DEPARTMENT OF THE INTERIOR, CANADA
FORESTRY BRANCH

ROLL OF HONOUR

Employees Enlisted for Active Service up to close of 1917.

Name.	Rank.	Place.
J. S. Leitch	Dominion Fire Ranger	Pas, Manitoba
H. C. B. Smith	Forest Clerk	Kamloops, B.C.
J. A. Ringer	Dominion Fire Ranger	Revelstoke, B.C.
A. E. Parlow	Forest Assistant	Kamloops, B.C.
F. W. Fraser	Draughtsman, For. Pro. Labs.	Montreal, Que.
*D. N. Trapnell	Asst. Chem. Eng., For. Pro. Labs.	Montreal, Que.
E. W. Conant	Forest Ranger	Nicola For. Res.
D. Smith	Dominion Fire Ranger	Norway House, Man.
W. J. McLaren	Chief Fire Ranger	Winnipeg, Man.
L. N. Seaman	Asst. Eng., For. Pro. Labs.	Montreal, Que.
H. Wey	Forest Clerk	Kamloops, B.C.
H. I. Stevenson	Forest Supervisor	Duck Mt. For. Res.
A. E. Wyatt	Clerk	Indian Head, Sask.
‡R. H. Palmer	Chief Fire Ranger	Edmonton, Alta.
P. G. Leman	Forest Ranger	Bow River For. Res.
W. A. Delahey	Student Assistant, Survey Party	Alberta
*G. E. Bothwell	Forest Assistant	Brazeau For. Res.
W. A. Lyndon	Forest Ranger	Crowsnest For. Res.
*G. G. Fuller	Forest Ranger	Bow River For. Res.
W. B. Campbell	Asst. Supt., For. Pro. Labs.	Montreal, Que.
†L. L. Brown	Computing Eng., For. Pro. Labs.	Montreal, Que.
W. E. Dexter	Student Assistant	Ottawa, Ont.
W. L. Scandrett	Forest Supervisor	Kamloops, B.C.
R. M. DeCew	Student Assistant	Montreal, Que.
*J. B. Brophy	Draughtsman	Ottawa, Ont.
J. J. Harron	Forest Ranger	Athabaska For. Res.
F. B. Robertson	Forest Assistant	Ottawa, Ont.
†R. A. Spencer	Testing Eng., For. Pro. Labs.	Montreal, Que.
*J. W. Smith	Forest Ranger	Long Lake For. Res.
†M. W. Maxwell	Testing Eng., For. Pro. Labs.	Montreal, Que.
J. P. Alexander	Forest Assistant	Crowsnest For. Res.
W. J. Boyd	Forest Assistant	Ottawa, Ont.
R. G. Lewis	Forester	Ottawa, Ont.
T. Woodman	Forest Clerk	Lesser Slave For. Res.
C. R. McCort	Testing Eng., For. Pro. Labs.	Montreal, Que.
D. C. Inman	Forest Ranger	Duck Mt. For. Res.
F. Haworth	Forest Clerk	Clearwater For. Res.
C. H. Morse	Asst. District Inspector	Calgary, Alta.
J. H. Vicars	Forest Clerk	Riding Mt. For. Res.
J. A. Hutchison	Act. Forest Assistant	Brazeau For. Res.
J. S. Holt	Forest Ranger	Sturgeon For. Res.
T. A. Millar	Forest Clerk	Brazeau For. Res.
G. Martins	Engineer patrol boat	Pas, Manitoba
F. Fischer	Chief Fire Ranger	Pas, Manitoba
*W. Waddell	Dominion Fire Ranger	Kamloops, B.C.
E. Beatty	Dominion Fire Ranger	Battleford, Sask.
O. Calverly	Dominion Fire Ranger	Pas, Manitoba
G. Halcrow	Dominion Fire Ranger	Pas, Manitoba
M. Nackaway	Dominion Fire Ranger	Norway House, Man.
R. Harvey	Dominion Fire Ranger	Winnipeg, Manitoba
L. C. Tilt	Forest Assistant	Winnipeg, Manitoba
S. J. Wade	Dominion Fire Ranger	New Westminster, B.C.

ROLL OF HONOUR

Name.	Rank.	Place.
Peter Mars	Dominion Fire Ranger	New Westminster, B.C.
A. W. Bentley	Student Assistant	Ottawa, Ont.
A. E. Haycock	Dominion Fire Ranger	Salmon Arm, B.C.
B. M. Stitt	Chief Fire Ranger	Pas , Manitoba
R. H. Simpson	Act. Forest Assistant	Lesser Slave For. Res.
J. R. Dickson	Forester	Ottawa, Ont.
O. C. Baillie	Dominion Fire Ranger	Brazeau For. Res.
D. A. MacDonald	Forest Assistant	Bow River For. Res.
G. T. Graydon	Asst. Test. Opr., For. Pro. Labs.	Montreal, Que.
S. H. Clark	Forest Supervisor	Brazeau For. Res.
J. A. Wright	Dominion Fire Ranger	Yoho For. Res.
Walter Keeper	Dominion Fire Ranger	Norway House, Man.
R. W. Scott	Forest Ranger	Arrowstone For. Res.
W. H. G. Crate	Dominion Fire Ranger	Norway House, Man.
E. H. Roberts	Asst. District Inspector	Prince Albert, Sask.
T. H. Welch	Forest Ranger	Brazeau For. Res.

* Killed in action or died of wounds. † Awarded Military Cross. ‡ Awarded D.S.O.

DEPARTMENT OF THE INTERIOR, CANADA
Hon. ARTHUR MEIGHEN, Minister; W. W. CORY, Deputy Minister
R. H. CAMPBELL, Director of Forestry

REPORT

OF THE

DIRECTOR OF FORESTRY

FOR THE YEAR 1917

(PART VI ANNUAL REPORT, DEPARTMENT OF THE INTERIOR, 1917)

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1918

23930—1½

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

REPORT OF THE DIRECTOR OF FORESTRY

This report concerns the work of the Forestry Branch for the year 1916-17, and includes the reports of the officials in charge of the outside divisions.

Owing to the reduction of staff from the enlistment of a number of the officers of the branch for service in the army no new work of importance has been undertaken, and the operations of the branch generally have been kept to as small proportions as possible in view of the large extent of territory to be supervised and the value of the public forest property requiring protection.

The total number of men who have enlisted is sixty-five.

During the year we have unfortunately lost several of our men who were fighting in France. Mr. George E. Bothwell, forest assistant on the Athabaska forest reserve, was killed by the treachery of a German prisoner who had surrendered. Mr. Bothwell was one of the most promising among the young technically trained foresters on the staff, and the loss of his services will be very much felt. Mr. John B. Brophy, who was employed in the head office of the branch, met his death from an accident while flying in England. He had previously done good service in the Flying Corps in France. There are also two members of the forest ranger staff who were killed in action, namely, Mr. G. G. Fuller of the Bow River forest and Mr. J. W. Smith of the Long Lake forest reserve, British Columbia; and one member of the fire-ranging staff in British Columbia, Mr. William Waddell. They were all good officers whom the service could not afford to lose.

It is only right also to mention the names of some of the undergraduates of the forest schools who had been employed on forest surveys by this branch. Four of these young men gave up their lives in the war, namely, Jack B. Hipwell, A. M. Thurston, R. A. R. Campbell, and J. D. Aiken. They were among the most promising of the undergraduates of the forest schools, and it had been their hope, and ours, that they would take a large place in building up forest administration in Canada.

The past season in the western provinces was generally wet, so that the danger of fire was not as a rule serious. In some localities there were dry spells of considerable extent, but the patrol staff were able to control the situation so as to prevent heavy losses.

The great loss of life and property in the province of Ontario in the summer of 1916, as a result of forest fires, forced a careful consideration of the conditions which made such a disaster possible. The season in Ontario was particularly dry and the natural conditions the worst possible. Of the controllable factors the one most prominent in causing the disaster was that of fires set out by settlers for clearing lands in conditions under which, as was found by the result, it was impossible to regain the mastery over them. It was felt, therefore, that the control of such fires was a necessary thing for the safety of the settlements now so generally extending into wooded districts. The setting out of fires on Dominion forest reserves is controlled by the provisions of the Forest Reserves Act and the regulations made thereunder, and the legislation in this respect is sufficient to meet the case. But, on the large areas of Dominion lands outside of forest reserves the matter is governed by the provincial fire acts, or by the homestead regulations; and outside of the province of British Columbia none of these previous to January, 1917, contained any provision which gave power to control the setting out of fires. The permit provision of

the Fire Act of the province of British Columbia has been in operation for a number of years, and has been working successfully and with decreasing evidences of any friction as the years go by. Recommendations have been submitted and approved that the homestead regulations be amended so as to provide for a permit from a fire ranger being required for the setting out of fire for the clearing of homesteads entered for after the passage of the Order in Council establishing such regulations, which is as far as Dominion legislation can go on the subject. The provinces of Manitoba, Saskatchewan, and Alberta have been considering changes in the Fire Acts to provide a permit system, and the provinces of Manitoba and Saskatchewan passed at the legislative session of 1917 the necessary legislation which, with proper co-operation between the Dominion and provincial authorities in the administration of the Act, should prove effective.

The relation between the forests and settlement is a question involving many interests, and is one not easy of solution. The need for land for settlement after the war will make it necessary to devote every possible piece of land to agricultural purposes, but on the other hand the financial demands for the war will make it advisable and necessary to protect the public forest property, and ensure that the forest on non-agricultural land is retained and brought into best producing condition. As was stated in the report of last year, this is a question which cannot be decided from the point of view of either interest solely, and which shows the necessity of co-operation between the agricultural and forestry interests for the development of an agricultural and forest survey of the country such as will determine the best general lines of development for each district.

The object of a forest policy is not only to perpetuate the forest but to make the products as readily and reasonably available to the consumer as possible, so that they may be most useful in the building up of the districts to which the forest is tributary. The permit system, under which a settler is given the right, at first free and later on payment of reasonable dues, to take timber and wood from the forest for his own use, was adopted for the purpose of enabling the consumer to get his wood supplies directly. Under this system the intention (and the actual practice in the early days of settlement) was that the settler should go into the forest and cut his own wood and timber. As the timber becomes scarcer and less accessible the difficulty of the settler getting out his own timber becomes much greater, and in some cases such a method is practically impossible. In order to preserve the direct right of the settler to timber through the permit system, even in such circumstances, an arrangement has been tried in the past few years by which the right to locate a saw-mill on a forest reserve where there is a quantity of timber is put up for tender, on the basis of the charge to be made the settlers for logging and sawing the timber they obtain under permit. This assists the settlers in two directions. It makes it possible for them to have their logs sawn in the locality where they are obtained, so that all they have to draw out to the settlement is the sawn lumber, and it provides that the logging and sawing shall be done for them at the lowest possible rate. This system is being tried on several of the forest reserves and gives prospects of working out successfully.

Scientific research in the forest to ascertain the conditions that affect the development of the forests has been found a necessity to ensure proper methods of management in every country where forest administration on a permanent basis has been provided for. This necessity is being felt in Canada, and the advisory committee which has been formed in connection with this branch has been giving the question consideration. The war conditions, preventing new appointments or expenditures, have, however, made it impossible to take steps toward any definite programme of investigations. The committee, however, prepared a memorandum for submission to the newly appointed Dominion Council for Scientific and Industrial Research, point-

ing out the great need for organizing forest research work in Canada. It may be permissible to quote the following paragraphs from this memorandum:—

"Ignorance, lack of definite information, opinions rather than knowledge of facts have characterized, and still to a large extent continue to characterize, the methods of handling the forest resources of the Dominion to their detriment and loss.

"Before any rational policy for the management of our timberlands can be put into operation two things at least must be determined, namely, the available supply of sawlog and pulpwood material, and the rate at which the commercial species are reproducing themselves.

"It is ignorance as to extent and character of these resources which has led governments and private owners to treat their forests like mines instead of like crops, administering timberlands rather than managing forests under forestry practice for a sustained yield.

Photo 11487. B. R. Morton.

Planting spruce seedlings, Spruce Woods forest reserve, Manitoba, 1917.

"Such ignorance can of course be removed only by systematic investigation or research.

"There is still abroad, even in authoritative quarters, a good deal of talk of 'inexhaustible timber resources' and especially are extravagant opinions afloat regarding pulpwood supplies. As a result of this loose talk propositions for a more conservative management find only lukewarm reception. Undoubtedly for some time to come if the demand does not increase unduly the timber and pulpwood supplies of the Dominion will be ample to meet the demand. But with growing demand the time of exhaustion of virgin supplies is drawing nearer, and if it is realized that Canada's timber wealth could not supply the present saw-mill capacity of our neighbours for fifteen or twenty years the inexhaustibility phrase should be dropped.

"It should be understood that there is only one way of keeping the forest resource inexhaustible, namely, by means of reproduction.

"We know next to nothing as to whether, and to what extent, the cut-over lands are reproducing the timber that has been removed, still less at what rate such new crop is growing.

"General principles of silviculture can be imported from Europe and, in so far as the same species occur in Canada that are found in the United States, we can profit to some extent from the work of their foresters; finally, however, climatic and soil differences make it necessary to learn how to manage the species under their home conditions. We have in Canada not yet undertaken the first systematic study of the biology of any of our species, a knowledge fundamental to its silviculture.. This is to be accomplished by observation in the field and by a systematic location of permanent sample plots placed under different treatment and observed periodically.

"As regards increment, the rate of production that may be expected from our species under varying conditions, we are also lacking in knowledge. There are neither volume tables as aids for timber estimating nor growth or yield tables as bases for calculating the results of our silviculture in existence. Meanwhile, truly foolish ideas prevail regarding the rate of growth of forest trees and forest acres. A correction of these ideas through systematic measurements will bring the wholesome realization that the replacement of our cut timber takes many more years than is generally believed. We may add that these investigations are most urgently needed for the species of the eastern provinces, which have already been largely exploited and where recuperative measures should be applied at once."

It is understood that the Council for Scientific and Industrial Research have considered the matter of such importance as to recommend its being given early consideration in the programme of research to be carried out in Canada.

The carrying on of forest research will involve co-operation with the provincial forest services so as to prevent unnecessary overlapping and to ensure the carrying on of the investigations in the most efficient way. The urgency of the general administrative and protection work of the forest services has not allowed much time for scientific investigation, but the necessity for it is being felt and any action in that direction can be assured of the co-operation of the provincial authorities.

The province of British Columbia has a well organized forest service which has administrative and protection work well in hand. It has also initiated some special scientific investigations and, as its staff is now appointed entirely under civil service rules and includes a number of specially well qualified foresters, it should be in a favourable position to co-operate in scientific investigation.

The province of Ontario is undertaking a reorganization of its protective and administrative work which will absorb the energies of its forest service for some time to come. The smallness of the technical staff also makes it difficult to organize investigative work, although the enlistment of the staff of the provincial forest school in this work would materially assist in its development. Ontario presents some of the most interesting problems of forest administration to be found in Canada and has proceeded so far in forest exploitation that the necessity for determining the scientific basis of forest management is becoming a pressing question.

The province of Quebec from the first organization of its forest service recognized the necessity for technical training, and provided the nucleus for a technical staff by having two foresters take special courses in forest schools in the United States and in France. This was followed later by the establishment of a forest school in connection with Laval University. This province is, therefore, in a good situation to co-operate in any general plan for forest investigations that may be laid out.

The province of New Brunswick has had until recently no technical forestry staff, and has considered in its administration only the revenue and protective sides. The recent organization of a forest survey of the province, and the employment of a staff of technical foresters in connection therewith, will probably result in the establishment of a forest service with sufficient of a technical staff to make possible the undertaking of scientific investigations in a definite way. The forest school in connection with the provincial university will also be able to render valuable assistance.

The province of Nova Scotia is in the difficult position of having alienated all but a small proportion of the forest lands, and consequently has not organized a special forest service, nor is it to be expected that that province will be able to provide a technical staff for forest investigations. It is probable that forest investigations in Nova Scotia will have to be largely provided for otherwise.

The increasing complexity of the work to be dealt with emphasizes the necessity for having the men employed in the forest service specially trained in the principles of forestry. While the forest schools now in existence in Canada can supply the men with the higher technical training there is no educational institution giving the training required for the position of forest ranger, and the want of such training is felt in many ways. The forest rangers in the employ of the department are given instruction in forestry principles as opportunity permits, but such instruction should be given on a more systematic basis. Assurance of permanency in the position of forest ranger would encourage greatly the disposition of the rangers to qualify themselves for better work and, with a standard of qualifications for appointment based on the character of the work required, would make one of the absolutely necessary forward steps toward a forest management adequate to the situation and creditable to the Dominion.

It may be advisable and necessary at the present time to point out the general plan which is being followed in the forest surveys which are being carried on. At the inception of the Dominion forestry work in the West the plan of intensive surveys was first adopted, surveys which would give accurate information in regard to the forest, its quantity, condition, etc., so that data on the subject would be complete. It was quickly realized, however, that such a policy was very costly; it gave complete information that would not be required for many years, and owing to the change in conditions later, particularly as a result of forest fires, much of the information was rendered useless for practical purposes. The policy of surveys was, therefore, carefully reviewed at that time and the general plan which is now being followed was determined on.

According to this plan the forest surveys that are being carried on are of three main classes.

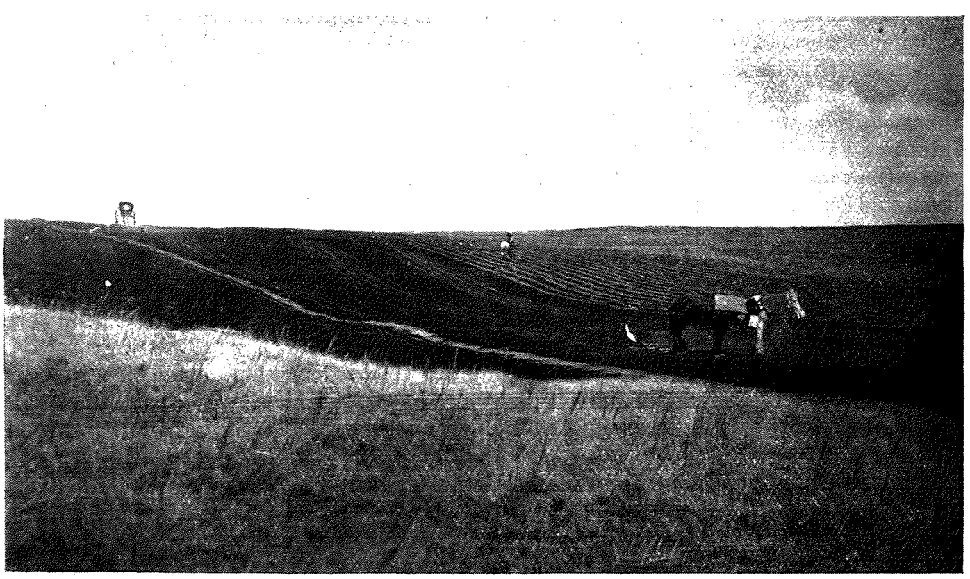

Photo 11525. B. R. Morton.

Planting seedlings in furrows, Dundurn forest reserve, Sa katchewan, 1917.

The first class is the general reconnaissance or exploratory survey to ascertain where the main bodies of timber are located, their general quantity and condition, and the tracts that are non-agricultural and should be permanently kept in forest. Such a survey can be carried out quickly and at small cost. The average cost per square mile of such surveys, so far carried out, is sixty cents. The greater part of the surveys now being carried on are of this character. They have covered the larger portion of the woodlands under Dominion jurisdiction, and if continued in the same way for three or four years more will cover the whole of such territory. Such surveys make it possible to determine the lands that should be included in forest reserves and to plan the protective organization for the whole timber-bearing area.

The second class of forest survey is that made after forest reserves have been established to obtain the exact location and stand of bodies of timber, the areas reproducing naturally, and generally the data necessary for planning the management of the reserve so as to provide for the best production. Surveys of this kind are dependent on the land surveys in the district being sufficiently far advanced to give reasonably accurate locations and permit of correct mapping. The land surveys may be either rectangular or topographical, but on many of the reserves they have not been completed sufficiently to make it possible to carry out the forest surveys properly. In consequence of this and the smallness of the staff in this branch qualified to make such surveys progress with this class of survey is not far advanced, though it is important that such surveys should be pushed forward as rapidly as possible.

The third class of forest survey is one made with the object of obtaining information for commerical exploitation. Such surveys ascertain carefully the quantity of timber, its conditions, the relation of species, accessibility, conditions that affect operations, and anything that may affect the commercial possibilities in connection with the particular area or district. Such surveys are being made only on such special tracts of timber as are applied for for commercial purposes, which form as yet but a small proportion of the area of woodlands. Surveys of this character require considerable time and expenditure, and are being undertaken only so far as commercial development demands.

The provinces are following the same general lines in their forest surveys, but in most cases they have not yet been organized on a systematic basis. A general reconnaissance survey of Nova Scotia was made by the Provincial Government, which gave valuable information as to the present stand and condition of the forests of that province. Similar studies of the provinces of British Columbia and Saskatchewan have been made by the Dominion Commission of Conservation in co-operation with the Dominion and provincial forest services. A similar survey of a somewhat more intensive nature is now being carried out by the province of New Brunswick. Beyond these the main forest surveys that have been made are of particular tracts that have been sold or are being put up for sale.

