A NETTLE-TREE IN THE FOREST

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THE CANADIAN FORESTRY ASSOCIATION.

NINTH ANNUAL MEETING.

As has already been announced, the Ninth Annual Meeting of the Canadian Forestry Association will be held in the rooms of the Montreal Board of Trade on the 12th and 13th of March next. The executive committee of the Forestry Association and the local committee in Montreal have prepared a programme covering so wide a field that most of the important questions relating to Forestry will be dealt with either in the addresses which are to be delivered or in the discussions which follow them. An evening lecture by a distinguished forester will be one of the features of the meeting.

The completed programme cannot yet be published but as usual the morning session of the first day will be taken up in part by the reading of the Directors' Report and the President's Address followed by a short paper. Among those who will deliver addresses are Monsignor Laflamme, Mr. E. G. Joly de Lotbiniere, Mr. L. O. Armstrong and Prof. A. H. D. Ross, Lecturer in Forestry at the University of Toronto. Representatives of the provincial governments, the leading universities and colleges and of the Fish and Game Association have been invited to this meeting, and the growing interest that is being taken in all matters relating to Forestry ensures a large attendance of members and others from all parts of Canada.

Professor Filibert Roth, of the School of Forestry of the University of Michigan, has been invited to lecture before the Association.

Return tickets will be issued from all parts of Canada at single fare rates, regardless of the number in attendance.

A good deal is being said and written in Great Britain of the afforestation of waste lands as a means of affording relief to the unemployed, but judging from the experience last winter of a writer in the *Quarterly Journal of Forestry* the scheme is not likely to prove a success. Work was begun on a large estate in October, thirty or forty men being employed during the whole winter. Great care was used in selecting the men, only those who appeared to be able and willing to work being engaged. Only twelve worked all through the winter, the rest coming and going the whole time the work continued, those leaving being replaced by others. The majority were found to be incompetent and unwilling to work. A great deal of teaching and constant watchfulness were necessary to get the work properly done. No interest whatever was taken in the work by the men and they did not particularly want to learn. The cost was found to be much greater than it would have been with a skilled permanent staff and in the opinion of the writer referred to afforestation of waste lands cannot possibly be made to pay if such casual labor be employed.

The tightness of the money market during the past year, and more especially during recent months, will have a direct beneficial effect upon the conservation of our forests. The rapidly growing demand from all quarters that there should be more stringent laws regulating lumbering operations, and especially the export trade, will almost certainly crystallize into some sort of remedial legislation within the year. Those who have seen most clearly the need of such legislation were powerless to prevent the wholesale destruction of our forests which is still being carried on by a few lumbermen. But what they could not do the scarcity of money is doing. Construction work of all kinds has been greatly curtailed, and the demand for lumber correspondingly lessened, and many of the lumbermen have themselves felt the pinch and have been unable to operate this winter on so large a scale as they had intended. Fortunately they will gain and not lose by this enforced restriction of their business for were the cut this winter as large as was intended the market next season would be glutted with lumber that there was not money to purchase. But to those who are not financially interested in the lumber business anything is welcome that keeps the axe and saw from the tree and many years of the most approved forestry methods could not replace the trees that would have been destroyed this year had money been plentiful.

THE EDUCATION OF FORESTERS.

By B. E. Fernow.

The engineer, the lawyer, the medical man, the teacher graduating from the College or from the professional school, knows what is before him in the matter of employment. He finds his profession well established and practised, differentiated into positions of various character and requirement, subdivided and specialized in various directions. He can choose the direction in which he desires to progress and, according to his abilities, his course is more or less distinctly before him.

The forester, at the present time in this country, sees nothing definite before him, his art is as yet hardly practised anywhere in this country, no definite positions await the graduate of the Faculty of Forestry, no gradations and differentiations point the direction in which he is to travel—his art is in more senses than one still "in the woods."

We have here the somewhat anomalous condition that the theory precedes the practice, that practitioners are to be educated before there is a definite actual call, though there is a great necessity, for their services; it is expected that their existence will create a desire for their employment.

Other arts develop from and in the practice as matters of immediate need; only after considerable empiric development is a systematized teaching of their contents attempted; the practice antecedes the theoretical development and education.

This was so with forestry in the European countries: forestry practice existed for a century and more in Germany before the first forest school was established in 1764. But the rapid development of the natural resources on this continent has seemingly forced a reversal of the usual order of things. The momentum of forest slaughter, first a necessity for securing farmland, and then a necessity for keeping industries going, has carried us too rapidly past the stage when forestry practice should have originated in the woods, finally to find entrance as a subject for academic teaching.

The art of forestry differs from most other arts in that it is a child of economic necessity, not of the immediate present, but of a more or less distant future. This is due to the fact that Nature unaided has provided and is capable of providing wood materials of satisfactory character in the virgin woods. As long, therefore, as natural timber supplies can be drawn upon, there appears to be no need of foresters; the necessity for a husbanding of the natural resources and of employing skill in

managing and reproducing them remains undiscovered or doubtful. The arrival of that necessity is determined by a statesmanlike balancing of three factors of statistical information, namely as to existing natural supplies at home and abroad, as to rate of consumption, at home and abroad—for we deal now with world markets instead of merely local needs—and lastly, as to the time it takes to produce a forest crop.

When it is realized that little short of one hundred years are required to produce trees fit for use in the arts—the trees in the virgin forest which attract the lumberman exceed mostly one hundred and fifty years—it will be readily admitted that the long time element is a serious factor in obscuring the arrival of the need of active measures in forest production to provide for the future. The present generation may be excused for taking an attitude of optimism, and for postponing the curtailing of present revenue or the making present expenditures for a distant future, which is implied in the application of the art of forestry. A forester, let it be understood, is nothing less but something more than a lumberman; his business, like that of the lumberman, is to supply the community with wood materials, but while the lumberman is concerned merely in the harvesting of the virgin supplies and with the needs of the present generation, the forester must also take into consideration the needs of the future and replace the harvested crop, which in every case means curtailment of present revenue, or else a change of income into investment—a re-investment in young timber growth.

From this consideration of the time element and financial aspect some other propositions will at once become evident, namely, that forestry can be practised only by those who have a long future before them, i. e. the State, municipalities and corporations, and secondly, that the ideals of the silviculturist—the forest crop producer—will always find limitations in the unwillingness of the present generation to make the expenditures which would insure silvicultural success, as long as financial success which can only come in the long run cannot be readily assured. Hence, the beginnings of forestry in the still productive natural woods will be crude, and will consist at first in negative rather than positive measures, namely, preventing waste by closer utilization, preventing loss by fire, preventing encroachment of inferior species, and securing a reproduction of the better kinds, as best may be, by natural means with as little present outlay as possible.

In fact, at first the forester will be called upon to do little more than the lumberman can and ought to do, and, indeed should be taught to do, and the knowledge of which he can acquire by reading or as a special student in the Faculty of Forestry.

So much, it appeared necessary to say on the general aspect

of the art of forestry, in order to have a basis for the discussion of what the education of a forester should be.

It is probably the experience of every University student that a large part of the information which he imbibes in the class rooms and in his reading, he is never called upon in the practice, to apply. The shallow-brained, and the *so-called* practical man, when he realizes that he has occupied himself with things that are "of no earthly use" to him, is apt to blame his teachers or the Institution for having misled him and wasted his time. He does not realize that imparting information is not primarily the end of an institution like a University, but the means to an end, namely to education; that there are many things we may forget, nay, we must forget in order to make room for others; but not to have known them, not to have secured the result of the temporary possession of that knowledge, which is an undefinable breadth of view and judgment, would be a serious drawback.

In other words, an education, even in a technical art, is not merely a conglomerate of information directly applicable in the art, but is capacity of appreciating broadly relationships which will lead to a ready grasp of conditions and to the devising of new methods, different from those learned, to suit new conditions. "The sooner the student learns that it is not what he studies, but how he studies, that the training he receives is of more value than the information stored, the sooner he learns the value of a college course."

As there are artists and artisans in every profession, leaders and assistants of various degrees, there may be educational institutions of various degrees, and the question arises when a new art is to be taught, what kind of an education is primarily desirable, whether that of the technical training school, which attempts little more than the imparting of information regarding processes and manipulations; or the special academy which lays a broader foundation of technical knowledge; or else the University, which, to justify its name, should give the broadest education, and secure that grasp of the entire field of the art, which makes artists and leaders. All three classes of instruction are needed in the end, but it would appear most desirable to provide for the last mentioned first, in order not only to secure a set of men, who will be able to direct policies and lead in the movement of introducing forestry practice, but also to secure the teachers for the lower grade schools which must eventually train assistants.

When the writer was called upon to formulate plans for the first forestry school on this continent, ten years ago, he submitted three alternative plans, one providing merely for a professorship, which would suffice to teach all that a forester would be likely to be called upon to apply at the present time, a second

plan expanding on the practical side, namely, a training school, laying stress on manipulations and operations, and the third providing for a full collegiate course which should in no way be second to those of the best forestry schools of Germany.

It was the privilege of the writer to organize a College on this latter plan, and he was gratified to find the reviewers in German forestry journals pointing out the plan of this school as superior in some respects even to their own institutions.

The University of Toronto, therefore, has also laid out a course which shall give the broadest professional forestry education: and to secure students of the most promising character, the entrance requirements to the Faculty of Forestry have been made higher than those existing for any other Faculty in the University, namely, honor matriculation in English and Mathematics.

The leading forestry schools in the States ostensibly require the Bachelor's degree of a College for entrance to a two year's course in forestry, which leads to the Master's degree in Forestry, but by peculiar devices the total time for the two degrees can be reduced to four years, insuring therefore nothing better than an undergraduate's education, with a high flown title.

The University of Toronto has only the straightforward four year's curriculum leading to the Bachelor's degree, which contains all that the postgraduate schools of the States demand, but, recognizing that a mere professional training even on a broad basis does not produce the highest type of leaders, except by accident and native ability, it is proposed also to offer a six years course, which is to include humanities and expansion into broader fields of science of a sufficient amount to entitle the graduate to the degree of Bachelor of Arts, besides his professional degree. The addition of this course, which, while demanding a prescribed curriculum for the prescribed work, leaves considerable choice of options in humanities and science work, will also be found advantageous by those of special aptitudes and interest, as well as of different ability. As at present constituted the course leading to the degree of B. Sc. F. and, after three years work in practice, to the degree Forest Engineer (F.E.) is a heavy one, and comprises laboratory and field work (counted two hours for one), 1850 hours or an average of 18.5 hours per week through the four-year course, of which 1100 hours are fundamental and accessory arts subjects. The forestry courses are comprised in 750 hours, divided into 16 courses.

The description of these courses, which will give an insight into the technical contents of the subject, may be found at the end of this article. It should, however, be understood that outside the regular prescribed courses which lead to the academic degree, and for which a prescribed previous education tested by

matriculation examinations is required, the University admits as special or occasional students, without examinations, any person of mature mind, showing ability to profit from University courses. These are treated in all respects like other students except that they may elect what courses they desire, the only difference being that the University degree, which is a certificate of having accomplished certain prescribed work, is withheld.

