is about 350,000,000 feet.

The sawyers work in gangs of two and cut on an average 17,000 feet a day per crew, for which they are paid 30 cents a thousand. Logs are cut in 24 and 32 foot lengths except on special orders. As soon as they are sawed and scaled they are skidded by a team of mules directly to the skidway if they are

near, or if far away from it they are paired off in convenient places and are later taken to the skid by a big two-wheeled skidding cart. These carts with their wheels seven feet in diameter are one of the most distinctive features of the lumbering of this region. Two logging irons are suspended from an eccentric drum above the main axle of the cart worked by a heavy beam lever attached by a chain to the skidding tongue. When the wagon is backed by the mules over the logs the irons lower automatically, are fastened to the logs about eight or ten feet from the front end, and, as the team starts, the tongue moves forward several feet and the logs are raised, their rear ends barely dragging. In this way logs can be carried to the skidway, even over obstacles such as other logs with quickness and comparative ease. Three such carts with teams can attend to the cutting of six or seven gangs of sawyers.

Each skidway holds a carload of logs. A car is left at each one and as the skidways are filled the cars are loaded. This is done ordinarily by a crew of seven men using four oxen. Five men roll the logs, one at a time with canthooks to two small logs forming an incline from the end of the skid to the top of the car; a chain, one end of which is fastened to the further side of the car and the other to the ox team, is passed around it and the team pulls it up the incline. At the proper moment the top loader gives the driver the signal, the chain is unhooked, and the log rests in its proper place; the chain is returned over the car and the crew is ready for the next log. The engine backs the loaded car up to the next empty, the loading crew moving up at the same time, and the whole operation is repeated until all the cars are filled. The sawyers, scaler and loader stop work at 5 P. M., but the skidding teams and carts usually continue to bring in logs until 5:30. The mules are then driven to the "corral" just outside of the works where they are cared for by the resident feeder. They are fed but once a day. The price for mules is now about $160 apiece, this is much higher than before the Spanish and Boer wars when many were exported.

J. M. K., Jr.

LAND OFFICE CHANGE.

The resignation of Mr. Filibert Roth as Chief of the Division of Forestry of the General Land Office is a severe blow to the honest and rational management of the forest reserves. During the short period of Mr. Roth's administration the regulations of the reserves were better enforced, the existing political appointees were being gradually replaced by better men, the service has been rearranged, properly graded, and provision made for the employment of technically educated men ; on one of the reserves, that of the Black Hills, a regular system of timber sales has been established ; in these ways and in others the Division had been greatly increased in efficiency. Mr. Roth is to be congratulated and thanked for the fine work he has done and it is most regretable that he should have resigned because his services were needed elsewhere or for some other reason.

With the announcement of his resignation from the Land Office comes that of his return to his Alma Mater, the University of Michigan, as Professor in Charge of the new Department of Forestry. A short sketch of Prof. Roth's career may be here apropos.

While still a college student he became interested in forestry and during the last two years of his stay at the University was employed in the timber physics work of the Division of Forestry, Department of Agriculture. On leaving Ann Arbor in 1893 he continued this work with the Division as Special Agent. The results of his investigations for the succeeding five years are contained in several well known bulletins, and he is regarded as the first authority on the subject in this country. With the founding of the New York State College of Forestry in 1898 he became Assistant Professor of Forestry with special charge of Timber Physics and Exploitation, and continued in this position for three years. From teaching he again returned to Washington, first as Agent of the Bureau of Forestry and then as Chief of the Division of Forestry, Department of the Interior ; his administrative ability and knowledge of Western conditions foretelling the success he has achieved. During the past year he produced his first private publication,* an elementary treatise on forestry in general.

* See page 103

NEW HAMPSHIRE.

The bill fathered by the Society for the Protection of New Hampshire Forests appropriating $5,000 for an examination of the White Mountain region by the Bureau of Forestry has been passed by the Legislature and signed by the Governor. The work will be done during the coming summer.

TIMBER AND LAND.

Justice White of the New York Supreme Court in a decision recently handed down, declared timber to constitute a part of the land on which it stands, and when the land is covered by a mortgage the timber can not be removed without consent of the party holding the mortgage. This is of course in line with the laws of the majority of the states, for they tax the total value of the land plus the timber upon it as one value. There can be no very great objection made to this procedure when the timber is of the original stand. It may then, perhaps with some right, be looked upon as a natural resource, a gift of God even as the minerals beneath the surface. When it is no longer the natural stand that exists, but one tended by man, raised by him, even created on barren soil, is it still a part of the soil or is it a crop? Should the forest crop be taxed and the field crop go free, should the crop of a century be burdened that the crop of a year may thrive?

PHILIPPINE FORESTRY SERVICE.

The following notice has been received from Capt. George P. Ahern, Chief of the Philippine Forestry Bureau:

WANTED.

Foresters and Inspectors for the Philippine Forestry Bureau.

The salaries of Foresters range from $1200 to $2400 per year.

The salaries of Inspectors range from $900 to $2400 per year.

There are a number of vacancies in the different grades, and good men are urgently needed for this interesting and important work. The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical knowledge is required.

Examinations will be held in different parts of the United States on May 5. For detailed information apply to Bureau of Forestry, Washington, D. C. Appointees from the United States are reimbursed after six months' service for traveling expenses from their homes to San Francisco. Half salaries begin on date of embarkation at San Francisco, and expenses of sea voyage paid on arrival at Manila. Foresters and Inspectors having from one to two and one-half years' service in the Islands find the field work very attractive, instructive and healthful.

The Philippine governing authorities are strong advocates of rational forestry. The laws protect the public timber lands (more than forty million acres) from speculators. All of this combines to assure success to the Philippine forest service.

PHILIPPINE PROMOTION.

Mr. William M. Maule, N.Y.C.F., ex-'03, formerly Inspector in the Philippine Forestry Service, has been promoted to Forester.

TO SAVE THE FORESTS.

The Federal officers in charge of the Northwestern forest reservations, including Forestry Superintendent Sheller, have just drafted two important bills for passage by the coming Legislature, with the object of preserving the Puget Sound timber supply. The first of the bills applies to State granted lands and will provide for their protection by a system of supervisors and rangers, in the same manner as the Government reserves are now protected by Federal rangers. The two systems of rangers can work in conjunction, thus policing a large portion of the State forests.

Superintendent Sheller finds that a great area of the State's timber is annually destroyed by fire, there being no efficient means, under the present State laws, of apprehending or punishing persons responsible for these fires.

The object of the second bill is to secure an appropriation for the purchase by the State of the logged-off lands which, on account of unpaid taxes, have reverted to the various counties of the State. Superintendent Sheller believes the State should buy these lands and inaugurate an extensive system of reforestation. Ownership by the State will exempt them from taxation.—*Wood and Iron, January.*

THE PROSPECT.

For the past twenty years the cause of forestry has been talked and worked for in this country; nature lovers, sportsman and economists have been of the workers, as forestry associations, forestry commissions and individuals have they worked. In those twenty years much was done; departments of forestry have been established under state and national government, state reserves have been created, the vast system of national reserves conceived and carried out, forestry schools founded, and last and most important the education of the people has been accomplished. They have been told of the destruction of the forests, taught that the tree can be cut and the forest preserved, taught that the waters of the lowland are born of the forest.

A new era is opening, one in which we will no longer talk why anything is to be done, but of what is to be done, and how to do it, an era when forest preservation has ceased to be a question of sentiment and foresight but of actual economic necessity.

It is the lumberman who finally will preserve the forest, not for its beauty, for its benefit to the community, but for the reason which led him to destroy it, his own financial benefit. Do we find any evidence that this state is approaching, that the lumberman is ready to cut without destruction, to sacrifice the present for the future?

TIMBER WASTE.

One of our Chicago contemporaries, in an article on "High Stumps and Short Product," calls attention to the practical economy that might be effected by cutting the trees closer to the ground, and seems to think the time has come when this should receive attention on the part of Southern pine manufactures. We are in hearty sympathy with every movement along this line, and would not say a word of discouragement against any suggested plan of timber saving. The extra unnecessary height of the stump in yellow pine, however, is almost an inconsiderable part of the waste. Where there is one yellow pine tree where a real saving could be effected by cutting the stump lower than is usual or customary, there are two or three where the stump is cut extra high on purpose to get rid of worthless wood or where a short "cut" is actually sawed off and discarded after the tree is

felled. Anyone who has ever passed over a section recently logged has no doubt been struck with the number of these high stumps and sawed-off butts.

On the other hand, such an one is even more forcibly impressed with the enormous waste in the "lap." Here the waste is evident in every tree cut. Above the first considerable limb, the body of the tree is left in the wood, not only an absolute waste, but to afford fuel to a fierce fire that sooner or later helps along powerfully to destroy the possibility of new growth. It is a common thing to see from 100 to 1,000 feet of timber left in one of those "laps" that cannot under present conditions be profitably manufactured.

For the present almost the only practical economy in timber cutting that offers a sure realization is in intelligent logging—to cut only the trees that have attained full growth, leaving the others for the future, and carefully collecting the present waste and burning it where it will do no damage. When all the big stumpage owners recognize, as some of them do now, that there is more in cutting the mature trees and letting the others stand, than in "clearing the ground" as they go, and that if they cannot operate on the former plan they are losing money every day the mills run, we will have entered upon a practical forestry that means something, and incidentally we will have given a stability to lumber values based upon actual facts and not pure speculation.—*Southern Lumberman.*

COLLEGE NOTES.

The third Annual Supper of the Cornell Foresters was held at the New Ithaca Hotel, on February 13th.

About seventy members and guests were present. The following graduates returned: C. R. Pettis, '01, Abraham Knechtel, '01, E. A. Sterling, '02. The toasts were responded to with the usual good spirit, as follows: "The College," Dr. B. E. Fernow; "Forestry—what it isn't," H. F. Weiss, '05: "Around Maine Campfires," G. B. Lull, '04; "With the Lumber Jacks," Mr. H. A. Field; "Our Natural Science Courses," R. S. Sloan, '05; "Suggestions," E. A. Sterling, '02; "Axton Stunts," A. S. Williams, '03. The Toastmaster, Dr. John Gifford, was absent because of severe illness, and Mr. H. O. Stabler, Sp., took his place. At the close a Foresters' Song, specially written for the occasion, was sung in chorus.

CONTENTS.

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FORESTRY QUARTERLY.

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FOREST PROBLEMS IN NEW HAMPSHIRE.

Observation of New Hampshire forests reveals two leading problems, that of reforesting the White Pine areas in the southern portion of the state, and of maintaining the output of spruce in the northern portion.

White Pine has an unrivaled growth in New Hampshire. Twenty-five years sometimes produce a merchantable crop suitable for the manufacture of boxes, pails and matches, while forty years produce trees that begin to have timber value. There are instances of pine land having been cut over twice by the same man, the profits of the second cut being greater than of the first, owing to changes in market conditions. Only a few scattered groves of the old, original White Pines remain.

The bulletin of the Twelfth Census relating to New Hampshire agriculture shows that one million seven hundred and sixty-four thousand (1,764,000) acres of land in the state have reverted from improved to unimproved farm land since 1850. These abandoned fields and pastures lie, for the most part, south of the White Mountains and contain much promising pine growth. One may find well-made stone walls in woods fifty years old, indicating that the land was once tilled; and choked and dying apple orchards in the woods are not infrequent. So much abandoned land would make a bad showing for New Hampshire were it not for the fact that through intensive cultivation, farm values have increased by eight million dollars during the last decade. Thirty-seven per cent. of the land area, chiefly non-agricultural, has never been taken up in farms. This with the unimproved farm land makes a total of more than 70% of the land area under some form of forest cover, a portion of it is, however, brush and not forest land. The chief difficulty from a silvicultural point of view is that nature's seeding has been in most places irregular.

As the pastures grow up to pines, a few trees appear first getting the start of the others, becoming limby and less profitable for lumber, and interfering with the growth of the trees that come later. It is estimated that the oncoming pine forests will ultilize not more than sixty per cent. of nature's forest and soil capacity, while some of it will utilize only thirty per cent. The problem is to develop this growing forest so that it will utilize the full capacity of the soil, by (1) Planting in the fail places. (2) Thinning when necessary. (3) Reforesting the cut-over areas, and and (4) Extending the forest area over land not profitable for agricultural crops.

Numerous experiments in sowing seeds of White Pine and transplanting young trees have been made in New Hampshire. The chief one of sowing seed was made by a gentleman in the town of Winchester, who sowed two hundred and ten acres, taking advantage of a good seed year and collecting the seed himself, and sowing about a quart to the acre. The ground not being well prepared the seed did not reach the mineral soil in all cases, and the stand is only partially satisfactory. On a portion of this tract only two hundred trees to the acre are now found after five years ; but over other portions a good stand is found of about twelve hundred trees to the acre. Experiments have been tried with fair success in transplanting natural seedlings two to ten years old. The best results are seen in Westmoreland, Moultonborough and Bedford, but none of them are on an extensive scale. Of groves thinned and pruned there are interesting examples throughout the pine region of the state, but the practice is not at all general. The great need is definite, practical instruction, attractively presented, in agricultural and other meetings. The Society for the Protection of New Hampshire Forests provides addresses with lantern photographs freely throughout the state. There is need also of a demonstration forest, conveniently located for showing results in management.

Taken as a whole, there is an extensive and very valuable second growth of White Pine in the state. In this respect New Hampshire differs from the western pine states, where the new growth is less vigorous and rapid. Besides, the soil in large portions of New Hampshire is better adapted to forest than to agriculture. The state promises to be a timber-producing state in years to come. Much more profit, however, can be secured by

improved management, and the forest area can be profitably extended. To supplement nature's seeding and to plant pieces of non-agricultural land not forested, the Society secured the introduction in the legislature of a bill for the establishment of a state nursery through which forest seedling trees and seeds adapted to the soil should be grown and distributed throughout the state at cost. This bill passed the House of Representatives, and though reported favorably by the Senate committee on forestry, failed of passage in the Senate.