It will be seen, therefore, that the forest surveys are being developed on the line of first obtaining general information as a basis of general organization and management, and gradually intensifying the surveys as they can be made most economically and efficiently, as commercial development requires, and as increased expenditure becomes possible.

For commercial development, therefore, the information now available can only be depended on in a general way, and special surveys of a more intensive nature will be required when it is desired to determine the commercial feasibility of any proposed operations or of the development of any district.

Reforestation was begun on several of the forest reserves in the prairie districts during the year, and sufficient planting was done to make a fair experiment. The reserves on which planting was done are tracts of almost pure sand on which the main tree growth is poplar of small size and poor character. Plantations were made of Scotch pine, jack pine, and spruce, and, with the exception of one reserve, the success is all that could be expected. The importance to the prairie districts of the rapid

development of this work cannot be overestimated, and it is hoped that it can be pushed forward steadily each year till the reforestation of these small but important reserves is completed.

At the request of the Home-Grown Timber Committee of the British Isles arrangements are being made for the collection of forest tree seeds of Canadian species for reforestation work in Great Britain. Samples of Canadian tree seeds for trial in China have also been supplied to the Agricultural College at Nanking.

As production of food supplies is an important duty at the present time it is pleasing to note that the number of live stock being grazed on the forest reserves has considerably increased, and the possibility of obtaining summer grazing and hay on the forest reserves has undoubtedly encouraged a number of farmers in the vicinity of the reserves to begin the establishment of herds. It may be expected that the business will develop to large proportions as there are considerable areas of grass land on the forest reserves which will not be reforested naturally or artificially for many years to come, and some not at any time. The forests in Europe, in most places, furnish grazing for large numbers of stock in open meadows or among the trees, and it may be expected that large numbers of stock will always be carried on the forest reserves in the West.

STAFF.

The total permanent staff of the branch for the past year was as follows:—

Head office	40
District inspectors	5
Assistant inspectors and forest supervisors	12
Forest assistants	11
Forest rangers	88
Chief fire rangers	10
Inspectors of tree planting	9
Forest Products Laboratories (technical staff)	19
Outside clerical staff	35
On military leave	36
Total	265

APPROPRIATION.

The appropriation for the year was $750,000.

The expenditure was divided as follows:—

Salaries at head office	$ 14,224 82
Salaries of officials on military leave	13,551 27
Travelling expenses	1,086 92
Printing and stationery	7,956 39
Miscellaneous expenses at head office	4,561 63
Statistics	2,898 75
Forest surveys	11,744 40
Fire-ranging	192,089 89
Forest reserves	357,827 29
Tree planting	56,536 58
Forest Products Laboratories	48,725 47
War appropriation	10,720 00
Total	$721,923 41

(NOTE.—The item of $10,720 shown under "War appropriation" was drawn from the Forestry appropriation and later refunded.)

The field expenditure, exclusive of tree planting on the prairie farms, is divided as follows among the provinces:—

Manitoba	$ 91,266 92
Saskatchewan	150,778 46
Alberta	202,285 69
British Columbia (Railway Belt)	117,330 51
Total	$561,661 58

CORRESPONDENCE.

The letters received and sent out by this branch were as follows: Number of letters received, 19,684; mail sent out, letters, circulars, etc., 35,407; bulletins and reports, 21,866; parcels, 256; total, 57,529.

LIBRARY.

During the year 29 books and 327 pamphlets were added to the library at the head office. Seventy magazines have been received during the year, 46 by subscription and the remainder by exchange. A question that is receiving attention is that of the maintenance of branch libraries at the offices of the various inspectors. The number of photographs received during the year is almost 1,400, a slight decrease compared with the number received during the year previous. The matter of the preparation of lectures, illustrated by lantern slides, has received considerable attention during the year. It is hoped in this way to bring the forestry work before the people of the western provinces, especially those living in the neighbourhood of the various reserves, thus drawing their attention to the necessity of it and enlisting their sympathetic co-operation in its accomplishment.

PUBLICATIONS.

The policy of reviewing the manuscript of every publication issued with the view of adapting it as closely as possible to the object for which it is intended has resulted, it is believed, in increased publicity at reduced cost. There has been a steady demand for the publications of the branch, which shows that the public is becoming aware of the technical and commercial information therein contained. Canadian newspapers, as in former years, continued to give great assistance in explaining what the branch is doing and in warning against forest fires.

One of the most effective methods of fire prevention is the posting up of notices warning all who use the forests of the need of care with fire. In the past these have been printed on a prepared linen called buckram, manufactured in Great Britain. The war has greatly reduced the supply and increased the cost of this material. The branch is, therefore, making tests of other material such as tough paper, galvanized iron, boards, and unbleached cotton. It is believed that with these new materials the branch will be able to produce more effective signs at a smaller cost.

During the year the following publications, in pamphlet form, were issued:—

Bulletin	56.	Forest Products of Canada, 1914:	Lumber, Lath and Shingles.
"	57.	" " " 1914:	(Being Bulletins 54, 55, and 56.)
"	57.	" " " 1914:	(French Edition.)
"	58a.	" " " 1915:	Lumber, Lath and Shingles.
"	58b.	" " " 1915:	Pulpwood.
"	58c.	" " " 1915:	Poles and Cross-ties.
"	58.	" " " 1915:	(Being a Combination of Bulletins 58a, 58b, 58c.)
"	59.	Canadian Woods for Structural Timbers.	
Circular	1.	General Suggestions for the Preparation of the Soil for Tree Planting. (Reprint.)	
"	3.	Government Co-operation in Forest Tree Planting. (Reprint.)	
		Dominion Forest Officers' Manual: "Property."	
		Regulations for Dominion Forest Reserves.	

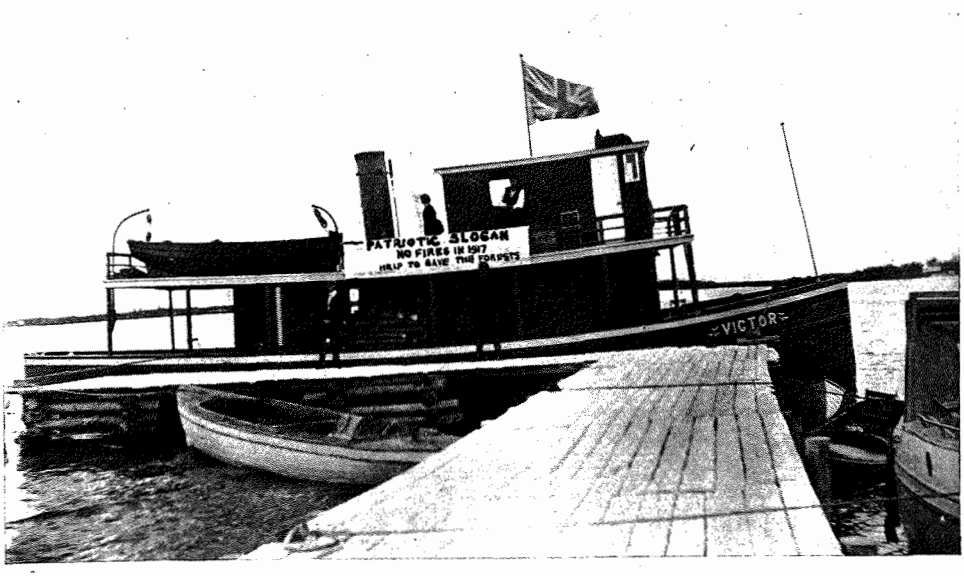

Photo 11262. J. T. Blackford.
Steamer on lake Winnipeg, Manitoba, showing patriotic banner "Patriotic Slogan: No fires in 1917. Help to save the forests."

STATISTICS.

The most notable feature of the statistical work of the branch has been the increased demand from manufacturers, firms located outside of Canada, and others, for special information regarding different features of the forest products industry. This indicates both an increased effort to secure special wood materials in Canada and a more widespread knowledge of the work of the branch in this particular.

The provinces of Quebec and British Columbia co-operated with the branch and collected the statistics of lumber and shingle mills within their borders.

The figures for the main items in the forest products industries show that, despite the changes introduced by the war, these industries operated with remarkable steadiness. The falling off in lumber was compensated for by increases in pulpwood and in ties and poles. The total value of lumber, lath, and shingles produced in Canada in 1916 was $66,072,222; of pulpwood, $19,971,127; of poles purchased in Canada, $427,154; and of cross-ties purchased in Canada, $3,307,319. The proportion of pulpwood manufactured into pulp in Canada is steadily gaining upon that exported in the raw state. In 1916, 62·3 per cent of Canadian pulpwood was made into pulp in this country as against 37·7 per cent exported in the raw state to be manufactured abroad. Of air-dry pulp, approximately 1,296,084 tons were manufactured in Canada in 1916.

The following is an estimate, from the information available, of the total value of forest products in Canada during the calendar year 1916:—

Lumber, lath, and shingles	$ 66,075,000
Firewood	62,000,000
Pulpwood	19,975,000
Fence-posts and rails	8,600,000
Cross-ties	3,750,000
Square timber exported	185,000
Cooperage	1,250,000
Poles	575,000
Logs exported	850,000
Tanning materials	140,000
Round mining timbers	750,000
Miscellaneous exports	280,000
" products	9,000,000
Total	$172,830,000

TREE PLANTING.

The demand for trees for planting on prairie farms was somewhat less during the past year, owing to labour conditions and other factors unfavourable to the undertaking of additional work by the farmers. This has, however, not had an unfavourable result, as it made it possible to give a larger number of trees to each farmer, which thus enabled him to start a plantation which would furnish more adequate shelter. The plantations are generally well established and growing satisfactorily, and have demonstrated finally that the growing of trees on the prairie is merely a question of proper preparation and care. The number of trees distributed in the spring of 1917 was 7,664,925, as compared with 4,618,800 in the spring of 1916.

Stock for reforestation by planting on the Dundurn, Elbow, and Manito reserves was provided from the nursery at Indian Head, and provision is being made for growing supplies for further extension of the work.

The permanent plantations at the forest nursery station were established partly for the purpose of giving shelter to the nursery beds and partly to obtain information in regard to the rates of growth of different species and their relations in mixture, Careful measurements of these plantations are taken annually, and much useful information is being obtained that will be of great value for guidance in reforestation and forest management in the future.

FIRES.

The season of 1916 was very much safer throughout than the average season. In the Railway Belt of British Columbia the driest period occurred in August but was of short duration and was preceded by an exceptionally heavy rainfall in July. In the provinces of Manitoba, Saskatchewan, and Alberta the temperature in March and April was high, and some fires occurred in May. Comparatively heavy rains in the latter part of the month reduced the danger and continued throughout the remainder of the season, so that altogether there were fewer fires than in either of the two previous seasons.

The total number of fires reported during the year was 891, as compared with 1,455 in 1915 and 1,986 in 1914. The number of these fires that burned over an area of ten acres or more was 146, as compared with 343 in 1915 and 388 in 1914. The percentages of the total number of fires started that burned ten acres or over were 16 per cent in 1916, 24 per cent in 1915, and 20 per cent in 1914.

The total area burned over was 116,310 acres. Of that area 2,000 acres were classed as merchantable timber, on which there were 4,608,000 feet board measure; 4,340 acres as cordwood, bearing 57,664 cords; and 20,684 acres as young growth. The average area of the fires spreading beyond ten acres was 796 acres, compared with 3,932 acres in 1915 and 1,804 acres in 1914.

The causes of fires were as indicated in the table hereunder. The number of fires is shown for 1916 only, but the percentage due to each cause is shown for the last three years for purposes of comparison.

	Number of Fires.	Percentages. 1916.	1915.	1914.
Unknown	270	30	30	41
Campers and travellers	179	20	33	14
Settlers	167	18	14	24
Railways	174	20	13	13
Lightning	59	7	4	4
Lumbering	30	3	2	1
Incendiary	5	1	1	1
Brush disposal (other than by settlers)	....	....	1	....
Other causes	7	1	2	2
Totals	891	100	100	100

The fire record and the statement of causes again emphasizes the necessity for public education on the subject. In spite of attention having been called to the subject all over the country by various means there are still hundreds of fires occurring every year due mainly to carelessness. The campaign of education is being carried on steadily through the press, through public lectures, through the public schools, and in various other ways. The public schools have been visited by officials of the Forestry Branch and talks given on the fire danger, the matter being emphasized by the presentation to the pupils of articles such as wooden rulers on which are printed mottoes impressing the lesson.

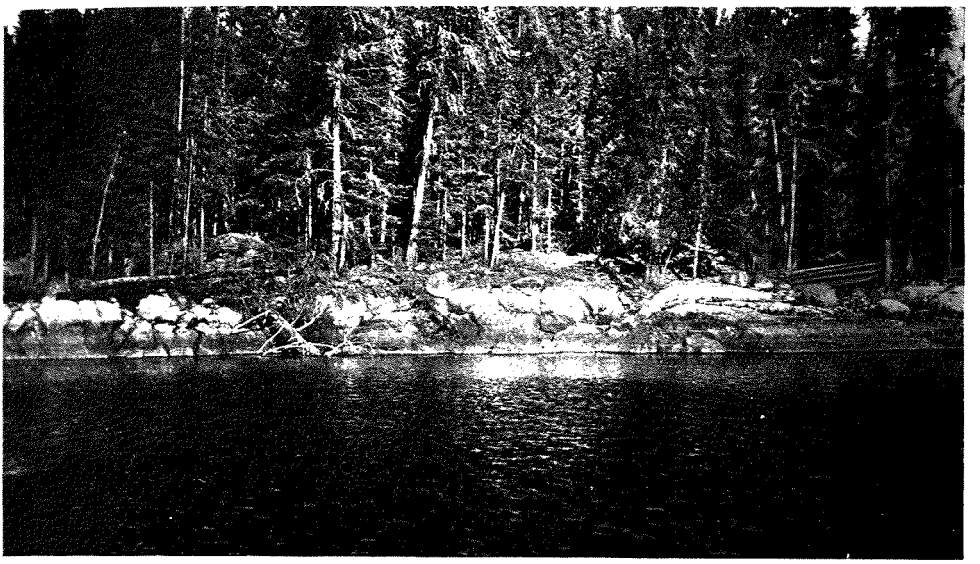

Photo 10942. L. S. Webb.

Jack pine and black spruce pole-wood on the north bank of Gunisac river, on the east side of lake Winnipeg, Manitoba.

FIRES AND RAILWAYS.

The patrol of the privately owned railways, which form the greater part of the mileage in the West, is carried out by the railway companies under the orders of the Dominion Board of Railway Commissioners, subject to inspection by the officers of this branch. On the publicly owned railways, consisting of a portion of the Transcontinental railway and the Hudson Bay railway, the whole responsibility for patrol and inspection has had to be assumed by this branch. One permanent inspector and eight temporary inspectors were employed in this work. The railway companies generally have co-operated well in the protection work and the results have been good. The Edmonton, Dunvegan and British Columbia railway is the only one against which any serious complaint has been necessary. Out of a total of 174 fires charged against railways this line has a total of 66. Locomotives were carefully inspected from time to time and out of 442 inspections made 36 locomotives were found defective. Of these 17 were on the Canadian Pacific railway and 10 on the Edmonton, Dunvegan and British Columbia railway.

On the government-owned railways conditions were considerably improved over the previous year owing to better co-operation on the Hudson Bay railway. Both the engineers in charge and the contractors have worked with the inspectors of the Forestry Branch to improve the protection, and the result showed only 1,640 acres burned over along this railway line last year as against one million acres the previous year.

Some difficulty is experienced with railways chartered by the provinces which do not come under the jurisdiction of the Dominion Board of Railway Commissioners or under Dominion jurisdiction in any way.

FOREST RESERVES.

The area included in forest reserves is 23,024,640 acres, and the permanent staff employed thereon is as follows: district inspectors, 4; supervisors, 12; forest assistants, 11; forest rangers, 88; total, 115. For the area to be managed the permanent staff is small, but the work required in winter is not great and the improvement and fire patrol work in the summer is carried out with the assistance of a temporary staff of rangers, of whom 57 were employed last year. A good proportion of the rangers have done their work well, but until there is some plan of selection on qualifications, and permanency of tenure of office based on merit, the organization cannot be placed on an efficient and satisfactory basis, or have that degree of permanency which long-time management like that of the forest requires.

Improvements.—Considerable improvement work was carried out during the past year, and was on the whole done satisfactorily and at reasonable cost. Following is a statement of the improvements completed during the year with the total and average cost, including the cost of labour by forest rangers:—

Class of Improvements—		Total.	Average.
Cabins	Number. 34	$ 9,832	$ 289
Houses	" 12	13,144	1,095
Lookout towers	" 8	1,039	130
Stables	" 23	6,430	280
Other buildings	" 7	895	128
Bridges	" 2	693	346
Telephone lines	Miles. 122	12,475	102
Fireguards ploughed	" 156	1,241	8
" cleared	" 50	2,332	47
Roads	" 96	9,426	98
Trails	" 418	29,226	70
Miscellaneous projects such as fences, etc		4,787	
Total		$91,520	

The proper planning of the system of communications in the forest reserves is being given careful attention and has been done pretty thoroughly for all of the older reserves, though the completion of the work of construction will take some years yet to accomplish. A study is being made of methods of construction of forest telephone lines and their use and of other methods of transmitting information, with the object of preparing a manual for the instruction of the forest officers. An immense amount of improvement work remains to be done on the newer forest reserves and in the tracts recommended to be set apart for that purpose.

Timber Operations.—For several reasons, including a scarcity of coal, there was more demand for wood from the forest reserves during the past season. The winter was a severe one and there was heavy snow which interfered somewhat with operations, but the demand for lumber was good enough to encourage considerable activity. The number of permits issued was 2,973 and the quantity cut thereunder was 4,549,215 feet board measure, 37,313 cords, 615,917 lineal feet, besides other products. The number of free permits was 1,657. Ten millsite locations for cutting under settlers' permits were granted and have proved a great convenience in every way. The further concentration of the cutting under settlers' permits has enabled better supervision, with the result that more efficient methods have been followed and brush disposal has been carried out more thoroughly. The owners of the mills understand better the requirements of the regulations and are following them more closely.

Operations were carried on during the past year on 22 sales, 10 of which were made during the past year. The cut of timber was 4,227,751 feet board measure, and of mine props, 460,240 lineal feet.

These sales are made to meet local requirements for timber supplies, and in the Rocky mountains in particular are made mainly to coal-mining companies. It is of the utmost importance that a supply of mine timber should be conveniently and readily available for coal operations, and through small areas this is accomplished, though it may be pointed out incidentally that, as a result of fires, there is but a small area of timber convenient to some of the coal mines in the more accessible districts. On these sales the method of operations is steadily improving. Where the operation is in green timber a selection is made of trees that should be left to produce seed for the reproduction of the forest, and the selected trees are marked for that purpose. The disposal of the débris of operations has been good and is steadily improving, and will soon develop into a well-established practice. The cost is still in many cases higher than necessary, owing to poor organization or bad methods. The quality of labour also adds to the cost as it is difficult to get good men, and brush disposal requires intelligence if it is to be done properly and at a reasonable cost.

Fires.—There were only 43 fires in the forest reserves as compared with 205 in 1915 and 408 in 1914, both of the latter years being, of course, very dry. Seventeen of the fires (40 per cent) burned 10 acres or more, covering a total area of 18,628 acres, of which 122 acres were merchantable timber, 970 acres cordwood, and 340 acres young growth. The greater part of the burned area was grass lands.

The proportion of fires due to various causes differs somewhat from that obtaining in fires on the lands outside the reserves.

Causes.	No. of Fires.	Percentage.		
		1916.	1915.	1914.
Unknown	15	35	35	41
Campers	7	17	21	9
Settlers	6	14	24	17
Railways	7	17	9	29
Lightning	2	4	2	1
Lumbering	4	9	....	....
Incendiary	1	2	6	1
Brush disposal (other than by settlers)	....	....	2	....
Other causes	1	2	1	2
Total	43	100	100	100

Surveys.—A reconnaissance survey was carried out on the Porcupine forest reserve in Saskatchewan to obtain fuller information in regard to the general conditions in the interior, which had not previously been examined. The result was to show, as usual, that owing to fires the area of merchantable timber is a small percentage of the whole. Information was obtained that will be useful in the planning of the improvements necesssary for the protection of the reserve.

Surveys for the marking of boundaries were also carried out on the Porcupine Hills and Cooking Lake forest reserves in Alberta.

Grazing.—The total number of stock grazed on the forest reserves was 17,147, of which 14,569 were cattle and 2,578 were horses. This is an increase over the previous year and the use of the grazing areas in the reserves may be expected to increase steadily. On the reserves in the prairie districts the fencing of areas for grazing purposes has been found to work satisfactorily. In two cases on smaller reserves in the province of Manitoba the plan has been tried of having the department erect the fence and assume the main responsibilities. In most cases, however, the fences are erected by stock associations or individuals who assume all responsibility

for looking after the stock. In such cases, however, the fences become the property of the Crown. It is probable that the latter plan will be most generally followed, although the former may turn out to be the better in special circumstances. Grazing will assist to a great extent in reducing the fire danger and, where properly regulated, in getting the lands into condition for forest planting where it is desired to have reforestation carried out.

There were practically no sheep grazed on the forest reserves last year, although in some parts of the Rocky Mountains forest reserve a large number of sheep could be accommodated. There are certain difficulties inherent in sheep grazing which have yet to be overcome. These difficulties are receiving consideration, and it is hoped that the coming season will witness a beginning in sheep grazing on a sound basis.