The next necessity will be the establishment, if not of schools, of short courses, given in the woods for forest rangers and woods' superintendents and foremen, men from the practical field without academic learning, who in a few weeks can be made acquainted with enough of the theory and practice of forestry to understand and appreciate its aims and superintend its execution in the woods intelligently. It is contemplated in connection with the practical field work designed for the University students for the late spring or early summer to organize such courses, when the right kind of men for the work are developed.

The scientific basis for the art of forestry is found in two different directions, according to its dual character as a technical art and a business. The technical art, called silviculture in the broadest sense of the word, relies upon natural sciences, business side which we may call "forest economy," relies upon mathematics, and political economy as well as knowledge of industries, markets and other business concerns.

The field of natural science which the forester must survey is quite extensive, but the different parts are of very unlike relative importance, and, what is from the practical standpoint of the teacher of the sciences which the forester must cultivate a misfortune, only limited portions of each are really needful; hence, it is not easy to limit each field where it is desirable in an institution whose courses are laid out not for the special needs of a special class of students. This brings it about, until possible adjustments are made, that some subjects will be gone into deeper than necessary, others will perhaps be hardly sufficiently expanded, and in this way practical limitations will, as everywhere, curtail the ideal.

Being engaged in plant production, the main study of a forester lies in the fields of botany, geology, and zoology. The botany of trees—dendrology—naturally forms the main basis, but to study such a segregated portion of the large field of general botanic knowledge, the general anatomy, histology and physiology must be familiar, and general ecology—the relation of plants to their surroundings—as well as the specialized ecology of trees, must necessarily form an important part of the forester's equipment.

The knowledge of species, of the plant material is, of course, the first needed equipment, but the knowledge of the life history

and of the laws of tree growth is infinitely more needed.

The field of botany, indeed, requires an extension in the University, if silviculture, which is applied ecology, is to be placed on a sure foundation. The development of methods of silviculture applicable to our special flora and special conditions is dependent upon a thorough knowledge of "silvics"—a linguistic crime perpetrated by our neighbors, but an expressive short term to denote the special ecological characteristics and behaviour of our timber trees—and hence we hope to have the Botanical Department develop in that direction.

The pathology of trees also needs special consideration, at least the commoner diseases should be recognized, and their progress understood as well as the insect pests which some day will play a more important role in the forester's operations than they will at the beginning, when other more potent causes of forest destruction require attention.

Of geology, petrography and mineralogy, there is likely to be offered too much detail for the necessarily limited time. This knowledge is to lead to an understanding of soil conditions, of soil physics and soil chemistry, and in connection with meteorology and climatology, is to explain the relationship between the plant and its performance.

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

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

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

In either case a complicated measurement and calculations are required to form the basis.

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

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

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

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

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

Every business man needs a certain amount of knowledge in practical commercial law. Singularly enough this has still all to be learned in practice, at the expense of employers and litigation, instead of a systematic course in the University. Every man who claims to have a modern education should have had the op-

portunity of acquiring such knowledge, and foresters, especially, who become administrators of properties away from civilization, cannot dispense with it.

Some of these courses of accessory subjects which are desirable, do not as yet exist in the curriculum of the University, and such knowledge must be acquired by well directed reading.

In the end, not everything can be taught or learned at a University, and life's continuous school must be relied upon to eke out the deficiencies. This is especially true with that part of the education of a devotee to an applied science, which we call the practical work, the manner of applying his science, what the engineer calls shopwork, or as we would call it in forestry, the fieldwork. It should not be forgotten that practice, the facility of applying knowledge, is acquired only by practicing, and the skill acquired is a direct function of time, during which the student has applied himself to the practicing. So is experience a function of time and circumstances as well as of mental ability to form judgments. It would be futile to attempt to secure in the short time of school sessions either of these two qualities, needful to the finished efficient practitioner.

All the fieldwork that it is practically possible to give in a University course is merely to illustrate the theoretical teaching, to stimulate observation, to fix in the mind of the student the methods and principles which are to be applied, and make him familiar at least with the possible applications in actual practice.

The academic training, in other words, must be mainly theoretical, and the presentation of the theory should be such as to awaken the faculties of the student, to give him a first grasp of the practical side, and to open his mind so that he may learn to form correct judgments.

To secure at least general insight into practical work, there are provided excursions to the woods, to logging camps, wood-working establishments, etc., and finally a continuous sojourn of six weeks in the woods for practice work in forest survey, forest mensuration, forest description, silviculture, and whatever the opportunities of the location may offer.

For the rest the students are encouraged to find employment for the summer in lumber camps, forest surveys or other actual practical work.

And what is it that a practical forester must finally know and be able to do? He must, of course, know his trees, where and how they grow, their life history, how much they produce. He must be able to survey, to describe, to measure and estimate timber. He must know the character and use of the wood and byproducts in the various industries. He must be a consummate logger, he must know what the sawmiller can produce from his logs, what the manufacturer does with his products. He must know how to market it and be familiar with transportation

problems. He must know more than his own narrow world in respect to forest products and supplies. He must know how to handle men. He must understand the relationship of matters which may influence the future, for he must be a seeer into the future, for which he works.

Finally, most important of all, he must know how to reproduce his crop in better condition than he found Nature's crop, and this knowledge is the most difficult to attain, and calls for superior judgment, for it is not merely by planting, but by managing the cutting, the harvesting of the old crop that this is done. He must know how to protect his crop against damage by fire, insects, fungi, frost and drouth, and how to advance it in growth.

Lastly he must be a financier, for the ultimate object of his business, like any business, is the earning of a revenue, hence, his operations must be shown to produce a profit. Since the long time element in the production of the forest crop defers the harvest to a period which is so distant as to change all economic conditions, he is confronted with a compound interest calculation, requiring a great deal of judgment in the choice of the factors to be used.

In short, the forester must be a man of superior judgment if he is to be successful. For many, the only hope of success lies in the hope that their mistakes may not be found out during their lifetime; but we hope at this Institution to avoid, as far as possible, the creation of such, and to produce worthy leaders and assistants. Whether a man will turn out artist or artisan, organizer, business manager or investigator, teacher, or else mere assistant, must necessarily depend largely on his own native ability and effort.

DESCRIPTION OF FORESTRY COURSES AT THE UNIVERSITY OF TORONTO.

1. *Synoptical Course.* An introduction to the subject of forestry, and a survey of the economic and political aspects of timber-land management.

This course, carried on in seminary style, is designed also for students of political economy, and all those who desire a general knowledge of forestry problems. 25 hours.

2. *Descriptive Dendrology.* A taxonomic study of the forest trees of North America, laying special stress on the characteristics which lead to the recognition of the species in the field; with practice work in securing familiarity with morphological and other characteristics for identifying Canadian trees and shrubs. 25 hours.

3. *Forest Physiography and Forest Description.* The geographical description, botanical composition and character of forests of the world, and of North America in particular, with special reference to the ecological factors, climate and soil, influencing forest growth. Field practice in recognizing forest types and in making forest description. 25 hours.

4. *Timber Physics and Wood Technology.* Study of the histology of wood, with a view to identification of the different woods, recognition of their normal and abnormal physical characteristics and faults. Mechanical and technical properties of wood and the various technological uses dependent thereon. Lectures and laboratory work. 50 hours.

5. *Pathology of Trees and of Wood.* The diseases of trees and decay of structural timber, their recognition, causes and prevention. 25 hours.

6. *Biological Dendrology.* Life history, laws of growth of trees, their dependence on ecological factors, and silvicultural requirements of different species. 25 hours.

7. *Silviculture.* Principles and practice of the art of forest production and forest improvement, nursery practice, planting, and methods of natural reproduction. 75 hours. Practice work in addition.

8. *Forest Mensuration.* Methods of ascertaining volume of felled and standing trees, of whole forest growths, timber estimating, determining accretion of trees and stands. 100 hours, including practice work.

9. *Forest Exploitation.* Methods and means employed in the harvest of forest products, logging, transportation, milling, and preparation for market. 50 hours, including excursions to field operations and mills, and special lectures by expert lumbermen.

10. *Business Methods in the Lumber Trade.* Description of usages in shipping, receiving and selling forest products; inspection and grading; financial methods. 10 hours.

11. *Forest Protection.* Methods of guarding against trespass, loss from fires, insect (applied entomology) and other damage to forest crops. 12 hours.

12. *Forest Management and Administration.* Principles and methods underlying the preparation of working plans for continuous wood and revenue production, and principles of administration of forest properties. 75 hours.

13. *Forest Valuation and Finance.* Methods of ascertaining money value of forest growths, and application of the principles of finance to forest management. 25 hours.

14. *History of Forestry.* Historical development of the economic and technical features of modern forestry at home and abroad. 25 hours.

15. *Administration of Timber Limits in Canada.* 5 hours, by special lecturers.

16. *Seminary in German Forestry Literature.* Reading from prominent authors, especially in silviculture. 25 hours.

In addition to the lecture and practicums at Toronto, there will be provided lectures and practical work in the woods during a summer term following the academic session, the details of which are not yet elaborated. These lectures will include the subjects of soil physics, field zoology, fish and game preservation, and logging methods.

The effects of the almost complete denudation of the forest is best seen in the regions that were thickly populated in ancient times, or which are densely populated to-day. Palestine and Asia Minor are frequently cited as examples of lands which have become to a great extent barren wastes chiefly because the needs of an increasing population caused the destruction of the forests with the usual results. China is the most densely populated of modern countries, and the one in which the greatest loss of life and property results from the lack of protective forests. The periodical floods which pour down its denuded mountains and spread over the low country are destructive to an extent quite beyond parallel in other countries. The recent awakening of the Chinese people is not better shown than by the fact that a school of forestry is to be established at Mukden. Mukden is an ideal spot for a forest-school and one at which practical work can be begun at once. The higher parts of some of the mountains are still clothed with forest, while on the lower slopes the effects of forest denudation can be seen and remedies studied. Anyone who was in our own Rocky Mountains twenty years ago and who visits them to-day cannot fail to note the irremediable effect that forest fires, followed by land slides and floods have had upon the landscape. The whole foot-hills of the Rockies from the International Boundary to the Peace River should be a forest reserve if destructive spring floods and summer water famine are to be escaped in the near future.

RESIGNATION OF MR. ROSS.

A further loss was sustained last autumn by the Forestry Branch in the resignation of Mr. A. H. D. Ross, M.A., M.F., who for over a year had been connected with the Branch as technical assistant. Mr. Ross left the Branch to accept a position as lecturer in the recently established Faculty of Forestry in the University of Toronto.

From the standpoints both of academic training and of experience in teaching it would have been hard to get a man better qualified for the position. After securing his preliminary training in the public and high schools of Carleton Place and the Kingston Collegiate Institute Mr. Ross matriculated into Queen's University in June, 1884, with first-class honors in mathematics, winning the Open Matriculation Scholarship in mathematics. Four years later, in 1888, he graduated from the University with the degree of B.A., having taken the honor course in mathematics throughout. Entering in that autumn the School of Pedagogy (as the institution for the training of secondary teachers was then called) in December he obtained his professional certificate as assistant master in High Schools and Collegiate Institutes, with specialist standing in mathematics. In April of the following year he obtained his M.A. degree, his thesis treating of "Pedal Curves." Returning subsequently to his Alma Mater, he took graduate work in science and obtained the specialist standing in science of the Ontario Education Department.