The spruce problem is different. The mountain region and northern portion of the state contain some forests of virgin spruce, much of it, however, on the high slopes where diameters are small. In a felling on Black Mountain forty trees six inches in diameter averaged one hundred and twenty-five years in age. The pulp and paper companies control the greater portion of the spruce in the state. As their mills are large and expensive it is the policy of the three most important companies to cut to a diameter of ten inches or sometimes twelve, expecting to return after twenty or twenty-five years for another crop. One of these companies cuts its logs into twelve foot lengths in the woods in order to remove them with less injury to the young growth. This restricted cutting applies only to the valley and lower slopes, however, because on wind-swept places, including all high slopes, and on all steep slopes it is not profitable except to cut clean. These high forested slopes are particularly attractive to the summer visitors in the mountains, who are reported to leave annually $8,000,000 in New Hampshire, a sum equal to about one-half the annual lumber output. The æsthetic side of forestry is more important, therefore, here than in many other places.

The wasteful method of the lumbermen on these high slopes is sometimes excessive, two-thirds or more of all the trees being left upon the ground, trunks down hill, in order that the remainder may roll down over them to the road below. Such timber should be cut only by a conservative use of the selective method, and this can probably be done only when the government takes control. New growth reappears very slowly and in places never. Besides, the smaller concerns slash the woods recklessly in the valleys as well as on the slopes, having no interest in a future crop.

Until the year 1869 New Hampshire owned the great portion of the White Mountain region which it then sold for $25,000. It

is reported that a single tract of spruce on the northern slope of the Presidential range was recently purchased by the company now cutting there for $600,000.

What can be done to prevent the rapid disappearance of the spruce forests on the high slopes and in the places of particular scenic value? This question is hard to answer. The principle of state interference by restricting the cut to a given diameter below which the operator may not fell his trees has been proposed in previous sessions of the legislature and defeated. This principle appears to be contrary to American independence, curtailing a man's right to do what he will with his own, and while there are instances of similar paternalism in our government—confiscation of diseased cattle for instance—the farmers to a man are opposed to such restrictive legislation for forest cutting. Moreover, no restrictive law has been formed by any of the states that cover the multitude of varying conditions in the forest. The principle of state ownership alone remains, and the education of private owners to better methods. While New Hampshire has no state debt, it is not a rich state. The burden of taxation is felt, particularly in the hill towns from which the forest has been removed. Population in these towns has greatly diminished, and the families remaining have difficulty in supporting the schools and many miles of road. In the legislature members from these rural towns, not yet aware of the true significance of the forest, have a preponderating influence, and refuse to submit to further taxation for forest purposes. They do not yet realize that New Hampshire can do in proportion to her means what Connecticut, Massachusetts, New York and Pennsylvania are already doing. State ownership, therefore, cannot be brought about except gradually, and meantime the virgin forests are rapidly disappearing.

A solution has been proposed through an appeal to the federal congress for a national reservation in the White Mountain region similar to that proposed in the Southern Appalachian Mountains. It has been objected that it is inexpedient for the United States to interfere with the forest management of any single state, but the interstate character of the White Mountains is sufficiently established by the fact that the waters flowing from them—the Androscoggin, the Saco, the Merrimack and the Connecticut rivers—supply power to more factories than any other waters in the country, and their even flow is of vast importance, and that

the mountains are visited already annually by people from every state in the Union for rest and recreation of a kind found in few other places. As nothing can be done by congress until the facts of the case are fully set forth, the Society for the Protection of Forests has had introduced in the state legislature another bill appropriating $5,000 for an examination of the forests in the mountain regions of the state by the Bureau of Forestry at Washington. This bill has passed, and the work will shortly begin.

The plan for a national reservation has the emphatic endorsement of President Roosevelt, Secretary Hay, and the senators and representatives from New Hampshire and prominent citizens in all parts of New England are giving active support. Aside from this hoped-for reservation much benefit must result from the examination itself, because it will give to New Hampshire people knowledge of their own conditions and offer suggestions as to the best means of managing our mountain forests.

PHILIP W. AYRES.

FACTORS INFLUENCING THE VOLUME OF SOLID WOOD IN THE CORD.

With the development of the pulp industry, the importance of the cord as a wood measure has largely increased. In the Adirondacks at present almost all the Spruce, Balsam, and Hemlock cut for pulp is measured by the cord. A cord contains 128 cubic feet of stacked wood, represented by a stack 4 feet high, 4 feet wide, and 8 feet long. In order to find the number of cords in a stack of other dimensions, the length of the stack is multiplied by its width and height, and the result divided by 128. Thus, a stack 4 feet high and 8 feet long, made of 12-foot sticks contains 3 cords, the same as a stack 4 feet high and 24 feet long, made of 4-foot sticks. If we attempted, however, to resaw the 12-foot sticks into 6-foot lengths and stack them 4 feet high and 16 feet long, we would discover that we have not enough wood to complete 3 cords. The stack would be smaller, and this shrinkage would be still greater were we to resaw the 12-foot sticks into 4-foot lengths and stack them 4 feet high and 24 feet long. Thus, the shorter the stick the more wood is required to make a given number of cords.

By careful investigation upon Spruce in Russia,[1] it was established that by resawing 7-foot sticks into 3.5-foot lengths stacks shrunk 5 per cent. ; 3.5-foot sticks into 1.75-foot lengths, 3 per cent.; 7-foot sticks into 2.33-foot lengths, 6 per cent., and 28-inch sticks into 14-inch lengths, 2 per cent. From this we may see that the shrinkage was greater the longer the sticks were before resawing.

Should we resaw the 12-foot sticks mentioned above, into 4-foot lengths and stack them 4-feet high and 24 feet long we would find that the stack had shrunk at least 12 per cent., to be very conservative. In other words, 3 cords of 4-foot sticks, 4 feet high and 24 feet long, contain 12 per cent. more of solid wood than 3 cords of 12-foot sticks 4 feet high and 8 feet long, though stumpage in both cases is paid for 3 cords only.

The 4- and 12-foot sticks in our example are not chosen arbitrarily, but are taken from actual practice. Pulpwood in the Adirondacks is cut mostly into 4-, 12-, and 14-foot lengths. It

[1] Prof. A. Roodzsky. "Lesnaya Taxaziya."

ought to be of great practical interest to the owner of a forest tract, whether his pulpwood is cut and stacked into 4- or 12-foot lengths. Twenty thousand cords are frequently cut from a single tract during one year, and the choice of 4- or 12-foot lengths means a difference of 2400 cords, or in money (at an average stumpage price of $2.50 per cord), of $6,000 on the stacking alone.

This example shows of what practical importance is a knowledge of the factors influencing the amount of solid wood in a cord, and will justify, therefore, an attempt to examine them more closely.

1. Length of Sticks.

The stick length, as we have seen above, has a decided effect upon the solid volume of the cord. The sticks are never entirely straight and smooth, and, in piling them one above another, there always remain cracks which become larger the longer the sticks are and *vice versa*. The shorter the sticks the closer can they be piled and the more wood will the cord contain. With 4-foot sticks as standard, changes in the stick length from 1 foot to 6 feet vary the difference in the solid volume of the same stack measure from 14 per cent. to 35 per cent. as the following table, based upon extensive experiments, shows :

INTERDEPENDENCE OF THE STICK LENGTH AND THE VOLUME OF SOLID WOOD PER 128 CUBIC FEET OF SPACE.*

Length of Stick. Feet.	Straight Sticks. Volume. Cubic Feet.	Straight Sticks. Difference. Percent.	Crooked Sticks. Volume. Cubic Feet.	Crooked Sticks. Difference. Percent.	Knotty Sticks. Volume. Cubic Feet.	Knotty Sticks. Difference. Percent.
1	99.81	+8.3	93.47	+14.1	89.60	+20.7
2	97.28	+5.5	89.60	+ 9.4	84.48	+13.8
3	94.72	+2.8	85.76	+ 4.7	79.36	+ 6.9
4	92.16	.0	81.92	.0	74.24	.0
5	89,60	−2.8	78.08	− 4.7	69.12	− 6.9
6	87.04	−5.5	74.24	− 9.4	64.00	−13.8

2. Diameter of Sticks.

The smaller the sticks, the more of them will there be in a cord. With the number of sticks in the cord increases also the number of cracks ; the solid wood, therefore, decreases.

The difference of solid volume in two stacks, of which one is composed of sticks twice as large as those in the other, may amount to 13 per cent ; and if the sticks of one stack are four times as large as those of the other, this difference may be even 25 per cent.

* From König, cited in Dr. Müller's "Lehrbuch der Holzmesskunde."

Baur's investigations* bring out clearly this relation between the number of sticks (or diameter of stick) and the solid volume of the cord.

Diameter of Stick. Inches.	Number of Sticks per cord.	Solid Cubic Feet per Cord of Hardwoods.	Softwoods.	Mixed Hardwoods and Softwoods.
6.8	94	102.40	102.40	102.40
6.0	126	94.72	98.56	96.00
4.75	205	88.32	97.28	92.16
3.5	378	79.36	90.88	84.48

From this table also follows that while we are dealing with logs of fairly large diameter (6.0″ to 6.8″) an increase in the number of sticks even from 94 to 126 per cord, an increase of 34 percent (*i. e.*, a small diminution in the diameter of each individual stick), causes a drop of 6.40 cubic feet in the solid volume, whereas practically the same drop is caused in the solid volume of a stack of sticks of smaller diameters (3.5″ to 4.7″) by an increase in their number from 205 to 378, or by an increase of 84 per cent.

3. *Split Wood.*

Large sticks are often split to facilitate their drying and handling. After being split the sticks cannot be stacked as closely as before and less wood is required to make the given stack. Splitting therefore reduces the amount of solid wood in the cord. Stacks of split wood always contain less solid wood than stacks of round wood of the same diameter.

By splitting in two sticks 21 inches long and 3.5″ to 7″ at the small diameter, a stack increases (the solid wood per given space consequently decreases) 6 per cent; 21-inch sticks thicker than 7 inches, 4 per cent; 14-inch sticks, 3.5″ to 7″ thick, 5 per cent; and 14-inch sticks thicker than 7″, only 2.5 per cent.† In other words, the longer and thinner the sticks split, the greater is the swelling of the stack, or, what is the same, the decrease of solid wood in the given stack measure.

4. *Form of Sticks.*

The straighter and smoother the sticks the fewer air spaces between them, and, consequently the greater the solid contents of the stack measure. For this reason the clear trunks of trees yield more solid wood per given space than the tops and branches.

* Franz Baur, "Untersuchungen über den Festgehalt," etc.

† Prof. A. Roodzsky, "Lesnaya Taxaziya."

The results of experiments upon the relation between the form of sticks and the solid contents of the cord are given in the following table :*

Class.		Number of Sticks per cord.	Solid Cubic Feet per Cord of Hardwoods.	Softwoods.	Mixed Hardwoods and Softwoods.
Large	Smooth	104	97.28	96.00	96.00
	Knotty	101	85.76	90.88	88.32
Small	Smooth	162	92.16	92.16	92.16
	Knotty	155	83.20	87.04	84.48

5. *Species.*

The preceding tables show that softwoods furnish more solid wood per given space than do hardwoods. This is undoubtedly due to the smaller taper, greater clear length, and smoother bark of conifers.

A cord of softwoods contain on an average about 3 per cent. more of solid wood than a similar cord of hardwoods. The species of the tree from which the cordwood is derived, therefore, must have some effect upon the solid contents of the cord, inasmuch as some species taper more or less than others. This effect is, to be sure, not very great, and since the taper and the general habit of trees vary with the locality and conditions under which they grow, no accurate arrangement of species in the order of their greater or less yield of solid wood to the cord is possible.

6. *Green Wood and Dry Wood.*

Sound, freshly-cut wood dries in the air, and the stack, therefore, shrinks, resulting in an increase of solid wood per given space. In drying, it is true, the wood cracks and the bark becomes detached, which tends to counteract the shrinkage of the stack, but not enough to neutralize it entirely. It makes, therefore, a difference how soon after felling timber the stack is measured. Hardwoods dry in the air more and shrink, therefore, more than do softwoods. Green hardwood completely air-dry shrinks from 9 per cent. to 14 per cent. according to species, while softwood only 9 per cent. to 10 per cent.† Consequently, stacks of dry hardwood have 9 per cent. to 14 per cent., and dry softwood 9 per cent. to 10 per cent. more, respectively, of solid volume than similar stacks of green wood.

* Franz Baur, "Untersuchungen über den Festgehalt und das Gewicht des Schichtholzes und der Rinde."

† Franz Baur. "Untersuchungen über den Festgehalt."

7. *Piling and Fixing the Stack.*

The higher the stack the less closely can it be piled and the less wood will it contain per given space. Stacks higher than 4 to 4.5 feet high can not be piled conveniently. The heavier the stick and the weaker the piler, the less close is the piling and the less solid wood in the cord. In order to hold the pile together, one or two stakes are used at each end. It has been observed that when one stake is used at each end of the stack, the volume of solid wood per cord is higher than when two stakes are at each end. In the latter case, the ends of the sticks, and in crooked sticks their concave sides, cannot reach much outside the stakes. This tends, therefore, to decrease the solid wood in the cord. There always remains some space between the stakes holding the stack together and the wood. Therefore, the fewer the stakes used for the total amount of wood to be corded (*i.e.*, the longer the stacks), the higher is the solid volume per cord.

The quality of labor has much to do with the solid volume of the cord. If the branches are not trimmed close to the body of the stick, if the sticks are chopped instead of sawed, if the laborer is careless in piling, there is less solid wood per given space.

8. *Measuring the Stack.*

The length of a stack is seldom the same at both top and bottom. The top of the stack is, as a rule, longer than the bottom. This is due to the spreading of the end stakes from the weight of the piled sticks or from their not being set vertically at first. Therefore, it makes considerable difference where the length of a stack is measured.