Acting in accordance with information obtained from an investigation of the forage plants on the Crowsnest forest reserve, by an agrostologist of the Department of Agriculture, changes were made in the grazing periods in certain districts where losses of cattle had occurred due to poisonous weeds, and, by keeping the cattle off the range during the time when these weeds were dangerous, losses from this cause were reduced to a minimum.

The grazing regulations have not been applied as yet in British Columbia except in regard to certain meadows designated "project meadows," which are situated in more inaccessible parts of the forest reserves which can now be reached by trails recently constructed. Special regulations have been established for dealing with such meadows, which it is hoped will result in their useful development.

Grazing on the forest reserves is developing so steadily and as the reserves become stocked to capacity will present so many problems, such as determining grazing capacity, improving range, etc., that a specially qualified man will be required for investigation and inspection work in connection therewith.

Fish.—The fishing provisions of the forest reserves regulations have been based upon those designed by the Fisheries Branch of the Department of the Naval Service for the different provinces in which the forest reserves are situated. The object has been, first, to take advantage of the expert knowledge at the command of the Fisheries Branch, in the interests of the protection of the fishing; and second, to save the public the inconvenience of finding two different sets of fishing regulations in the same province. The forest reserves fishing regulations vary from the regulations of the Fisheries Branch only in such particulars as are called for by local conditions. The regulations have been found to work smoothly during the past year, and the arrangement by which a fishing permit, issued either under the forest reserves regulations or under the Dominion Fisheries regulations, is good for all waters in the province has been found to give general satisfaction. In the more northerly parts of the provinces of Manitoba, Saskatchewan, and Alberta, where a number of forest reserves have been established which contain large bodies of water, domestic and game fishing has been carried on for years past under the Dominion Fisheries regulations. It was arranged that such fishing should be continued under the same regulations and supervision, and this arrangement has also worked satisfactorily.

On lake Max and other waters in the Turtle Mountain forest reserve, where the fishing has been one of the most attractive features, large numbers of fish were found dead in the early spring of 1916. While the cause has not been definitely established a sample of the water was found upon analysis to be strongly alkaline, due probably to the lack of rain which resulted in these naturally somewhat alkaline waters becoming unduly charged with alkaline matter. This condition was pronounced by experts to be inimical to fish life, but a contributing cause was doubtless the very heavy fall of snow which came immediately after the lakes froze and excluded the air. Last winter conditions were different. Fish were observed during the winter at the water holes and no fish were found dead in the spring.

On lake Madge, in the Duck Mountain reserve, some of the pickerel with which the lake was stocked two years ago were taken but were returned to the water. The success of the stocking experiment is thus established.

The construction of roads and trails in the forest reserves is having an appreciable effect on sport fishing, as new bodies of water are thereby rendered more easily accessible to the exploratory instincts of the fisherman. This applies with equal force to the game hunter and to the nature lover.

Game.—A change has been made by the Manitoba Government in the Riding Mountain game preserve by the withdrawal therefrom of approximately four townships. The game preserve has now an area equal to six townships.

Efforts are being continued, in co-operation with the Department of Indian Affairs, towards the removal of certain Stony Indians who have located on the North Saskatchewan river in the Rocky Mountains forest reserve. Reference was made last year to the importance of this step in the interests of game protection. The task presents considerable difficulty, but the indications are that it will ultimately be accomplished.

Some years ago a number of half-breeds removed from Jasper Park and squatted on lands in the vicinity of Grand Cache, in the Athabaska division of the Rocky Mountains forest reserve. These people are inveterate game hunters and it was feared that their continued occupation would result in the rapid extinction of the game in that district. Steps were, therefore, taken to secure the removal of these half-breeds. The question was the subject of some correspondence with the Alberta Government, in which authority the property rights in the game of the province are vested. The provincial authorities did not consider that the protection of game was of sufficient importance to warrant taking the action proposed, and under the circumstances no further action for the removal of the half-breeds has been taken. The forest officers will, however, while having no executive authority as provincial game officers, continue to co-operate as far as possible with the provincial authorities in the matter of game protection.

Photo 11951. R. M. Watt.
Cottage at Madge Lake summer resort, Duck Mountain forest reserve, Manitoba.

FIRE-RANGING.

The area actually included in the districts of fire rangers outside the forest reserves was approximately 132,000,000 acres in the provinces of Manitoba, Saskatchewan, and Alberta, and 6,000,000 acres in the Railway Belt of British Columbia. There were 126 patrol districts in the former region having an average area of 1,047,000 acres, and 58 patrol districts of an average area of 107,000 acres in the latter. In Manitoba, Saskatchewan, and Alberta about half the fire rangers have assistants, especially where the patrol is carried out in canoes. The enormous area of patrol districts in that region means that the fire rangers must be concentrated along the edge of the forested region adjacent to the settlement where the greatest number of fires start. Farther north only the main routes of travel can be patrolled. In British Columbia the mountainous country, more extensive stands of valuable timber, and more widely distributed settlement throughout the Railway Belt make smaller districts necessary.

The number of fires on Domionion lands outside the forest reserves was 848, as compared to 1,501 in 1915 and 1,567 in 1914. The fires burning ten acres or more numbered 129, 15 per cent of the total number. The total area burned over was 97,682 acres, of which 1,879 acres bore 4,315,000 feet board measure of saw-timber, 3,370 acres bore 18,000 cords of small timber, and 20,344 acres were young growth. The remaining area of 72,089 acres was without either merchantable timber or young growth.

The causes of the fires outside the forest reserves were as follows:—

Causes.	No. of Fires.	Percentage.		
		1916.	1915.	1914.
Unknown	255	30	31	41
Campers	172	20	34	15
Settlers	161	19	13	25
Railways	167	20	14	9
Lightning	57	7	4	5
Lumbering	26	3	2	1
Incendiary	4	*	*	1
Brush disposal (other than by settlers)			*	
Other causes	6	1	1	3
Total	848	100	100	100

* Less than one-half of 1 per cent.

RECONNAISSANCE SURVEYS.

Manitoba.—In Manitoba Mr. L. S. Webb continued the examination of the country east of lake Winnipeg.

An area of approximately 12,500 square miles, from Poplar river northward to township 58 and from lake Winnipeg east to the Ontario boundary, was examined. About 47 per cent of this is muskeg and water, 5 per cent is covered with timber and poles, and 48 per cent has been burned over in the last fifty years. The reproduction on the brulé is fair and is composed chiefly of poplar and jack pine. The country is of the Laurentian formation with numerous pronounced rocky ridges and outcroppings, and is comparatively level; only in a few places are there any hills that rise more than 90 feet above the general level.

The soil is on the whole unsuitable for agricultural purposes, only very small isolated areas of good land being found here and there along the rivers.

White spruce is found chiefly along the banks of rivers and shores of lakes, jack pine occupies the sandy and rocky ridges, and aspen and balsam poplar grow on moderately dry land throughout the area, while stunted tamarack and black spruce are found on the wooded muskegs.

Another party under Mr. J. E. Guay examined the country lying between lake Winnipegosis on the east, the Porcupine forest reserve and the Saskatchewan boundary on the west, township 37 on the south, and township 51 on the north.

This area is very flat and low, and is to a very large extent covered with muskeg. Here and there a low ridge breaks the monotony. A plateau is met with on the Overflowing river. It follows the river from a point about 15 miles east of the Saskatchewan boundary westward towards the Canadian Northern railway.

The soil is, of course, too wet for agricultural purposes.

All this country has been visited by fire several times and very little timber of merchantable size is left. This, composed of spruce, poplar, and fir, occurs chiefly along the slightly elevated river banks and lake shores, and on the plateau mentioned above. Tamarack and black spruce of small size are found on or along the edges of the muskegs. The area examined is 3,500 square miles in extent.

Saskatchewan.—In northern Saskatchewan a party under Mr. G. A. Mulloy examined an area of about 3,750 square miles, bounded on the south by Torch river, on the west by range 22, on the north by township 62, and on the east by range 11.

The western half of the area is a high plateau, while the eastern half is almost level and on that account lacks drainage. It is completely covered with the regular muskeg type of the north—black spruce and tamarack of small size and slow growth—and floating or quaking bog of sphagnum moss with an under-soil of stiff clay.

The western half is on an average of about 800 feet higher in elevation than the muskeg area. The southern portion of it is rather level in character, while the northern part is very hilly. The soil is sandy, sandy clay loam or pure sand of a reddish tint, overlying a very loose gravelly or sandy subsoil.

Of the total area examined, 57 per cent is muskeg, about 29 per cent is covered with timber or poles, 12 per cent is burned with more or less satisfactory reproduction, and the remainder is water.

It is estimated that fires in this district in the last twenty-five years have caused a loss of 2,400,000 cords and 20,000,000 feet board measure of timber. The reproduction on the "burns", however, is quite satisfactory.

White spruce and poplar occur on the well-drained soils, and jack pine covers the sandy ridges. Balsam fir is found in places, mixed with spruce and poplar.

Very little of the land examined is considered to be of agricultural value.

Another party under Mr. J. E. Hall examined or re-examined certain portions of the interior plateau of the Porcupine forest reserves Nos. 1 and 2 in Saskatchewan and Manitoba. In addition to the examination of topographical conditions, soil, and forest cover, several road and trail surveys were made by Mr. Hall.

FOREST PRODUCTS LABORATORIES.

No effort has been made to develop new work in the Forest Products Laboratories owing to the economy, both as regards men and expenditure, required as a result of the war. Further, the staff of the laboratories have been carrying on a certain amount of work in connection with munitions, the superintendent giving practically all his time to inspection work for the Imperial Munitions Board.

Considerable work has been carried on in the divisions organized, and a large amount of useful data in regard to Canadian woods has been compiled from published reports or obtained by direct investigation, so that inquiries in regard to Canadian woods and their comparison with those of other countries, which are becoming increasingly numerous, may be answered as fully as the present development of investigation work generally will permit. Original investigations now under way cover some of the most important fundamental questions in regard to the constitution of wood, and would hardly ever be undertaken by any but government research laboratories. Such an investigation is the one now being carried on in regard to the chemical composition of the principal Canadian pulpwoods, which work is now well advanced and promises to bring out information of the utmost value to the pulp and paper industry.

Nothing in connection with the laboratories is more gratifying than the interest and co-operation of the industries using wood in the work now being carried on at the laboratories. This is particularly exemplified in the pulp and paper industry. The Canadian Pulp and Paper Association, as a whole and individually, have always taken

an active interest in the work which is being carried on, and the Advisory Committee appointed by the Technical Section of that association have given a great deal of time and trouble to assist the laboratories in the planning of investigations and the necessary equipment therefor.

The bulletin on "Canadian Woods for Structural Timbers" (Forestry Branch Bulletin No. 59) that was published during the year, was a fair presentation of the value of Canadian timbers for this purpose as compared with timbers of other countries, and has had a wide distribution throughout the Empire and in foreign countries. The information contained in the bulletin was obtained from investigations made at the laboratories and from reports of investigations made elsewhere, but it was considered of importance to Canadian industry to publish the information available without waiting till all the Canadian woods had been thoroughly investigated at the laboratories. From the interest taken in this bulletin it is evident its publication has been timely and has given to prospective customers of Canada in foreign countries reliable information as to the properties of Canadian timbers and the respects in which they show superiority.

An investigation into the production of wood oils for ore flotation, which was undertaken at the request of the Canadian Mining Institute and was carried out in co-operation with the Mines Department, resulted so successfully that it illustrates well the possibilities that scientific investigative work opens up. The Canadian mines were dependent on the United States for their supply of pine oil, which, though not required in large proportions, is an essential ingredient to ensure the proper frothing action necessary to carry out the process of extraction of ore by flotation, and the demand so greatly exceeded the supply that the Canadian mines were likely to be left in a difficult position. The investigation demonstrated that several of the light creosote oils produced from hardwood distillation will successfully take the place of pine oil in the flotation process, and as sufficient of such oils to meet the requirements of the mines is already being produced in Canada the difficulty has been solved for the mines, while an important new use and value has been obtained for a practically waste product of hardwood distillation.

R. H. CAMPBELL,
Director of Forestry.

Photo 11475. E. H. Roberts.

Brush left adjacent to boundary of Porcupine forest reserve after timber operations on Dominion lands, Saskatchewan.

STATEMENT of Revenue, Fiscal Year 1916-17

Reserve.	Timber Sales.	Timber Permits.	Timber Seizures.	Grazing Permit and Trespass Dues.	Hay Permit and Seizures.	Surface Rental.	Special Uses.	Nursery Stock.	Unclassified.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Turtle Mountain		108 05		1,214 00	76 90	80 00			157 50	1,636 45
Spruce Woods		33 25		570 00	18 75					622 00
Riding Mountain	705 91	4,997 22	1,302 44	145 10	329 40	49 60	313 35			7,843 02
Duck Mountain		1,706 33	64 53	89 25	177 50	155 00	103 25			2,295 86
Moose Mountain		252 90	87 70	33 75	235 30	55 00	7 78		25 00	697 43
Beaver Hills		39 75		135 00	201 60		0 50			376 85
Porcupine	527 98	807 75	59 42	102 35	97 70		103 55			1,698 75
Pasquia	270 47	1,456 95	26 70		8 00		26 75			1,788 87
Fort à la Corne	371 80	166 80			4 50		0 25			543 35
Pines		172 85	12 50	94 95	54 50					334 80
Nisbet		661 95		17 00	81 85		2 50			763 30
Big River	230 50	8 00	119 33	9 70	70 25		3 50			441 28
Steep Creek		39 60	6 00							45 60
Sturgeon		0 25	50 75		2 25		0 50			53 75
Keppel		185 00		128 40	25 90		0 50			339 80
Manito		91 70		471 95	47 75		4 75			516 15
Dundurn		3 00		257 10	6 20		1 50			267 80
Seward				256 20	58 60		3 25			318 05
Elbow		18 25		614 15	61 65		6 00		45 00	745 05
Cypress Hills	272 28	421 97	2 00		322 45	25 00				1,043 70
Cooking Lake		76 40		54 35	117 35					248 10
Crowsnest	5,284 23	570 67	302 69	2,131 38	31 35	28 40	145 55			8,494 27
Bow River	0 25	116 50	16 00	731 95	74 80	42 79	14 20			996 49
Clearwater	4,524 84	90 25		26 40	16 50	481 04	42 75			5,181 78
Brazeau	1,352 09	406 00	189 29			143 38	55 00			2,145 76
Athabaska				89 25			10 00			99 25
Lesser Slave			23 56				0 75			24 31
British Columbia Reserves	73 54	66 00			12 70	147 40	31 00		4 50	335 14
Indian Head							16 50	1,452 00	1,358 89	2,827 39
Total	13,613 89	12,497 39	2,262 91	7,172 23	2,133 75	1,207 61	893 68	1,452 00	1,590 89	42,824 35

STATEMENT of Timber Permits issued on Forest Reserves, Fiscal Year, 1916–17.

Reserve.	No. of Permits.		Kinds and Quantities of Timber Authorized to be Cut.								Dues and Fees.
	Free.	Paid.	Roof Poles.	Fence Rails.	Fence Posts.	Saw Timber.	Mine Timber.	Building Logs.	Green Fuel.	Dry Fuel.	
						Ft. B.M.	Lin. Ft.	Lin. Ft.	Cords.	Cords.	$ cts.
Turtle Mountain	129	15		10	600	14,000		360		3,476	108 05
Spruce Woods	24	16								485	33 25
Riding Mountain	273	465	1,660	500	23,089	2,126,276		56,086	103	5,998	4,997 22
Duck Mountain	89	143		100	8,520	803,800		16,827		3,118	1,706 33
Moose Mountain	49	93	977	375	3,925			4,312	210	1,322	252 90
Beaver Hills	46	3	100	150				3,200		375	39 75
Porcupine	95	25	3,826	24,800	9,550	742,484		3,670		1,228	807 75
Pasquia	24	40	400	6,026	2,500	174,555		13,250	400	4,038	1,456 95
Fort à la Corne	75	45	10,300	59,220	19,028	377,550		10,125		1,818	165 80
Pines	29	32	800	5,500	3,790	39,750		4,945	12	1,020	172 85
Nisbet	49	55	4,800	24,000	9,300	111,000		245		2,233	661 95
Big River	33		3,600	18,500	5,000	95,750		1,600		592	8 00
Steep Creek	16	13	800	4,000	1,565	24,500		210		406	39 60
Keppel	168	69	6,790	8,900	13,775	1,300		71,600	397	1,965	185 00
Sturgeon	1		400	2,000	500	9,250				25	0 25
Elbow	29	17	100		325			500	6	255	18 25
Manito	42	35	3,550	14,885	8,571			14,500	179	671	91 70
Dundurn	12									300	3 00
Cypress Hills	288	130	34,901	11,500	48,765	29,000	1,790	111,765	153	2,252	421 97
Cooking Lake	26	15		50	200			12,180		720	76 40
Crowsnest	90	55	2,620	8,260	7,355		98,468	30,988		1,791	570 67
Bow River	27	19	3,185	4,400	2,650			14,616		561	116 50
Clearwater	24	7					10,000	500		775	90 25
Brazeau	8	11	350				116,500	4,900		279	406 00
British Columbia Reserves	11	13	1,240	1,200	550			12,780		150	66 00
Total	1,657	1,316	80,399	194,376	169,958	4,549,215	226,758	389,159	1,460	35,853	12,497 39

STATEMENT of Grazing Permits issued Fiscal Year 1916-17.

Reserve.	No. of Permits.	Number of Stock.				Dues and fees collected.
		Cattle.	Horses.	Sheep or Hogs.	Total.	
						$ cts.
Turtle Mountain	72	1,093	118		1,211	1,212 00
Riding Mountain	21	497	13		510	132 60
Duck Mountain	9	341	4		345	89 25
Spruce Woods	30	477	19		496	570 00
Moose Mountain	6	129			129	33 75
Porcupine	7	437	59		396	102 35
Pines	8	350	6		356	94 95
Beaver Hills	11	435	30		465	135 00
Nisbet	4	42	21	7	70	17 00
Keppel	35	434	54		488	128 40
Big River	1	42			42	9 70
Manito	53	1,267	253		1,520	468 45
Elbow	92	1,494	390		1,884	505 80
Seward	25	393	143		536	248 75
Dundurn	12	797	113		910	257 10
Crowsnest	66	4,678	721		5,399	2,131 38
Bow River	29	1,431	379		1,810	731 95
Clearwater	3		83		83	26 40
Athabaska	26	46	172		218	89 25
Cooking Lake	6	186			186	48 85
Total	516	14,569	2,578	7	17,054	7,032 93

TIMBER CUT on Forest Reserves under authority of Timber Sales, Fiscal Year 1916-17.

Reserve.	Previous Sales still operating.	Sales made Current Year.	Saw Timber.	Mine Timber.			Dues collected.
				Props.	Props.	Lagging.	
			Ft. B.M.	Ft. B.M.	Lin. Ft.	Cords.	$ cts.
Riding Mountain	1		20,000				60 00
Fort à la Corne		1	65,781				98 67
Big River		1					
Pasquia	1	1	599,041			356	1,026 98
Porcupine	1	1					
Cypress Hills		1	121,220				181 94
Crowsnest	5	4	2,076,375		461,240		3,926 52
Clearwater	1		175,053	422,759		85	1,575 44
Brazeau	2	1	737,902				1,106 84
Fly Hills	1		9,620				7 22
Total	12	10	3,804,992	422,759	461,240	441	7,983 61

Statement showing the quantity of Timber sold and Revenue due during Fiscal Year ending March 31, 1917, on License Timber Berths within Dominion Forest Reserves.

MANITOBA.

Forest Reserve.	Timber Berths.	Area in Reserve.	Quantities Sold.			Revenue.		
			Lumber.	Laths.	Other Products.	Dues Payable.	Rent Payable.	Total Payable.
	No.	Sq. Mls.	Ft. B.M.	No.		$ cts.	$ cts.	$ cts.
Riding Mountain	5	45·43	325,000			148 79	227 15	375 94
Duck Mountain	11	99·98	11,514,252			5,213 66	499 90	5,713 56
Total	16	145·41	11,839,252			5,362 45	727 65	6,089 50

SASKATCHEWAN.

Porcupine and Pasquia	44	960·99	22,296,544			11,599 78	4,886 90	16,486 68
Sturgeon	12	177·78	37,573,287	8,226,500	4,021	16,444 39	891 33	17,335 72
Big River	3	260·77	34,135,316	16,538,150	6,811	12,743 14	1,303 85	14,046 99
Nisbet and Pines	5	116 80			3,004	410 25	173 15	583 15
Total	64	1,516·34	94,005,147	24,764,650	13,836	41,197 56	7,255 23	48,452 54

ALBERTA.

Crowsnest	11	254·94	2,558,766		780,051	2,846 63	1,295 95	4,142 58
Bow River	15	374·44	6,540,403	974,300	4,473	4,793 64	1,860 95	6,654 59
Clearwater	4	377·56					1,887 80	1,887 80
Brazeau	11	177·64			35,307	1,466 70	1,131 30	2,598 00
Total	41	1,184·58	9,099,169	974,300	819,831	9,106 97	6,176 00	15,282 97

BRITISH COLUMBIA.

British Columbia Reserves	11	133·57					667 85	667 85
Grand total	132	2,979·90	114,943,568	25,738,950	833,667	55,666 98	14,826 13	70,492 86

Photo 11964. E. H. Roberts.

Stand of young jack pine along Lily plain, Wingard road, Pines forest reserve, Saskatchewan.