Over twelve years of experience in various High Schools and Collegiate Institutes have given Mr. Ross a firm grasp of the art of teaching, his work in this line lying almost entirely in the subjects of mathematics and science. Some of the positions he has held follow: Almonte High School, Sept. 1889 to Dec. 1891; Morrisburg C. I., Sept. 1893 to Dec. 1895; Ottawa C. I., Jan. 1896 to June, 1896; Tillsonburg High School, Sept., 1896, to Oct., 1904. During much the larger part of his teaching at Tillsonburg he was principal of the school. He has also held positions in Pembroke and St. Mary's.

Nor is his present position his first experience of university teaching, for in July and August, 1896, he was instructor in Botany at the summer school of Queen's University, when most of his students were high school masters engaged in work leading to the Ontario Education Department's specialist standing in science.

Experience in the field, moreover, has not been lacking. From May to October, 1893, he was with Mr. A. P. Low, B. Ap. Sc., now Director of the Geological Survey, as Botanist and Assistant

Surveyor in an exploration of the East Main river in Ungava territory. Previous to this, two summers, namely those of 1886 and 1887, were spent with survey parties in the Northwest, in trail surveys and township subdivision, under Mr. J. Lestock Reid, D.L.S., and Mr. T. D. Green, D.L.S., respectively. During much of the latter season Mr. Ross had charge of the transit and the field notes.

Extending his researches to the practical application of his scientific knowledge Mr. Ross took up the International Correspondence School's course in Metal Mining, which he completed in 1902.

Mr. Ross's first connection with forestry subjects began in the summer of 1884, which he spent working in the A. H. Edwards sawmill at Carleton Place. In July, 1904, he entered the junior class of the Yale Forest School, taking the summer term's work at Milford, Pa., and during the time decided to devote his energies to forestry work. Continuing his studies, he graduated from the Yale Forest School in the spring of 1906, obtaining the degree of M.F. (Master of Forestry) from the University. During the summer of 1905 he acted as "forest agent" for the U.S. Bureau of Forestry, making a study of the reproduction of white pine in Eastern Pennsylvania. Immediately on graduation he was appointed Inspector of Tree Plantations in connection with the Dominion Forest Service, his work for the season lying in the northern part of the Province of Manitoba and along the C. P. R. main line from Maple Creek to Calgary. In November he was appointed Technical Assistant in the Forestry Branch. In the spring of 1907 he assisted in the distribution of two million seedlings from the Forest Nursery at Indian Head, Sask. During the summer he had charge of a party of twelve men employed in forest survey work in the Riding Mountain Forest Reserve, in Northern Manitoba, and at the conclusion of this work joined the staff of the Provincial University.

Mr. Ross had considerable experience also along literary lines. During his teaching career he was a constant contributor to the Educational Monthly; scientific subjects were his favorite, and he was a constant advocate of the introduction of Nature Study into the public schools. In October, 1894, Mr. Ross's account of his trip up the East Main River appeared in the Canadian Magazine, under the title of "A Canoe Trip to Lake Mistassini and James Bay." He is not unknown, too, to readers of the FORESTRY JOURNAL, articles on "The Forest Resources of the Labrador Peninsula," and "Canadian Forestry Education," from his pen, having been much appreciated contributions to former numbers.

Among those who know Mr. Ross and the needs of forestry education in Canada there is no doubt that Dr. Fernow has

found, in his assistant, the right man for the place. Among those best qualified to judge, the excellent work he is doing in his new position is already remarked. Mr. Ross has charge of the work in Forest Mensuration, Forest Utilization and the Protection of Woodlands.

Mr. Ross leaves the Forestry Branch amid the general regret of the staff, for he has always shown himself able and conscientious in the discharge of his duties and most agreeable in his intercourse with his fellow members of the staff. The Branch's loss, however, is a gain to the cause of forestry in affording Mr. Ross opportunities, larger and, perhaps, more to his liking, in extending the knowledge and practice of forestry throughout the Dominion.

THE NETTLE-TREE (*CELTIS OCCIDENTALIS*).

The Nettle-tree or Hackberry ranges in Canada from Montreal westward almost to Windsor but is so rare in most places where it is found that the "natives" seldom know of its occurrence. In appearance it much resembles an elm tree to which it is nearly related. It is one of our most beautiful shade-trees and were it better known would be more generally planted on the streets of towns and cities. In the Niagara peninsula it is quite common and as its roots are fibrous and shallow, well grown trees may be dug up and transplanted. Its wood is used in the manufacture of furniture and agricultural implements. Its purple berries remain on the tree all winter and add to its attractiveness as a shade tree.

The maps which were sent in the autumn to members of the Canadian Forestry Association form part of the new Atlas of Canada, prepared by Mr. James White, Geographer of the Department of Interior. The data from which these maps were compiled is of the most trustworthy kind and the limits of trees as there shown may be assumed to be as accurate as it was possible to make them. The scientific names of some of the trees may not be familiar to all who received the maps but they are those now in general use and accepted by most botanists. It was through the courtesy of the Minister of the Interior and Mr. White that the privilege of distributing these maps to members of the Association was secured.

A NETTLE-TREE IN THE OPEN

ONTARIO'S PROGRESS TOWARDS A RATIONAL FORESTRY SYSTEM.*

By Thomas Southworth.

Such progress as has been made in Ontario towards a rational system of handling our immense resources in forest wealth has not come as the result of pressure upon our legislators by a well informed public opinion. On the contrary, the slight advance we have made has usually preceded and led public opinion on this important phase of our national welfare.

Even in the southern and thickly settled part of the Province where public opinion has the greatest effect upon legislation, the battle of the pioneer with the trees that were obstacles to the growing of crops required for his sustenance is so recent that it has been difficult for the "man-in-the-street" to realize that there could be any danger to the public weal from a scarcity of forest cover in this "wooden country."

To only a comparatively few, who had the time and inclination to apply the lessons of history in other lands to conditions here, was it apparent that the rapidly lessening percentage of woodlands in our southern counties created a menace to the State.

These people, however, were able to impress the legislative authorities with the necessity of doing something, and in 1883 the Provincial Legislature took action by appointing an officer termed "Clerk of Forestry," whose work under the Minister of Agriculture was in the direction of informing the public as to the dangers likely to arise from cutting away the forests too thoroughly.

By means of pamphlets, letters to the press, and in other ways, this campaign of education was carried on till 1893, when the last report of this officer was issued. The only legislation bearing on the subject during this period was the passage of the "Ontario Tree Planting Act," by the terms of which municipalities were authorized to pay a bonus of 25 cents each for trees planted along highways or farm boundaries, half of the amount so paid to be refunded to the municipality by the Provincial Treasury. The sum of $50,000 was set aside by the Province for the bonus to be paid under the Act.

The planting of shade trees, however meritorious and advisable from an aesthetic standpoint, can scarcely be designated as forestry, and as the Act was taken advantage of to a very limited extent (only about $5,000 having been paid out in ten years), the Act was repealed in 1896.

*Reprinted from the Toronto *Globe*, Feb., 1908.

In 1885 an important step in advance was made by the Department of Crown Lands in the way of a fire partol—or fire-ranging as it is termed in Ontario. Anything that tends to lessen forest destruction is a practical forestry measure, and the Ontario fire-ranging system has been reasonably successful in lessening the loss by forest fires. In the year mentioned a circular was sent out to the holders of timber licenses intimating that if they would select men to patrol or "range" the "limits" they held under license during the season of danger from forest fires, the Department would bear half the expense. At first but very few of the lumbermen holding limits had confidence enough in the efficacy of the ranging system to take advantage of the offer of the Government, but gradually the work done by the rangers in preventing fires—little can be done in extinguishing them—came to be generally recognized, and to-day practically all the Crown Lands under license are more or less patrolled by fire-rangers during the summer.

Much remains to be done to bring the fire-ranging system up to the state of efficiency the expenditure upon it should secure, but there is no doubt whatever that many incipient fires have been discovered and put out by the rangers, while their mere presence or supposed presence in the forest has made tourists, prospectors and others more careful. The net gain to the Province from the fire-ranging system has been considerable.

In 1895 the forestry office was transferred from the Department of Agriculture to the Department of Crown Lands, and the forestry officer was directed to make a study of the situation on the lands of the Crown, to ascertain what was best to be done in the way of reforesting the cut and burned over areas of Crown Lands not suited for farming, as well as to suggest improvements in the handling of the timber on the Crown Domain.

Without any particular attention having been devoted to the subject, it had come to be generally conceded that where a crop of our most valuable tree, the white pine, had been removed, it was invariably succeeded by a crop of some other and less valuable variety, and that if we were to have successive crops of pine timber artificial planting would have to be resorted to. The large initial expense this would have entailed at that time over the enormous area in question rendered this course out of the question. The Forestry Report for 1896, however, recorded the fact that over a large part of these burned areas, white pine was growing vigorously among the birch and poplar that had first sprung up after the fire, and that these areas only required to be protected from fire and the settler's plow to ensure that in time a new crop of pine would replace the one cut away of greater money value than the original.

The same report also dwelt at some length on the unwise

policy previously followed of opening for agricultural settlement lands quite unsuited for the purpose, but which in the interest of the State and of the individual settlers unfortunate enough to have located upon them should have been kept in forest for the growing of tree crops.

It was accordingly recommended that the Province adopt a policy of the separation of two classes of land, only land known to be suitable for agriculture to be opened for settlement, the other lands of the Crown to be placed in permanent Forest Reserves and kept for growing timber.

In 1898 a Royal Commission was appointed to consider the subject. This Commission, which included in its membership two prominent lumbermen, made similar recommendations, and in 1899 the Legislature passed the most important forestry legislation so far enacted in the "Act to Create Forest Reserves."

Under this Act the Lieutenant-Governor in Council is given power to withdraw forever from agricultural settlement such areas of Crown Lands as may be considered more profitable for tree growing purposes. The first Reserve created under the Act was a small one of about eighty thousand acres in Eastern Ontario, a territory that had been formany years under license, had been lumbered and burned over, and on which a vigorous crop of young pine and other trees was growing. The license holders relinquished the license for a small consideration, reserving the right to cut such mature timber as was upon it for a term of five years. It is worthy of note that at the expiration of five years, the license holders were very desirous of a renewal of their license owing to the increasing value of the young timber.

Another small Reserve of about forty-five thousand acres of similar cut-over territory, but not under license, on the north shore of Lake Superior was created in 1901.