The length should be measured half way up the stack, because if the top length is used it would give less solid wood than the stack actually contains. The use of the bottom length would give more than the actual solid volume.

The height of the stack is seldom the same on both sides. The height of the stack should be measured at several places on both sides, and the average of these measurements taken for the height.

9. *Conclusions.*

This brief review of the factors influencing the amount of solid wood per given space teaches that no correct comparison can be made etbween two stacks containing the same number of cords,

but having sticks of different lengths, diameters, and shape, unless the actual solid volume of the two stacks is known. It is extremely desirable, therefore, to be able to tell how much solid wood is in a cord made of sticks of given length and diameter. Only by knowing this can one avoid paying the same amount of money for the same number of cords and getting different amounts of solid wood.

An attempt is made here to present tables in which the solid volume of wood in a cord can be found. Of all the factors influencing the amount of solid wood only the length and thickness of the stick are taken into account as being of greater importance and uniform in their effect. The rest are more variable in their influence and are, therefore, less easily computable.

The wood is divided into several classes according to its thickness. In the first class are sticks more than 5.5″ in diameter at the small end. Such sticks are usually derived from the lower part of the trunk; they are free of branches and cylindrical in shape. The best pulpwood belongs to this class.

The second class contains sticks 2.5″ to 5.5″ in diameter. This and the first class are most frequently found together. Most pulpwood is a mixture of these two classes.

To the third class belongs wood 1.0″ to 2.5″ in diameter. This and the second class mixed together furnish most of the extract wood, firewood, etc.

Table I gives the solid volume of a cord containing 128 cubic feet of stacked wood for sticks 10″ to 14′ long. Table II that of stacks 4 feet high, 8 feet long, and 10″, 12″, 14″, 16″, etc., wide.

In order to find the solid volume of a stick length not given in Table II, take the stick length nearest it, divide its solid contents by its length, and multiply the quotient by the log length desired. Thus, if it be required to find the solid volume of a cord of 13-inch wood, 4 feet high and 8 feet long, divide 23.50 by 12 and multiply the quotient by 13, or divide 27.32 by 14 and multiply by 13. The result in either case will give the solid volume for the required stick length.

The figures given in the table are average figures, and as such are subject to changes in accordance with local conditions. If, for instance, the majority of the trees cut into cordwood are more than 12.0″ in diameter breast high, the solid volume of the cord may be raised about 5%. Should the majority of the trees be no larger than 5″, the solid volume of the cord may be reduced about

5%. If the trees have rough, thick bark, the solid volume of the cord may be reduced 3%. Thin-barked trees would raise it 3%. Tall, straight trees, clear of branches to a great height, would raise the solid volume of the cord 10% in first-class wood; in the second class, 5%. Low, crooked, and branchy trees would reduce the solid contents 10% and 5%, respectively, and so on. As can easily be seen from this, these tables are not absolute for all conditions. To be perfectly correct, such tables should be made for a limited locality. The merit of the tables given, therefore, lies in pointing out the relative solid contents in cords of sticks of different length and diameter, and, as such, they ought to prove of value to all industries which buy timber for its actual solid volume, like pulp and extract manufacturers.

By giving the actual solid volume in cords of different length and diameter, these tables help to establish just and uniform prices, and ought, therefore, to be the basis of all specifications in contracts for pulp-, extract-, or firewood.

TABLE I.

VOLUME OF SOLID WOOD PER 128 CUBIC FEET OF SPACE.

Length of stick	1st class: small diameter over 5.5″	2nd class: small diameter 2.5″–5.5″	3rd class: small diameter 1.0″–2.5″	1st and 2nd classes mixed	2nd and 3rd classes mixed
INCHES		CUBIC FEET.			
10	91.98	85.40	65.70	88.69	75.55
12	91.80	85.25	65.69	88.53	75.47
14	91.67	85.10	65.65	88.39	75.38
16	91.50	84.95	65.60	88.23	75.28
18	91.37	84.80	65.55	88.09	75.18
20	91.20	84.67	65.50	87.94	75.09
22	91.05	84.50	65.40	87.78	74.95
24	90.90	84.35	65.32	87.63	74.84
26	90.75	84.20	65.23	87.48	74.72
28	90.60	84.05	65.12	87.33	74.59
30	90.45	83.90	65.00	87.18	74.45
FEET					
3	89.98	83.40	64.60	86.69	74.00
4	88.92	82.42	63.62	85.67	73.02
5	87.75	81.30	62.60	84.53	71.95
6	86.45	80.00	61.60	83.23	70.80
7	85.38	78.82	60.55	82.10	69.69
8	83.75	77.20	59.40	80.48	68.30
9	82.40	75.80	58.20	79.10	67.00
10	81.00	74.30	56.90	77.65	65.60
11	79.60	72.80	55.60	76.20	64.20
12	78.05	71.20	54.25	74.63	62.73
13	76.45	69.60	52.90	73.03	61.25
14	74.85	67.95	51.50	71.40	59.73

TABLE II.

VOLUME OF SOLID WOOD IN STACKS

4 ft. high, 8 ft. long, and 10″, 12″, 14″, etc. wide.

Length of stick	1st class: small diameter over 5.5″	2nd class: small diameter 2.5″–5.5″	3rd class: small diameter 1.0″–2.5″	1st and 2nd classes mixed	2nd and 3rd classes mixed
INCHES		CUBIC FEET.			
10	19.50	17.50	14.00	18.50	15.75
12	23.50	21.00	16.00	22.25	18.50
14	27.32	24.50	19.00	25.91	21.75
16	31.00	28.50	21.50	29.75	25.00
18	35.00	32.00	24.30	33.50	28.15
20	37.50	35.00	27.00	36.25	31.00
22	42.20	39.00	30.00	40.60	34.50
24	46.02	42.00	32.70	44.01	37.35
26	50.00	46.00	35.20	48.00	40.60
28	53.21	49.00	38.00	51.11	43.50
30	57.00	53 00	41.00	55.00	47.00
FEET					
3	68.50	63.00	50.00	65.75	56.50
4	88.92	82.42	63.62	85.67	73.02
5	108.50	101.50	78.00	105.00	89.75
6	128.50	120.00	92.30	124.25	106.15
7	149.55	138.05	106.41	143.80	122.23
8	170.00	165.00	119.90	167.50	142.45
9	190.00	175.00	133.50	182.50	154.25
10	211.00	193.00	147.50	201.00	170.25
11	230.00	210.50	161.20	220.25	185.85
12	250.00	228.00	175.00	239.00	201.50
13	269.00	245.50	189.00	257.25	217.25
14	287.50	262.50	203.00	275.00	232.75

RAPHAEL G. ZON.

THE NEW YORK FOREST FIRE LAW.

It seems, on account of the disastrous forest fires which have recently occurred in the Northeastern United States, quite apropos to describe the fire law of the State of New York.

"Self preservation" is said to be "the first law of nature," and forest protection should be the first consideration in forestry. Fire is by far the greatest of all the destructive agents of the forest. A well-known writer uses the expression · "It takes thirty years to grow a tree and thirty seconds to cut it down and destroy it." Fire will destroy the thirty-year-old tree equally as quick and usually at the same time destroy the soil.

The law of the State of New York gives to the Forest, Fish and Game Commission the "care, control and supervision of the Forest Preserve,"* the enforcement of the laws relating to forest fires, and the authority to "make rules for the prevention of forest fires and cause the same to be posted in all proper places throughout the state."

The laws relating to forest fires consist of nine sections in Chapter 20, Laws of 1900, Article XIII. They may be summed up as follows: Section 220, Powers of Commission. Section 224 a, Authorizing the office of Chief Fire Warden. Section 225, Town Fire Wardens and Fire Districts. Section 226, Duties of Fire Wardens. Section 227, Compensation of Fire Wardens and others employed at fires. Section 228, Railroads in forest lands. Section 229, Fires to clear land. Section 230, Forest fires prohibited. Section 231, Proceeds of actions for forest fires.

The wording and fundamental purpose of the law is to *prevent* fire, and at the same time have an efficient organization which can quickly get to the place and cope with a fire while it may yet be controlled, or render such services as may be expedient. The public welfare requires and the law provides that all forests, whether on state or private lands, be entitled to the same consideration and protection.

* The Forest Preserve includes all the wild lands of the state situated in the Adirondack and Catskill counties, except the lands in the towns of Altoona and Dannemora, Clinton county, which are under the supervision of the Comptroller. The Forest Preserve includes all or portions of the following counties, of which 1,436,686 acres are state lands, viz: Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, Oneida, Saratoga, St. Lawrence, Warren, Washington, Delaware, Greene, Ulster and Sullivan.

There are three grades of fire wardens. First. The Chief Fire Warden, who is appointed by the Commission. He has "supervision of the town fire wardens, visits and instructs them in their duties, and enforces the law as to fire districts in the towns, and under authority of the Commission commences prosecutions for violation of laws to prevent forest fires. He fills vacancies and removes town fire wardens with the consent of the Commission; has charge of fire wardens' reports, and when a fire is not reported ascertain its origin and result." In addition he has supervision of all bills against the state rendered by the various towns for fighting fires.

Second. The town firewardens are appointed by the Chief Firewarden with the consent of the Commission. Under the Commission a town firewarden is charged with preventing and extinguishing forest fires in his town. In case of fire in, or threatening, forest or woodland the District Firewarden, if any, or, if none, the Town Firewarden shall attend thereto forthwith and use all necessary means to confine and extinguish the same. The Town Firewarden or District Firewarden may summon any resident of his town to assist in putting out fire. Any resident summoned, who is physicially able, and refuses to assist shall be liable to a penalty of ten dollars. In case a fire burns over an acre or more of land the fire warden of the town in which it occurs shall forthwith make an examination and report the same on blanks furnished for this purpose to the Commission, giving the area burned over, the quantity of timber, woods, logs, bark or other forest products, and of fences, buildings, and bridges destroyed, with an estimate of the value thereof. He shall also report the cause of the fire and the means used in putting it out.* Should the fire be in his vicinity, although in an adjoining town, it will be his duty to go there immediately and use the same means too extinguish it as though it were in his own town. If no warden from that town be present he shall assume the same authority and the same duties as though the fire was in his own town, until the arrival of the warden from the town within whose limits the fire occurs; but when a warden from the town in which the fire occurs shall arrive he shall assume charge of the fire. No matter which warden orders out the men to fight the fire the town in which it occurs shall be liable for the expense

*Section 226—Duties of Firewardens.

thus incurred. He shall also see that the district wardens are supplied with printed notices, which are furnished by the Commission, containing the rules and regulations relating to the prevention of forest fires, and shall see that the same are posted. He shall be the District Warden of the district in which he lives and a resident of that town. He shall divide the town into districts, if not previously done, and appoint district wardens therein. In dividing the town into districts, mountain ranges, rivers, brooks, and highways are used as division lines. In some cases school districts constitute a fire district. This information is sent promptly to the Chief Firewarden and he locates the district on his map. His pay is $2.50 per day and reasonable expenses, *when he works.* In accordance with the law he issues permits to farmers to burn fallow and audits the bills against the town for services rendered in fighting fire.

Third. District firewardens are appointed by the Town Firewarden, subject to the approval of the Chief Firewarden. They have jurisdiction over their districts, although they may go beyond when they deem it for the best interest of the forest. They shall see that their district is properly posted with the cloth fire notices.* They do not make a report to the Commission, but assist the town warden in making a report of such fires as may occur in their districts. They shall promptly notify the town warden of any fire in their districts and also report to him a complete list of all men, who may have assisted in putting out a fire, with the number of days or hours each man worked. They receive for their services the same pay as a town warden, viz: $2.50 per day for time rendered. They may issue permits to farmers to burn a fallow, which is situated within their district.

Locomotive sparks and fallow fires cause the larger part of the forest fires. Hence the portion of the law which relates to "Railroads in forest land" and "Fires to clear land" deserves the most consideration. The section relating to fallow fires reads as follows:

*The notices are of white duck 14″ by 21″ and have the words "Look out for FIRE" at the top in heavy large letters. Below are rules to campers, hunters, fishermen and others in regard to care in building fires, peeling bark, etc. Then follows the law in regard to clearing land. Notices are usually posted on fences, barns, trees and stumps along roads and trails It often seems like a bit of sarcasm to find one or more of these white cloth fire warnings posted on a charred stub in a burned section, but they are doing a large amount of good.

"Section 229: Fires to clear land.—Fallows, stumps, logs, fallen timber, brush or dry grass shall not be burned in the territory hereinafter described from April first to May thirty-first both inclusive, or from September sixteenth to November tenth both inclusive. From June first to September fifteenth both inclusive such fires may be set therein if written permission of the Town Firewarden of the town or District Firewarden of the district in which the fire is set is first obtained. If in a locality near forest or woodland, the fire warden or district firewarden shall be personally present when the fire is started. Such fires shall not be started during a heavy wind or without sufficient help present to control the same, and the same shall be watched by the person setting the fire until put out. Any person violating any provision of this section is guilty of a misdemeanor, and in addition thereto is liable to a penalty of three hundred dollars. This section applies as follows.* The section is completed by the enumeration of sixty eight Adirondack and seventeen Catskill towns, which are known as "fallow towns."