Photo 11490. E. H. Roberts.

Forest along Greenwater trail, Porcupine forest reserve, Saskatchewan.

APPENDIX No. 1.

This report concerns the tree-planting division for the fiscal year 1916-17.

The past season as a whole has been very favourable to nursery and tree-planting work. The spring of 1916 opened much later than usual, following a severe winter with an exceptionally heavy snowfall. The previous autumn left the ground in good condition as regards moisture, and the heavy covering of snow prevented evaporation during the winter and furnished additional moisture following the spring thaws. The soil, therefore, was in excellent condition for all planting operations. On account of the late spring growth was more or less retarded, and very little injury was caused by spring frosts.

The shipping season opened late, packing for the general distribution not commencing until April 25; as compared with April 10, in 1915. The weather, however, was cool and remained favourable during the shipping season. The evergreen shipments were completed by May 15. The growth of all stock in the nursery was excellent. The quality of all seedlings dug in the fall was above the average. The evergreens transplanted from seed beds to nursery rows showed very few losses, and the older transplants made strong growth and will make fine plants for distribution this spring (1917).

On September 10, 1916, digging was started. From that time until the ground froze up the season was the worst we have yet experienced. A continual run of bad weather—snow, rain, frost, mud, and cold winds—made the getting up of the stock a most disagreeable and unpleasant business, so that it was not until November 6 that the digging of the seedling stock was completed. Soil froze up solid on the 8th, so that no further work on the land was possible. We were, therefore, unable to get our usual fall sowing done, the ground being too wet and muddy to operate the seed drill.

The reports received from the inspectors covering the farm plantations are uniformly favourable. The plantations set out in the spring of 1916 made an excellent showing in all districts. All classes of stock, both seedlings and cuttings, gave a very high percentage of live plants. The older plantations made correspondingly good growth and but slight damage has been reported from winter-killing. The poplar leaf-beetle, which was noted in 1915 in certain districts of west central Alberta, apparently was much more in evidence last summer. The territory affected was very much larger and extended well into central Saskatchewan, the beetle being reported as far east as Morse on the main line of the Canadian Pacific Railway and at scattered points even east of Saskatoon. These beetles seem to suddenly appear in millions. Letters from farmers describe them as being so numerous that the sky is literally darkened by enormous clouds of the insects. In about three or four minutes after the beetles strike a plantation every poplar and willow in the belt is absolutely defoliated. Apparently no other varieties, with the exception of currants, are affected. After a few days the beetles disappear and are not seen again during the season. The suddenness with which these attacks occur make it almost impossible to effectually protect the plantations, unless the trees can be thoroughly sprayed with arsenate of lead in anticipation of the invasion. Of course in some cases the beetles are not quite so numerous and then they might possibly be controlled by spraying after the first ones were noticed on the trees. Fortunately, from all reports received, the defoliated trees leaf out again and make more or less growth before fall, but such attacks must necessarily weaken the trees and it is doubtful whether they will be able to survive severe attacks in consecutive seasons. It is to be hoped that some natural control will keep

this insect in check, as it would seem quite impossible at present to guard efficiently against it by any artificial means. When we realize that in the affected parts of Alberta the only broad-leaved trees that we can absolutely rely upon for hardiness for cultivated shelter-belts are different varieties of poplars and willows, it can be seen what serious effects repeated attacks from these leaf-beetles will have on the planting of trees generally in these districts. In Manitoba the fall canker-worm, which works principally on the Manitoba maple, is the only insect reported as at all general, although the area affected is gradually increasing. This caterpillar can be easily controlled if the trees are sprayed with Paris green or arsenate of lead at the proper season. The aphis which did so much damage in 1915 was not in evidence in 1916. In 1914 the larch saw-fly threatened to become a serious pest in the tamarack and larch plantations on the nursery station. These plantations cover in the total approximately 20 acres, and in order to save them roads were cut through at intervals of 40 feet and all the plantations thoroughly sprayed, in 1915, with arsenate of lead as soon as the larvæ were noticed at work. This spraying appears to have been at least temporarily effective as not a single specimen could be found in any of the plantations during the past season.

In my last report mention was made of an arrangement arrived at with the Saskatchewan Provincial Department of Education to encourage tree planting on rural school grounds and to more effectively ensure the success of these school plantings. Under this arrangement fifty-five schools will be supplied with trees this spring. As the local school boards become more familiar with the details of this arrangement we may expect to have a very much larger number on our lists next season.

Owing to the present abnormal conditions due to the war it cannot be expected that farmers will be able to devote as much time as in the past to any farm operations that are not directly productive. In referring to Table 1 it will be seen that the number of men receiving trees this spring is approximately 400 less than in 1916. This reduction is due largely to shortage of farm labour, and, again, many of those who applied for trees have since enlisted for overseas service. A great reduction will be noticed in the number of new applications, the difference being something like 1,400. At the same time the available stock has very nearly doubled, so that, instead of an average of 875 trees and cuttings sent out to each individual in 1916, the average this spring will be about 1,675.

Up to 1916 the demands on our stock were becoming almost too heavy for us to take care of, and the average allotment of 875 trees was hardly sufficient to make anything like an efficient shelter-belt, and, in fact, in many cases the individual allotments were quite inadequate. The present falling-off in applications will allow a more generous distribution and will make it possible to furnish enough stock to each individual to enable him to set out a really practical shelter.

TABLE 1.—Annual Distribution of Deciduous Stock.

—	1912.	1913.	1914.	1915.	1916.	1917.
Number of applicants receiving trees..	3,618	3,536	3,420	3,459	5,072	4,627[2]
Seedlings and cuttings distributed.....	2,729,135	3,495,375	3,685,455	3,730,375	4,460,600	7,797,125[2]
Average number per applicant	626	988	1,077	1,078	875	1,684
Number of applicants on inspection list	7,375	6,987	7,167	9,570	10,275	9,577[1]
Number of new applications received...	1,649	1,899	1,559	3,693	2,853	1,454[1]

[1] Compiled March 19, 1917. Figures will be slightly altered when 1917 lists are completed.
[2] Supplementary to these figures considerable stock will be shipped to the Saskatoon Nursery, Manitoba Education Department, and other Public Institutions.

For inspection purposes the three prairie provinces were divided into nine districts, each one covered by an inspector. The following table shows the number of applicants in each of these districts, number of trees allotted in each district, etc.

TABLE 2.—Distribution of Trees in Relation to Districts, 1917.

District.	Number men on list.	Number to receive trees.	Number trees allotted.	Average number per applicant.
Central and Southern Manitoba	804	272	472,950	1,738
Central Saskatchewan east of Saskatoon	1,077	437	690,925	1,581
Southeastern Saskatchewan	1,228	570	1,174,700	2,061
Northern Manitoba, Saskatchewan and Alberta	1,115	571	833,575	1,459
Southern and Western Alberta	1,283	652	988,600	1,516
Central Alberta	1,275	525	731,950	1,394
Southern and Western Saskatchewan	1,217	477	909,025	1,901
Central Saskatchewan West of Saskatoon	1,140	553	945,725	1 774
" " "	1,136	590	1,049,675	1,779
Total	10,275	4,627	7,797,125	1,684

The following is a statement of the planting plans prepared during the winter and the correspondence handled during the fiscal years 1915-16 and 1916-17:—

Planting plans prepared, fiscal year 1915-16, 4,441; 1916-17, 3,583.

Pieces of mail received, fiscal year 1915-16, 22,076; 1916-17, 18,598.

Pieces of mail sent out, fiscal year 1915-16, 29,536 (including 4,276 plans franked); 1916-17, 26,982 (including 3,574 plans franked).

New files added, fiscal year 1915-16, 4,864; 1916-17, 2,604.

The record of pieces of mail sent out does not include bulletins, these being sent out from the head office at Ottawa.

Photo 11529. B. R. Morton.

Interior of aspen poplar stand, Beaver Hills forest reserve, Saskatchewan, where underplanting with spruce was done in May, 1917.

NURSERY WORK.

For the first time a distribution of stock was made from the new Saskatoon Nursery station at Sutherland. This nursery, located in the outskirts of Saskatoon, is situated so that it can serve all the country to the north of Saskatoon and the main lines and branches running east and west into Manitoba and Alberta; while the Indian Head station covers all shipments in the southern halves of the three provinces. In order to equalize the stocks at these two distribution centres it will generally be necessary to exchange different quantities of certain varieties between the two nurseries. Last spring we, therefore, shipped from Indian Head to Sutherland 1,042,000 seedlings of maple and ash, and from Sutherland to Indian Head 59,000 cuttings of Russian poplar. In 1916 a somewhat larger stock was raised at Sutherland, so that the transfer will not be so heavy from Indian Head this spring.

At Indian Head the following areas were under nursery stock: Maple, 17 acres; one-year ash, 21 acres; two-year ash, 24 acres; conifers, 11 acres; caragana, 8 acres; Russian poplar stock, 6 acres; willow stock, 3 acres; total, 90 acres. In the fall of 1916 we managed to get 11 acres of ash sown, but no caragana or maple.

At the Saskatoon station the areas under nursery stock were as follows: Maple, 22 acres; one-year ash, 21 acres; two-year ash, 20 acres; caragana, 5 acres; Russian poplar stock, 2 acres; willow, 3 acres; total, 73 acres.

Owing to rather inadequate shelter, the plots at Sutherland suffered some setbacks because of drifting soil, and the ash was badly damaged from summer frosts, so that the output of ash seedlings is very small compared to the average.

Stock available for distribution in 1917:—

At Indian Head—		
Maple seedlings	1,617,325	
Ash seedlings	1,297,000	
Caragana seedlings	764,000	
Willow cuttings	474,375	
Russian poplar cuttings	344,800	
Total		4,497,500
At Sutherland—		
Maple seedlings	2,031,000	
Ash seedlings	67,000	
Caragana seedlings	552,000	
Willow cuttings	1,247,000	
Russian poplar cuttings	487,000	
Total		4,384,000
Total of broad-leaved stock	.....	8,881,500
To these may be added the following conifers from Indian Head—		
Scotch pine, 4-year transplants	13,800	
Jack pine, 4-year transplants	43,200	
Lodgepole pine, 4- and 5-year transplants	32,200	
White spruce, 5-year transplants	115,500	
Total		204,700
Grand total		9,086,200

Collection of seed.—From the seed collector's standpoint 1916 was a comparatively good seed year for ash but poor for other varieties, the very unfavourable fall weather making collections very difficult. The following were collected: Caragana, collected on Indian Head nursery, 325 pounds; ash, collected in Qu'Appelle valley, about 4,500 pounds; Scotch pine, collected on Indian Head nursery, 10 bushels of cones—seed extracted, 8½ pounds; Manitoba maple, collected in the nursery and in Qu'Appelle valley, about 1,400 pounds. All seeds used in the Saskatoon nursery have been collected, cleaned, and sent from the Indian Head station.

Conifers.—In the spring of 1916 the following seedlings were set out in nursery rows:—

White spruce, 3-year seedlings	84,268
Scotch pine, 2-year seedlings	47,112
Jack pine, 2-year seedlings	72,264
Lodgepole pine, 2-year seedlings	32,840
Total	237,484

The following were dug and shipped under the usual conditions in the spring of 1916 at a nominal price of $1 per 100; White spruce, five-year transplants, 110,400; jack pine, four-year transplants, 28,100; lodgepole pine, four-year transplants, 17,600; Scotch pine, four-year transplants, 7,600; total, 163,700.

About 2,400 of these were sent to various experimental farms and ranger stations. In all 730 separate shipments were made. In addition to the above the following seedlings and transplants were sent out for planting on the Dundurn, Manito, and Elbow reserves in Saskatchewan: White spruce seedlings, 6,300; white spruce transplants, 2,100; jack pine seedlings, 10,500; Scotch pine seedlings, 6,300; total, 25,200; making the total number of conifers shipped out 188,900.

The reports from the individual planters, in reference to the planting of these evergreens, indicate very general success. In many cases lots of 500 were set out without losing a single plant. Three per cent would cover all losses on the average. Very encouraging reports are also being received on the growth of similar stock sent out in previous seasons. The farmers are beginning to learn from experience that the evergreens are as easy to handle as the broad-leaved varieties, and although somewhat slower growers at the start, they eventually make a more efficient shelter, especially during the winter. Once these hardy evergreens become established there is practically no danger of winter-killing, and up to the present they appear to be but little subject to any serious insect attacks.

At present under lath-screened seed beds are the following areas:—

	Square Feet.
White spruce, 3-year plants	1,550
" 2 "	3,100
" 1 "	2,400
Scotch pine, 2 "	650
" 1 "	2,400
Jack pine, 2 "	1,850
" 1 "	2,400
Lodgepole pine, 2-year plants	300
Total, exclusive of paths	14,650

The seed of the Scotch pine sown in 1916, as stated in my last report, was extracted from cones collected on the nursery here from trees raised from seed and set out in permanent plantation in 1906 as three-year-old transplants. These trees were in 1916 only 13 years old and we were doubtful as to germination of seed and quality of the seedlings. The resulting stands in the seed beds are practically perfect and the growth of seedlings strong and vigorous. We shall, undoubtedly, from now on be able to secure all the seed of this variety which we are likely to require without going off the nursery. Seed secured in this way is more likely to produce stock suitable for prairie planting than that procured from European sources and of doubtful origin.

PERMANENT PLANTATIONS.

No additions have been made to the permanent plantings since my last report. The growth during the season of 1916 was good. The usual growth measurements were made as in past seasons.

GENERAL FARM WORK.

Owing to pressure of other work no new land was brought under cultivation. Fifty acres of oats, which were, however, about 50 per cent hailed out, furnished grain and straw for the horses. Thirty-five acres were summer-fallowed. Thirty acres were in hay, of which 25 acres were ploughed immediately after cutting. Ten acres of new hay land were sown, and besides this about forty acres of nursery land were ploughed and cultivated after the stock was lifted in the fall.

Photo 11518. A. W. Barnhill.

Brush disposal properly done, Porcupine forest reserve, Saskatchewan, 1917.

SASKATOON NURSERY STATION.

The amount of stock grown on this nursery has already been stated. This nursery, located at Sutherland adjoining the city of Saskatoon, is now well established, though shelter-belts and hedges, naturally, will require time for development. Good permanent shelter-belts of conifers have been set out on the east, south, and west sides of the half-section. At present only the south quarter is to be used for nursery plots. These are to be divided from each other by caragana hedges, following practically the same plan which has given such good results on the Indian Head nursery. The main approach to the buildings consists of a well-graded and gravelled road, planted along both sides with wide borders of ornamental shrubs and trees. In front of the superintendent's residence an ample lawn has been laid out, also enclosed by an irregular border planting of trees, shrubs, and perennials. This portion of the grounds has made good progress and has already attracted numerous visitors to the nursery.

A much needed addition to the buildings, in the shape of a roomy boarding-house, was made during the past season and this will help to simplify the labour problem. This nursery could now be considered as thoroughly equipped if adequate water supply can only be secured. The original well, which when sunk gave promise of an abundant supply of water, has since then gradually silted up and proved quite insufficient. Attempts were made to sink deep wells last spring but on account of quicksand and boulders two holes had to be abandoned after drilling to a depth of about 90 feet. Apparently the only reliable supply is to be secured by piping water

from the Sutherland water-mains. At present all water for domestic use and most of that required for the stock has to be hauled in tanks from Sutherland. This means a great deal of lost time both for teams and men and is generally rather unsatisfactory.

PLANTING ON THE FOREST RESERVES.

Experimental plantings of 4 acres each were set out on each of the following reserves in Saskatchewan: Elbow, Dundurn, and Manito. The sites for these plantings were selected, so far as possible, in situations typical of the larger areas which must be subsequently planted up.

On the Spruce Woods reserve in Manitoba a more extended planting of some 27 acres was undertaken. The stock for this latter planting was grown entirely on the reserve, in a nursery adjoining the ranger house.

The soil on all these reserves is very similar, being an almost pure sand supporting a very light growth of grass; in places patches of various sizes are grown over with ground cedar which spreads over the surface forming a dense, matted growth from 2 to 6 inches high. The prostrate stems of this cedar are very tough and often 2 inches in diameter, so that it is not practical to plough or cultivate such patches.

The planting was done entirely in plough furrows which run east and west, with the sod thrown to the north, the seedlings being set in the bottom of the furrow and close up to the land side so that they would be more or less shaded. Seedlings were set in wedge-shaped holes made with planting irons, but in handling transplants it was found necessary to dig out holes with spades.

Figures, as accurate as possible, were kept in all cases as to labour cost of these plantings. The small plantings on the three Saskatchewan reserves averaged $11.39 per acre, not including cost of transporting seedlings or the labour of the ranger in charge of the work. The cost of setting out approximately 30 acres on the Spruce Woods reserve is given as $9.93 per acre for seedlings and $20.75 per acre for transplants. This includes the cost of digging in the nurseries and transport to the planting site, which, however, in this case was close at hand. These figures do not include charges for supervision or the ranger's time, except when he was actually doing planting personally. Thus the cost of planting and digging the transplants is double the cost of handling the seedlings, and the cost does not take into account the great expense of transplanting in the nursery, or the larger area of nursery ground required. From the reports this season it would appear that on the small reserves the transplants have shown less loss than the seedlings, but on the Spruce Woods the reverse is the case. This is probably to be accounted for by the fact that the stock sent out from the Indian Head nursery, having been grown on much richer soil, has good compact root systems, whereas the stock grown on the almost pure sand of the Spruce Woods reserve had very thin, straggly roots and consequently gave poorer results. Again, white spruce, which was used on the Saskatchewan reserves, in our experience always transplants with less loss than the pines, which were the only varieties of transplants used on the Spruce Woods.

The composition of each of the four-acre plantations on the Dundurn, Elbow, and Manito reserves was similar. The four acres were divided into eight half-acre plots and these were planted as follows: (1) alternate rows of caragana and Scotch pine seedlings; (2) Scotch pine seedlings; (3) alternate rows of caragana and jack pine seedlings; (4) alternate rows of caragana and white spruce seedlings; (5) white spruce seedlings; (6) white spruce transplants; (7 and 8) jack pine seedlings.

Reports sent in by rangers in the autumn show fairly good results on the Manito and Dundurn reserves, but not so good for Elbow reserve. As conditions are practically similar on all three it is difficult to account for the comparatively large losses on the latter reserve. The reports are as follow:—

Dundurn reserve: loss covering all varieties, due largely to drifting sand burying the young seedlings, 3 per cent.

Manito reserve: white spruce transplants, no loss; white spruce seedlings, 5 per cent loss; jack pine and Scotch pine seedlings, 3 per cent loss; with some damage due to moles covering up plants.

Elbow reserve: white spruce transplants, 2 per cent loss; jack pine seedlings, 9 per cent loss; white spruce and Scotch pine seedlings, 30 per cent loss.

On the Spruce Woods reserve the following stock was planted:—

Lodgepole pine transplants, 3¾ acres, 10,900 plants.
Jack pine transplants, 5½ acres, 15,100 plants.
" and caragana alternate rows, 1½ acres, 1,968 (of each).
" 2-year-old seedlings, 17 acres, 50,100 plants.

An examination of these plantings, made by the district inspector late in June, showed a loss of 1 per cent in the seedlings and 2 per cent in the transplants. A report from the ranger in September is to the effect that the seventeen acres of jack pine seedlings were looking very well, only a very small percentage of the plants had died, due, probably, to the excessive heat. The jack pine and lodgepole pine transplants had done well but showed a loss of probably 10 per cent.

Photo 11847. R. H. Campbell.

Plantation at Lachute, Quebec, set out under the direction of the Provincial Government. Planting done 1913, photograph taken 1917.

In all the reserve plantings the spacing was, as far as practical, the same in every case. That is, the furrows were run approximately four feet apart and the plants placed about four feet apart in the row.

All the plantings, to date, are of a more or less experimental nature and as yet no definite scheme has been worked out for the more extensive plantings which must be made in future seasons. Before any such planting can be worked out it is first necessary to have a definite knowledge of the portions of the reserve which will require to be planted. A surface survey of each of these reserves will, therefore, have to be made, which should show, when mapped, the general topography such as creeks, sloughs, important elevations, trails, etc., and also the areas at present partially timbered and those entirely bare of trees, which will, of course, be the portions to be first planted. On most of the reserves certain areas are more or less covered with a natural growth of aspen and such deciduous shrubs as are usually found growing with it. The aspen

will spread rapidly when given good fire protection, and, as it makes quite a good fuel and is the common wood fuel of the prairies, it may possibly be the best policy to encourage the reproduction of aspen wherever possible, instead of trying to introduce conifers which must be artificially planted. In any event there are large areas on all the reserves which cannot possibly become forested except by artificial methods, and these should receive first attention.

A survey was started on the Manito reserve, but unfortunately was stopped after a few weeks, owing to the man in charge leaving to engage in other work. In all, twenty-seven sections in the northwest corner of the reserve were covered, being in townships 42 and 43, ranges 27 and 28. A map (scale 3 inches to the mile) showing the data obtained was prepared and forwarded to Ottawa.

VIDAL'S POINT PARK.