The purpose of the Forest Reserve Act was to create permanent Crown Forests for purposes of public reserves and timber supply as well as the great incidental advantages in the way of water protection. In arranging for an extension of these Reserves to take in the non-agricultural areas still in the Crown, the fact became obvious that our system of disposing of our timber wealth, while better than the plan followed in the United States where the land and the timber upon it was sold in fee simple to individuals, gave our licensees or limit holders practically a perpetual lease of the territory in their license, except where the lands in question were desirable for agricultural settlement. True, a license to cut timber upon the Crown Lands was given for one year only, but as this license to cut over a given area was put up for public competition and the successful competitor often paid a large sum for the license, based on the estimated quantity of timber standing on the

area or "limit," it was understood that the license would be renewed from year to year to enable the purchaser to remove the whole of the standing timber on which he had based his advance payment or bonus. Under this system timber licenses or limits changed hands in the market sometimes for very large sums, and the Crown could not resume them, by refusing to renew the license, without compensating the holders or confiscating the property of an innocent purchaser. That the legal right of cancellation existed is probable, but that it should be exercised without compensation, unthinkable.

At the same time the Government could scarcely afford to remove the possible uncertainty of tenure to the present holders unless under conditions that would give the Government complete control of cutting operations, and a larger share of the rapidly increasing value of the stumpage than is now received by placing these limits under the Forest Reserves Act.

In consequence, very large areas of Crown Lands that are clearly suitable only for forest lands are still unclassified, while the Forest Reserves so far created are confined to lands that have not yet been licensed.

Over ten millions of acres have now been placed in Forest Reserves, and it is fortunate that these Reserves contain the major part of the pine timber yet unsold. No careful estimate has yet been made, but it is probably quite within the mark to say that the present Crown Forest Reserves contain fully ten billions (ten thousand millions) of feet board measure of pine timber.

The Reserves so far created, their areas and the dates of their creation are as follows:—

April —, 1898—Eastern Reserve.....	80,000 acres
Feb. 10, 1900—Sibley "	45,000 "
Jan. 11, 1901—Temagami "	1,408,000 "
Dec. 16, 1903—Western Temagami Reserve...	2,368,000 "
Jan. 24, 1904—Mississaga " ...	1,866,240 "
June 7, 1905—Nepigon " ...	4,578,560 "
Nov. 17, 1905—Nepigon Addition	91,520 "
Total.....	10,437,320 acres

When all the land unsuited for general farming or that from its location at the head waters of important streams should be kept forest covered, is placed in Reserves, Ontario will have a permanent Forest of forty to fifty million acres, and when this immense territory is administered under a rational system of forestry, this Province will be an important factor in the world's timber supply. That the non-agricultural lands now under license will some time be included in the Reserves is probable, for it should be quite possible to reach an agreement with the holders of these areas to this end.

The creation of Forest Reserves having forced the undesirable features of the then system of selling timber upon the notice of the authorities, a change was made in 1899, when some timber berths or limits were sold with the express condition that the license would not be renewed beyond a period of ten years. It was soon recognized, however, that this might prove too short a period for the lumberman to remove his timber profitably, and in subsequent sales the time was extended to fifteen years.

While this overcame the difficulty of the question of tenure, it was not conducive to the forestry interests of the State, but tends to destructive lumbering methods to an even greater extent than the former system of indefinite or perpetual tenure. When the lumberman has paid a large sum of money in advance for the timber on his limit, and has only a fixed term of years to remove it, he is not likely to leave much merchantable timber on it when he abandons it, nor be particular about the danger of fire when his own timber has been cut. In buying the limit he has based his price on the estimated quantity of merchantable timber, the greater part of which is paid for in advance. The stumpage dues to be paid as the timber is cut, usually represent but a small part of the stumpage value, consequently there is an incentive to cut timber too small to be taken into account in the original estimate. Moreover, as the timber scale used to measure this timber only accounts for a small portion of the actual contents of small logs, the lumberman would be a poor business man if he did not cut every stick of pine that was not too small to repay the cost of the labor expended in taking it out.

It will be readily apparent that while this system would be wise and proper on lands that were intended for subsequent agricultural settlement, it was very unwise for the future welfare of the forest.

In 1905 a further advance towards rational forestry methods was made when a small block of timber was sold at auction on the basis of a specified rate per thousand feet of the timber actually cut. It was feared at the time that lumbermen would hesitate to buy on these terms, but the sale was so successful and the price obtained for the timber so high, that this method of sale has been followed in subsequent sales.

In former sales practically no cutting regulations were exacted. There was no limit to the size of the tree or sapling that might be cut, and as has been pointed out, this would naturally permit very destructive methods. In the latest sale in 1907, by which the timber was sold at a high price per thousand feet as cut, cutting regulations are provided for, but it is to be feared that they are such as to be unnecessary, and from a forestry standpoint ineffective. These regulations fix a diameter limit of 10 inches, below which no tree may be cut, but it is very doubtful if the successful bidder could be induced

to cut trees so small. It would not pay him to do so. On the other hand, there might be a condition of affairs where trees of this or even a smaller diameter as well as larger but defective trees, should be removed to assist the growth of the new crop, and these cutting regulations might well provide for the removal of trees in such cases. To the same end, the work of the fire rangers might be supplemented by requiring the lumbermen to burn the brush after cutting operations, as is now being done in the National Forests of the United States.

All this will no doubt come in time.

Another important step in advance has recently been taken in the establishment of a College of Forestry in connection with the Provincial University. We are slowly creating a permanent National Forest. This forest to attain its maximum production and greatest usefulness must be managed by practical and scientifically trained men, and it is important that these men should receive their training under conditions such as they will be called upon to meet in actual work. There is reason to expect that there will be work for the graduates of our Forestry College in our Provincial Forest when they are competent to undertake it.

At the beginning of this article reference was made to the dangerously deunded character of the southern counties of the Province. The first action taken to restore the proper balance of wooded to cleared land in this part of Ontario was taken in 1904 by the Department of Agriculture, when forest tree nurseries were established at the Guelph Agricultural College to furnish seedling trees to farmers who would plant and care for them under the direction of the Forester of the Department.

Nurseries have been established on the Guelph Farm and at Homewood not far from Guelph. The success of this work naturally depends on the willingness of farmers throughout the Province to plant part of their farms with trees supplied by the Department. These seedling trees are supplied free to such farmers as will undertake to plant them under proper conditions, and the Forester or his assistant is expected to visit the farmer, examine his lot and submit a planting plan. Only about 200,000 trees were planted during 1907 in this way, while much more planting stock could have been supplied from the nurseries.

In order to meet the needs of farmers who might apply by having seedling trees of a suitable size for planting without waiting to grow them from the seed, the Department has purchased a considerable number of one year old trees in Germany grown from Canadian seed.

Unless the farmers more generally appreciate the advantage of having the waste places on their farms planted up to trees rather than left waste than has been the case so far,

it will be a long time before the proper proportion of wooded to cleared land in the older parts of the province is secured. If every farmer planted the land on his farm which is more suitable for trees than for other crops, there would undoubtedly be restored the proper proportion of woodland, but in case they fail to do this, there are considerable areas of waste land in the way of rough and sandy tracts which might be utilized for tree-planting by the general Government, or by the Municipalities to advantage.

The history of most nations indicates that very little can be expected in a forestry way from private individuals, even under pretty stringent State control, and it has been found more effective for the State or the community to undertake the work, particularly if it is done on a large scale.

However, the work of the Forestry Branch of the Department of Agriculture is very important, not only in the way of growing trees for planting in Old Ontario, but the Forester is also a Lecturer in Forestry at the Guelph Agricultural College. By this means the graduates of the College are given a practical knowledge of the best way in which to treat the woodlot that occurs on nearly all the farms in the Province, much neglected in most cases, but generally productive of revenue and of value to the community.

To sum up, what I consider to be the most important steps in advance made in recent years are, in chronological order, the adoption of the fire-ranging system in 1885; the passage of the Forest Reserve Act in 1899; the establishment of tree nurseries and lectures in forestry at the Guelph Agricultural College in 1904; the adoption of the plan of selling timber at a price per thousand feet on the stump in 1906; and the establishment of a Forestry College in 1907.

There has yet to be done the examination and mapping of the Forest Reserves; the application of scientific forestry practice in their management; the gradual inclusion in Forest Reserves of all the non-agricultural lands of the Province still held by the Crown; and more extensive reforestation in the settled and denuded areas in the southern part of the Province.

INSPECTOR OF FOREST RESERVES APPOINTED.

The staff of the Forestry Branch of the Interior Department has been greatly strengthened by the appointment to the position of Inspector of Forest Reserves of Mr. A. Knechtel, lately the Forester employed by the New York State Forest, Fish and Game Commission. This is but one step in the direction of enlarging and strengthening the staff of the Forestry Branch,

which is being done as rapidly as trained men become available. It is also a good example of the fact that the tide is turning in the direction of Canada, and that Canadians who have gone over to the United States are finding that Canada is now offering greater opportunities.

Mr. Knechtel is a native of Huron County, Ontario, where he helped to clear his father's farm. He taught school for a number of years in Canada and afterward in the United States. He completed the four years' agricultural course in the Michigan Agricultural College and graduated with the degree of Bachelor of Science. His forestry course was taken at Cornell University, where he received the degree of Forest Engineer from the New York State College of Forestry. While teaching school and attending college he spent his vacations looking after the work in a sawmill owned by him in Muskoka.

After completing his course he was first employed by the United States Bureau of Forestry in making a study of the natural regeneration of the commercial trees of the Adirondacks. Since that time he has been the Forester for the Forest, Fish and Game Commission for New York State, under direction of which he made a classification of the forest lands of the State, established forest nurseries, superintended the planting of 2,500,000 trees in the Adirondacks, organized the work of collecting forest tree seeds and took charge of the fire protective service.

In 1904 he made a four months' tour of Europe, visiting France, Germany, Austria, Switzerland and Italy, studying and photographing the forests.

Mr. Knechtel has published a number of bulletins and articles on forestry subjects. Some of the more important are: The Cultivated Forests of Europe; Methods of Estimating and Measuring Standing Timber, and Making a Woodlot from Seed.

Courtesy of N.Y. State Forest, Fish and Game Commission.]

A PLANTED FOREST (Four years old)

[Photo by A. KNECHTEL

PLANTING A FOREST OF EVERGREENS.

By Abraham Knechtel, Inspector of Forest Reserves.

INTRODUCTORY.

Forest history repeats itself. There is first a period of forest destruction, then comes forest conservation, and lastly, generally too long delayed, forest restoration. Canada is now in the second period—that of conservation. Of course, the periods lap somewhat, and even now forest restoration is receiving considerable attention. Here and there through the country one can already find private plantations, some of them made many years ago. I received, three years ago, from Mr. E. G. Joly de Lotbiniere of Quebec, a section of black walnut tree that had grown to be eight inches in diameter in a plantation made by his father, Sir Henri, eighteen years previously.

Sir Wilfrid Laurier, in an address before the Canadian Forestry Convention, held at Ottawa in January, 1906, urged upon the convention the great necessity of restoring the forests.

In view of the increasing interest in this subject, it may be of some benefit to consider the method by which an evergreen forest is established and managed.

Collecting Seed.

The collection of seed is the first step in planting a forest. The seed of evergreens exists in the cones which hang at the tops of the trees. These are gathered about the end of September by men who climb the trees and knock them off. Or, if a lumbering job is conveniently located, as the trees are felled the cones are picked from their tops. The cones or "burrs" as they are called by the lumbermen are put into sacks and taken to a dry, open, airy room and spread out in a thin layer on the floor, or better on wide shelves, about three bushels on every sixteen square feet of space.