The firewarden law has been in force for some time, but not until three years ago, when the office of Chief Firewarden was created, was it effective. Before the Chief Firewarden was appointed there was no one who had the time to look after the large number of wardens; they were a law unto themselves, negligent about reports and some of them lawbreakers. The present law places all the responsibility in a single person—the Chief Firewarden. He in turn holds each Town Warden responsible for reports of all fires and the enforcement of the law, in his town. The town warden in turn depends on his district wardens in the same manner. The law is very weak in that there is no punishment for inability or negligence of firewardens, except their removal. This weakness will exist unless the office is made a salaried one, when a person would be willing to be responsible for enforcement of the law and attention to his duties, or by placing the responsibility on some town officer, *e.g.*, the Supervisor. It so happens in some towns that the firewarden has so much business of his own that he does not have time to

*This section was amended by the Legislature of 1903 to read as above. The words "brush or dry grass" were inserted and the time to allow farmers to burn fallow extended ten days in June and fourteen days in September.

attend to his duties as promptly as he ought. For any inattention, that comes to the notice of the Chief Firewarden, the warden is called upon for an explanation. Frequently wardens are removed or resign and a process of weeding is going on and the force is constantly improving in efficiency. It is always the endeavor to appoint as a warden a man who has not only had experience in fighting fire, but a fellow who can command the respect and obedience of a "posse" of fellow citizens, and has an interest in the preservation of the forest. *The one great trouble is to regulate the use of fire by land owners on their own property.* Many farmers have had no respect or regard for the law and are willing to risk all the woodland they have in order to burn over an acre of fallow. The effect of prosecution has been very beneficial in nearly every case, and it has resulted in letting the careless and lawless know that the time has come when they cannot openly violate the law. However, much has to be done yet as they feel it is an infringement upon their right, which they have exercised for generations, when they are restricted in the time that they shall burn. Early in May this year three farmers at Tupper Lake were fined in one day for burning fallow in violation of the law. Another farmer at the same place set a fallow two days later, and after he had been warned. He was also convicted, but this only shows the difficulty and slowness with which the Adirondackers are grasping the new situation. In the case of fallow fires there is the difficuly of proving how the fire originated. Men have been known to hire others to set their fallows afire when they were away and then they return in time to see that all the brush is burned up. To overcome this difficulty an eflort was made last winter to have the law amended to read as follows: "if a fire occurs on fallow land in violation of the provision it shall be presumptive evidence that it was set by the owner or possessor thereof." This measure passed the Senate but was over-ruled by the Adirondack members in the Assembly.

The greatest danger from fire is in the spring after the snow leaves until the vegetation is in full leaf, and less so in the autumn after the leaves fall until snow. The intention of the law in prohibiting fallow fires at certain times of the year is to lessen the danger of fire at the two dangerous periods. An extreme case of drought such as has happened this spring in New York State

brings up obstacles which any law could not cover as long as there are careless and negligent people at liberty.

The rules on the cloth notices urge the greatest care from hunters, fishermen and others who travel in the woods. As said before fires which burn over more than an acre must be reported promptly to the Chief Firewarden, thus any violation may be taken up and considered while there is still a chance to secure evidence. There has been times in the past when wardens would not report fires or report them as cause unknown in order to shield a guilty party. But this has largely changed and wardens are quite on the alert to fine a guilty party as they receive half of the fine, but not exceeding fifty dollars in any one case.

It is a noticeable fact in the northeastern and middle portion of the state that burned areas are all, or nearly all, in the vicinity of roads, settlements, or farms. The lumberman makes no fires, simply makes everything ready for fires, as they do their work in the winter time. The sooner the residents of the forest realize that the preservation of the forest is their greatest welfare, the sooner will the danger from fallow fires, smudges, camp fires, and carelessness be reduced. Our fires are all caused by human agencies, and if each person in the woods was placed under strict surveillance as to the use of fire then the danger would be largely reduced. The farmers, hunters, fishermen, campers, and last, but not least the railroads burn our woods.

—Clifford R. Pettis.

FOREST PLANTING ON THE PLAINS.

Tree planting in the semi-arid West dates its beginning with the first settlement of the country. The first settlers came mostly from the East, where the conditions for tree growth are, on the whole, favorable. They planted whatever varieties were available without any consideration of their adaptability to the soil and the climatic conditions. The results of these early attempts at tree growing are still visible in many parts of the semi-arid West. The few scattered remains of dead and dying trees bespeak the disappointment met by the early settlers in their attempt to surround their habitations with forest growth. In a few favored localities the planting of the early settlers proved successful and their groves are now considered landmarks and points of interest by the traveler.

The reason why many forest trees do not succeed in the semi-arid portion of the West is well understood—droughty conditions in summer and winter.

The two main problems which confront the western tree-grower are: First, the proper selection of drought-resisting species best suited to the climate; second, the best method of preservation of moisture. Where irrigation can be had these two problems are of relatively small importance, but where the conditions do not permit the use of water for artificial watering the problems are vitally important. Yet the success of a few pioneers in the relatively humid section of Kansas and Nebraska and along the river courses of these states where the conditions for forest growth are more favorable, led to a considerable amount of tree planting in this portion and an extension into the more arid western country with more or less success.

In the selection of species those most easily propagated and most readily adapted to droughty conditions were foremost, with little regard to their commercial value, and the manner of planting was that of the orchardist or nurseryman, with the attendant cultivation of the soil. Although conifers had been used sparingly, they were usually planted merely as ornaments, in single specimens or groups.

In 1890 Dr. B. E. Fernow, then Chief of the Forestry Division, pointed out that conifers and especially pines would be the most

satisfactory plant material, especially on the extensive sand hills of Nebraska, and that the proper method was to plant here without cultivation of the soil, but in dense position, to make the crop self-supporting as soon as possible. On these premises four experimental plats were started to prove the correctness of this proposition. The reasons, objects and detailed instructions as to methods pursued are given in full in the report of the Chief of the Forestry Division for 1891, and a report of the first year's success in report for 1892.

In moving northward from the Platte River in Western and Central Nebraska a series of low ridges or benches are encountered to which the general term "sand hills" has been applied. These ridges begin, in many instances, within a few miles of the Platte River before mentioned and gradually extend in an irregular series of broken hills or sand dunes northward into South Dakota. The extent of country covered by these sand hills amounts to about one-third of the state, or in the neighborhood of 15,000,000 acres. Geologists tell us that this part of the country was once the site of a large inland lake or sea, whose sandstone deposit gradually disintegrated under the influence of climate, and whose waters were gradually carried off by drainage and evaporation. This whole area, once the drainage basin of a vast territory, is underlaid with currents of water flowing towards the streams. These underground currents are in many places relatively close to the surface and keep the soil moist up to within a few inches of the surface, even during the most protracted drought. The soil is almost entirely composed of loose sand with a small admixture of vegetable matter in the draws or hollows. The prevailing winds are mostly from the northwest and they exercise a decided influence upon the temperature of the country. The land is covered with a scanty growth of bunch grass which affords a limited pasturage for stock. In traveling over this region Dr. Fernow was impressed with the possibilities of converting this semi-barren section into forests.

That such conception was not based upon bare speculation is evidenced by the fact that numerous remains of former forests have been found embedded in the sand at various depths and in various places. The experiment in question was carried out on the farm of Mr. Edgar G. Bruner, Swan, Holt County, Nebraska. Mr. Bruner agreed to follow out the instructions as laid down by

Dr. Fernow. The object of the experiment as stated by Dr. Fernow was as follows: "The object of this experimental planting is to test the adaptability of various conifers for forest planting on the Western Plains and especially in the sand-hill region of Nebraska, and also to find out whether or not dense planting without special preparation and cultivation of the soil is preferable to wider spacing with cultivation. It is also intended to compare the success of mulched with that of unmulched parts, and the behavior of various combinations of kinds in varying widths of planting."

In planning the experiment, Dr. Fernow had in mind to make the conifer the dominant factor in the plantation, using the deciduous-leaved species for filling and nurse trees.

The following conifers were planted Bull-pine, (*Pinus ponderosa*), Scotch Pine (*Pinus sylvestris*), Banksian Pine (*Pinus divaricata*).

Of these species Dr. Fernow had the greatest faith in the Bull-pine, mostly because indications would point to the fact that this species of Western pine once occurred in at least parts of this region. The Scotch Pine was used because of the success with which this species has been grown in other parts of Nebraska and in Kansas. The Banksian Pine was planted because of its adaptability to poor sandy soil, being native to the large tracts of loose, sandy, drift soil in Minnesota and Wisconsin. The deciduous-leaved species were composed of black locust, birch, box elder, hackberry, black cherry and red oak. The last-named two species were intended for permanent trees should they prove sufficiently adapted to the severe conditions. It will be seen from the above that the experiment was of unusual practical and economic value and its inception marked the beginning of experimental forestry among the sand-hills of Nebraska. Planning an experiment of this nature is only one feature of the work. The difficulty of carrying out all the details of all its provisions soon became apparent. The materials used for planting did not arrive in the best condition, nor were the plants of the best quality. But in spite of all these obstacles one great lesson has been learned which has practically solved the problem of clothing with forests this large tract of practically barren land, and to bring it into the production of valuable timber. The experiment, after the lapse of twelve years, has fully substantiated the

experimenter's prediction that this section is fully capable of sustaining forest growth, that the pines are the most suitable material, and that cultivation of soil is undesirable. The plantation marks a new era in tree planting in Central and Western Nebraska.

In a letter from Mr. Bruner to the writer in response to inquiry in regard to the present condition of the plantation, the following may be quoted: "The larger trees (Banksian Pine) are between fifteen and twenty feet high. The Austrian Pine from four to twelve feet high, and the Bull Pine from three to eight feet high. The Banksian Pines are very nice and even in growth and would undoubtedly make fine plantations, planted alone. They would quickly furnish materials for fence posts and telephone poles which are in great demand here.

"The grove presents the appearance of a dense corn-field. I am sure that if there were a nursery here to start the pine seedlings, millions would be planted and these otherwise worthless sand-hills could be covered with a dense growth of pine trees." The result of the experiment has been so satisfactory that last year the Federal Government reserved 200,000 acres of these sand-hills for forest purposes and we may look forward to extensive forest planting operations.

The method of planting may be briefly described as follows: The land was not previously plowed or otherwise prepared. Furrows were plowed out two and one-half (2½) feet apart and the seedlings were planted in them immediately. The distance apart in the rows was about two and one-half (2½) feet apart. One-half of the plantation was mulched with straw and grass. One plot was left to be cultivated. The best method to plant in such sandy situations is not to stir the ground at all, but to use either the Wartemberg iron or a light hoe to set the trees. Prairie fires destroy the greater part of the deciduous-leaved trees and what were left did not seem to do well. The result shows that there is practically no difference in growth between the plots where the soil was mulched as against that without mulch or cultivation. The cultivated plot proved an entire failure, as predicted, the reason being that the capillarity is destroyed and evaporation is much greater in the surface soil.

In the sand-hills, therefore, no distinct advantage was gained even with shallow cultivation or by mulching. On the heavier

lands in Kansas, Nebraska and South Dakota this method might not prove successful. Here a thorough preparation of the soil is first necessary. The land should be sub-soil-plowed to the depth of twelve (12) inches to provide a reservoir of water during the rainy periods to be drawn upon by the plants as needed. If only shallow plowing is done the soil is very apt to dry and kill the plants. The plowing should be done as early as possible in the spring so as to give the plants the full benefit of the spring rains.

It is, however, questionable whether the planting on these soils fit for agriculture will ever assume the dimensions of forest planting. Shelterbelts and wind breaks will probably continue to be the object of the planter on the prairie and plain.

E. P. Sandsten.

CURRENT LITERATURE AND REVIEWS.

Eighth Annual Report of the Forest, Fish and Game Commission of the State of New York. Albany. Pp. 164. Illustrated,

In this report are several articles of interest and of importance. Mr. E. A. Sterling, now Field Assistant in the Bureau of Forestry, describes a number of successful chestnut orchards. Mr. Pettis, in detail, describes the manner of collecting a large quantity of Red Spruce seed. The seed has since been used in the State nursery at Saranac Junction and in broadcast sowing of bare lands.

The Forest, Fish and Game Commission has been curtailed, perhaps wisely, in its range of work by the constitutional amendment forbidding cutting on state lands. The 150,000 acres of waste land in the Adirondack Park have no economic future in the natural course of events; the acres which may slowly grow up in poplar and birch are as nothing to the many which burn and reburn; that the state is duty bound to protect these lands. to render them productive, the Commission has recognized. The wisest and most important advance in policy yet made by the Commission was the starting of artificial reforestation.

The first large plantation made is described in this report. Six hundred thousand plants were placed over a tract of 700 acres, more or less, the cost averaging less than one-half a cent per tree.

The plantation is in the midst of a large stretch of flat sandy country similar to thousands of acres in the northern townships of the region. Originally covered by a fine growth of pine and underwood, it was lumbered, burned, and again burned, until of the forest there now remain but a few charred stumps of the pine. The depth of humus was burnt with the timber, bringing the white silicious soil slowly to the surface where it still remains, scattered in strong contrast to the intermediate patches of blackest ashes. Ground cover of brake, huckleberry, alder and various grasses and sedges has struggled in scantily on the lower levels; on the upper a few scattered poplar have started and lived on in spite of frequent setbacks from frost and drouth.

Viewed on a hot May day the tract presented as melancholy and deplorable an example of desolation as could well be found. As a site for a plantation the dry loose sand, the almost total lack

of humus, litter or ground cover promised little but failure. The plant material, consisting of two to four-year-old seedlings and transplants of Scotch Pine, White Pine, Norway and Douglas Spruce, was put in spaced at six feet, square distribution, and mixed according to site.

One year after planting the pines had made leaders of from five to twelve inches in length, the spruces considerably less. The Norway Spruce showed a successful per cent. of about 80, the White Pine of between 90 and 95, and of the Scotch Pine hardly a dead one could be found; in rapidity of growth after planting and in hardiness it showed itself to be remarkable; in many places it was growing vigorously where hardly a vestige of native vegetation occurred. If judgment may be passed only one year after planting, and experience in the region has shown the greatest danger to be in this first year, the success of the plantation is assured.

The Redwood. By R. T. Fisher. Bulletin No. 38, Bureau of Forestry. Pp. 40. Pl. xii. Fig. 4.