The public park property, locally known as "Vidal's Point," on the northwest quarter of section 4, township 20, range 12, west of the 2nd meridian, has been under the supervision of the Indian Head office for several seasons. This property comprises about twenty acres along the shore of lake Katepwe, the most easterly of the Fishing lakes, a chain of five lakes in the Qu'Appelle valley. This is the only land along the lake shores not held in private hands and, consequently, is largely used by the neighbouring public for camping and picnics. Certain portions of the property were originally well treed, but a great many of the trees were destroyed or damaged by thoughtless campers, principally through the biting away of the bark by horses which were tied to the trees, often for days at a time. Soon after being put under the supervision of this office, in 1911, the property was fenced and a farmer living alongside engaged as caretaker, to see that horses were not allowed to be brought inside the fence and to warn the public generally against injuring trees or shrubs.

When the ground was first fenced it was divided into two portions, one part to be used for camping purposes and the other only for picnics, bathing, etc. There is an excellent sand bathing-beach here, and as a summer hotel is situated on the immediately adjoining property there is always a large number of people who make use of this portion of the park.

Last spring the other part was surveyed into 58 camping lots with an average of 30 feet frontage. Permits are granted for camping privileges at a nominal fee of 50 cents per lot per month. Nineteen permits were issued during the summer, covering periods of from one to five months each. Probably each permit represents about four people, mostly women and children, so that, roughly, about 75 people camped here during the past summer.

NORMAN M. ROSS,
Chief of Tree-Planting Division.

APPENDIX NO. 2.

The following report concerns the work done in the Manitoba inspection district during the fiscal year 1916-17. It covers the work done on the Riding Mountain, Duck Mountain, Turtle Mountain, and Spruce Woods forest reserves, and on the Manitoba South, Manitoba North, Pas, and Port Nelson fire-ranging districts.

IMPROVEMENTS.

Riding Mountain forest reserve.—The road work on this reserve was confined to maintenance only, and principally to parts of the Central road and opening up of the

Birdtail road. This work covering some 73 miles consisted of replacing and repairing bridges, grading, corduroying, etc., and was done by Forestry Branch teams and small gangs of men assisted by the rangers.

The present road system enables the officers to reach almost any part of this reserve with horses, but when funds can be obtained and conditions return to their normal state it is the intention to make further improvements, so as to permit automobile travel on some of the principal routes. This will give much more rapid access in case of fire, will enable the public to get in and out of the reserve, and will give travellers an idea of the work being carried on by the Forestry Branch. Frequent requests have been made to have this work carried out.

Work was performed on some 60 miles of fire lines and boundaries. New work covered 35 miles and consisted of clearing out the lines and piling the débris ready for burning. Ten miles of this were cleared under contract and the work was so satisfactory that it is hoped more can be done in this way. On the lines where clearing had been done in former years the débris was burned, some parts which were open were ploughed, and in one section bridges were erected so as to enable teams to travel over it. Forestry Branch teams were used on all work possible for horses.

One steel look-out tower was erected in the Whirlpool district where a commanding hill permits an extensive view.

No new buildings were erected, though two ranger houses were improved and material laid on the ground for a new house in the Russell district which will be erected at an early date. The four cabins with their stables, which were built last year, were completed by being chinked and plastered so as to be habitable during the winter. These have proved great conveniences to officers when their work necessitated their being absent from headquarters over night.

Photo 11513. A. W. Barnhill.

Clean brush disposal, settlers' cutting, Porcupine forest reserve, Saskatchewan.

The telephone work consisted of maintenance and covered some 200 miles, on 24 miles of which, in the Whirlpool section, poles were erected, as the original tree line was not found satisfactory. A quantity of new poles was taken out for repairs during the coming season.

Although it was reported that this line was not satisfactory no complaints have been laid by the officers on the reserve, and only on rare occasions has it been impossible for the supervisor to get in touch with the rangers, who report to him daily.

Duck Mountain reserve.—The principal road work on this reserve was done in the extension of the central road with the intention of completing it to the north boundary at Minitonas ranger station, but owing to the scarcity of labour and the high rate of wages and supplies this was not accomplished, though 28 miles were finished, leaving 6 miles to complete, which will be taken in hand as soon as possible.

New construction to the extent of 2 miles was found necessary on the Kamsack-Lake Madge road, as a homesteader, through whose property the original road led, desired to fence it in. We have now, however, a much better road over which visitors to the lake can travel with automobiles.

Work was commenced on a road from the north boundary to lake Madge to enable patrons from the Swan River valley to reach a very pretty beach at the northeast angle of the lake, where it is desired to establish a second summer resort. Some 4½ miles of this were put in first-class condition, and it is the intention to complete this at an early date.

Six miles of fireguard were cut and cleared in the Grandview district and the débris burned; in the Deepdale district 4 miles were improved and put in condition for travel, which will save the ranger some five miles when travelling north. Other fireguards were cleared up, and on one the line was widened five feet, and the débris burned wherever it was possible to do so.

Several minor trails were cleared out and repaired, and on the whole the work carried out has done much towards the opening up of this reserve and is most satisfactory, though it entailed very heavy work owing to the hilly nature of the country traversed.

The principal work on telephone lines was concentrated on the extension of the line following the central road, which comprised 28½ miles of No. 9 grounded line, which is practically all strung on poles, though, when suitable, trees were cut off and used. The maintenance of older lines demanded a good deal of attention, such as setting new poles and re-tying. It is desired to have telephone connection with the Kamsack ranger station, and in order to do this material was taken out to erect a line from lake Madge to the western boundary to connect with the Kamsack local system. The idea, however, had to be abandoned as it was found impossible to make satisfactory arrangements with the owners of the Kamsack system.

The Lake Madge summer resort as usual attracted a great number of people, on Sundays and holidays especially, the improvement on the road permitting the use of motors. Several very attractive cottages were erected and more attention generally was paid to this beautiful spot. A restaurant, with public stables in connection, was opened and proved a great convenience to transient visitors.

Material was taken out and work commenced on a wharf for use of the campers, and lumber laid down for two bathing-houses for the convenience of the lessees of lots who have, I understand, formed themselves into an association, with the intention of framing rules for the management of the resort and making marked improvements to their premises during the coming summer.

Turtle Mountain reserve.—The improvement work done was principally in the way of maintenance of trails and fire lines, only 6 miles of new construction having been undertaken and this was along the Canada-United States boundary, where 2 miles were cleared and ploughed while the timber was cut out along the other 4 miles, some of the heavy stumps having had to be blown out preparatory to ploughing. The remainder of work under this heading was in improving roads which also serve as fireguards, and consisted in grading, building bridges and culverts, and mowing and burning the growth at the sides. No new buildings were erected, but improvements were made at both headquarters establishment and the West cabin.

The pasture fence called for considerable repairs. Material was also placed on the ground for dividing the main pasture in two, the object being to keep the stock owned by patrons living to the west of the reserve separate from the stock of those living to the east.

The system of "cutting-out" corrals was installed at the east end of the pasture to facilitate the distribution of the stock in the fall, and has proved so convenient that it is intended to erect a similar set at the west end, for which purpose material has been secured from the Riding Mountain reserve, where some of the fire-killed timber was taken out during the winter.

Spruce Woods reserve.—No new work was undertaken on this reserve in the way of roads or fireguards, though maintenance work on the latter to the extent of 102 miles was carried on by re-ploughing 68 miles and disc-harrowing 34 miles. Nothing was done in the way of new buildings on this reserve, but necessary repairs were made.

The only new construction was that of a wind-driven pumping-plant set up at the south end of the pasture enclosure, consisting of a 10-foot wheel, 4 by 16 syphon-pump, 80-barrel storage tank, and a 24-barrel watering-trough. The water is obtained through four sand points, and an ample supply is always on hand. This plant was found necessary as stock had to travel too far to reach the ranger station.

All necessary repairs were made to the pasture fence by fastening wire, which in many places the moose had stripped off the posts for considerable distances, and setting new posts.

The work on telephone lines on this reserve was all maintenance, consisting of putting in some new poles, re-setting others that had been broken off at the ground but were still serviceable, and tightening wires.

SILVICULTURE.

Riding Mountain reserve.—There were 504 timber permits issued during the year, covering fuel, fence-posts, etc., to the amount of about 1,500,000 feet board measure. A large proportion of all timber taken out was from areas burned one or two years ago. The brush disposal was very satisfactory, the mill operators complying with instructions readily.

A quantity of fence-posts and rails was taken out for use on the Turtle Mountain and Spruce Woods reserves, where it is not possible to secure such material, and a supply of tamarack telephone poles was cut and distributed for repairs.

Duck Mountain reserve.—A long period of exceptionally cold weather prevented many people from going to the bush for timber, and of the 235 permits issued two-thirds were for free timber. The permits issued covered 500,000 feet board measure of lumber besides fuel and fence-posts.

The mill operators are realizing more each season that it is to their own advantage to leave the forest in good condition, the result being that the brush disposal on the Duck Mountain reserve was most satisfactory.

A quantity of telephone poles for repairs and new construction was taken out, together with material for a wharf at Lake Madge summer resort.

Turtle Mountain Reserve.—The number of permits was larger than in any former year, due, it is thought, to the financial stringency, as numerous settlers who had heretofore purchased fuel from outside points took advantage of the free supply offered under permit. One hundred and twenty-nine applications were made, calling for 3,311 cords of fuel, all of which was cut from dead or diseased timber.

No planting was done, but the experimental plantation was cultivated, trees were hoed and cleared of weeds, and protection given by the erection of a rabbit-proof fence, as during the previous year these rodents had done considerable damage to the transplants.

Spruce Woods reserve.—Fifty-seven timber permits calling for 366 cords of fuel were taken out. These permits covered only dry or diseased timber, as the practice of confining cutting to these classes is still adhered to. No trouble was experienced on this reserve over the brush disposal question.

While no tree seeds were sown on either of the nurseries, these were kept in good condition and the usual work of weeding and watering carried on. Sunflowers were planted round the tree beds to protect them from drifting sand.

To the south and west of Shilo headquarters, 28 acres were planted from the nursery beds. This plantation comprised jack pine seedlings, 17 acres; mixed jack pine and caragana seedlings in alternate rows, 1½ acres; jack pine transplants, 5½ acres; lodgepole pine transplants, 4 acres. The results of this planting have been very good and the losses have been light.

Vigorous growth has taken place in the Scotch pine plantation to the south of Camp Hughes, where the only work required in the past season was that of clearing the fireguards. Little damage was done last winter by rabbits, though heavy drifts of snow broke down and injured some of the trees.

The success met with in this project is very gratifying and demonstrates that when funds are available the reforestation of this reserve can be undertaken with fair prospects of success, provided the fire danger can be controlled. Already our work in this line is showing good results.

Photo 11958. E. H. Roberts.

Forestry Branch exhibit at Agricultural Fair, Prince Albert, Saskatchewan, August, 1917.

GRAZING.

Riding Mountain reserve.—There is no closed grazing on this reserve, but twenty permits were issued for open grazing covering 499 head of stock. As there are very large areas of excellent, well-watered pasture lands to be found, it is hoped greater use will be made of these advantages in the near future.

Duck Mountain reserve.—Little attention was paid to the large areas of pasture land on this reserve, and only two permits covering 68 head were taken out. This is no doubt due to the fact that there are large areas of unoccupied land adjacent to the reserve which furnish grazing for such stock as are owned by the settlers in the vicinity.

Turtle Mountain reserve.—On this reserve seventy-two permits were taken out for 1,231 head of stock, of which 118 were horses and about 75 head, under six months

of age, the progeny of the herd. This shows a steady increase from former years and is practically double the number grazed last year. Stock were brought from a distance of 50 miles, and as many as 40 head were the property of one owner.

The pasturage was excellent, and stock when handed over to the owners at the end of the season were in the pink of condition.

There is ample accommodation for many more head, and the herd is expected to be increased this coming season. Arrangements are being made to keep stock coming from the west separate from that from the east, thus making it more convenient for patrons to remove them in the fall. There was no open grazing this year on this reserve.

Spruce Woods reserve.—The number of stock grazed did not come up to expectations, high prices for all classes of stock and the great demand induced many owners to dispose of or reduce their herds. Permits covering 292 head of cattle and 77 horses were issued for the enclosed grazing and for 60 head of cattle on the open grazing. The trouble formerly experienced from footsoreness, caused by the long walk to water, was overcome this season by the installation of the wind-mill pumping-plant at the south end of the enclosure. This was found most satisfactory and the stock in the enclosure were delivered in good condition.

USES OF LAND.

Fish and Game.—On lake Max and other bodies of water in the Turtle Mountain reserve, where in the past the good fishing was such an attraction, great numbers of fish were found dead on the opening of spring. While the cause is not known it is thought this may have been due to the heavy snowfall which occurred early in the fall, immediately after the lakes froze, and which excluded the air from the water. The result was that no fish were caught in these waters and many of the former patrons did not visit the lake. During last winter, however, fish were seen at the water-holes. This, together with the fact that the same trouble occurred in lakes in the vicinity of the Duck mountain, confirms my opinion that it was lack of air which caused the fish to die, and not the decay of vegetable matter; and I hope the stock may be replenished,

On lake Madge, in the Duck mountain, good fishing was to be had and some of the pickerel, with which the lake was stocked two years ago, were taken but returned to the water.

A large number of sportsmen hunted in the Riding and Duck mountains during the big game season and most parties met with success.

The game laws were changed at the last session of the Manitoba Legislature and the killing of elk and all varieties of grouse was prohibited. This was very necessary, as the former are getting scarce while practically no prairie chicken or partridge were to be seen during the shooting season last fall. Numbers of partridge and chicken are, however, to be seen now, and it is hoped that if this is a favourable breeding season and the law is enforced, the supply will increase.

Hay permits.—Three thousand six hundred and forty-two tons were covered by 196 permits which were distributed over the different reserves as follows:—Riding Mountain, 101 permits, 1399 tons; Duck Mountain, 50 permits, 1505 tons; Turtle Mountain, 37 permits, 578 tons; Spruce Woods, 8 permits, 160 tons.

As a safeguard against fire, and to improve the yield, rangers have been instructed to burn off all meadows wherever possible before the snow melts in the bush.

Summer resorts.—Owing to the financial stringency and the absence of so many of our young men who have enlisted, the summer resort patrons did not improve their lots as it was expected, though week-end visitors were quite numerous, particularly at lakes Max and Madge which are the most popular summer resorts.

Clear Lake summer resort.—Little attention was paid by the public to this resort in the Riding mountains and at the original site no new lots were taken up, but

another beach was laid out at the east end and several of these lots were taken up. The holders intend to build this summer.

Lake Max summer resort.—Though there were not the usual number of campers attending lake Max, Sundays and holidays found very large parties, and all the cottages were occupied during the season. The failure in fishing had a great deal to do with this falling off of visitors.

Lake Madge summer resort.—The road leading from Kamsack to the summer resort at lake Madge was improved so as to enable motors to travel over it, with the result that there were more transient visitors than during any previous year. While but few additional lots were taken up a number of very attractive cottages were erected and more attention was paid to keeping the premises neat. The lot-holders are taking keen interest in this resort, and have formed themselves into an association with a view to establishing rules for its management. A number of new boats, several being motor driven, were placed on the lake and a boat livery was in operation for use of transient visitors. A wharf for the use of the public is in course of construction, which will encourage the use of better and larger craft on the lake, an ideal spot for boating.

There is another very pretty beach at the northeast angle of the lake where the residents of the Swan River valley desire to establish a summer resort, it being more accessible for them than the present site. It is the intention to lay out a number of lots along this beach during the coming summer, and, as the road to it is practically completed, I expect it will become a popular camping ground.

SURVEYS.

No alterations were made in the boundaries of the forest reserves in Manitoba during the year, but reconnaissance surveys were carried on outside of the reserves by two parties, the object being to ascertain whether the areas covered were suitable for agriculture or should be formed into forest reserves.

Messrs. L. S. Webb and G. M. Linton covered that tract situated on the east shore of lake Winnipeg northward from Poplar river to the north boundary of township 57, and from the lake front to the Ontario boundary, some 12,456 square miles, through which area several large streams flow. Practically no agricultural lands were found, and recommendations have been made that it should be formed into a forest reserve so as to provide better protection from fire. This would also provide for the proper administration of the timber, much of which, it is thought, will ere long be of such value as to warrant marketing.

The territory examined by Messrs. E. J. Guay and Thomas Maher covered some 3,500 square miles, between townships 37 and 51 and the Canadian Northern railway and lake Winnipegosis. No agricultural lands of any value were found in this area, but there was not a sufficient quantity of timber to warrant the establishment of a forest reserve, nor does it contain the source of any streams whose watersheds would call for conservation. A few isolated areas were found suitable for settlement, most of which were occupied.

FIRE-RANGING.

The fire-ranging work outside of the forest reserves was divided into four districts, viz.: Manitoba South, Manitoba North, Pas, and Port Nelson.

Manitoba South district.—This district was divided into thirteen patrols, there being thirteen rangers and four assistants. The staff, on the whole, was a great improvement over the previous year and gave very good service.

The patrols were made both by canoe and on foot, the lake Winnipeg and lake Winnipegosis patrols being made by canoe and sail-boat. We also had a small skiff with a detachable gasolene engine which proved very advantageous to the service.

On account of the heavy snowfall in the winter of 1915-16 and frequent rains in the spring and early summer the country was very wet and most favourable for our work.

In all we had five large fires reported, covering an area of 1,040 acres and incurring an expenditure of $7.20, exclusive of ranger service, which is indeed most satisfactory. There was no merchantable timber destroyed and very little young growth. There were also 34 small fires, covering not more than ten acres each, which were extinguished by the rangers and caused no extra expense.

The season can be termed as very fair, and the good service rendered by the majority of the rangers is in no small measure accountable for the result.

Manitoba North district.—The Manitoba North fire-ranging district has been for some time under the charge of Mr. J. T. Blackford at Norway House, the patrol work being performed by Indian rangers who have an intimate knowledge of the districts to which they are assigned. These men work in pairs, and patrols are made by canoe.

Mr. Blackford has been furnished with two motor-canoes, for his use in the waters accessible to his district without portaging, which are found most serviceable. He frequently makes inspections of the outlying districts to see that the rangers are doing their work properly, and at the same time interviews as many of the Indian tribes as possible. When it is not possible during the summer to complete the reports or prepare maps of each of the fires that may have occurred Mr. Blackford travels by dog train in winter and secures this information.

It is very pleasing to note that only six large fires and six small ones are reported for the season of 1916, and though they burned over a considerable area very little damage was done.

The season, on the whole, in this district was very satisfactory and is no doubt due to the strong influence Mr. Blackford has with the people in his district and the co-operation he receives from the Indian chiefs.

Pas district.—This district was again handled by Chief Ranger Fischer and nine rangers, eight of whom were allowed assistants as all the patrols are made by canoe. It might be well to mention that Mr. Fischer enlisted for overseas service in August and his place was filled by Mr. B. M. Stitt who handled the district very well during his term of office. Very good results were obtained in this district, there being only three fires reported which burned over an area of 680 acres and incurred an expenditure of $79, exclusive of ranger service. Very little damage was done to the timber, the estimate of damage done being $2,000. This is a very satisfactory report when one takes into consideration the fact that miners and prospectors were so active in different parts of the district.

Port Nelson district.—This district was organized during the early part of the season, there being two rangers, each with an assistant. Patrols were made in canoes, one ranger taking the Nelson river and the other taking the Hayes river. The patrol work was kept up until the latter part of October and no fires were reported during the season, which is indeed very satisfactory.

Fires in forest reserves.—The past season has probably been the most satisfactory we have had in this district. No fires were reported from the Turtle Mountain or Spruce Woods reserves, and only one on each of the Riding and Duck Mountain reserves. This is most satisfactory, and is no doubt due to a large extent to the publicity work done and educational policy carried on by several of our officers in the course of the last year. It is very gratifying to note the hearty co-operation we are receiving from the settlers living adjacent to the reserves in respect to forest fires. The weather conditions for the greater part of the season were very favourable to our work and, coupled with the heavy snowfall the previous winter, helped materially to keep the fire danger down.

F. K. HERCHMER,
District Inspector of Forest Reserves for Manitoba.

APPENDIX No. 3.

This report concerns the Saskatchewan inspection district for the fiscal year 1916-17.

The province of Saskatchewan has a total area of 251,700 square miles or 161,088,000 acres, with an average population of about two people to the square mile, or one person to every 320 acres. Approximately 151,000 square miles or 96,640,000 acres lie south of the Churchill river, with an average population of three and one-third people to the square mile, or one person to 200 acres. At the present time the work of the Forestry Branch pertains only to that part of the province lying south of the Churchill. The work of the branch is divided into two classes in this district: (1) the forest reserves, and (2) the fire-ranging outside forest reserves.

Photo 16911. J. A. Doucet.

Boat-house at McMurray, Alberta, showing how property used in fire ranging is cared for.

FOREST RESERVES.

There are fifteen forest reserves with an area of 10,279 square miles or 6,578,560 acres. They can be divided into prairie reserves and timber reserves. The prairie reserves are: Dundurn, Elbow, Keppel, Manito, Moose Mountain, Beaver Hills, and Seward, with an area of 469,696 acres. These reserves occupy areas totally unfit for agricultural purposes, either on account of the sandy condition of the soil or on account of the unevenness of the topography, and at the present time a large portion of the area is open grazing land with only scattered areas of timber, composed mostly of aspen or white poplar.

The timbered reserves are located mostly in the northern part of the district and comprise the following reserves: Big River, Fort à la Corne, Nisbet, Pasquia, Porcupine, Pines, Steep Creek, and Sturgeon, with an area of 6,108,864 acres. The area within the boundary of these reserves is suitable only for the growing of timber and for grazing purposes either on account of the soil or topography.