In every good cone are many seeds, two above nearly every scale. A bushel of cones will yield about a pound of seed when thoroughly cleaned. But when the cones are gathered the seed is imprisoned, for the scales are firmly closed and sealed with pitch. This is the reason why they need to be spread out on shelves. If the weather be dry, and the air passes freely over them and under them, in two or three weeks the pitch becomes brittle, and the scales loosen and open. Of course, the more the cones are moved about with the hand, the sooner will they open.

When the seed is sufficiently loose, it is thrashed out with

a flail. It is separated from the empty cones by shovelling it on to a screen stretched over a box, the screen having three meshes to the inch. As the material is moved about with the hand the seed passes through the screen and is caught in the box beneath, the empty cones remaining on top.

Each seed as it comes from the cone has a wing, by which, when falling from the tree, it is borne by the wind .This is one of Nature's methods of dispersing seed and clothing the earth with vegetation. In handling the seed, however, these wings, which, in white pine are about an inch long, are not needed, and are even objectionable. So they are removed by rubbing the seed through a screen which has six meshes to the inch.

The seed is cleaned by putting it through a fanning mill with three screens, the upper one with two meshes to the inch, the middle one with four, and the lower with nine. It is then put away till spring in a cool, dry room free from vermin.

The Nursery.

In the spring, as soon as the soil is thoroughly thawed out, a piece of ground is prepared pretty much in the same way as for a vegetable garden. Good sandy loam is suitable soil, and upon this is put two inches of black muck, or other rich soil, and a bushel of fresh hardwood ashes for every fifty square yards of surface. The muck and ashes are thoroughly worked into the soil.

Then beds are made, usually four feet wide and twelve feet long, and a box is put around each, made of boards one and one-half inches thick and eight inches wide, set on edge. The box is placed so that it projects about five inches above the bed, the upper part being bored full of holes with an inch bit, so as to permit a free passage of air over the bed, and yet keep out the birds. Sometimes the box is made with its lower part a board three or four inches wide, and its upper part a frame with screen four or five inches wide stretched over it, the screen having a three-quarter inch mesh.

The surface of the bed is made convex and the soil is raked until it is very fine. Sometimes it is put through a sieve. If the weather is dry, it is watered thoroughly with a watering can. The seed is sown so that the grains will lie about one-fourth inch apart. This will take for each bed three-fourths of a pound of pine seed, or half a pound of spruce. The surface of the soil is then compacted with the back of the spade, and sand is sifted over the bed, just enough to put the seed well out of sight.

Then a screen with half-inch mesh is put over the bed to keep the birds from taking the seed, and over this is put a lath screen made by placing the pieces of lath the width of a lath apart to give the bed shade. Extra lath pieces are also laid

Courtesy of N.Y. State Forest, Fish and Game Commission.]

THE FOREST NURSERY

[Photo by A. KNECHTEL

into the spaces in the screen so that the bed is thoroughly darkened. As soon as the seed germinates, however, these extra pieces are removed, and on cloudy days the lath screen is lifted off entirely, but on bright days during the first summer it is kept on the bed.

The weeds must be kept out of the seed beds, and in the eastern provinces of Canada great care must be given the trees during the first two years lest they damp off. "Damping off," as it is called, is a fungus disease which, on close damp days, seems to rot off the little trees near the surface of the soil. On such days the trees must have constant care. Any device which will throw over the beds a constant current of dry air will save them. In absence of such device, charcoal powdered and heated should be sprinkled over the beds every quarter hour.

A short time before the snow falls, the screens and the boxes are removed and the beds covered with burlap laid right down upon the trees. This keeps the trees from being heaved out during the winter. The burlap is removed in the following spring as soon as the danger from heaving is over.

The trees remain in the seed beds for two years. During the second summer the beds need only to be weeded and guarded against "damping off."

In the spring of the third year, as soon as the ground is thoroughly thawed out, the little trees are transplanted into other beds in the nursery. This causes them to throw out many fibrous roots so that later when the tree is set out in the field, its chances for living are very much increased. In transplanting, a spade is thrust under the plants, and they are lifted from the bed. The trees are shaken out very carefully so as not to tear off any of the roots, and are placed immediately in a pail containing thin mud. In handling the trees great care is taken not to permit the roots to become dry, not even for a second. It is astonishing how quickly the fine rootlets will become dry in the sun and wind.

The trees are set in the transplanted beds in rows, four inches apart, the trees placed also four inches apart in the row. A string is stretched along one side of the bed. A board four inches wide, with nicks cut every four inches along one edge, is laid across the bed to space the plants, one end of the board being brought to the string for every row. The soil is dug away from the edge of the board with a trowel, the plants are set opposite the nicks and the trench then filled in. White pine and spruce are left in the nursery until they are four years old. At this age they will be from nine to twelve inches high and will have cost where wages are $1.75 a day, about $2.50 per thousand.

The plants are then taken up with a spade, the roots puddled, and the trees packed into baskets or boxes lined with wet burlap and are taken to the planting field. When they arrive

there a trench is dug and the trees are taken from the boxes, dipped into water, and set in the trench in a thin row, tops up, the trench filled in, and the soil tramped thoroughly against the roots. They will stand thus "heeled in" for two weeks without suffering.

In setting them in the field, they are spaced five feet apart each way. This may seem close planting, but it is necessary to have the trees soon grow together, so that they will become tall and slender, lose their lower branches and make timber free of knots. One can easily see the effect of close planting by comparing trees growing in the dense forest with isolated individuals grown in the pasture field. The former have cylindrical trunks, often without branches for a height of eighty or one hundred feet; while the latter have short conical shafts with branches almost to the ground.

In planting, the men work in pairs, one with a grub hoe who makes the holes, the other with a pailful of plants who sets the trees. Two men can plant fourteen hundred trees in a day of eight hours. A force of sixty planters needs two men extra as foremen, two to set stakes over the field so that the men can plant in straight lines, two to carry plants, and one to carry water for the men to drink, and to keep water constantly in the planting pails. A time-keeper is also necessary.

To house these men comfortably on the field, there is needed two cooking tents, each 12 x 14 feet, provided with a range and cooking utensils; two dining tents 14 x 20 feet; six sleeping tents 14 x 20, each one provided with a stove, six spring mattresses, six straw mattresses and thirty-six good blankets; also a small tent for the foreman and time-keeper, furnished with proper bedding. This tent should have a floor as the time-keeper will spend much of his time in it, in keeping his accounts. In the eastern provinces, good board can be furnished the men for fifty cents a day, including the wages of the cook and his assistant.

After the forest is planted, a few trees, of course, die, and it is necessary for a few years to replace these with live ones from the nursery. With this exception the young planted forest needs but little care.

Thinnings.

But when the forest reaches the age of about twenty years, it needs to be thinned, as the trees will be crowding each other so hard that each will be hindered in its growth—the struggle for existence will have become intense. More than half the stock is taken out in this first thinning. The trees can be used in Canada for Christmas trees. Then about every ten years after this, another thinning must be made. The second thinning may be used for pulpwood, and the third and subsequent ones for

Courtesy of N.Y. State Forest, Fish and Game Commission.]

PLANTING A FOREST

[Photo by A. KNECHTEL

pulpwood and lumber. In these thinnings the poorest trees are taken, all the dead, diseased and crooked being also removed.

The Final Cut.

The trees left for the final cut will remain until they are from eighty to one hundred years old. That is a long time in the life of a man, but in the life of a province or nation it stands close to zero. And that is a reason why forest planting should be done by the State, and not be left to the private citizen. Moreover, because of the long time it takes for the crop of trees to mature, it should be planted now, while we still have timber to tide over the period while the crop is growing. It is a long time to wait for a harvest, but when the time does come for the final cut, there will stand on every acre from 30,000 to 40,000 feet of the finest quality of timber, to say nothing of the thinnings removed, which, in European planted forests, often amount to almost as much as the final cut. The lumbermen of Canada know that the best forest we have in the eastern provinces will not cut more than 20,000 feet per acre. Even the fine Douglas fir of British Columbia will scarcely exceed that figure.

The natural forest has a few acres well stocked with trees, and these are often very poor ones, while many acres are only half stocked, and many are not stocked at all. The cultivated forest has every acre fully stocked with fine trees. Entering such a forest, one walks through it with a continuous leafy canopy over his head. A planted forest serves well all the purposes for which a forest should exist. It furnishes wood, feeds the springs, prevents floods, hinders erosion, shelters from the wind, gives health and recreation, protects the fish and game, and gives the country æsthetic features. And it serves all these purposes better than the natural forest. How much better would the streams be protected if the banks were all clothed with cultivated forests. Now we find, to be sure, the shores of rivers well protected in places, while in other places there are long stretches along the shores wholly unprotected.

The forest lumbered periodically and then left to itself will not restore itself with valuable timber any more than a flower garden will restore itself with beautiful flowers if, periodically, all the finest specimens are taken and the others are left to contend with the weeds. For two hundred years France and Germany hoped thus to have their forests restored, only to meet with disappointment. Canada has fine natural forests, and though she is wisely conserving them, they are still being used with amazing rapidity, and it might be well for us to consider if we had not better get started in time, as Sir Wilfrid suggests, along lines of restoration which European countries were finally forced to follow.

FORESTRY EXHIBIT FOR THE VICTORIA MUSEUM.

Acting under the instructions of the Director of the Geological Survey, Prof. John Macoun began last summer to collect material for a Forestry exhibit for the new Victoria Museum. It is proposed to represent every indigenous species by tree sections, polished deals and photographs. About fifty species were collected last season chiefly in southwestern Ontario. The tree sections when ready for exhibition will be four feet in height, cut so as to show the grain of the upper half, the lower portions remaining as the sections came from the tree. The deals will be polished in the usual way and the photographs framed in wood of the species they represent. The photographs have all been taken by Mr. Horace N. Topley, and form the most complete and beautiful series of the kind ever taken in Canada. Each tree has been photographed as it stands in the forest surrounded by other trees and in the open as well. The photographs of Tulip-tree published in the last issue of the *Forestry Journal* and those of the Nettle-tree in this number are from this collection.

The lumber cut of the United States according to statistics published by the Forest Service was in 1906 the largest in the history of the industry. It amounted to 37,550,736,000 feet, with a mill value of $621,151,388, and shingles and laths are not included in this estimate. These were valued at $35,644,125. Yellow pine heads the list with Douglas fir next and the white pines third. The quantity of yellow pine and Douglas fir cut in recent years has greatly increased, Douglas fir 186 per cent. and yellow pine more than 20 per cent. since 1899, while the cut of white pines has decreased nearly 41 per cent. Of the hardwoods oak has decreased 36.4 per cent. and poplar 38.7 per cent. There has also been a very decided decrease in the quantity of cottonwood and elm cut but chestnut and basswood have increased, the former 97 per cent, the latter 22 per cent.

It is estimated that on some areas of lodgepole pine a second cut may be made in thirty years if trees not below 11 inches in diameter at breast height be cut and the smaller trees properly protected.

FORESTRY CONDITIONS IN THE ARID REGIONS OF THE UNITED STATES.