An interesting account of the Redwood, showing it to be possible even practical to hold cut-over Redwood lands for a second crop.

Conservative Lumbering at Sewanee, Tennessee. By John Foley. Bulletin No. 39, Bureau of Forestry. Pp. 36. Pl. xii.

The reader will not find in this bulletin of the Bureau of Forestry complicated tables showing the future yield per acre down to fractions of board feet and to dollars, nor volume tables showing the contents of trees of different diameters and heights, nor curves and tables of the rate of growth of different species, but notwithstanding this the contents of this publication must appeal to the common sense of the lumberman and practical forester more forcibly than any other bulletin of its kind. It is a plain and simple tale of how, under intelligent management based upon a thorough local knowledge of the forest tract, higher returns have been obtained from lumbering without entirely impairing the chances for future forest growth.

Our forests, in contradistinction to most of the European forests, are not sown or planted artificially, but are the result of free play of natural forces. They are irregular, in the majority of cases

composed of many different species, which constantly dispute with each other for the occupancy of the land. Gradually as the marketable trees are culled out the remaining species occupy their place and the composition of the forest is changed. Under such conditions, and without knowledge of the silvicultural behavior of most of our forest trees, it is, to say the least, very risky to predict the future growth and yield of the species that is most lumbered, nor is it useful from a practical point to know thoroughly how the old trees of the primeval forest now cut have grown, for the conditions under which they have grown up may never be repeated again, and Mr. Foley wisely, in our opinion, left out from discussion in his working plan the future yield and rate of growth of old trees.

The difference between mere lumbering and lumbering upon forestry principles lies in the taking care of the young forest growth, *i.e.*, in silvicultural measures, to which much attention is given in the bulletin.

The observations made of the demands upon soil, moisture, and light of the different species are too local to be of general value, and in the table of comparative sprouting capacity of the different species no mention is made of what was taken for comparison—the number of sprouts or the height and diameter of the predominant sprout during the first year, considerations which would change the order in the table.

The bulletin is an interesting one and judging from it the operations at Sewanee should prove most successful.

The Principal Species of Wood. By Charles Henry Snow. New York, John Wiley & Sons. Pp. 203. Pl. 39.

A comprehensive work, illustrated by photographs and original drawings ; to be reviewed in a subsequent number.

United States Geological Survey, Professional Papers Nos. 4, 5, 6, 7, and 8. Series H, Forestry 1.

The results of recent investigations by the Geological Survey of Western timber resources have just been published under separate covers as follows : The Forests of Oregon, and The Forests of Washington, by Henry Gannett ; Forest Conditions in the Cascade Range, Washington, by Fred G. Plummer ; Forest Conditions in the Northern Sierra Nevada, California, by John B.

Lieberg ; and Forest Conditions in the Olympic Forest Reserve, Washington, by Arthur Dodwell and Theodore F. Rixon.

These reports, like former ones of the Survey, are mainly in the nature of a census ; the works appear to have been done with care and intelligence, and many excellent regional descriptions and silvicultural notes are to be found scattered through them. The usual excellent photographs and maps are included and add greatly to the value of these papers.

Sylviculture par A. Fron, ingénieur agronome, inspecteur adjoint des eaux et forêts, professeur à l'ecole forestière de Barres (Encyclopédie Agricole) Paris 1903. Pp. 563 16°, Pl. 55. 6 frcs.

This latest volume is of interest because it is written for the farmer rather than the professional forester, explaining in simple language yet with professional background the principles and practices of silviculture. It includes also chapters on forest measurement and forest economy.

PERIODICAL LITERATURE.

Pulp and Paper Magazine of Canada.
May.

This is a new magazine published at Toronto and judging from the first number will contain many articles of interest.

Rod and Gun in Canada.
May.

Forest Fire Protection in Europe, by A. Harold Unwin, D.Œc., is a short article on German protective methods.

Transactions of the Royal Scottish Arboricultural Society. Vol. XVII, Part 1.

The Injurious Effects of Smoke on Trees is the title of an interesting paper by John Boyd.

Naturwissenschaftliche Zeitschrift für Land-und-Forstwirthschaft. 1 Heft.

Contains an account of a top dryness of spruce due to peculiar electric discharges during a thunderstorm, by Dr. von Tubeuf; and a paper by Dr. Hiltner bringing new light on the mycorhiza.

Jahrbuch der Preussischen Forst- und Jagdgesetzgebung und Verwaltung. XXV Band., 1 Heft.

Contains the new working plan of the Experiment Stations for thinnings and interlucations. It classifies, as formerly into five tree classes. It recognizes ordinary thinnings (*éclaircie par le bas*) with three degrees, light, moderate and severe; the last degree moving in the fourth or even fifth classes; and *éclaircie par le haut* with two degrees, light and severe. Here a part of the dominated stand is retained and the final harvest crop is recognized.

A working plan for experiments on the influence of cultivation on the accretion is also given.

Allgemeine Forst- und Jagd-Zeitung.

Jan.

Aus den Berichten des Direktors der St. Petersburger Forstakademie über die Pariser Weltausstellung contains statistics of the forests of Bosnia, Herzegovina, Rumania, France, Tunis, Austria, Finland, Scandinavia, Canada and Ceylon.

Feb.

Pflanzenzucht und Zuchtwahl, by Dr. Köhler accentuates the desirability of using only selected vigorous plant material and shows the advantages of such practice in the long run. Dr. Kohler advocates that at least one third of nursery seedlings be thrown away as inferior and that no attempt be made to save it by transplanting.

Saegeversuche by J. D. Dominicus Söhne, gives an account of comparative tests by Lorey of the efficiency of American (Simonds) and German (Dominicus) saws, the German make being apparently better for hardwoods.

March.

Under the title Deutsche Reisebilder, Oberförster Dr. Heck says of the enormous quantities of Southern Pine lumber entering at Bremen: "Especially remarkable is the knotty quality and high price. This was explained by the enormous demands for this wood in the United States, hence it increases in price and the importers must be satisfied with the leavings, which are, however, no better than the cheaper home products."

Versammlung des badischen Forstvereins.

The report of this meeting contains a very good discussion on the proper management and regeneration of spruce woods. "The question of natural regeneration stands or falls with the wind firmness of the species and the suitability of the soil as a seed bed. The spruce where it can penetrate with its root system into rock fissures is as wind firm as any other species. It is different on shallow impenetrable soil; here, especially in exposed situations natural regeneration must be abandoned and clearing with the usual precautions must be substituted."

The Versammlung des deutschen Forstvereins contains a discussion on the conversion of poor hardwood into coniferous forests, today the great forest problem in the eastern United States. The discussion is on the basis of eighty years experience in Saxony on 23,000 acres. At first clearing and sowing of pine with spruce and larch was practiced, but planting gradually took the place of sowing and is now the almost exclusive method pursued. The conversion was made in forty years.

Although the spruce was not on its natural site and both pine and spruce suffered much in their early stages the expectations have been entirely fulfilled, the stock on hand being nearly doubled and the yield per acre more than quadrupled.

May.

Waldbrandfolgen im Lichte forstwirthschaftlicher Erfahrungen, by Oberförster Renne.

Discusses the effects of fires on trees of different species and forest growth of different conditions.

Zeitschrift für Forst- und Jagdwesen.

Die agrarstatistischen Erhebungen und das Forstareal in Preussen. By H. A. Reinick, is a review of the official census of 1900 of the soil area and its use in Prussia, running through the February, March and April numbers.

The census shows that small farm ownership, fifty acres or less, is in preponderance, namely, with 85 per cent.; that only one-quarter of all the farms have woodlots with a total of 11.5 million acres, while 9.2 million acres are forest properties purely. The waste area capable of reforestation is over 1.3 million acres.

The total of the forest area has in the last twenty years been increased by 366,000 acres, namely an increase in state forests of 518,000 acres, in corporation forests of 256,000 acres, and a decrease in private forest of 408,000 acres. The distribution of silvicultural systems show that only 11.5 per cent. is selection forest, while just 10.5 per cent. is coppice or standard coppice, the remaining 78 per cent. being timber forest other than selection; 69 per cent. is coniferous and 31 per cent. deciduous forest; of the coniferous 75 per cent. belongs to the state.

February.

Forstliche Zustände in England, by Dr. Schwappach. A highly interesting clear statement by a competent observer of the forest conditions of England. They are described as deplorable, 39 per cent. of the entire Kingdom exists as treeless wastes. To the hunting or rather shooting passion is credited the lack of interest in forestry, the rent for shooting grounds bringing a sure and satisfactory income from these wastes, namely 40 to 60 cents per acre, so that the higher returns from forestry which can only be had in the dim future by present expenditures do not appeal to the owners.

The state owns only 68,000 acres of woodlands and that is mostly mismanaged.

Wanderversammlung des nordwestdeutschen Forstvereins. The report of this meeting contains an interesting statement regarding the behavior of the White Pine in Germany.

March.

Die Drillsaat im Forstbetriebe, by Oberforster Titze. Reports in detail on the use of a seeding machine for forest planting, comparing cost and result with hand sowing. The saving in seed and in labor over hand sowing amounts to 40 per cent.

April.

In ueber unsichtbare Rauchschaden. Dr. A. Wieler discusses at great length the observations of damage done to vegetation by smoke.

Zusammenstellung der Samen preise im Frühjahr, 1903, gives seed quotations of sixteen firms for seventeen tree species. White Pine varies in price between $1.62 and $2.16, and its germination per cent. between 50 and 70; Scotch Pine fluctuates at 75c. and Norway Spruce from 22c. to 32c.

Uebersicht der durchschnittlichen Verwertungspreise für ein Festmeter aller Holzarten und Sortimente in den Preussischen Staatsforsten im Etatsjahr, 1900. A detailed account of wood prices with quantities sold. Wood, taking the average of logs and cordwood, increased 8 per cent. in price over the previous year.

Centralblatt für das Gesammte Forstwesen.

Die forst-und volkswirthschaftliche Bedeutung der Anbauversuche mit nordamerikanischen Holzarten für Deutschland und Nord-Amerika. By Dr. Unwin. (Continued from January and through April and May numbers.)

In the first two numbers the American species introduced into Germany are enumerated with some of their characteristics. In the last two issues their silvicultural requirements and treatment are discussed in a manner highly interesting to American foresters. It is stated that the American species of spruce, fir, larch, oak, elm, maple and ash are subject to the same physiological and silvicultural laws as the corresponding European species, that they may be treated like these and then furnish products equal in quality and in the time required for production. These conclusions, especially the last two, can hardly be correct in their generality, since our many species of oaks, ash, maple are well known to vary themselves in quality, rate of growth and ecologic adaptation.

From the discussion of single species the following remarks may be briefly noted :

Acer saccharinum and *A. negundo* are not considered as forestally important. *A. saccharum* is supposed to be like *A. platanoides* and is called half tolerant and a rapid grower, while with us it appears most shade enduring and of rather slow growth.

Betula lutea is compared to the European birches in all silvicultural requirements. This is undoubtedly an error, there can hardly any similarity be found ; for *B. papyrifera* it would perhaps be true.

Hicoria ovata on account of its slow development for the first decade should only be introduced in groups between rapid growers and then only on best soils, *H. glabra* thrives on poorer soil, *H. minima* in spite of its more rapid growth is said to deserve no consideration.

Catalpa speciosa is said to suffer mainly from early and late frosts, and hence is to be grown under shelter ; this seems a peculiar experience considering the ease with which the species is grown in the west.

For *Juglans nigra* small pure stands or groups are recommended, single planting is not satisfactory except in the region of the chestnut where growth is rapid.

Abies balsamea is said to be similar to the European Fir which is questionable when we consider its habitat in the Northern swamps, and its rapid rate of growth but short life.

To *Pinus divaricata* very high tribute is paid for its use on the poorest driest sands and gravels, and in swampy conditions, on dunes and for wind or fire mantles. Enormous demands for plant material have brought the price of seed to $16 per pound.

Regarding the soil requirements of *Pinus strobus* various doubtful statements occur. It is said to be useless on pine soil of the third class, yet within sight of the writer two White Pine stumps five and six feet in diameter on a purely siliceous poor soil testify to the contrary, at least for the rigorous alpine conditions of the Adirondacks. Its absolute frost hardiness is praised.

Thuja occidentalis is noted for its excellent wood, its hardiness, and shade endurance ; it is recommended for admixture with ash or White Pine or under-planting under oak, pine or larch, especially on fresh soils.

Tsuga canadensis is given as a rapid grower which it is not with us.

Chamaecyparis lawsoniana a shade endurer, in a warm climate with humidity corresponding to ash sites is credited with frost hardiness and rapid growth ; under other conditions it succumbs to summer or winter drouth. It is recommended for under-planting with deciduous trees or pines, but not with spruce or fir.

Of *Pseudotsuga taxifolia* the rapid growth, shade endurance and adaptation of the root system is praised. Its sensitiveness to early and late frosts, and to low winter temperatures followed by sun make its use in the plain with its contrasts of moisture and temperature conditions unsatisfactory, unless a nurse cover is provided. It is recognized that the Colorado variety differs in this respect, but it is also sensitive to late frosts and grows much more slowly.

Summarizing the silvicultural characteristics of the American species, the superior hardiness of the east American species to the Rocky Mountain species is recognized. It is contended that the cultivation of European species in eastern America may be successful only in Canada, which is of course contrary to facts. As to value for European planting *Pinus strobus*, *P. divaricata*, *Robinia pseudocacia* and *Pseudotsuga taxifolia* are placed first, *Hicoria* and *Juglans* next, the *Cupressineae* are questionable, and only to be used when no native species of the genus exists.

Ueber Holzkonservirung durch Petroleum, by A. Adiassevich.

The author has succeeded in producing a creosote from petroleum, which is cheaper and superior for impregnating railroad ties, than the usual product.

Ueber die gesetzmäszigan, Beziehungen der Massenfaktoren in normalen Fichtenbeständen, by A. Schiffel.