Each forest reserve is divided into ranger districts, according to the size of the same. These districts have an average area of 187,973 acres. On each district are constructed comfortable headquarters for the ranger, and he is required to live on his district during the entire year. Each reserve is placed in charge of a supervisor or ranger-in-charge, and this man is held responsible by the Forestry Branch for the proper handling of all classes of work on the reserve under his jurisdiction.

FIRE-RANGING.

The fire-ranging area practically comprises all the timbered country south of the Churchill river and north of the Saskatchewan river, outside of the forest reserves. It is divided into the Battleford and Prince Albert fire-ranging districts. These districts have a total area of 47,736 square miles, or 30,551,040 acres. This area is divided into ranger districts varying in size from 391,680 acres to 2,534,400 acres, with an average of 1,041,108 acres. The smaller districts are located along the northern line of settlement, where the danger from fire is at a maximum. In the larger and more northern districts only the used waterways are patrolled. The districts, however, are very much too large to give the best results, but the men are doing good work and there has been very little loss from fire during the past two years in these outlying districts. The primary work of the men on the fire-ranging staff is fire patrol, but during the periods when there is very little fire danger they are employed on improvement work, such as keeping all old trails and portages open, cutting new trails and portages when needed, constructing lookout towers, small cabins for stopping places, tool caches, and storehouses. There is always plenty of work to keep the men busy at all times.

The Battleford district lies west of the line, passing approximately north and south through the town of Big River, and comprises an area of 16,812 square miles, or 10,759,680 acres. This area is divided into eleven districts, with a chief fire ranger and one sub-chief fire ranger. The average area for each ranger district is 978,153 acres.

The Prince Albert fire-ranging district comprises all the country east of the Battleford district, and is divided into seventeen ranger districts with one chief fire ranger and two sub-chief fire rangers. It comprises an area of approximately 30,924 square miles, or 19,791,360 acres. Each ranger district has an average of 1,164,197 acres.

IMPROVEMENTS.

During the past year the making of improvements was carried out steadily on the reserves. They included 4 houses, 7 cabins, 19 stables, 7 other buildings, 101 miles of roads and trails, 20 lookout stations, 42 miles of telephone line, and 46 miles of fireguard. Considerable fencing and other improvements were also carried out. On the smaller reserves, in the prairie districts, the necessary improvements are now fairly well on towards completion. Good progress has been made on the large reserves in the northern part of the province. On the Porcupine and Sturgeon forest reserves the roads and telephone lines constructed have greatly improved communications on these extensive and previously largely inaccessible tracts. The programme of improvements on the other of the larger reserves in the north, the Big River reserve, is not so far advanced.

On the Nisbet forest reserve a special improvement cutting was made for a distance of four miles along the road through the eastern block of this reserve. Travel to and from the city of Prince Albert along this road is frequent. All the brush, infected timber, and dead and down material was cut along this road, thus removing a serious fire danger and greatly improving the conditions in that locality. Improvements and extensions of fireguards, not included in the figures given above, were made on other reserves, particularly the Beaver Hills, Pines and Moose Mountain reserves.

FIRES.

No serious fires occurred during the year in the district, and only two-tenths of 1 per cent of the forest reserve area was burned over, this being mostly grass land, including only 10 acres of merchantable timber damaged.

The total expenditure, including ranger's time expended on extinguishing fires, amounted to $180, or less than 1 per cent of the previous year's cost. The danger period only lasted a fortnight in the spring, while during the remainder of the year moisture conditions and precipitation were such that very little danger of fire existed. What few fires occurred were mostly small. The causes to which fires were attributed were divided into the following classes: settlers, 51 per cent; campers, 19 per cent; unknown, 17 per cent; railways, 10 per cent; lightning, 3 per cent.

Inside forest reserves there occurred 8 large and 15 small fires, a total of 23, which burned over 11,195 acres. Damage to the extent of $725 was done, and the expenditure to extinguish amounted to $45.

The size of the average fire exceeding ten acres amounted to 1,381 acres burned over, in contrast to 2,000 acres the previous year.

Outside forest reserves and in fire-ranging districts, 8 large and 24 small fires occurred, a total of 32, which burned over 24,605 acres, costing $135 to extinguish, and doing an estimated damage of $5,820. Less than three one-hundredths of 1 per cent of the area patrolled was burned over.

The erection of lookout towers, opening of trails, building of telephone lines, and the appointment of assistants to the rangers with canoe patrols, greatly increased the efficiency of the force. The addition of three sub-chiefs, to continually cover several districts and direct the work of the men, secured better results in the work and more prompt action in the submission of reports and the handling of accounts in the fire-ranging territory. The forest reserve rangers had additional assistance for a few days in the spring in order to burn off fireguards, and hay and grass lands, thus insuring a large amount of protection at a very low cost. This was an exceptional season compared with last year, when the total loss of merchantable timber amounted to $742,000, and when also there were large and valuable areas of young growth destroyed.

The average loss each year of all classes of timber, i.e., merchantable saw-timber, cordwood, pulpwood, and reproduction—would be close to one million dollars. This loss is the same as a total destruction of interest-bearing assets, and the interest is lost as well as the principal. It will take one hundred years of hard labour on the part of the Forestry Branch to replace the principal, the loss of which was due, to a great extent, to lack of interest. A great part of the loss of merchantable timber was due to the fact that the operators on timber berths are allowed to leave a fire-trap on all cut-over areas.

So long as the present system of cutting is allowed on timber berths it will be practically useless to attempt the restocking of burned-over areas, and the loss from fire will always be great until some change is made for the better.

EQUIPMENT.

Within the year a fairly good supply of fire-fighting tools, portable telephones, telephone construction equipment, wagons, canoes and all other necessary equipment, has been supplied to the reserves and fire-ranging districts. These tools and supplies are placed at reserve headquarters, ranger stations, stop-over cabins, and tool caches. Each ranger is required to have the equipment in his district always ready for immediate use. An adequate supply of equipment is very necessary in all districts, as articles of this nature cannot be secured locally in quantities sufficient to meet emergencies.

A supply of provisions is also placed in the more remote districts for fire-fighting purposes. In fact, every effort is made to keep the men in the field well supplied with all necessary tools, etc., so that there can be no excuse for not getting results because of lack of equipment.

GRAZING.

The development of the grazing industry on forest reserves has taken place within the past three years. This has been brought about by a system of regulations which allow stock owners to place stock on the reserves under a permit system at very reasonable rates. The applicant is required to take out a permit each year for the number of head he wishes to run, but, in order to make the industry as permanent as possible, the permittee is assured that the permit will be renewed each year in accordance with the regulations in force on the reserves. Permits are issued, at a nominal charge, to users of the range for the construction of corrals, herders' cabins, stables, water-tanks, and all other improvements that are required to properly develop the range.

The conditions in the vicinity of the prairie reserves are such that the Forestry Branch is practically forced to issue fencing permits in order that the range can be used by the stock owners. It is always desired that as large areas as possible be fenced, as good-sized fenced areas are better for the stock, there are fewer gates to be opened by the travelling public, and the cost of fencing per head is much less than for small pastures. In order to secure these advantages the small owners are forming stock associations, fencing large areas, and running their stock in common, under rules made by the association and approved by the department. This method seems to work to the advantage of all concerned. Five stock associations are organized and using fenced areas at the present time.

The number of stock under permit on reserves in 1915 was 4,500. In 1916 there were approximately 100 permits issued for 6,500 head of stock, an average of 65 head per applicant. Approximately 10 per cent of the number were horses. Placing the average value per head at $75, the stock on the reserves had a total value of $487,500. Six thousand head of this stock were run on the prairie reserves with an area of 469,696 acres, and only 500 on the northern reserves with an area of 6,108,864 acres.

The range conditions on the prairie reserves are ideal, as there are large areas of open grass land well supplied with good water. The range on these reserves is stocked to 50 per cent of its capacity. The prairie reserves will carry about 12,000 head.

There are large areas of good range country on the northern reserves, equal to any on the prairie reserves. These areas are open, hilly country, with good feed and water. There is also excellent feed on the burned areas, and in many places there is an excellent growth of pea-vine, etc., in the green timber, which makes excellent feed in late fall and early winter. Cattle on the Porcupine reserve were doing well on this class of feed as late as the middle of November. Fully 30 per cent of the wooded reserves could be used to advantage for grazing purposes, and, if used, would carry 60,000 head of stock where only 500 were grazed last season. This valuable asset is being neglected at the present time, but I believe that within ten years these areas will be fully stocked. When the need arises larger areas of the reserves will be used for grazing purposes, as the above only applies to the more accessible areas. The proposed reserves will carry as many stock as the present reserves.

Permits were issued in 1916 for 5,000 tons of hay on the prairie reserves, and for 1,700 tons on the northern reserves. The cut on the prairie reserves could probably be increased by 25 per cent, but on the northern reserves 30,000 tons of hay could be cut with very little improvement work on the meadows. Large areas of hay land could be made available by drainage, clearing out the willows, etc.

SILVICULTURE.

Sales and Permits.—The timber sale work has been increasing yearly and during the past fiscal year two old sales have been running, four new ones were awarded, and four applications reported on but not advertised, due to the small amounts applied for very late in the season or to the immature material desired. The total amount cut on these sales in the district will run about one million feet board measure. About 90 per cent of the timber is white spruce, the remainder is divided among tamarack, jack pine, balsam fir, poplar, and birch. Two sales were in operation on the Porcupine reserve, two on the Pasquia, one on the Fort à la Corne, and one on the Big River reserve. Ten small mills have been operating on the reserves in this district, six of which have been running in connection with timber sales, while the remainder were sawing mostly on settlers' permits. The demand for lumber has been very brisk during the latter part of the season and the prices obtained by the manufacturers have again reached a par with the high prices prevailing during 1912. Several of our sales have covered burned timber or territory culled over by previous operators or settlers, and a considerable improvement in the condition of the forest

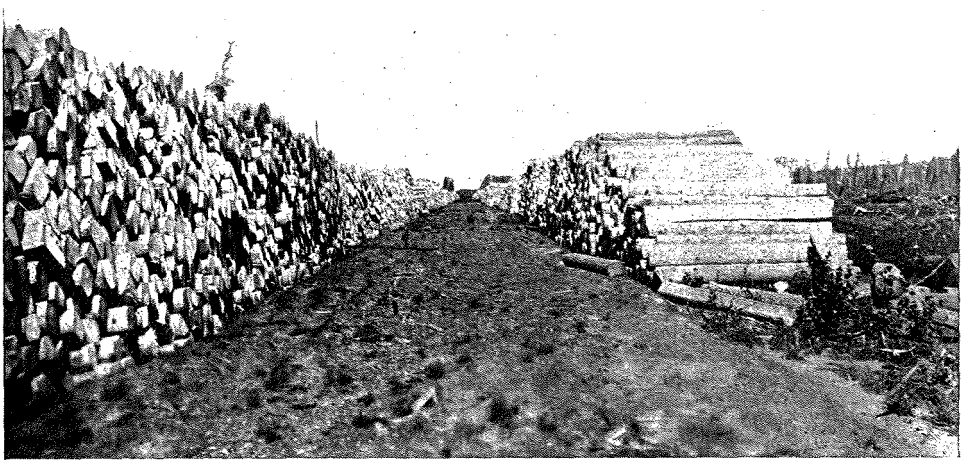

Photo 10906. J. A. Doucet.

Spruce ties along line of the Alberta and Great Waterways Railway, northern Alberta.

has been obtained by the present operations. Burned and wind-felled timber has been taken out and saved from decay; old logs and tops, which had been left from previous cuttings, have been removed and sawn. Considerable over-mature material has been cut and, with the cleaning up of the areas by the strict enforcement of the brush-burning conditions, the safety of the remaining timber is increased, and the silvicultural conditions greatly improved. Close supervision by the forest officers in marking, scaling, and the enforcement of brush burning has greatly improved the appearance of the cutting areas, and the present staff are securing fair results in this silvicultural work, when there is taken into consideration the short time the regulations have been in force and that the staff had no previous experience. As the timber sale work continues to increase, the men on the ground will require better qualifications in order to properly handle the work, and the efficiency of the present staff would be greatly increased by a system of ranger meetings in which the men would be instructed in the fundamental principles of mapping, estimating, marking, and scaling.

The wood-cutting operations were quite extensive on all of the reserves last season, and the price on cars averaged from $3.50 per cord for poplar to as high as $5 per cord for tamarack. The average for all species was about $4 per cord, f.o.b., throughout the district. The retail price ran from $6.50 to $10 per cord. On all the operations within the reserves all brush was burned.

In granting all timber sales, timber permits, and wood permits, it is the aim of the branch to dispose of all the dead, down, diseased, and over-mature timber that can be used under the requirements of any of the above permits. In all cases the permittee is required to burn all brush and refuse from his operations. The brush and refuse from a logging operation is always ready for a match and when once started nothing can stop it until the entire area is burned. The best method of protecting this valuable national asset is to require all operators to dispose of the brush as the logging operation proceeds, so that fires which do start may be controlled.

PLANTING.

Four-acre experimental plantations of white spruce, Scotch pine, jack pine, and caragana were set out on the Dundurn, Manito and Elbow forest reserves in the spring of 1916. The seedlings used were mostly 2- to 3-year-old stock which was planted in both pure and mixed arrangement. The areas were located in close proximity to ranger headquarters in order to ensure the maximum protection. Sites were selected that were typical of the whole reserve as nearly as possible, and thus a variation in exposure and soil was secured, depending upon the topography of the areas, which was mostly rolling. The areas planted were open and of sandy soil, and the planting was done in furrows with the planting iron. The stock was shipped from the Indian Head nursery, and supervision of the planting was given by a special man detailed from the nursery station assisted by the forest rangers. The rate of planting averaged about one thousand trees per man per day, and the cost per acre about $15. This should be greatly reduced if the work were conducted on a larger scale. The areas were fenced and surrounded by fireguards. The season was very favourable, with an abundance of moisture, and the growth, so far, has been fairly good. Reports show that less than 1 per cent of the jack pine seedlings have failed, while the Scotch pine and white spruce show approximately 33 per cent failure, due to winter-killing and being covered up by moles.

Some fifteen hundred seedlings were planted out in the old "burn" on the Pines forest reserve. This stock consisted of white, Norway, blue and Engelmann spruce; and of Scotch, jack, rigid, yellow, and lodgepole pine, all grown in the local nursery at the headquarters of the reserve. The planting was done in furrows with the planting iron, and the trees have made a very good showing for the first season. Forty-seven new beds in the nursery were seeded down to jack pine in the spring, the seed of this species being the only kind obtainable for this purpose. The seedlings all made a good growth, with the exception of four beds which were killed by the cutworm and had to be re-sown in July.

The small plantations around the ranger stations on the Nisbet, Moose Mountain, and Beaver Hills forest reserves were increased by the addition of four hundred trees at each place, and these are all doing well. The trees planted during previous years are beginning to make a very noticeable growth, and not only greatly improve the appearance of the grounds but attract the attention of the public.

Planting on a large scale will not be practicable until the fire danger is reduced to a minimum. This can be accomplished on the prairie reserves where there are no timber license operations, but, as to the reserves which contain timber berths, until it is the rule that brush from operations on timber berths is burned or otherwise disposed of, it would be a waste of money to attempt restocking these reserves as, under present conditions, it is impossible to protect what nature has placed there at no expense. More young material is burned in an average year on cut-over lands within reserves containing timber berths than could be replaced by planting in fifty years.

SURVEYS.

A reconnaissance survey was completed by Mr. G. A. Mulloy on an area of 2,500,000 acres lying north of the Torch river and east of the Candle lake. This area is classified as follows: lakes, 2·05 per cent; muskeg, 53·8 per cent; merchantable timber, 4·8 per cent; old "burn", with reproduction, 6·09 per cent; old "burn", not reproducing, 0·38 per cent; woodland or cordwood, 27·87 per cent; "burn" with scattered trees, 5·01 per cent.

Mr. Mulloy states that in the whole area examined hardly an acre of agricultural land was discovered and that the well-wooded portion of the area will, if protected, prove to be of immense value to the adjoining prairie in supplying firewood, ties, posts, poles, and a large amount of saw-timber. The greater part of the area is young, thrifty reproduction about twenty-five years old, and this, if protected for a few years, will produce an enormous quantity of valuable material.

SUMMARY.

All branches of the work in the district are progressing very favourably and along permanent lines. Practically all of the development in the district has taken place since 1912. The reserve areas were in very poor shape when turned over to the Forestry Branch as they had been devastated by fire, cut over without supervision, and all slash left on the ground. This slash is the worst fire danger to the forest and is the primary cause of more fire loss than any other one agent. The slash is being burned on reserve operations without trouble.

The staff on the reserves has developed rapidly in the past three years, and the officers are interested in their work and are showing good results. The progress of improvement work has been rapid and at the present time all supervisors and rangers have good, comfortable living quarters located on the reserves. Lines of communication are well opened up, and the fire protection system improved by the building of many lookout towers, provision of equipment, and construction of telephone lines.

From a silvicultural standpoint the reserves are being cleaned up as fast as possible, by removing the dead material and burning all slash on operations under the Forestry Branch supervision. The first aim is to protect the forest areas from fire and this can be done only by removing the chief source of danger—slash.

G. A. GUTCHES,
District Inspector of Forest Reserves for Saskatchewan.

APPENDIX NO. 4.

This report concerns the Alberta inspection district for the fiscal year 1916-17. In presenting the annual report of the work of the district for the past fiscal year it is perhaps unnecessary to point out that this organization, as well as others, has been working under very serious handicaps, brought about by a state of war. Organizations which have been brought to a high state of efficiency are generally able to contend, more or less adequately, with conditions that may come about; others, not so highly developed and organized, must naturally suffer to a greater degree, and at times must face conditions which are discouraging and sometimes appear almost hopeless. Forestry, which in this country is still in a very elementary state of development, must naturally suffer a retarding effect under present conditions. Not

only is it difficult to provide for new lines of work which are of extreme importance, but it is necessary to considerably curtail work which is fundamentally essential to normal development. There is, however, one aspect of the work which, in spite of present handicaps, should add incentive and bring into play all the energy and initiative at command—the national importance of the work both for the present and future welfare of the country. Forestry has given its quota of men who have fought and died in the great conflict taking place. Some of these went from the lower ranks, while others were young men who had devoted a number of years to a study of the profession. If for no other reason we owe it to these heroes to "carry on."

BOUNDARIES.

No material change took place in the boundaries or areas of the forest reserves in Alberta during the past fiscal year. In the Peace River country, however, numerous temporary reservations were made, on the basis of reconnaissance surveys previously conducted by officers of the Forestry Branch. These reserves have been made not with a view of decreasing the amount of land available for legitimate settlement but for the purpose of preventing, so far as possible, the occupation of non-agricultural lands by settlers who have little knowledge of land or by those having in view some ulterior motives, rather than legitimate agricultural pursuits. The withdrawal of these lands from indiscriminate settlement is a measure calculated to protect not only the interests of the country at large but also the individual interests of the incoming settler. In every country there are lands which are essentially agricultural and which, consequently, should be devoted to that purpose; there are also lands which are absolutely unsuited to agriculture but which are very suitable for forest production, and it is self-evident that in such cases the land should be so utilized. Between these two extremes there are lands which might serve, to a very limited extent, the purpose of agriculture, but which, in the final reckoning, can never be so productive for agricultural pursuits as to warrant their being set aside for that purpose. In the case of temporary reserves of the Peace River district an effort has been made to exclude, so far as possible, all areas having even a semblance of being real agricultural land. In other words, so far as possible, the policy of including in such reservations only absolute forest land has been followed. There are some who are of the opinion that greater areas might consistently have been included within the temporary reservations, but it is considered that the steps which have been taken by this branch, in so far as these reservations are concerned, are adequate for the present time, and that, if sufficient development takes place on these areas, with a view to proper protection and management of them, a very good beginning will have been made in establishing a forest policy in that district. In some parts of the western provinces there are notable examples where settlement was allowed on absolute forest land, which action simply resulted in the denudation of the land by the bogus settler and its ultimate abandonment by him. By having these land examinations made as far in advance as possible, measures can be taken to protect the country and the people against this detrimental class of settlement. As soon as it is possible to do so these temporary reserves should be set aside and administered as forest reserves in full standing. It is self-evident that if such reserves are to be placed on the same basis and run along similar lines of organization as the older established reserves it will be necessary that adequate provision of funds should be made. Under present appropriations it is not possible to give more than an exceedingly limited measure of fire protection to these areas. Not only is considerable expenditure necessary in connection with the development of proper forest management, but also, if only for the development of a systematic scheme of fire protection, it is necessary that considerable funds should be available for the development of transportation and other facilities in the reserves.

The readjustment of boundaries between Dominion parks and forest reserves has not as yet been finally settled. It appears, however, that this problem is at last nearing

a state of solution, and it is sincerely hoped that the next fire and improvement season may be entered upon with definite and final ideas as to the respective boundaries between Dominion parks and forest reserves. In some cases it is evident that co-operative measures must be adopted for the protection of adjoining parks and reserves, but, as has been pointed out in reports submitted during the year, there are no legitimate reasons why such co-operation could not be established.

The work of boundary surveys was continued, and during the past year a complete survey of the outer lines of the Cooking Lake forest reserve was made. In conjunction with this a considerable amount of interior survey work was done for the purpose of re-establishing lines which had become obliterated. Boundary work was also carried out on the Porcupine Hills section of the Crowsnest forest. It was expected that this latter survey would be completed, but, owing to the serious situation which developed in labour conditions, it was found necessary to discontinue the work before completion.