By W. N. Hutt, Formerly of the Agricultural College Logan, Utah

Arborescent vegetation and moisture are inseparable. It takes a certain amount of moisture to produce plants, even those the most zerophtic in habit. The giant redwoods of the Pacific slope, the largest trees in the world, are the product of a torrential precipitation.

Passing eastward across the lofty barrier of the Coast Range and the Sierra Nevada Mountains a hundred or so miles would bring an aerial traveller to the region of minimum rainfall averaging about 6 inches in twelve months. Such thirsty places would hardly be expected to produce any vegetation that could be dignified by the name of tree, yet they are not the barren wastes of sand that imagination would picture to those who have never seen the desert. Nature seems to have kinds of vegetation suited to every condition of humidity and aridity. In the dryest places will be found some hardy cactus, sage brush or greasewood that is holding its own in spite of sun, wind, sand and salt. It takes at least 13 inches of rainfall to grow wheat, which is the most drought-resistant of cultivated plants. Nature has many hardier children that can live and even flourish on less than half such an amount. Few if any of these, however, can be characterized by the name of tree.

In regions the most arid there are varying degrees of aridity. Under most circumstances dryness decreases in direct proportion to the elevation. It is for this reason that plain land, mesa or table-lands are so largely treeless and that the forests of the west are in the mountains. Though the plains are largely treeless, wherever a little "seep" of water is found the hardy cottonwood and quakenasp will generally be growing. Fringes of them may be found along creeks and rivers. In desert travelling one can invariably locate watering places by the growth of the quakenasp. They stand as the outposts of arborescent vegetation.

In mountain regions a wide variety of trees may be found, their size depending on their favorable location as regards moisture. Where the plains elevate into the foothills may generally be found a fringe of mountain maples. This species (*Acer grandidentatum*) is more of a shrub than a tree, for it usually grows in bush form and seldom has a well defined trunk. Above the maple growth will be found the mountain juniper (*Juniperus*

occidentalis) which is found at all elevations to the extreme timber line. Unlike the maples they always have a well defined trunk, even though it be gnarled and twisted by growing in the most rocky or wind-swept locations. At high elevations they are usually so stunted and warped and gnarled in growth that they present a very weird appearance. In traversing a belt of them one would scarcely be surprised if he encountered a pigmy race of men. Many of these trees though scarcely higher than the head of one's horse are a couple of centuries in age. From their slow growth the wood is so dense as to be almost as solid and heavy as mahogany. The bark on one of these trees of the size that could be used for a fence post is often between two and three inches in thickness.

In high dry regions similar to that occupied by the mountain cedar will be found the pinion pine (*Pinus edulis*). It, also, is of stunted growth, seldom over 20 feet in height, with straggling branches which produce numerous small cones containing large seeds or nuts. Such trees are usually on high southern slopes where the snow melts in the early part of the season. They must therefore make their growth while the moisture lasts, and during the latter part of the season it is a struggle for existence. For this reason they are never large trees.

Mountain forests show the greatest contrasts in growth according to the slope to or from the sun. The stunted trees just described are those that usually characterize southern exposures. The most elevated portions of high southern slopes are almost invariably treeless. Sometimes where the slope is rocky there may be stunted cedars clinging to points of vantage where obstructions ward off the full glare of the sun, but smooth slopes which get the unbroken force of the sun are almost entirely treeless and even plantless. On passing over the ridge to the northern slope one is almost startled by the contrast. Here instead of looking down on a barren sunbaked soil one sees a dense mass of the tall green tops of stalwart firs and spruces reaching skyward for over a hundred of feet. Here are the forests of the west. Such wonderful trees they are—tall and straight and clean like ship masts. They cover the ground in the densest profusion. Underneath their closely-locked branches there is a silent twilight even at noon-day. In midsummer the snow still lies upon the ground melting slowly and feeding the mountain rivers and streams. The snow is so firm that one can ride upon it with his horse and it scarcely shows the print of its shoes. In such locations there is abundant moisture, a soil unswept by fire and rich with the accumulation of ages. Here is the chosen home of the mountain spruce and fir. These trees grow well in such cool locations and with their dense tolerant foliage they have accommodated themselves to growing in positions of subdued light. They never get the burning rays of a noonday sun and

obtain sufficient solar energy from a few hours of the slanting beams of sunrise or sunset.

It is from forest locations like those just described that the splendid lumber of the west is derived. The general direction of the Rocky Mountain system being north and south, there are innumerable ranges and spurs running east and west. It is on the northern slopes of these that the best timber is found. From high elevations one can look down into numerous canyons running east and west, the south sides of which will be reflecting the brilliant sunlight from their nude surfaces, while on their northern sides one can peer into the hazy purple depths of the forest primeval. On going down into the forest of these northern slopes one is forced into admiration and wonder by the stalwart grandeur of the individual trees. Many of them rise clean and straight for fifty or sixty feet without a limb, then tower off into the blue in a maze of tossing branches for another half-a-hundred feet. One begins to wonder how they ever got there and the practical mind speculates on how they can ever be gotten out.

Numerous systems of lumbering are in use for harvesting the forests from the steep slopes of these lofty altitudes. As the ground on which these magnificent trees grow is too steep and broken to take the mill to the forest, they must necessarily be taken to the mill. One of the commonest methods of doing this is by means of the donkey engine and cable drag. The trees are felled by saws and cut into log lengths, then they are grappled and "snaked" out by the cable of the donkey engine. Gravitation and the steepness of the slope very materially assist in the operation. Often where considerable timber is to be taken out a log-road or skid-way is made. Where a sufficient stream of water can be obtained, high up in the mountains, a wooden V-shaped flume is made, and the logs floated down to the mills or railroad below. Often these flumes run for many miles and bring the logs to the mill and carry the lumber away from it to the railroad.

In the forest regions of high mountain slopes there is not the danger from fire that there is in lower and more populated altitudes, and as such forest lands are altogether out of the range of homesteading, conditions are more favorable for natural forest reproduction than in lowland forests. There is, however, a great menace to western forests in the sheep-grazing industry. To one who has never seen the effect of sheep-herding as it is seen in the west, it would be hard to believe how deadly they are to all kinds of vegetable life. Sheep will go up into the mountains as high as vegetation will grow, and any country that has been systematically "sheeped" is a dead country.

The demand for lumber, owing to the extension of all branches of industry, has wonderfully increased. The song of the axe and the saw and the hammer is still ringing throughout

the land and it is singing the death knell of the forest. To the observant it is evident that without a strong governmental policy of forest conservation the twentieth century will be recorded in history as the age of the passing of the forest.

The British Columbia government is now going thoroughly into the question of forest protection and new regulations with that object in view may soon be looked for. The fact that pending legislation all unstaked timber has been reserved promises well for the future. The B. C. Timber and Forestry Association which is actively urging upon the government the need of a change in the regulations has drawn special attention to the bad effect of the regulations now in force under which holders of special licenses must log their lands within 21 years, and in many cases much earlier, on pain of losing title to the timber. The Association in a petition which has been signed by nearly all of those most interested states clearly the objections to the present regulations. Chief among these are: Loss of revenue to the government; detriment to the logging and saw-milling industries and to the best interests of all consumers of wood. The government would lose its revenue from timber licenses as fast as the limits were culled and abandoned. The destruction by fire of the lower grades of timber left standing on the hastily culled lands would be very great. Operators would be forced into the keenest possible competition in the disposal of their products and the twenty-year period of timber slaughter would be followed by a much longer period of timber scarcity. The Timber and Forestry Association asks that special licenses be made renewable at the expiration of the present period of twenty-one years, for a further period of twenty-one years, and that the present rate of annual rental for special timber licenses be declared statutory for the present renewal term of twenty-one years.

CONSERVATIVE LUMBERING IN NEW BRUNSWICK.

The Miramichi Lumber Co. was one of the first in Canada to enlist the services of a trained forester in its lumbering operations. Mr. Reginald R. Bradley, the Company's forester, graduated from Biltmore in 1904 and soon afterwards began work on the limits of the newly incorporated Miramichi Lumber Co. Before doing so, however, he spent some time in practical lumbering work, following the log from the woods to the sawmill and studying the various methods employed by lumbermen in getting out logs, transporting them to the mill and there turning them into merchantable lumber. With characteristc modesty Mr. Bradley describes the forestry methods he employs as "crude," but judging from the results secured and comparing the methods now practised by the Miramichi Lumber Co. with those of the average lumberman, he is to be congratulated on the great measure of success which has rewarded his efforts. In the first issue of *The Canadian Lumberman* for the new year he gives a detailed account of his operations which should be read by everyone interested in work of this kind. The following is a brief summary of his paper.

The total holdings of the Company exceed 1000 square miles of which about 200,000 acres is granted land, the remainder being held under license. The restrictions which control the cutting on government ground do not differ materially from those imposed by the Company in operating its granted lands and do not in any way interfere with the Company's working plans. The commercial trees found on their limits are spruce (red, white and black), cedar, hemlock and hardwoods, but at the present time red spruce alone is lumbered on a large scale. The red spruce is most abundant on areas bordering streams where it extends back in some cases several miles and absolutely pure stands are found on steep mountain sides bordering deep ravines.

Low stumpage values, untrained help and above all the grave danger from fire preclude any but the simplest and cheapest forestry methods, but the changes that have been introduced have proved very effective and are paving the way for more aggressive work later on. The logging operations are carried on mainly by jobbers cutting and hauling by the thousand and under the old system it was the custom to take only the available trees. The cheap logs were "skinned off" and when these were taken off the camp was moved elsewhere. The Company, under the new system, blocks about 50 square miles each year into square miles. Each block is cruised by a

petent man who estimates the quantity of timber on the block, gets some idea of the topography of the ground, decides how the logs are to be hauled and fixes the probable cost of obtaining them. The cruiser, in locating a camp, decides what blocks are to be cut from it and in what order they are to be taken, but the block lines do not always confine the jobber. His work is necessarily governed by the topography of the ground, but the lines enable the forester to control the jobber in a way that could not otherwise be done. The jobber is confined to a certain area each year either within natural or artificial boundaries and this he must cut clean before he is allowed to go further afield.

A future crop is provided for by cutting down to a diameter limit of about 14 inches breast high. This leaves a young growth on the ground after cutting and trees of the size left are quite capable of bearing a heavy seed crop and therefore of restocking the ground. The only cases in which trees under 14 inches in diameter are cut is when there would otherwise be a blow-down, when they grow on barren ground and would never reach a large size, and lastly in a burn. Chief among the places where a blow-down is a practical certainty after an inroad is once made is the steep hillside. Unless a clean sweep is made of such an area a blow-down is inevitable and it is to everyone's interest that all trees of any commercial value whatever be taken. On barren ground trees of sawlog size are seldom found so that unless trees of smaller size are taken no operation is possible. In this case and in that of fire the Miramichi Co. takes every tree that will measure 8 inches breast high.

All trees are sawn down and now that the men have become trained to its use more pieces are being obtained to the yard crew per day than was the case with axes. The Company insisted on the use of saws for two reasons—much lower stumps can be cut and the axe scarf is saved. The Company insists on all trees being cut at the point where the tree bole begins to swell into the knee or root.