There is here discussed in detail the practical applicability of certain laws of relation between the volumes of stands and the single factors of height, diameter and form factor. The discovery of such laws has the practical result of reducing the amount of measuring necessary to determine the contents and sortiments of a stand. The laws discovered and formulated by Kopezky and Fekete have been tested, and the latter which established a relation between the diameter, height or form and certain percents of the stem classes has been found to furnish very satisfactory means of reducing the amount of measurement necessary.

The general law which broadens the relationships pointed out by Weise for the average tree is formulated to read : In normal spruce stands a tree corresponding to a given percent. of all the trees has in any stand a given proportion of the total volume, height and form ; or in two different stands the volumes, heights, cross section areas, form factors and form heights of two trees correspond to the same stem class percent. as the volumes, areas, form factors, and heights of their average trees.

NEWS AND NOTES.

The Biltmore Forest School will hereafter give to successful graduates the term "Bachelor of Forestry." Such successful graduates as desire to obtain the degree "Forest Engineer" will be placed on actual trial, namely: In charge of a forest range inside Pisgah Forest, aggregating from 10,000 to 30,000 acres, for a term of at least six months. They are expected to do full ranger's duty during that time. They will be in charge of logging crews, of surveys, of buildings and farms, of the stock on pasture, of saw-mills, and of whatever other work there might be at hand within the specified range.

Whether or not a salary will be paid to the graduate whilst working for the degree of "Forest Engineer" in the capacity of a forest ranger, is a question partly depending on the financial conditions of the range and partly on the ability of the candidate.

The Lawrence Scientific School of Harvard University opens in the fall with a new course in forestry, which is No. 13 in its catalogue. Harvard is thus the third of the great eastern universities to give regular instruction in forestry. The first school of forestry in this country was opened at Cornell in 1898 by Mr. Fernow, who since 1886 had been chief of the then Division of Forestry at Washington. The Yale school began in 1901 with Mr. Graves, also of the Division of Forestry, at the head. The Harvard course is a nearer parallel to the one offered at Cornell, which is of four years, while the one at Yale is of two. The instruction in this four-years' course will be divided among four places, namely, Cambridge, the Arnold arboretum and the Bussey institution at Jamaica Plain, and the field. The instruction will be largely given by professors and instructors now at Harvard, but there will be engaged in addition two skilled foresters to give special courses in practical and historical forestry. One of these men is R. T. Fisher, Harvard, '98, who will also keep his connection with the Bureau of Forestry. The other, who is not a government man, has been approached, but has not yet accepted. Whether he will accept the place or not will be settled in the next month.—*Springfield Republican.*

THREE STATE BILLS.

Three bills of import to forestry were introduced in the New York State Legislature during the last session.

The first of these was for an appropriation of $6,000 to the Forest, Fish and Game Commission for use in planting of waste lands. It had apparently every chance of passage. The plantation made the previous year was eminently successful, and had been favorably reported by the special Adirondack committee of the Senate ; the project in general of planting up the waste lands of the State has been considered with favor, even enthusiasm, by the public both visiting and resident, and by the press ; again the appropriation called for was but a small sum ($6,000) and its passage was absolutely without political significance. The Legislature made the appropriation, the Governor vetoed it.

The second bill and one of a very similar nature provided for a special appropriation of $5,000 for use in reforestation of the Cornell Demonstration Forest. This appropriation was made by the Legislature and approved by the Governor.

The third and most important was the annual appropriation bill of $10,000 for the support of the New York State College of Forestry ; it passed the Legislature without opposition but was vetoed by the Governor.

For a proper understanding of the action taken in regard to the last two bills it is perhaps well to explain here the relation of the Cornell Demonstration Forest and the New York State College of Forestry, two separate and distinct institutions. The former was created to demonstrate the most profitable way to perpetuate State and private forests by use, the latter to teach the principles and practice of forestry ; they are supported by different appropriations and the sole connection between them is that they are under the direction of Cornell University.

Considerable protest has been made against the system of clear cutting with artificial and natural regeneration as practiced in the Forest ; protest arising solely from one or two influential estate owners in the neighborhood, but sufficiently strong to influence a number of legislators and even the Governor himself to express themselves publicly as being against the present policy. It would seem therefore that this bill aiding the present management with a $5,000 appropriation would have had but poor chance for success.

The passage of the bill for the College of Forestry seemed assured: it was an appropriation that had been made annually for the past four years; the success of the College during the five years of its existence has not been doubted in any quarter; the number of students has doubled yearly and at last registration the school was larger than any French or German forestry school; the students who have gone from it are now occupying important positions in the National, the Philippine and various State services.

Concerning his action in vetoing the College appropriation the Governor is reported to have said, "the operations of this college of forestry have been subjected to grave criticism, as they have practically denuded the forest lands of the State without compensating benefits. I deem it wise, therefore, to withold approval of this item until a more scientific and more reasonable method is pursued in the forestry of the lands now under control of Cornell University."

Of the Governor's desire to change the method of operations in the Demonstration Forest little need be said, the question is merely one of personal opinion or rather of professional judgment, and those capable of doing so may judge. But his method of attempting to change the policy in the Demonstration Forest is to say the least extraordinary, namely, the abandonment of a school of training to express disapproval of a method pursued by a connected experimental department; his method is more extraordinary for the veto of the College appropriation in no way affects the work in the Demonstration Forest; nothing has been accomplished but the ruin of a flourishing institution whereby seventy young men are seriously handicapped in their careers. Why?

At a meeting of the trustees of the University of Maine held in Orono, April 14, it was voted to establish a Department of Forestry at the University, and President Fellows was authorized to employ a Professor of Forestry. The last State Legislature provided the sum of $2,500 a year for the support of the Department.

The Luquillo Forest Reserve containing 65,950 acres in Porto Rico was created January 7, 1903; Dr. John Gifford will investigate this reservation for the Bureau of Forestry during the coming summer.

A forest reserve of 100,000 acres in Miffin, Juniata and Huntingdon Counties in Pennsylvania has been recently created and named the Rothrock Forest Reserve, in honor of Dr. J. T. Rothrock, the present Forest Commissioner. The region is rich in oil, gas, fire clay and ganister and an arrangement has been made for their development under proper supervision.

Mr. Gifford Pinchot, Chief of the Bureau of Forestry, has been made Professor in the Yale Forest School. Assistant Professor J. W. Toumey has been advanced to a full professorship.

Mr. R. H. Charlton, Sp. N.Y.C.F., has been promoted to be Inspector of Forest Reserves.

Mr. Walter Mulford '01, N.Y.C.F., has been elected President of Connecticut Forestry Association. A portion of the appropriation made by the Legislature two years ago has been expended in the purchase, survey, and protection of about 700 acres of land in Portland. The work at Windsor, which is being conducted at the expense of the Connecticut Experiment Station, has consisted in the planting of 60,000 trees to determine the best methods of reclaiming the waste lands of the State.

Theodor Karlowitsch Arnold, Councillor of the Public Lands Office of Russia and justly known as the Father of Russian Forestry, died recently at an advanced age. His work for forestry dates from the 40's of the last century and he was directly or through his pupils the teacher of all Russian foresters.

SUMMER LECTURES ON FORESTRY.

A course of lectures on forestry will be given at Idyllwild, San Jacinto Mountain, California, under the auspices of the University of California. The regular work will be under Dr. Willis L. Jepson, of the Department of Botany, and Prof. Arnold V. Stubenrauch, of the Department of Agriculture. In addition special lectures will be given by Mr. Gifford Pinchot. The course lasts from July 29th to August 10th.

CANADA.

Canada is rapidly progressing in forestry work. The Department of Interior is encouraging planting in the Northwest by

free distribution of seeds and trees. Under the direction of Mr. Stewart, the Superintendent of Forestry, this work, started several years ago, has met with increasing success. During the past year plants were distributed to over six hundred applicants for use in protective planting. To meet the rapidly increasing demand for plant material two large nurseries are being established at Indian Head and Brandon.

The principal work of the Department of the Interior in forestry of late has been the protection of Crown lands and the creation of forest reserves.

The following complete list of Canadian reserves has been completed for Dr. John Gifford by Mr. R. H. Campbell, Department of Interior, Secretary of the Canadian Forestry Association.

FOREST RESERVES IN THE DOMINION OF CANADA.

PROVINCE OF BRITISH COLUMBIA.*

RESERVES UNDER THE CONTROL OF THE GOVERNMENT OF THE DOMINION.

1. *Long Lake Timber Reserve*—Townships 17 and 18, Range 19, and the westerly two-thirds of Townships 17 and 18, Range 18, all West of the 6th meridian. The range of mountains included in this reserve reaches a height of 6,200 feet and forms the watershed for a number of small streams which take their rise in the numerous small lakes and swamps. The land is of too great elevation to be of use for successful farming operations and to make agriculture profitable in the valleys below the water from these hills is absolutely necessary. There is a good growth of timber, mainly Douglas Fir (*Pseudotsuga Douglasii*) and Black Pine (*Pinus Murrayana.*) Set apart by order of the Minister of the Interior on the 15th August, 1902. Area, 76,800 acres.

2. *Yoho Park.* This is really a part of the Rocky Mountains Park of Canada, but being on the west slope of the Rocky Mountains and therefore within the Province of British Columbia it was thought advisable not to risk complications with local legislation by attempting to place it under the provisions of the Park Act and the regulations. It was set apart by Order in Council of

*As a return for the building of the Canadian Pacific Railway, which obtained large financial and other assistance from the Dominion, the Province transferred to the Dominion a belt of land twenty miles wide on each side of the main line of the railway.

the 14th December, 1901, under the authority of Clause 78 of the Dominion Lands Act, which was included as part of the Regulations for the Railway Belt in British Columbia. Area 530,240 acres.

3. *Glacier Forest Park.*—Set apart by order in council of 11th October, 1888. Area, 18,720 acres.

NORTHWEST TERRITORIES.

4. *Rocky Mountains Park of Canada.*—Set apart by special act of the Dominion Parliament in the year 1887, extended by Act of 1902. Approximate area, 2,880,000 acres.

5. *The Foothills Timber Reserve.*—Set apart by order of the Minister of the Interior, 21st February, 1899. Covers the foothills on the east slope of the Rocky Mountains north to the Bow River. Area not estimated.

6. *Waterton Lakes Forest Park.*—Set apart under the authority of Clause 78 of the Dominion Lands Act by Order in Council of 30th May, 1895, Townships 1 and 2, Ranges 29 and 30, west of the 4th meridian. Approximate area, 34,000 acres.

Lake Louise Forest Park, southeast of Laggan Station, Sand Lake Forest Park in Township 24. Range 9, west of 5th meridian, and Mount Stephen Forest Park, set apart under the same authority, are now included in the Rocky Mountains Park of Canada as extended or in Yoho Park.

7. *Cooking Lake Timber Reserve*—In Northern Alberta, South-East of Edmonton, containing over 109,000 acres, set apart by Order of the Minister of the Interior under same authority as No. 5, 6th June, 1899.

8. *Moose Mountain Timber Reserve*—In Eastern Assiniboia, containing over 103,000 acres—set apart by same authority as No. 5.

9. *Beaver Hills Timber Reserve*—Set apart 20th August, 1901, under same authority as No. 5—Area about 170,000 acres.

PROVINCE OF MANITOBA.

10. *Turtle Mountain Timber Reserve*—Near the International boundary,, containing over 75,000 acres—under same authority as No. 5, 13th July, 1895.

11. *Spruce Woods Timber Reserve*—Set apart under same authority as No. 5, 8th January, 1898. Area 190,000 acres.

12. *Riding Mountain Timber Reserve*—Comprises an area of about 1,215,000 acres—under same authority as No. 5, 13th July, 1895.

13. *Duck Mountain Timber Reserve*—Set apart provisionally 5th Feb., 1902, under same authority as No. 5. Area 840,000 acres.

14. *Lake Manitoba West Timber Reserve.*—13th July, 1895, under same authority as No. 5. Area, 159,460 acres.

15. *Northwestern Manitoba.*—Reserved from settlement only. Timber licenses may be granted 24th August, 1900.

RESERVES UNDER THE CONTROL OF THE GOVERNMENT OF THE PROVINCE OF ONTARIO.

16. *Algonquin Park.*—Set apart by Act of the Ontario Legislature of 1893 as a national park and forest reservation ; extended in the following year to include an area of 1,109,383 acres. A large proportion of this reserve was and is under timber license. One of its chief functions is as a game preserve. It controls the watershed for a large district. It has been lumbered over for a long time, but contains a large quantity of mature timber.

17. *Eastern Reserve.*—In the counties of Addington and Frontenac, set apart under the Forest Reserves Act by Order in Council of April, 1899, comprises about 80,000 acres. Mainly burnt over and cut over lands, pine reproducing itself.

18. *Sibley Reserve.*—North shore of Lake Superior, set apart under Forest Reserves Act by Order in Council of 10th February, 1900. Comprises about 45,000 acres. An isolated point growing up with mixed forest, including White Pine, Spruce, etc.

19. *Temagami Reserve.*—Set apart under Forest Reserves Act by Order in Council of 11th January, 1901—comprises about 1,408,000 acres. A magnificent forest of White and Red pine, White and Black spruce, Banksian Pine, Yellow and White birch, Hard Maple, etc. Includes one of the largest bodies of pine still remaining in Ontario. There is estimated to be about 5,000,000,000 ft. of pine in the Temagami district. None of this timber is under license but much of it is ready for cutting. Li-

censes will not be granted but the system of management has not yet been determined.

20. *Rondeau Park.* Mainly a park and game preserve—set apart in 1894.

PROVINCE OF QUEBEC.

21. *The Laurentides National Park.*—Established by an Act of the Legislature of Quebec dated 12th January, 1895, comprises an area of 2,531 square miles.

22. *Trembling Mountain Park.*—Established by an Act of the Legislature of Quebec dated the 12th January, 1895—never made operative.