FIRE PROTECTION.

The conditions which obtained during the fire season of 1915 were practically repeated during 1916, and at no time during the season did the conditions on any

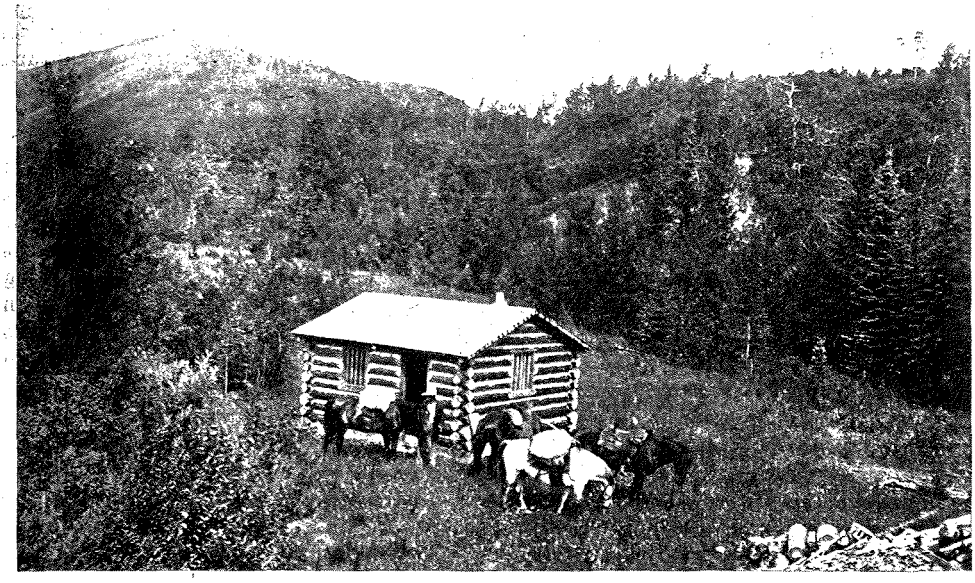

Photo 11063. J. Y. Greenwood.

North Fork cabin, Bow River forest reserve, Alberta.

reserve in the district become really serious. Throughout the Rocky mountains and also, with the exception of a few short dry spells, on the other reserves there was abundant precipitation distributed fairly well during the season. While the occurrence of these wet seasons certainly reduces the actual loss in forest resources for these particular seasons, it is, unfortunately, not a condition which is in itself conducive to the building up of an efficient fire-fighting organization. It follows that urgent efforts must be directed toward educating both forest officers and the general public along such lines as will secure, so far as possible, the prevention of fires. Also, every effort must be made to develop to the utmost the facilities for actual fighting of fires which must inevitably occur. From the experience of the past few years it may be stated that fires are, in the majority, confined to those caused by human agencies. Lightning fires do occur, but the situation of this inspectorate in this respect is much

better than that of some other forest protective organizations. In any case, when the organization here is so developed that it can successfully combat, under any conditions, fires directly attributable to human agencies, it will, incidentally, be in a position to keep good control of fires which may have their origin in lightning.

The total number of fires reported as actually occurring on the reserves of the district is ten. This figure in itself is indicative of the character of the season. The area burned over was confined to approximately 7,000 acres, which is almost a negligible figure as compared to the total area of the forest reserves of the district. The total damage resulting from these fires is estimated at approximately $1,800, including damage to both merchantable timber and young growth. While the total number of fires occurring was so small that statistics are not of much value for comparsion it may be pointed out that more fires occurred during the month of May than at any other time. June and July, according to the statistics, were the next worst months, although as an actual matter of fact there was very extensive precipitation during these two months and, consequently, they were not really as dangerous as the statistics would imply. Of these ten fires, four are attributed to railways; for three, the causes are unknown; and one each is attributed to lightning, hunters, and saw-mills. If a bad season had been encountered in 1916 there probably would have been considerable difficulty in adequately coping with it, owing to the exceedingly serious condition of the labour market. While it is true that for some fires help can be drawn from the farm and ranching lands in the vicinity of the reserves, as a general rule, when it comes to serious fires, it is necessary to draw for help from the labour markets of the towns and cities. Last year the help of this character which could have been secured was exceedingly limited. Probably during the coming season the branch will be still more seriously confronted by this situation and, as previously indicated, it is felt that some arrangements should be made whereby it might be possible to draw to a certain extent on the military forces which may be mobilized and available. It seems that an arrangement of this kind would be quite in keeping with the fundamental idea of National Service, for it is of the utmost importance to this country that the natural resources should be protected. In view of the fact that there may also be a shortage of labour on the farms it would seem desirable to avoid, so far as possible, the ordering out of labour so employed; consequently, it would appear that the only material source of labour supply may be the military forces. Although there is no reason, on the basis of present conditions, to anticipate a particularly dangerous season it appears that the amount of snow which fell in the mountain sections during the past winter was considerably less than in the previous winter. If there is a fairly dry spring and not the usual rainfall in June and July conditions may become very serious indeed.

IMPROVEMENTS.

I have pointed out that the unusually wet season rendered conditions very favourable for fire protection; in the case of improvements the reverse is true, and work in this direction was attended by considerable difficulties; moreover, the serious labour shortage was keenly felt on every reserve of the district. For these reasons it was entirely out of the question to complete the programme of improvement work which had been laid out and for which funds had been provided. When the labour shortage occurred it might have been possible to complete the plans laid out by paying extremely high wages, but it was considered inexpedient to increase wages unduly, owing to the fact that there was evidence of a very serious shortage of labour in the agricultural sections of the country. Notwithstanding weather and labour conditions very material progress was made, and another fire season will be approached with better improvement facilities than heretofore.

Athabaska forest.—A total of approximately 57 miles of trail was constructed, 15 miles primary and the remainder secondary. Toward the end of the fiscal year steps

were taken for the provision of telephone poles for the first link of the Lower telephone line, which will probably be constructed during the coming season. Two or three cabins and tool caches were constructed, and one 40-foot lookout tower was framed from timber. A considerable amount of time was expended by the staff of the reserve in the preliminary location of trails, as a basis for improvement work of the next few years.

Brazeau forest.—On this forest approximately 13 miles of primary trail were constructed and 27 miles of secondary. Other trail work which had been planned had to be abandoned. A considerable amount of maintenance and preliminary location work was also performed by the staff. In telephone work two short branch lines, totalling 17 miles in length, were completed.

Clearwater forest.—In this forest there were built 19 miles of primary trail and 127 miles of secondary. This, added to the trail equipment provided in previous years, renders a very considerable part of the reserve accessible within reasonable length of time. In addition to this entirely new construction a very considerable amount of maintenance work was done on previously constructed trails which had suffered damage as a result of floods. Two cabins were constructed in outlying parts of the reserve, while at Nordegg a good beginning was made in connection with the various buildings and fences of the headquarters at that point. Toward the end of the fiscal year steps were taken to provide telephone poles, in anticipation of a certain amount of telephone construction during the coming improvement season.

Bow River forest.—A total of approximately 85 miles of primary trail and wagon road was constructed. The construction of these trails renders accessible certain parts of the reserve through which travel was formerly tedious and slow. The most important improvement project constructed on the reserve was the North Trunk telephone line, connecting Morley, on the main line of the Canadian Pacific railway, with the Red Deer ranger station, a total construction distance of 45·3 miles. About half of this line is of standard pole construction, while the remainder is of the tree line type. The line is of first-class construction, and places the district inspector's office in quick communication with two important administrative headquarters on the north half of the Bow River forest. Another exceedingly important project, which was started during the winter months, is the Elbow bridge. In previous reports I have drawn attention to the necessity of reducing, so far as possible, the hazard which occurs in fording some of the larger rivers in the Rocky mountains. This was mentioned in connection with the drowning of Forest Ranger E. House on the Clearwater forest during the season of 1914. Another sad accident occurred last fall, when Assistant Ranger Carlson on the Brazeau forest was drowned while endeavouring to cross the main Brazeau river. While it is undoubtedly true that men engaged in forest administration will always have to take certain chances in their work, it is just as certain that this branch should make every effort possible for the provision of safe crossing of the larger streams, at least at the more important points. Although the Elbow river is by no means one of the most dangerous streams, the crossing was considered as of such importance as to warrant the construction of a bridge.

Crowsnest forest.—Between 45 and 50 miles of new trail were constructed on this forest. Telephone work assumed considerable proportions in this reserve, a total of 45·7 miles being constructed. The line in question connects the Porcupine Hills section with the Trunk line running north and south from the Livingstone gap, inside the range. With the extension of the existing telephone lines in the Crowsnest forest, for comparatively short distances in various directions, this forest will be fairly well served with telephone communication.

Lesser Slave reserve.—Progress was made in the trail work, although it was not possible to complete the programme. A total of 64 miles of primary trail was constructed, of which a considerable portion can be travelled by wagon, and work was also done in the construction of auxiliary trails.

Cypress Hills reserve.—The most important improvement work in the Cypress Hills was the construction of complete headquarters buildings in the Battle Creek ranger district. Fireguards were constructed to a considerable extent throughout the reserve, and some repairs and alterations were made on some of the important trails.

Cooking Lake reserve.—Improvement work on this reserve was decidedly limited; good work was done, however, in bringing up to a higher standard some of the already existing trails.

General.—Summarizing the work done it may be stated that a total of about 440 miles of roads and trails was constructed; that 108 miles of telephone line were built; that one first-class ranger station house and numerous smaller buildings were constructed; and finally, that a considerable amount of work was done toward providing bridges, tool caches, lookouts, and other facilities. This and previous reports indicate the completion of a large amount of improvements, and to the casual observer it might appear that this district would be well provided with such facilities. One has but to travel through the forests, however, to really appreciate the tremendous volume of work which is still to be done, before the reserves may, in any sense, be considered as provided with sufficient trail facilities. As for the telephone work the next few years will necessarily involve the construction of hundreds of miles of telephone lines, ere the reserves will be sufficiently provided with that very necessary adjunct of modern forest protection—quick communication.

At this point I feel that some remark should be made with regard to the educative work performed by Professor W. N. Millar of the Forest School, Toronto, consulting forester of this branch. Two demonstration camps were held in this district, one at Morley and one at Coalspur. With the exception of the Clearwater forest every reserve of the district was represented at one or other of these meetings, and forest officers had the opportunity of hearing lectures on quick communication and of taking part in field demonstrations in telephone construction. Each camp involved about a week's time, and the interest in telephone work on the part of a considerable number of the men was given a very desirable impetus. The equipment which Mr. Millar had provided for the demonstration could scarcely have been improved upon, and I have little hesitation in stating that probably never before was such a complete and, at the same time, compact outfit gotten together for the purpose in view.

SURVEYS.

Aside from boundary work, previously described, no special survey work was conducted during the past year. During the three previous seasons substantial progress had been made in preliminary survey on some of the reserves, but a very great amount of work still remains to be done. A good topographic map is a fundamental requirement of forest administration; more particularly in the Rocky mountains there is a very pressing necessity for such data, both for ordinary administration and fire protection. Within the past few years a topographic survey of the Crowsnest forest was conducted under the direction of the Surveyor General; the map resulting from this survey provides data which we should have for every forest. There are, however, a few points in connection with such surveys and maps where a little closer co-operation between the two organizations will result in more complete data and possibly a certain reduction in expense. It is with satisfaction that I look forward to the co-operation of the Surveyor General's Branch in this work.

EQUIPMENT.

During the past season progress has been made in providing the various reserves of the district with the equipment necessary for the various operations taking place. It will be realized that to provide reserves embracing areas of two or three million acres with sufficient equipment and tools for improvement work, and also to provide

caches of tools for fire protective purposes, is by no means a small matter, nor one which can conveniently be handled during any one season. The policy has been to add, each year, as many as possible of the necessary articles of equipment, and before very long each reserve should be very well provided for in this respect. Toward the end of the fiscal year, especially, it was possible to take into account the requirements of the various reserves, and the probability is that this district will start into the new season in a much better position as regards equipment than has heretofore been the case. No new equipment has been developed, but more and more the standardization of equipment for forest reserve work is being approached.

Photo 11930. J. Y. Greenwood.
Portable saw-mill cutting settlers' permits on Bow River forest reserve, Sundre, Alberta.

TIMBER SALES AND SILVICULTURE.

During the year four timber sales, which had been in operation for periods of from one to three years, expired. Six new sales were started, involving the disposal of approximately 5,500,000 feet board measure of timber; over 90 per cent of this is fire-killed, the remainder being over-mature or defective green timber. While the lumber markets have shown a marked improvement during the past year this has not materially affected the disposal of timber from the forest reserves. The bulk of the timber disposed of by this branch in the Rockies consists of mining timber, and, as the coal-mining situation during the past year has, due to financial, transportation and labour difficulties, been anything but satisfactory, the utilization in this direction has not been so great as might otherwise have been expected. Detailed inspections of numerous sales were made by an officer definitely assigned to the timber sale work of the district. As a result of these inspections it was found that in some instances operators were not satisfactorily complying with the conditions of sale. Careful attention has been given to such cases, however, and the operators have been compelled to observe, to every reasonable extent, the conditions and requirements under which such sales were made. Timber sale work of this district is still confined to the Crowsnest, Clearwater, Brazeau, and Cypress Hills reserves, no development having as yet taken place on the Bow River, Athabaska, and Lesser Slave reserves. On the last named reserves there have as yet been no commercial mining developments, and there probably will not be much expansion in this direction until some of the mining

properties are opened up and made commercially productive. The timber permit business of the past year was conducted along the same lines as previously, although an effort has been made to establish definite cutting areas, and thereby to confine cutting operations to areas where they are most necessary from the standpoint of improving the forest. By far the greater part of the timber disposed of under permit, also, is fire-killed.

On numerous occasions it has been pointed out that there are billions of feet of fire-killed timber in the Rocky mountains, for the bulk of which no scheme of utilization has been devised. Only an insignificant proportion of this timber offers any hope of being utilized as saw-timber; in fact, even for timber killed in the fires of 1914 the branch has been able to find no saw-timber market, and as the bulk of the dead timber was fire-killed during or previous to the summer of 1910 it will be appreciated that the branch cannot expect to enter the lumber markets with this class of material. While it will be possible to dispose of very limited quantities for fuel purposes it is evident that to a greater extent dependence must be placed on mining industries. In 1916 the amount of coal produced in Alberta was 4,648,604 tons; probably not more than twenty-five million lineal feet of mine-timber would be required in the production of this amount of coal. Assuming that the next eight years will witness an increase of 100 per cent in coal production, it would appear that in the neighbourhood of 300 million lineal feet of mine-timber, or, in round numbers, half a billion feet board measure, will suffice for coal-mining operations in Alberta until 1925. Even if dead timber were used in all the mines of the province, which is by no means the case, the branch cannot expect to dispose of more than a small proportion of the fire-killed timber to be found in the Rocky mountains forests. Dead timber is subject to serious deterioration in quality and usefulness from year to year, and, although the rate of deterioration is not so rapid in mining timber as in saw-timber, it is my opinion that a period of eight or ten years will probably place the bulk of the fire-killed timber beyond usefulness for mining purposes. The foregoing remarks indicate that, although the coal-mining industry is the only extensive outlet for fire-killed timber, operations for this purpose must be decidedly limited and, consequently, will be more or less confined to the more accessible blocks of timber. It must be recognized that the bulk of the fire-killed timber must rot where it lies ere it can be put to any use whatsoever. That, even under the most favourable conditions of mining development, it will likely be possible to dispose of only a small part of it is a fact which should make clear the necessity of taking advantage of every possible outlet. The policy should be to reduce, so far as possible, the ultimate amount of waste as a result of fires of the past. To some of these points attention has been given during the past year, and during the coming year it is the intention to carry on further studies with a view to securing an extension in the use of fire-killed timber. Needless to say, if such markets are to be developed it is necessary to offer the products to the consumers under the most advantageous arrangements possible.

During the year steps were taken for the collection of data and the preparation of rough maps which will show the various forest types in the Rocky Mountain forest reserve. With rather a limited and untrained staff the results can by no means be considered as accurately representing conditions; nevertheless, before long there should be completed a map which will show roughly the conditions which exist. Incidentally, the training which is given to the forest officers in work of this kind is of great value from an educational standpoint.

GRAZING.

No great development in connection with the grazing on forest reserves of the district can be reported for the past fiscal year, this to a certain extent being due to the fact that it has not as yet been possible to provide for the assignment of a grazing assistant to develop this particular line of work. While on two or three of the reserves a certain portion of the range has been used for a great many years, and,

therefore, there are always applicants willing to range their stock on the reserve, there are other reserves where the available range is considerably removed from the settlements, and consequently the settlers have not become familiar with the grazing facilities obtainable. Even on the reserves quite accessible to the settled country it appears that the settlers are not yet sufficiently familiar with the situation to take advantage of all the range which is available. It will readily be perceived that the best way to bring this range into conservative use is to have a thorough reconnaissance made of the grazing resources, and to have a well-qualified man assigned to the work of developing the grazing business. Undoubtedly the present conditions have curtailed the expansion in the stock-raising industry which, normally, might have taken place. While I am not in a position to quote figures on the general stock situation in this province, it is clearly evident that the settlers in the country accessible to the forest reserves have not been able to increase their holdings very much, and, in fact, in some cases there have been considerable reductions. A total of approximately 6,500 head of stock was grazed under permit on all reserves of the district. Of this number a little over 80 per cent were cattle, the remainder being horses. Although a certain amount of range in the Crowsnest pass was reserved for sheep, no advantage was taken of the facilities offered, owing to the prejudice which existed against sending sheep by railway to the Crowsnest pass.

When one takes into consideration the very extensive grazing resources of the numerous forest reserves in Alberta it is regrettable that the total number of stock handled should be confined to the rather insignificant figure quoted above; on some reserves there are grazing resources which are practically untouched. Present indications are that in some places there will be a very marked increase in the stock grazing on the reserves during the coming season. In the Rocky Mountains forest reserve there are thousands upon thousands of acres of range which might readily be put to conservative use if it were possible to stock the range with sheep. Unfortunately, however, there stand in the way certain difficulties which it is not possible to overcome immediately. So far as possible, however, this important question is being considered, and for the coming season it is hoped to be able to make at least a small start in connection with sheep grazing on the reserves.

Due to the abundant rainfall which was experienced throughout the Rocky mountains the range was in excellent condition for the grazing of stock. Reports indicate that in nearly all cases the stock came off the range in excellent condition, and in no case has any evidence been received of over-stocking having taken place. I am pleased to state, also, that no reports have been received indicating any extensive losses of stock due to poisoning. It will be remembered that some difficulties of this kind were experienced, particularly in the Crowsnest forest, two years ago. In this respect, however, the past season has been entirely successful, as more detailed attention has been given to the choice of grazing periods and, where necessary, stock has been kept off the range at such times as the poison weeds are most dangerous.

USES.

Commercial uses of the forest reserves have to a certain extent been discussed under other headings. The war conditions are undoubtedly responsible for a retardation in commercial activities within the reserves. Probably the greatest commercial development which may be expected is that of coal mining. This industry is, of course, more or less tied up with railway facilities, and, although there are railway lines projected into the various coal-fields, construction has been delayed by financial conditions. No new railways have been constructed during the past year, although we have indications that a start may shortly be made on the Smoky Valley and Peace River railway which will traverse a portion of the Athabaska forest. Townsites within the reserve are also dependent to a very great extent on the progress in coal-mining operations and, consequently, none has been laid out or

applied for during the past year. Recreational use of the forest reserves has, also, been retarded by conditions. The only summer resort in the forest reserves of the district, namely, that at Elkwater lake in the Cypress hills, is still utilized only to a very small extent. With the exception that three or four lessees have constructed small cottages there has been no development at all. It will be appreciated that under conditions such as the present there are, comparatively speaking, but few persons living at a distance who can take advantage of the recreational facilities offered in the forest reserves, and while as usual there have been a considerable number of hunting, fishing and camping parties, there has been no increased use in this direction. Numerous reserves offer particularly advantageous attractions, and with the considerable progress which has been made in road and trail construction, whereby various portions of the forest are made more easily accessible, there should be a very considerable increase in the number of persons from the surrounding country and also from the towns and cities of the province resorting to the forest reserves for recreational purposes. Particularly good opportunities are offered to fishermen and hunters, as well as to those who merely desire to spend a period of quiet camp life in the woods.

FIRE-RANGING.