Pursuing the policy of wasting nothing of commercial value the tops of all trees are cleaned up and sawn off where the diameter measures about 5 or 6 inches. Pulpwood has reached such a value that it pays to take these rough tops and, moreover, the smaller the top left in the woods the sooner will it disintegrate and become fireproof. As an illustration of the care exercised by the Company in pursuing its policy of saving everything of commercial value, Mr. Bradley cites the following incident: Some limits were acquired last summer from an operator who handled nothing below 10-inch sawlogs, the tops of the trees being left in the woods to rot. Some of the camps at work in this tract this fall will do little else but swamp out and yard these tops which will be taken for pulpwood. Such

CEDAR PIERCED BY FIRE-KILLED HEMLOCK

an operation has probably never before been undertaken in New Brunswick and affords a good example of the ideas that control the policy of the Company.

Wherever other species are available no young spruce are allowed to be cut for skids but whenever they are cut they are taken and marked for pulpwood. War cannot be waged to any extent against forest weeds as the present stumpage values do not warrant the expense but jobbers are encouraged to use tree weeds for building and other purposes whenever possible. The machinery for enforcing these regulations is very simple and has proved quite effective. The jobbers all sign written contracts wherein all the detail of the regulations that control their operation is set forth. The company reserves the right to charge the jobber stumpage for all the timber wasted and to take the contract out of his hands if in the opinion of competent men his work is unsatisfactory. So far it has not been found necessary to exercise this prerogative.

Fire wardens are stationed during the summer months at each of the chief operating stations. These centres are connected by telephone with the central office so that in case of fire details can be transmitted to the settlement with the least possible delay. It is the duty of the fire-warden:(1) To patrol the area under his charge and to constantly visit lookout stations on the mountain tops; (2) To follow up fishing and hunting parties, identify them and caution them in regard to fires; (3) To see that fire notices are properly posted in prominent places and to transmit word immediately to the settlement in case of fire.

The illustration facing this page represents a giant cedar, four feet in diameter at the ground which has been perforated by a young fire-killed hemlock about a foot in diameter just above the base and about 25 feet long to the broken point. The photograph was taken by Mr. J. E. Porritt, Managing Director of the Montezuma mine, which is about six miles up the south fork of Kaslo Creek. The pierced tree is near the mine. The original direction of the hemlock, Mr. Porritt, says, was almost horizontal as shown by the scar on the lower cedar. Dr. Jas. Fletcher, Botanist and Entomologist at the Central Experimental Farm, who has seen the trees and through whose kindness the photograph is here reproduced says that the motive force was evidently a snow slide as these trees are just on the edge of the track of an annual slide which is plainly visible in the photograph with the overthrown timber lying on the ground.

EXTRACT FROM LETTER FROM MR. G. S. WILGRESS, OF HUNTSVILLE, ONTARIO, DATED NOVEMBER 10, 1907, TO MR. R. H. CAMPBELL.

"I must say the work of the Association is bound to have a good effect, not only in reminding people of the value of our timber resources, but also in guiding those who are dealing with growing timber in any way, to manage it carefully with an eye to the future, and in checking wastefulness. The Association has much yet to do, educationally, both in introducing more careful and prudent practices, in management of forests, large and small, and in combatting injurious practices. Now here, in Muskoka, where there has been great abundance of basswood, e.g., it is being cut without the slightest regard to renewal of the supply, although it is a very quick growing tree and sends up suckers, which are unfortunately generally cut or damaged young when the parent tree which they surround is being felled, cut and skidded. These suckers could easily with a little care and attention be enabled to grow big and replace the mature ones that are cut.

"Then again, the operations of the companies which take out cordwood for chemical purposes, far different from those of the sane log operators, cannot but be held to be injurious to the country. They come and buy a lot and with imported, cheap labour, principally Italian, strip it in a winter, leaving nothing standing but a few odd elm, ash and basswood, and the evergreens, and the tops and brush littered about all over, a veritable fire-trap. The lot will be abandoned by them, and will be of no use to anybody for years to come, and the neighborhood will be deprived of the forest covering over so much area.

"We have in this Huron and Ontario territory one of the best areas in Canada for the production of hardwoods, a moist, humid climate; a light, mostly sandy, stony, quick-growing soil, and a long season of growth.

"The lumbering of the timber and sawlog men has never injured the character of the country here to any extent, although it has made the pine scarce, but the chemical companies are doing so, and it seems to me they should be brought under some regulation."

WHAT PRACTICAL FORESTRY ACCOMPLISHED ON A SPRUCE TRACT IN MAINE.

Mr. Austin Cary, in his report on his six years' experience as forester for a large New England lumber and paper company, attributes the following improvements to the direct application of practical forestry to the company's tract. (1). Increased economy in utilizing the stock of timber standing on the land. (2). A system of cutting adapted to the land, the timber, and the business organization, and at the same time directed toward the promotion of future growth. (3). The heading off of insect depredation. (4). A map devised and in a large measure carried out which renders it possible to handle a large land property with far more economy than could otherwise be done.

Destruction of forest trees by insects is constantly going on, and when their depredations become so extensive as to be distinctly noticeable, most lumbermen, feeling that the matter is hopeless, trust entirely to Nature for a remedy, and sooner or later Nature does come to their assistance. But as a practical forester, Mr. Cary could not do this. When, to quote from his report, he "first entered the upper Androscoggin basin in Maine the country south of the Rangeby Lakes was practically free from insect depredations. North of the lake system, however, damage in many places was severe. The best field for insects was in the virgin timber, and much of great value was either involved or threatened. The insect which caused the damage was a small, black beetle that killed the trees by cutting channels in the inner bark. Ordinarily the insects spread from one tree to others in its neighborhood, and thus clumps of dead or infected timber would be scattered over a valley. It was only occasionally that young broods spread far from their base. This was clearly shown by the fact that bodies of timber which were separated from the infested places by areas of cut-over lands had escaped attack. Even the width of Parmachenee Lake had long proved an effective barrier, though the insects finally attacked the fine timber on its western shore."

"The chief measure of relief was plain—to cut and drive the dead and infested timber, in order to both save the lumber and to drown the beetles. The company, of course, could not send crews over its vast holdings to search for small clumps of dead and infested trees; indeed such strenuous measures did not appear necessary. Certain things could be done, however, which were both profitable and practicable. These were: (1) To at once direct the regular logging operations into the heavily infested valleys, taking crews when necessary from those free

of insects; (2) to locate in each valley that was being logged, the stands of insect-killed timber, and, when they were within reach, to cut them ahead of the green timber; (3) wherever it would pay, to begin special operations to get out the dead timber, with such other material as it would be necessary to take with it."

"To carry out these measures, however, required persistence and great labor. The company was very cautious about changing the principles which had guided its operations, and when its consent to a change was secured came the work of carrying it out on the ground."

"Yet the remedial work indicated was in large measure carried out, and the dead and infested timber was put through the mill, though the work was not done with either the promptness or the thoroughness that would have been desirable. However, much of value to the company and to the region was accomplished. Much valuable timber was rescued from decay, and insect depredations were reduced to insignificant proportions. What this saved the company is very hard to estimate. Certainly it was more than $100,000. But whatever the saving, the credit for it must lie with the application of forestry."

"To-day there is little danger from insects on the tract. The larger colonies of beetles were taken out by the logging, and the wood-peckers and other enemies of the insects keep the lessened numbers in check. Moreover, the region has learned and digested an important lesson. Probably twenty woodsmen understand thoroughly the work of the beetle in all its practical bearings. From now on they will be on the watch, and serious trouble, if it should appear, will not escape them. It is safe to say that if the tract remains under continuous management, no serious damage from this source will ever occur again.'

Another important work done by Mr. Cary was the mapping of the whole area controlled by the company he represented. The maps have been used to locate camps and roads, to let contracts by, to plan operations of all kinds. The lands of the company lay for the most part in townships that had not been subdivided. These were divided into mile squares—a system of survey found serviceable for the help it gives in estimating timber and laying out roads. This work was done by compass and chain. Into the frame work so obtained the detail features of the country could readily be put by one man working alone, by the method of compass and pacing. The examination of the timber could be done in connection with this and largely at the same time. Contour maps were also made. The facts regarding a timber township were divided into two classes and represented on two sheets. One sheet contained permanent features, such as property lines and lines of division, permanent roads, waters

and the contours. The other embodied facts regarding the timber. These included the character of the timber and estimates of the stand. Camps and supply roads were located. These sheets were drawn on tracing linen, so that one may be laid over the other and the topography and the timber be seen in direct relation. The map system, supplemented as it was by a man to map in the cuttings, renew lines, and keep watch of the timber, was of benefit to the company in the following ways:—

(1). Operations could be planned and largely controlled from a central point. The cut could be located for years ahead, and with full consideration for the most economical driving and hauling of supplies.

(2). The location of all roads, whether logging roads or supply roads, was greatly facilitated. Exploring was saved and distances were accurately known.

(3). Great saving in the aggregate was effected through the detection of small losses such as windfall and insect depredation, and by knowledge of the location of bodies of unhealthy timber.

(4). Information about the tract could be preserved in permanent form. Many old lumbermen or cruisers possessed knowledge of the holdings which would have been lost when they died or stepped out, unless maps were at hand.

(5). Working knowledge of the territory could be gained by a new manager within a year, when otherwise he might be in the hands of his employees for a long time.

(6). The company could show its stockholders, investors, and directors just what property it possessed.

In addition, the map system was supplemented by topographic models, which showed in miniature the land just as it lay. These were a great satisfaction to the company, and were clearly understood by strangers and lumbermen, where contour maps might not have been.

As to cost, the whole operation, renewal of outside boundaries, division into mile squares, timber examination and topographical mapping—the whole represented in model and maps—was carried out for less than $1,500 per township. A good deal more might, of course, have been spent, and in easier or less valuable country a sufficiently good result might have been obtained for less.

THE CONSUMPTION OF PULPWOOD BY THE UNITED STATES IN 1906.

That the pulpwood consumed in the United States is rapidly increasing in amount and value is known to everyone, but accurate figures were not available until quite recently when the U. S. Forest Service issued a special circular (No. 120) in which the consumption of pulpwood in 1906 is compared with that of 1905 and previous years. Before 1905 statistics of this kind were collected by the Bureau of Census, but the demand for reports that would be published more frequently than those which issued from the Bureau of Census was so great that the work was undertaken by the Forest Service with the co-operation of the Census.

The condition of the pulp and paper industries in the United States, the value of the woodpulp consumed and the available sources of future supply are all matters of paramount interest to Canadians, whether they believe that there should be no restrictions placed on the export of pulpwood and wood-pulp, or whether they are of the opinion that the wood should be manufactured into pulp and the pulp into paper here in Canada. All the wood imported into the United States for the manufacture of pulp comes from Canada, and the amount has increased from 369,217 cords in 1899 to 645,428 cords in 1905 and 738,872 in 1906.* The increase has been confined to spruce, the exports of poplar having fallen off nearly 25 per cent. between 1905 and 1906. Canada exported, however, about 10,000 tons less of wood-pulp to the United States in 1906 than in 1905.