PROVINCE OF NEW BRUNSWICK.

23. By an Act of the Legislature passed at the Session of 1902, authority was given for the selection and setting apart of a forest reservation, but reserve not yet selected.

APPENDIX.

BIBLIOGRAPHY OF FORESTRY.

This bibliography is a list of articles on forestry which are contained in the United States Congressional documents and printed in the sheep set. Publications of the Division of Forestry or any other department, not included in the sheep set, will not appear in this list. For a list of articles contained in the Reports of the Department of Agriculture see the Bibliography in Fernow's Economics of Forestry. There are articles on forestry in foreign countries to be found in the Consular reports not brought out in this list.

The references are made to the serial numbers, *i. e.*, the consecutive volume number of the whole sheep set, instead of to the Congress and session. As the year is given in every article there is no bibliographical loss.

OLIVE WILLIAMS.

FORESTRY—GENERAL.

Agriculture Department. Special report of the Commissioner upon the subject of forestry. Dec. 14, 1877. 3 p. Ser. 1802. Doc. 24.

Andrews, C. C. Report on forestry in Sweden. New and rev. ed. Washington, 1900. 35 p. Ser. 3878. Doc 452.

Edinburgh international forestry exhibition. (In Report of the Division of Forestry for 1884. p. 167–179.) Ser. 2212.

Fernow, B. E. Forestry for farmers. (Agric. Dept. Year book, 1894. p. 461–500, ill.) Ser. 3326. Doc. 355.

Fernow, B. E. Forestry in the U. S. (In Reports of U. S. commissioners to the . . . Exposition of 1889, Paris. v. 5. p. 747–777. Plates.) Contains articles on Forest botany, Forest utilization, Forest culture. Ser. 2757. Doc. 410, pt. 5.

Fernow, B. E. Relation of forests to farms. (Agric. Dept. Year book, 1895. p. 333–340, ill.) Ser. 3441. Doc. 380.

Fernow, B. E. Report upon the forestry investigations of the U. S. Department of Agriculture, 1877–1898. Washington, 1899. 401 p., ill. Pl. Maps. Ser. 3813. Doc. 181.

Fernow, B. E. Work of the Division of Forestry for the farmer. (Agric. Dept. Year book, 1897. p. 143–160.) Ser. 3693. Doc. 454.

Forestry associations. List. (Agric. Dept. Year book, 1900–1901.) Serial 4179. Doc. 519.

Forestry Division. Report of the Chief, 1883—date. (In Annual report of the Secretary of Agriculture.)

General Land Office. Reports of the Commissioner. (In Report of the Secretary of the Interior.) There is a report on forestry in each of these reports.

Graves, Henry S. Practice of forestry by private owners. (Agric. Dept. Year book, 1899. p. 415–428. Plates.) Ser. 3996. Doc. 588.

Hall, William L. Forest extension in the Middle West. (Agric. Dept. Year book, 1900. p. 145–156. Plates.) Ser. 4179. Doc. 519.

Hough, Franklin B. Report on forestry prepared under the direction of the Commissioner of Agriculture in pursuance of an act of Congress, approved Aug. 15, 1876. Washington, 1880–82. v. 2–3. Vol. 1 pub. in 1878, not in the sheep set. Vol. 4 pub. in 1884 by N. H. Egleston, not in the sheep set. Ser. 1922. Doc. 37. Serial 2046. Doc. 38.

Interior Department. Communication from the secretary in relation to an appropriation to meet expenses of an investigation and report by the National Academy of Sciences on the inauguration of a rational forest policy for the forested lands of the U. S. March 11, 1896. 4 p. Ser. 3428. Doc. 306.

Keffer, Charles A. Tree planting in the western plains. (Agric. Dept. Year book, 1895. p. 341–360, Ill.) Ser. 3441. Doc. 380.

Keffer, Charles A. Tree planting in waste places on the farm. (Agric. Dept. Year book, 1896. p. 323–340.) Ser. 3496. Doc. 6, pt. 2.

National Academy of Science. Report of the Committee appointed by the Academy upon the inaugration of a forest policy for the forested lands of the U. S. May 1, 1897. 49 p. Ser. 3562. Doc. 105.

Philippine Islands—Forestry, Bureau of, Special report of Capt. G. P. Ahern . . . covering the period from April, 1900, to July 30, 1901. p. 679–738. Plates. (In Report of Sec. of War.) 57th cong., 1 sess. H. D. no. 2.

Pinchot, Gifford. Notes on some forest problems. (Agric. Dept. Year book, 1898. p. 181–192. Plates.) Ser. 3824. Doc. 293.

Pinchot, Gifford. Primer of forestry. Wash. 1901. 2 pts. Ser. 4184. Doc. 727.

Pinchot, Gifford, Progress of forestry in the United States. (Agric. Dept. Yearbook, 1899. p. 293–306. Plates.) Ser. 3996. Doc. 588.

Price, Overton W. Practical forestry in the Southern Appalachians. (Agric. Dept. Yearbook, 1900, p. 357–368. Plates). Ser. 4179. Doc. 519.

Progress in forestry in 1900–01. (Agric. Dept. Yearbook, 1900–01.) Serial 4179. Doc. 519.

Sargent, Charles S. Report on the forests of North America exclusive of Mexico. Wash. 1884. 9 + 612 p. Pl. Maps. Ser. 2137. Doc. 42.

Sellergren, G. Utilization of forest products. p. 557–611, Ill. Plates. (In Rept. of the Committee on awards of the World's Columbian Commission, Vol. 1.) 57 Cong. 1 Sess. H. D. 510.

Suwa, Shikazo. Forests in Japan. p. 551-556. (In Rept. of the Committee on awards of the World's Columbian Commission, v. 1.) 57 Cong. 1 Sess. H. D. 510.

FOREST FIRES.

Interior Department. Letter of the Secretary relative to the destruction by fires of timber on the public lands June 17, 1890. 3 p. Ser. 2688. Doc. 152.

Public Lands Committee. Report on bill (H. R. 9123) entitled "A bill to prevent forest fires on the public domain." May 22, 1896. 1 p. Ser. 3464. Doc. 1975.

Public Lands Committee. Report on bill (H. R. 9124) entitled "A bill to protect the forests on the public domain from destruction by fire." May 22, 1896. 1 p. Ser. 3464. Doc. 1976.

Public Lands Committee. Report on bill (H. R. 8585) to amend an act entitled "An act to prevent forest fires on the public domain." Mar. 2, 1900. 2 p. Ser. 4022. Doc. 482.

Public Lands Committee. Report on bill (H. R. 8585) to amend an act entitled "An act to prevent forest fires on the public domain, recommending its passage." Apr. 10, 1900. 2 p. Ser. 3890. Doc. 937.

FOREST PRESERVATION.

Agriculture and Forestry Committee Report on preservation and protection of trees. June 25, 1891. 2 p. Ser. 2710. Doc. 1411.

Amer. Assoc. for the Advancement of Science. Memorial upon the cultivation of timber and the preservation of forests. Feb. 6, 1874. 6 p. Ser. 1580. Doc. 28. Ser. 1623. Doc. 259. Ser. 2682. Doc. 36.

American Association for the Advancement of Science. Memorial in behalf of a proper forest policy; report relative to the preservation of the forests on the public domain. Jan. 11, 1890. 4 p. Ser. 2682. Doc. 36.

Borcherdt, Albert. Memorial [presented by Mr. Wolcott] in relation to the destruction of forests in the U. S. Jan. 21, 1890. 1 p. Ser. 2698. Doc. 51.

Merriam, C. Hart. Destruction of the forest means destruction of the fauna and flora. p. 404–405. Pl. (In Smithsonian Institution. Report of the Regents, 1902.) 57 Cong. 1 Sess. H. D. 707, pt. 1.

Pinchot, Gifford. Notes on forest destruction. p. 401–404. Pl. In Smithsonian Institution. Report of the Regents, 1902.) 57th Cong. 1 Sess. H. D. 707, pt. 1.

Public Lands Committee. Report on special message of the President of the U. S. communicating information in relation to the cultivation of timber and the preservation of forests . . . with a communication from the Commissioner of General Land Office upon the same subject. Mar. 17, 1874. 119 p. Ser. 1623. Doc. 259.

FOREST RESERVES.

Agriculture Committee. Report on bills (H. R. 3128, H. R. 6543 and H. R. 12138) for the purchase of a national forest reserve in the Southern Appalachian Mountains to be known as the National Appalachian Forest Reserve . . . and recommended that the . . . bill H. R. 13523 be substituted and that it do pass. Apr. 11, 1902. 4 p. Serial no. 4404. Report no. 1547.

Agriculture and Forestry Committee. Report on the bill (S. 3235) to provide for the establishment, protection and administration of public forest reservations. July 20, 1902. 12 p. Ser. 2915. Doc. 1002.

Forest reservations and the protection of game committee. Report . . on the bill (S. 492) to provide for the establishment of a national forest reserve in the Southern Appalachian Mountain region, recommending that it do pass. Feb. 5, 1902. 3 p. Ser. 4259. Doc. 339.

Forest reservations and the protection of game committee. Report on the bill (S. 5228) for the purchase of a national forest reserve in the Southern Appalachian Mountains to be known as the National Appalachian Forest Reserve . . . recommending that the bill (S. 5228) do pass as amended and substituted for Senate bill 5518. Apr. 18, 1902. 4 p. Serial no. 4261. Rept. 1172.

General Land Office. Communication from the Commissioner relative to legislation necessary to protect the government in the exchange of denuded lands in government reservations for other lands on the public domain. Feb. 16, 1900. 3 p. Ser. 3854. Doc. 187.

General Land Office. Draft of a bill and a letter from the Commissioner relating to grazing within forest reserves. Apr. 2, 1900. 2 p. Ser. 3995. Doc. 598.

General Land Office. Partial report relating to acreage in forest reserves. Apr. 26, 1900. 6 p. —— —— Additional information in regard to forest reserves. May 18, 1900. 16 p. 24 maps. Ser. 3997. Doc. 643.

Geological Survey. Forest reserves (In nineteenth, twentieth and twenty-first reports, part 5. Vols. of plates.) Serial nos. 3763, 3923, 4109, 4110, Doc. 5.

Geological Survey. Report of surveys made and accompanying papers in relation to the forest reserves since June 4, 1897. Mar. 5, 1898. 159 p. Ser. 3600. Doc. 189.

Geological Survey. Report of the Director relative to the survey of the public lands that have been designated as forest reserves by executive proclamations. Dec. 22, 1897. 16 p. Ser. 3592. Doc. 47.

Gettysburg National Military Park. Letter from the Commissioners submitting a draft of a bill for protecting ornamental and other trees on government reservations. Feb. 27, 1898. 2 p. Ser. 3679. Doc. 372.

Interior Dept. Communication from the Secretary submitting an estimate of appropriation for the survey of public lands within forest reserves. Dec. 29, 1899. 2 p. Ser. 3974. Doc. 211.

Interior Dept. Letter from the Secretary transmitting . . . copies of the orders of the President of Feb. 22, 1897, and copies of papers relating to the establishment of forest reservations. Apr. 5, 1897. 36 p. Contains Proclamations of President Cleveland establishing 13 forest reserves. Ser. 3559. Doc. 21.

Interior Dept. Letter from the Secretary of the Treasury transmitting a copy of the communication from the Secretary of the Interior submitting an estimate of appropriation for protection and administration of forest reserves. Jan. 8, 1902. 7 p. 57 Cong. 1 sess. H. D. no. 219.

Interior Dept. Letter from the Secretary transmitting a draft of a bill relating to use of timber from forest reserves. Jan. 7, 1902. 1 p. 57 Cong. 1 sess. H. D. 193.

Letters and memorials [Presented by F. E. Warren] relating to the new forest reservations. May 6, 1897. 11 p. Ser. 3562. Doc. 68.

Military Affairs Committee. Report on bill (S. 1054) to authorize the U. S. to secure title to certain military and timber reservations. Jan. 23, 1879. 7 p. Map. Ser. 1837. Doc. 621.

Public Lands Committee. Report on bill (H. R. 119) to protect forest reservations, recommending amendments. Oct. 4, 1893. 5 p. Ser. 3157. Doc. 78.

Public Lands Committee. Report on bill (H. R. 119) to protect public forest reservations, recommending amendments. May 4, 1894. 23 p. Ser. 3271. Doc. 897.

Public Lands Committee. Report on bill (H. R. 119) entitled, "A bill to protect public forest reservations," recommending an amendment in nature of substitute." May 2, 1896. 20 p. Ser. 3462. Doc. 1593.

Public Lands Committee. Report [recommending] the protection of forest reservations. Feb. 7, 1893. 3 p. Ser. 3141. Doc. 2437.

Public Lands Committee. Report on bill (H. R. 4991) to open the forest reservations in the State of Colorado for the location of mining claims, recommending its passage. Feb. 4, 1896. 1 p. Ser. 3362. Doc. 191.

Public Lands Committee. Report on bills (H. R. 5267, H. R. 9668 and H. R. 10739) relating to lieu sections of land in forest reserves, national parks, etc. May 24, 1900. 3 p. Ser. 4026. Doc. 1700.

Public Lands Committee. Report on bill (H. R. 7332) relating to the establishment of forest reserves in the States of Washington and Idaho. June 5, 1900. 6 p. Ser. 4027. Doc. 1986.

Public Lands Committee. Report on bill (H. R. 8162) entitled, "A bill to authorize the Secretary of the Interior to rent or lease certain portions of forest reserves" [recommending an amendment.] April 4, 1898. 3 p. Ser. 3720. Doc. 942.

Public Lands Committee. Report on bill (H. R. 8162) entitled, "A bill to authorize the Secretary of the Interior to rent or lease certain portions of forest reserves," recommending its passage. Jan. 23, 1899. 3 p. Ser. 3739. Doc. 1512.