The consumption of wood of all kinds in the manufacture of pulp in the United States in 1906 exceeded the consumption of 1905 by 469,053 cords, there being an increase in all kinds of wood used, except balsam, which fell off about 40 per cent. The increase in the consumption of poplar was very slight, but more than 40 per cent. was added to the quantity of hemlock used, and the increase under the heading "all other" was more than 100 per cent., showing that the scarcity of spruce is forcing manufacturers of wood-pulp to use a great variety of woods which formerly were not utilized in this way. The woods classified in the circular referred to above are, in the order of the quantity consumed, spruce, poplar, hemlock, pine, balsam, cottonwood.

The total consumption of wood in the United States in the manufacture of pulp was 3,661,176 cords in 1906. Three processes were used: 1,197,780 cords were made into pulp by

*These figures are for the fiscal, not the calendar year.

the mechanical process, 1,958,619 by the sulphite process and 504,777 by the soda process. Nearly all the hemlock is manufactured into pulp by the sulphite process. The average price per cord of wood in 1906 was $7.21, $1.65 higher than in 1905. There is no duty on pulpwood imported into the United States, and the duty on mechanical pulp is only $1.66 a ton. Unbleached chemical pulp pays $3.33 a ton and bleached chemical pulp about $5.00 a ton.

THE DRAIN UPON THE FORESTS.

The estimates that have been made of the quantity of timber growing in Canada and the United States vary even more greatly than similar estimates of the world's supply of coal and the available data are about as uncertain in the one case as the other. Faced by the admitted fact, however, that the forests of the United States are being depleted far more rapidly than they can be reproduced by either natural or artificial means, the Government has thoroughly investigated the whole question and the conclusions reached by Mr. R. S. Kellogg, Chief, Office of Wood Utilization, may be accepted as being more nearly correct than any that have been published. He states that a conservative estimate of the present consumption of wood in all forms in the United States is equivalent to at least 100 billion feet, and the most detailed estimates of standing timber range from 1,400 to 2,000 billion feet. If growth be altogether left out of the calculation and 1,400 billion feet be assumed to be the present stumpage, the timber supply of the United States would last 14 years. If it be assumed that there is an annual growth of 40 billion feet, it would last 23 years. The annual use of wood in the United States is by some, however, estimated to be as high as 150 billion feet; on this assumption the above figures would be changed from 14 and 23 years to 9 and 13 respectively. If the larger estimate of standing timber, 2,000 billion feet, be taken and an annual growth of 40 billions assumed, the supply would last 33 years, if 100 billion feet be used annually, and but 18 years if 150 billion be used. No matter how bright a view may be taken of the situation in the United States, it is evident that the most rigid forest protection and reforestation on a large scale are absolutely necessary if anything like an adequate supply of timber is to be maintained, and so long a time must elapse before the trees that are now being planted will yield merchantable timber, that something approaching a timber famine may almost certainly be expected within the next 20 years.

FORESTS AND FLOODS.*

What has been done in this country regarding the preservation of our forests, both in a scientific and a practical manner, both as a subject in literature and as a physical resource of the greatest economic importance, has only been the veriest nibbling around the edges of a subject of gigantic magnitude. Some of the states in the union which yet have great forest wealth are beginning to realize its value; others are hardly awake to it, while yet others which once had large areas in valuable timber trees are now poverty stricken in this particular and are not only importers of lumber but are fearfully devastated every few years by unmanageable floods in their large rivers, due to the destruction of nature's equilibrium in the destruction of forests about the headlands and primitive water sources of these rivers.

It is not so many years ago that Pennsylvania, New Jersey, Ohio, Wisconsin, New York and several other mid-Atlantic states were heavily timbered and had great wealth of forest resources. Now, and for several years past, these states have been importers of the lumber used in building construction, for wharves, piling, telegraph and telephone poles, railroad ties and other purposes. In many of these states certain kinds of trees, like the pine, hemlock and some species of hard woods have become nearly or quite exhausted.

The severity of the spring floods in Ohio, Pennsylvania and other states is an object-lesson against the depletion of the natural growth and the main watersheds of the great rivers. Gifford Pinchot, chief of the forestry service of the general government in a recent public letter affirms that these great floods are due fundamentally to the cutting away of the forests on the head waters of the Ohio, Alleghany and Monongahela rivers. These steep mountain slopes once contained as fine hardwood forests as existed in the country, but the work of denudation has gone on until many of the slopes are barren and the water falls into the valley almost as from the roof of a house.

There were floods on these rivers last spring but they were far less severe than those which have taken place this spring and apparently the situation grows worse with the passage of time. Not only does the present damage to property amount to millions of dollars (it is said to have amounted to $10,000,000 in the one city of Pittsburg alone, and to $50,000,000 in the state of Pennsylvania) but more than 100,000 people have been temporarily thrown out of work, while lives have been lost by the score.

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The process of forest destruction which has caused floods to be things of annual occurrence in the states named, is going on in the White Mountain and Appalachian regions and cities and towns on the Connecticut and Merrimac rivers as well as those on the Saco and Androscoggin in this state, will become uncontrolled avenues of destruction to life and property unless a system of forest preservation is established and lived up to. Even the head waters of the Penobscot and Kennebec, as well as Maine rivers of the second class must eventually come into the same category unless forest conservation is made a rigid state policy.

The late meeting at Augusta to organize a state forestry association is a tangible evidence of the awakening of the public mind to the importance of forestry preservation. That convention was the first real assemblage of the practical and scientific experts in forestry study and the lumbering industry that has ever been held in Maine. It was eminently representative in the character of its members. The Harvard and Yale Forestry schools were represented; the representative of the national forestry service was present; large forestry owners and lumber operators made up a considerable part of the audience; civil engineers from Boston were in attendance; our own state forestry commissioner and the professor of forestry at the state university took an active part in the proceedings and the call for the convention was headed by the governor of the state and the president of the University of Maine. This shows the high character of those forming the personnel of the meeting, while the bringing together of the three classes interested in forestry —the timberland owner, the operator and the expert student of forestry—showed that all interests could unite in a work in which each had an equal share of interest.

The science of forestry is new in this country and when our national and state forestry departments and schools were first established they had no guide for work. Naturally they turned to the methods and systems of foreign countries, mainly those of continental Europe for the examples and models, and after a time found them unsuited to conditions in our own country. Hence some mistakes were at first made in methods of instruction and actual work. Now, however, our various state forestry departments, the national forestry service and the expert students of forestry in charge of classes of forestry at our state universities have established methods of work based upon our own conditions and our own needs and are building systems of study and schools of practice which will meet the particular conditions of different states and result in work of untold value for the preservation and permanency of our forest wealth —which, if once ruthlessly destroyed will require generations of time before it can be restored.

Maine should rejoice over the formation of this new association and at the present renewed public spirit in behalf of forest preservation, the salvation of our rivers from floods and protection to the great wealth represented in our forests.

With the beginning of 1908 the Canadian Forestry Association has inaugurated a series of newspaper bulletins, or short articles, the first of which has recently been sent to the newspapers throughout Canada. A number of favorable responses have already been received to the request for their publication. The bulletins will be printed in both English and French, and sent to the press at suitable intervals. It is the intention to make them brief and to the point, seldom, if ever, exceeding half a column in length. The articles will treat, among other topics, of Canada's forest areas; the consumption of timber; Canadian forest reserves, their purpose and extent; forest protection; forestry education and many other subjects.

The difficulty in procuring railway ties is, of course, not so great in Canada as in the United States, but in one respect at least the scarcity that is sure to come might be anticipated. Railway companies all over the United States are planting millions of young trees from which ties will be made in future years. Some planting of this kind has been done in Canada, but it can hardly be said to have gone beyond the experimental stage. Except in the prairie country, tree-planting within the right of way would not be tolerated on account of the danger from fire, but there is not a railway in Canada which does not pass through rocky, swampy or "barren" land which could be acquired at a nominal price and planted with trees of the kinds best adapted for tie-making. What private individuals do not feel warranted in doing railway companies may well do as they do not need to consider the question of quick returns on the money invested, and though railway presidents and directors may come and go, the railways remain. The amount of money required would not be great and the growing trees could always be reckoned among the assets—would indeed be among the most valuable assets of a company, as they would increase in value every year.

REVIEW.

Experimental Farms Reports for 1906, pp. 430.

These reports deal almost wholly with matters of special interest to those engaged in some form of agriculture but are not without interest for the forester and tree-grower. The horticulturist at the Central Experimental Farm furnishes a detailed statement showing the growth of trees in the forest belts at the Central farm. This statement which was summarized in a paper read by Mr. Macoun at the last annual meeting of the Forestry Association and published in the June number of the FORESTRY JOURNAL gives full details relative to the character of the soil in which each species was planted, the distance the trees were planted apart, date of planting and the average height and diameter of each species for a series of years. The superintendent of the Brandon farm reports that Russian poplars on the hillside there are greatly damaged by the fungus which is weakening the stems. Nearly all the cottonwoods have been destroyed by leaf fungus, though on low land they do well. The following trees among others are hardy at Brandon: Manitoba maple, canoe birch, American mountain ash, white spruce, balsam spruce, Tartarian maple, sharp-leaved willow, laurel-leafed willow and American elm. Fifty one-pound bags of maple seed were sent out during the year. The superintendent of the farm at Indian Head advises the sowing of maple seeds late in October or early in May, but it is not safe to sow all the supply of seeds in the fall as very often germination takes place too early in the spring and frost kills the entire crop. Ash seed should be sown in October, elm seed as soon as gathered in June, though it sometimes succeeds if sown the following spring. Elm seed requires a very light covering of fine moist soil not over one-half inch in thickness, while maple and ash should be covered one or one and a half inches. Tree and shrub seeds should be sown in rows 30 inches apart to permit horse cultivation when considerable quantities are grown. In all cases land should be prepared the year preceding sowing so as to have the soil as fine as possible. Breaking and backsetting new land and summer-fallowing old make the best and safest preparation. Trees should be transplanted when seedlings are two years old. When left until three or four years old, the trouble and expense are greatly increased. From the Indian Head farm 780 half-pound packages of maple seed were distributed and 285 similar packages of ash seed.

The report that railway ties and telegraph poles were being brought by the Canadian Pacific Railway Co. from the United States to Canada surprised those who were not familiar with the region from which they were being brought. They will be cut in northern Minnesota on or near streams running into the Rainy River and will reach the Lake of the Woods and the C. P. Ry. in that way. While there is difficulty in procuring railway ties in some parts of Canada, especially in the West, this difficulty is immensely greater in the United States. Oak ties which still form nearly half the total number used there must soon be replaced in many parts of the country by softer woods, although in 1906 the number of oak ties used by the steam railways of the United States exceeded the number used in 1905 by 6,855,325. The total number of ties purchased by steam and street railways in the United States in 1906 was 102,834,042, the average price paid being 47 cents per tie. With the increasing use of the softer woods for cross-ties chemical treatment has become necessary, though in Canada this has hardly got beyond the experimental stage. In the Northwest, however, a beginning has been made in the planting of tamarack and other trees suitable for the making of ties and this will soon become a profitable industry for farmers and others who will thus utilize low land or ground unsuited for agriculture.

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