Public Lands Committee. Report on House bill 9202 providiug that the timber procured from forest reserves . . . shall not be used outside of the state or territory where cut . . . June 30, 1902. 5 p. Ser. 4407. Rept. 2739.

Public Lands Committee. Report on bill (H. R. 11357) providing that new forest reserves shall be created, and additions to be made hereafter only by act of Congress. June 5, 1900. 3 p. Ser. 4027. Doc. 1985

Public Lands Committee. Report on the bill (H. R. 11536) to transfer certain forest reserves to the control of the Department of Agriculture ; to authorize game and fish protection in forest reserves, and for other purposes. March 15, 1902. 15+7 p. Ser. 4402. Rept. no. 968.

Public Lands Committee. Report on bill (H. R. 13390) to amend "An act to set apart certain tracts of land in the State of California as forest reservations." Feb. 5, 1891. 3 p. Ser. 2888. Doc. 3696.

Public Lands Committee. Report on bill (H. R. 2280) "To open the forest reservations of the State of Colorado for the location of mining claims," recommending a substitute. Jan. 28, 1896. 1 p. Ser. 3457. Doc. 152.

Public Lands Committe. Report on bill (S. 1632) to permit owners of claims to iron and coal mines on forest reservations . . . to perfect their titles

thereto . . . recommending . . . amendments. Feb. 26, 1896. 1 p. Ser. 3363. Doc. 359.

Public Lands Committee. Report on bill (S. 1632) to permit owners of mining claims on forest reservations to perfect their title thereto and to procure a patent therefor, recommending amendments. Mar. 24, 1896. 1 p. Ser. 3460. Doc. 933.

Public Lands Committee. Report on bill (S. 5657) to prevent discrimination in grazing permits on the Uintah Forest Reservation. June 3, 1902. 2 p. Ser. 4263. Doc. 1742.

Public Lands Committee. Report on bill (S. 2866) for the relief of bona fide settlers in forest reserves . . . recommending that it do pass. Jan. 21, 1902. 2 p. Ser. 4257. Doc. 212.

Public Lands Committee. Report on bill (H. R. 3084) for the relief of bona fide settlers in forest reserves . . . recommending that it do pass . . . amended. March 26, 1902. 4 p. Ser. 4260. Doc. 860.

Public Lands Committee. Report on the bill introduced upon recommendation of the . . . Commissioner of the General Land Office to afford relief to a class of worthy settlers who had established their homes upon various forest reserves in advance of the date of the establishment of such reservations . . . Jan. 18, 1902. 4 p. Ser. 4399. Rept. no. 71.

Roth, Filibert. Grazing in the forest reserves. (Agric. Dept. Year book, 1901. p. 333–348. Plates.)

Senate. Testimony taken by the Select Committee of the U. S. Senate appointed under Senate resolution of July 29, 1893, to investigate the matter of the reservation of certain lands in the State of California. Jan. 5, 1898. 24 p. Ser. 3592. Doc. 48.

FORESTRY–STUDY.

Letters, reports, etc. on the subject of the establishment of a school of forestry. May 19, 1880. 22 p. Ser. 1891. Doc. 91.

Parks, C. Wellman. Forestry education. (In Report of the Commissioner of Education. 1894.) p. 809–818. Ser. 3309. Doc. 1, pt. 5.

Public Lands Committee. Report on bill (S. 158) granting to the State of North Dakota 30,000 acres of land to aid in the maintenance of a school of forestry, recommending its passage. Jan. 30, 1900. 2 p. Ser. 3886. Doc. 209.

Public Lands Committee. Report on bill (S. 597) granting to the State of North Dakota 30,000 acres of land to aid in the maintenance of a school of forestry . . . recommending that it do pass. Jan. 13, 1902. 2. p. Ser. 4257. Doc. 103. House rept. on same bill. Ser. 4407. Rept. 2747.

Schools of forestry [List]. (Agric. Dept. Year book, 1900–01. Ser. 4179. Doc. 519.

LUMBER.

Forestry Division. Statement prepared by the Chief of the Division regarding white pine lumber supplies. Apr. 15, 1897. 21 p. Ser. 3561. Doc. 40.

Labor Dept. Letter from the Commissioner relative to the cost per 1000 feet board measure of producing white pine lumber in the U. S. and Canada. May 5, 1897. 26 p. Ser. 3562. Doc. 70.

Memorial from the citizens of Newbern, N. C. asking that lumber be restored to the dutiable list. Dec. 30, 1895. 1 p. Ser. 3349. Doc. 48.

Memorial [presented by Eugene Hale] for the use of the Senate in relation to that part of the Wilson bill which places lumber on the free list and remonstrating against the adoption of same. Feb. 19, 1894. 10 p. Ser. 3167. Doc. 93.

National Lumber Convention. Letter from the Chairman of the Executive Committee commenting upon the report of the Commissioner of Labor relative to the cost per thousand feet board measure of producing white pine lumber in the U. S. and Canada . . . June 4, 1897. 5 p. Ser. 3563. Doc. 139.

Statistics Bureau (State Dept.) American lumber in foreign markets. Wash. 1896. 11 + 217 + 11 p. (Special consular repts., v. 11.) Ser. 3342. pt. 2. Doc. 92.

Statistics Bureau (Treasury). Lumber business and lake transportation. (In Rept. made by Mr. G. G. Tunell on lake commerce. Feb. 3, 1898. pt. 5. p. 94–106.) Ser. 3679. Doc. 277.

TIMBER.

Agriculture Committee. Report on bill (S. 313) entitled, "An act appropriating funds for investigation and tests of American timber," recommending its passage. Aug. 15, 1894. 4 p. Ser. 3272. Doc. 1442.

Agriculture Dept. Information in relation to investigations and experiments in the planting of native pine seed for the growth of native pine in the sand hills of the Northwest. Aug. 2, 1894. 14 p. Ser. 3163. Doc. 172.

Agriculture and Forestry Committee. Report on bill (S. 364) to appropriate funds for investigations and tests of American timber. May 2, 1900. 3 p. Ser. 3894. Doc. 1177.

Forestry Division. Report on the probable amounts of white pine and other coniferous timber standing and consumption in the U. S. 21 p. Ser. 3561. Doc. 40.

Hall, William L. Timber resources of Nebraska (Agric. Dept. Yearbook, 1901. p. 207–216. Plates.)

Indian Affairs Committee. Report on bill (H. R. 11218) to enable the Secretary of the Interior to protect the timber in the Indian Territory, recommending its passage. Jan. 10, 1899. 1 p. Ser. 3840. Doc. 1726.

Laidley, T. T. S. Report on the timber and mineral resources of the Deep River country in North Carolina. April 29, 1856. 5 p. Ser. 859. Doc. 109.

Public Lands Committee. Report on growth of timber on western prairies. Feb. 5, 1874. 2 p. Ser. 1623. Doc. 66.

Roth, Filibert. Uses of wood (Agric. Dept. Yearbook, 1896. p. 391–420. Ill.) Ser. 3496. Doc. 6, pt. 2.

TIMBER CULTURE LAWS.

General Land Office. Report on the amendment intended to be proposed by Mr. Pettigrew to the sundry civil appropriation bill the object of which is to provide a method for the entry of lands in the Black Hills forest reservation, South Dakota, under the homestead law. Jan. 18, 1899. 3 p. Ser. 3731. Doc. 94.

Public Lands Committee. Report on bills on pre-emption, homestead and timber culture laws providing a substitute therefor (repealing the timber culture laws). May 12, 1884. 4 p. Ser. 2258. Doc. 1544.

Public Lands Committee. Report on bill (H. R. 9291) to extend the timber and stone acts to the district of Alaska recommending its passage. March 9, 1900. 1 p. Ser. 4023. Doc. 568.

Public Lands Committee. Report on Senate bill 2866 on timber culture laws. Apr. 12, 1900. 5 p. Ser. 4024. Doc. 1002.

Public Lands Committee. Report on bill (H. R. 412) to amend an act entitled "An act to repeal timber culture laws." Mar. 29, 1892. 2 p. Ser. 3044. Doc. 915.

Public Lands Committee. Report on bill (H. R. 2657) to declare the meaning of section 7 of an act entitled "An act to repeal the timber culture laws." May 26, 1892. 4 p. Ser. 3046. Doc. 1495.

Public Lands Committee. Report on bill (S. 3393) to amend an act approved March 3, 1891, entitled "An act to repeal the timber culture law" . . . recommending amendments. July 11, 1892. 1 p. Ser. 2915. Doc. 905.

Public Lands Committee. Report in addition to report no. 915 . . . recommending amendment to the bill (H. R. 761) to amend an act entitled "An act to repeal timber culture laws." Dec. 12, 1892. 1 p. Ser. 3140. Doc. 2151.

Public Lands Committee. Report on bill (S. 2564) to amend section 6 of the act . . . entitled "An act to repeal timber culture laws," recommending its passage." Feb. 9, 1893. 1 p. Ser. 3142. Doc. 2450.

TIMBER CUTTING ON RESERVATIONS AND PUBLIC LANDS.

Copies of letters and accompanying enclosures from the Commissioner of the General Land Office and the Commissioner of Indian Affairs relating to the estimating of timber and the cutting of dead and fallen timber on the Chippewa Indian reservations in the State of Minnesota. Jan. 21, 1899. 253 p. Ser. 3731. Doc. 70.

General Land Office. Report on pine timber on lands included within forfeited or lapsed railroad grants. June 1, 1874. 3 p. Ser. 1615. Doc. 260.

General Land Office. Papers relative to cutting timber for mining purposes. Sept. 6, 1888. 23 p. Ser. 2514. Doc. 259.

General Land Office. Information relating to cutting and removing timber from forest reservations and public lands and the action taken to protect timber lands from trespass or depredations. Jan. 25, 1895. 16 p. Ser. 3275. Doc. 45.

General Land Office. Communication from the Commissioner inclosing a draft of a bill to authorize and regulate the sale and use of timber on certain public lands. Feb. 28, 1900. 5 p. Ser. 3988. Doc. 487.

Indian Affairs Committee. Report on bill (H. R. 998) providing for the sale of pine timber on White Earth and Red Lake diminished reservations in the State of Minnesota recommending amendments. Mar. 5, 1900. 3 p. Ser. 4023. Doc. 492.

Indian Affairs Committee. Report on bill (S. 4758) granting permission to the Indians on the Grand Portage Indian Reservation in the State of Minnesota to cut and dispose of the timber on their several allotments on said reservations. May 28, 1900. 2 p. Ser. 3895. Doc. 1513.

Indian Affairs Committee. Report on sale of timber on certain lands in Wisconsin. Apr. 14, 1892. 1 p. Ser. 3045. Doc. 1077.

Interior Dept. Draft of a bill to amend the act of June 4, 1897, relating to the sale of timber on forest reservations. Jan. 28, 1899. 2 p. Ser. 3812. Doc. 186.

Public Lands Committee. Report on bill (H. R. 6063) to amend . . . an act entitled "An act making appropriations for sundry civil expenses of the government for the fiscal year ending June 30, 1898, and for other purposes" (relating to the publications of notices of proposed sales of forest reserve timber.) Feb. 1, 1900. 3 p. Ser. 4021. Doc. 178.

TIMBER DEPREDATIONS.

General Land Office. Report of the Commissioner relative to depredations committed on timber situated upon the public lands, and the appointment of agents. June 27, 1854. 24 p. Ser. 727. Doc. 115.

General Land Office. Report of Commissioner touching the seizure of logs, lumber, etc. Dec. 19, 1877. 2 pts. Ser. 1780. Doc. 9.

General Land Office. Letter from the acting Commissioner asking an appropriation to supply deficiency in the appropriation for depredations on public timber . . . March 14, 1884. 2 p. Ser. 2206. Doc. 115.

General Land Office. Report from the Commissioner relative to instructions given to C. A. M. Schlierholz, special agent at Batesville, Ark., as to seizing timber. June 16, 1898. 3 p. Ser. 3615. Doc. 295.

Interior Dept. Estimate from the Secretary of deficiencies in the appropriations for depredations on public timber and for protecting the public lands. Feb. 4, 1890. 2 p. Ser. 2746. Doc. 190.

Interior Dept. Letter of the Secretary relative to timber trespasses on public lands. Dec. 22, 1887. 6 p. Ser. 2504. Doc. 42.

TIMBER LANDS.

Bowers, Edw. A. Report submitting a plan for the management and disposition of the public timber lands. March 12, 1887. 24 p. Ser. 2566. Doc. 242.

Indian Rights Association. Memorial relating to timber lands on the Chippewa Indian reservation in Minnesota. Jan. 6, 1899. 75 p. Ser. 3728. Doc. 49.

Interior Dept. Communication from the first assistant secretary in relation to the disposal of the timber lands and the proposed plan for the preservation of natural forest lands at the head waters of navigable rivers. Feb. 9, 1888. 4 p. Ser. 2558. Doc. 144.

Public Lands Committee. Report on bills (H. R. 29 and H. R. 5142) relating to the disposal of timber and stone lands unfit for cultivation, recommending a substitute. Feb. 28, 1892. 3 p. Ser. 3043. Doc. 482.

Public Lands Committee. Report on bill (H. R. 410) to provide for the sale of timber lands in the States of California, Oregon, and in the Territories of the U. S. which have not been offered at public sale and are valuable chiefly for their timber. Dec. 23, 1874. 3 p. Ser. 1656. Doc. 8.

MISCELLANEOUS.

Packard, Alpheus S. Insects injurious to forest and shade trees. Washington, 1890. 8+957 p. Pl. (U. S. Entomological Commission, 5th report.) Published also as Bulletin no. 7 of the Entomological Commission. Ser. 2800. Doc. 269.

Turpentine orchardiug and industry. (In Report of the Forest Division, 1892. p. 342–358. Ill.) Ser. 3095. Doc. 1.

INDEX TO VOLUME I.

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