The organization for forest protection on Dominion lands not included within the forest reserves is divided into four main fire-ranging districts, namely, Edmonton, McMurray, Slave, and Mackenzie River. Although some minor changes were made, involving to a limited extent the redistribution of patrols, the general organization remained the same as in the previous year. Work in the Edmonton district involved the employment of a staff of about forty men. About fifteen men were employed in the McMurray district. The Slave district was patrolled by two steamboats each manned by a crew of from three to four men, supplemented in one or two cases by canoe patrols. Work in the Mackenzie district was not very extensive and consisted in operations, more or less of an educational character, carried on by a staff of four men acting under the direction of the Government agent at Fort Simpson. Owing to the weather conditions which prevailed, the McMurray, Slave, and Mackenzie River districts suffered comparatively little loss from fire. In parts of the Edmonton district, however, notably the Peace River country, there were periods of considerable fire danger, and a total of 247 fires is reported, of which 25 covered an area of more than ten acres. The total area burned over appears to have been in the neighbourhood of 40,000 acres, the bulk of which was grass land and old "burn"; only about 5 per cent of the total area was covered with desirable young growth or merchantable timber. Out of a total of 247 fires the causes of 113 were not determined; 63 were caused by campers and travellers; 51 were caused by the operations of settlers in clearing land, etc.; 16 are attributed to railways; and 4 are reported to have been of an incendiary nature. While the weather conditions which prevailed in the Peace River country were more dangerous than obtained elsewhere on the northern forest reserves, the large number of fires which occurred is indicative of the situation which may be expected in any country where settlement is in the development stage. During the past few years it has been necessary, in order to avoid serious conflagrations, to maintain a more or less extensive patrol of the whole country. As the country becomes more settled, however, the most logical solution of the fire situation is, so far as possible, to withdraw the efforts to lands which it is desired to consider permanently as forest reserves and, in confining attention to such areas, to make them just as fire-proof as possible. This involves not only the provision of more intensive patrol but also the development of the various tracts, by providing trails and other means of communication so essential to efficient fire protection. While the control exercised over the fire situation by the present staff and organization has probably justified the expenditure, just as soon as possible the effort should be confined to definite areas over which the branch can absolutely control all operations under the Forest Regulations.

With regard to the McMurray and Slave districts a special inspection was made by Mr. J. A. Doucet under the direction of this office. This officer spent two or three months in detailed inspection operations in that country. As a result of this work it is expected that the branch will be able to make an entire reorganization of the fire-ranging operations in both these districts. Previously I have pointed out the necessity of providing for closer supervision of the operations in that country, and it is hoped that by an amalgamation of these two districts and the assignment of a competent man in charge of both, whose exclusive duties will be those of fire protection, a very material improvement will be made in the organization.

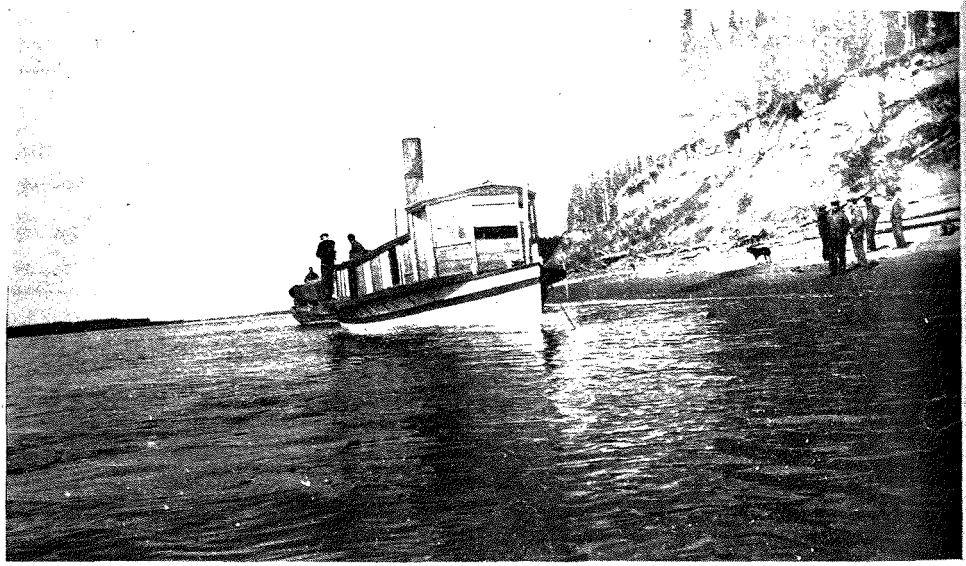

Photo 10992. J. A. Doucet.
Forestry Branch fire patrol steamer "Hope" on the Slave river, northern Alberta.

RAILWAY FIRE PROTECTION.

In co-operation with the Board of Railway Commissioners for Canada notable progress was made in fire protection along railway lines. Railway work in this province was again supervised by District Fire Inspector McNaughton and his two assistants. Both the Canadian Northern railway and the Grand Trunk Pacific railway took active steps in connection with right-of-way clearing. In connection with the Grand Trunk Pacific railway I am glad to report that there has been marked development in the efficiency of the patrol organization. In my last report I indicated that their patrol organization had been entirely unsatisfactory. The past year, however, witnessed a notable change in this direction, and a good patrol was maintained. I regret that I cannot present a similar report in connection with fire protective measures taken by the Edmonton, Dunvegan and British Columbia railway. Last year I indicated that there had been a very decided improvement over the previous season. For some reason or other during the fire season of 1916 the branch was not able to secure such satisfactory service. Toward the close of the fiscal year strong efforts were made to provide for a thorough cleaning up of the right of way on this particular road, and the situation during the coming season will to a very large extent depend upon the success which rewards these efforts. Detailed reports have previously been submitted to the Director of Forestry, indicating very clearly the exceedingly dangerous condition on some portions of the right of way. It is perhaps unnecessary to point out that a combination of these conditions and a fairly dry season would create

a situation with which it might be exceedingly hard to deal. A large number of fires occurred along this line during the past season, and it is more a matter of good fortune than anything else that a very large portion of the country was not burned over. Every effort will be made to secure a thorough compliance with all the fire protective requirements, in order that this railroad may be brought to completion without such evidences of wanton destruction as are to be found along some of the older established lines. In the territory through which new construction was carried on last season the fire prevention efforts of the branch were very successful, and it is hoped that this experience may be repeated.

EDUCATION AND PUBLICITY.

No extensive programme of publicity work has been undertaken during the past year, owing to the exceedingly limited staff. It was not possible to provide for a series of lectures and meetings for the purpose of bringing the public into closer touch with our work. A considerable amount of educational work has, however, been done in a smaller way, by means of the use of various advertising materials, so that it is felt there is a little more appreciation on the part of the public as to the value of the work. When it is possible to advertise more extensively the facilities at the disposal of the public, both commercial and recreational, in the forest reserves, we may expect that principles underlying the establishment of the reserves, and the necessity for protection and rational use of the forest resources of the country, will be more fully appreciated.

E. H. FINLAYSON,
District Inspector of Forest Reserves for Alberta.

APPENDIX NO. 5.

This report concerns the work done in the British Columbia inspection district for the fiscal year 1916-17.

The fundamental basis and all-important feature of Forestry Branch administration in the Railway Belt of British Columbia is adequate and efficient protection of the forests from fire. During the past year the interrelation between the forest resources and the economic condition of the people of British Columbia has been brought out by the fact that the stimulation of forest industries has resulted in a returning prosperity to all classes of the population. This fact has been impressed upon the public by newspapers and public men, with the result that the people as a whole are more in sympathetic touch with the value of our work than ever before.

The forest resources of the Railway Belt in British Columbia are large and, owing to proximity to transportation, these forests are inevitably destined to be the first utilized in the great world demand which the termination of the war will inaugurate. The importance of adequate protection as an insurance for future raw materials is, therefore, manifest to all.

During 1916 weather conditions favoured the work of fire prevention very greatly. Partly owing to this fact and partly due to increased efficiency of personnel all along the line, both the number of fires reported and the fire damage in 1916 were the smallest yet recorded. There were fought 272 fires, or approximately 60 per cent of last year's number. The total damage resulting was reduced from $15,675 to $1,826, a splendid record.

The fire statistics for the past year throw an interesting light on the greater efficiency of patrol. The percentage of fires of unknown origin, which has steadily decreased since intensive administration was established, has this year reached the

lowest stage yet, 25 per cent. Railways, from being the greatest menace to the forests, have reduced the percentage of fires so much that they have fallen to the bottom of the list, largely through the excellent patrol system established by authority of the Board of Railway Commissioners.

The higher percentage of forest fires due to fires left by campers, 22 per cent, indicates the need for still further educational work. Fires caused by lightning assume a relatively higher percentage than ever before, 20 per cent. During the past year despite the great decrease in fires recorded there was an increase in the absolute number of fires caused by lightning.

FOREST RESERVE ADMINISTRATION.

The forest reserves established in the dry belt portion of the Railway Belt owe their origin not mainly to the conservation of the timber resources thereon, which are relatively less important, but to the necessity of protecting the watersheds of innumerable rivers and creeks whose water, used for irrigation, is absolutely essential to the well being of this part of British Columbia.

A proper realization of this fact is being gained by the public at large and, together with the settlement of the agricultural lands difficulty, is dissipating adverse criticism of forest policy and administration. It would appear that we are coming appreciably nearer the goal sought, namely, full sympathic support by all sections of the community.

As set forth in detail in my report for 1915-16 it is urgent, if the Forestry Branch is going to guarantee to the public a proper fulfillment of the functions delegated to it, that additional watershed areas should be placed under permanent forest reserves.

The further development of favourable public opinion mentioned above has also been aided considerably during the past year by increased use of forest reserves, both in regard to resources in timber and hay, and for recreation in camping and fishing at Trout and Paul lakes.

There is in these two lakes what was described at the annual meeting of the Kamloops Fish and Game Protective Association as probably the most wonderful fishing on the continent of North America. The Forest Reserves regulations in regard to fishing are conserving this sport, and together with occasional restocking of the lakes by the Fisheries Branch will guarantee an unsurpassed attraction for tourists from all parts of the world.

The summer resort at Trout lake in the Long Lake forest reserve is growing in popularity yearly. Recently a very largely-signed petition was received asking for the establishment of a similar resort at Paul lake in the Niskonlith forest reserve, and it is hoped that action may be taken in regard to this matter during the coming year.

AGRICULTURAL LANDS.

Some mention should be made in this report of the procedure authorized in respect to the granting of homesteads in forest reserves. I mentioned in my last report the difficulty which had arisen in this district as a result of the retention of some lands of value for agriculture in the forest reserves, despite recommendations made over two years ago for their elimination. The arrangement for recognizing the rights of settlers or applicants for entry for such lands has largely removed this difficulty. Under this arrangement lands are not taken out of the jurisdiction of this branch until application for entry has been made, even though recommendation has been made by this branch for their elimination from the forest reserve.

This procedure while not in accordance with the policy advocated in my report for 1915-16 is probably a fair compromise. As it is a plan of administration co-ordinated with the Dominion Lands Branch, and having the support of the general

public, I consider that it is of very great value in forwarding the ends desired in forest policy, namely, efficient administration backed by the full support of all classes of the public.

GRAZING.

No further steps have been taken to establish grazing regulations on the forest reserves of British Columbia. Considering the present reduced condition of the staff it is probably necessary that this matter should be held in abeyance until after the war.

In my report for 1915-16 mention was made at some length of proposed regulations for the use of hay meadows on forest reserves. These regulations had the approval of the Interior Stock Breeders' Association and have been put into effect by Order in Council of December 19, 1916. Many applications for the use of meadows under these regulations have already been received and it is expected that much good will result, not only in increased prosperity to the grazing industry but also in a better understanding of the purposes of the reserves. The availability of these meadows for use will remove another of the criticisms sometimes made that the setting aside of forest reserves results in locking up natural resources and in preventing the development of the community.

FOREST INVESTIGATION.

Advantage has been taken of the application for sale, under the Forest Reserves regulations, of a large tract of timber of a sub-alpine type, on the summit of the Fly Hills forest reserve, to employ the regular forest rangers on a forest survey under the direction of Forest Assistant K. G. Wallensteen. This party while making the necessary examination preliminary to disposal under timber sale are also making the start in scientific silvical investigation, in this district, of this spruce-alpine fir type. This type covers large areas of the forest reserves and has in the past clothed practically all the summits of the interior plateau of British Columbia. This study is along the lines suggested by Mr. H. C. Wallin in his memorandum of January 2, 1917, advocating forest plan investigations, and should add considerably to the data now available on this type. This work also serves as a very valuable experience to the forest rangers employed. While no definite reports have been turned in as yet I am very well satisfied with the results obtained as shown to me during a recent visit to the scene of operations.

IMPROVEMENTS.

The favourable fire season permitted the giving of a great deal of attention to improvement work on the forest reserves. Practically all the rangers were thus employed either on new projects or on maintenance of existing ones for the greater part of the season. As a result most of the reserves are now completely equipped with the necessary trails, telephone lines, lookout stations, headquarters stations, and cache cabins. Special attention was paid to the last named, thirteen cabins being erected for storing fire-fighting equipment and to serve as stopping places for rangers on patrol. The district is thus in the fortunate position of being able to accept the reduction of allotments for the coming season and consequent cancellation of improvements with a fair assurance of success in combating fires.

PUBLICITY.

Although the exigencies of a much reduced staff prohibited the personal attention of forest officers to public education in the value of our work, still a great deal of good was accomplished among school children by the distribution of rulers and

blotters bearing appropriate inscriptions, and among users of the forest by the distribution of whet-stones, and by placing blotters in hotels, banks, etc. Articles bearing on forest administration were also written for the newspapers from time to time.

EQUIPMENT AND SUPPLIES.

Further additions to the fire-fighting equipment available were made during the year, principally for storage in the cache cabins mentioned above.

FIRE PROTECTION ON DOMINION LANDS.

The organization of fire protection on the forested areas within the Railway Belt, outside of forest reserves, differs from the work explained above in several essentials:—

(1) The object to be attained is not the protection of watershed areas lightly covered with inferior tree species but the conservation of merchantable timber resources whose value is direct rather than indirect;
(2) The system of patrol is not so intensive, nor have the ranger districts been opened up by improvements in communication and transportation to nearly the same extent;
(3) Administration of fire permit regulations, supervision of burning of settlers' slash, and the situation of fire-ranging districts close to the settled areas of the Railway Belt bring the fire rangers into much more intimate contact with the general public than is afforded to the forest rangers on reserves in the discharge of their duties;
(4) Appointments to the fire-ranging staff are only temporary instead of permanent as they should be to get the best results.

It will be seen readily that conditions 2 and 4 operate adversely in any endeavour to secure maximum efficiency. The general public, and particularly the lumbermen whose vital interests are at stake, find it hard to understand why the Forestry Branch should expend its best efforts on the least productive areas, the forest reserves, rather than in alleviating the conditions mentioned above, which undoubtedly detract from the value of the protection afforded the merchantable timber areas, most of which are held under license as timber berths.

It has, therefore, seemed advisable to put on record here some of the considerations which have affected the origin and development of the present system of fire protection established by this branch, namely, the forest reserve and the fire-ranging administrations. In the first place it should be understood that the latter system is an adaptation of the original organization established by the department when the Crown Timber agents were charged with the supervision of the fire-ranging staff. As the organization of the Forestry Branch was extended this work was gradually taken over by it, but in a large number of cases the actual field work continued to be handled by the Crown Timber agents, who reported on all matters relating to fire protection to the Superintendent of Forestry. A later development of the organization consisted in the appointment of separate chief fire rangers, in place of the Crown Timber agents, as supervising officers of the ranger staff. Later, on the setting apart of forest reserves in certain sections of the West, a separate field staff was organized for their management along the lines followed by the United States Forest Service. At the present time it may be considered that the whole work is in a transition stage. As further forest reserves are created the field organization is readjusted to conform to the altered status of the lands protected. The extension of the area under forest reserve, by parliament, has in general followed the spread of public sentiment in favour of adequate conservation of national resources. Consequently, action has been not continuous but intermittent and irregular. This is as it should be, for it is a

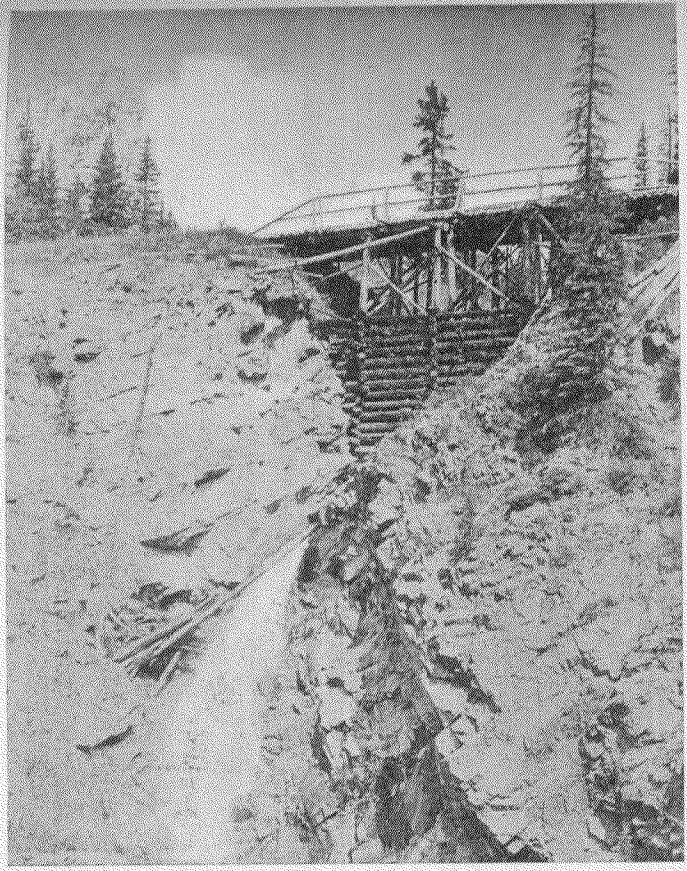

Photo 11071. J. Y. Greenwood.
Canyon bridge, Sheep river, Bow River forest reserve, Alberta.

Photo 11182. F. Nelmes.
Transporting supplies for winter survey, Niskonlith forest reserve, British Columbia.

fundamental axiom of democracy that governmental action to be lasting and effective must either follow public demand or result as the outcome of an educational campaign adequate to bring public opinion to the point where it will agree to and approve of radical changes in national policy. The experience of this branch has shown that where the people of this country realize that the welfare of the basic industry of Canada, namely agriculture, is directly concerned there will arise automatically from the people themselves a demand for action on the part of the government adequate to meet the situation. Where the connection is not directly apparent or where subsidiary industries are concerned there is a tendency to public indifference to the administration of natural resources, which may easily be fanned into opposition by self-seeking exploiters unless an educational campaign is waged by those having the ultimate good of the country, as a whole, at heart.

This aspect of the public thought is illustrated by referring to the conditions relative to the origin of the forest reserves in British Columbia and on the east slopes of the Rocky mountains in Alberta. In this province the initiative came from the community, in a request to the department to protect the watersheds of streams used for irrigation purposes by creating forest reserves. In Alberta the forest reserves were established as a result of an educative propoganda which impressed upon the thinking men of the Prairie Provinces the correlation between the mountain forests and the stream flow of the great rivers of the prairies.

It is necessary that a distinction be drawn between the nature of the country patrolled under the fire-ranging organization in the Prairie Provinces and in the Railway Belt of British Columbia. In the former instance, while there are undoubtedly areas which should be included in forest reserves, there are also large areas, particularly in the north country, where settlement is so remote and the timber so scattered and inaccessible as to make it probable that for a very long time at least these districts can best be handled by a loosely organized fire-ranging staff appointed for the danger season only. In British Columbia, on the other hand, the fire-ranging districts comprise areas containing either valuable stands of merchantable timber or well-established reproduction of calculable value, which should be given the utmost protection possible. Both transportation facilities and growth condition render the forests in this district, whether mature or in the younger age-classes, the hope and mainstay of future development in the lumbering industry. Consequently, the fire-ranging organization can only be considered as a temporary makeshift to fill in the gap till public sentiment forces the proper and necessary action, namely, the setting aside of all non-agricultural lands within the Railway Belt as forest reserves, with full administrative authority, a permanent staff, and an adequate improvement system developed on the ground.

The consummation of this plan is hindered both by the present state of public sentiment and by the interior organization of the department. As regards the former, I have mentioned in former reports the agitation raised against the forest reserve policy on the charge of locking up agricultural lands which, though largely unfounded, yet remains an obstacle not entirely overcome. Concerning the latter it is only necessary to refer to the address of Dr. B. E. Fernow on "Co-operation in Forestry" delivered at the sixth annual meeting of the Commission of Conservation, and printed on page 120 of the annual report of the Commission for 1915. It is doubtful if the creation of forest reserves and the application of reserve administration over these merchantable timber areas would result in any considerable reduction in the fire hazard, unless the management of the logging operations on timber berths were carried out in accordance with correct forestry practice as regards brush disposal. Such a reorganization of the department would appear to be a necessary corollary to the establishment of forest reserves over the remaining non-agricultural lands within the Railway Belt, as it offers, naturally, a relatively greater obstacle to further progress along this line than the mere obtaining of legislative action with respect to the status of the lands involved.

Such a broad increase in the scope of the functions of this branch could not be carried out without a considerable increase in the staff both of technically trained

foresters and competent men of experience in logging operations. Under present conditions it is doubtful whether the necessary staff could be obtained.

Provided, however, that the solution of this difficulty is arranged for I do not anticipate serious objections to such a reorganization on the part of the lumbermen operating in the Railway Belt, who comprise the section of the public most intimately concerned.

I think it might be safely stated that the lumbermen of the Railway Belt are not averse to paying out large sums of money on fire protection of their limits, providing they can be shown that an improvement in the fire risk results from more intensive organization and larger expenditure on the part of the Government. This view has been expressed publicly several times by lumbermen at the annual meetings of the fire rangers.

Whether or not new forest reserves, with their attendant necessities for increased staff, are established in the near future, it is time that thought be given to the matter of future appointments to the staff. The Order in Council directing that preference in all appointments be given to returned soldiers brings up the question of the necessity of establishing some safeguards to guarantee efficient officers. While no one can disagree with the policy of preferential treatment of our returned soldiers, yet the public interest requires that all officials should be fully qualified for their duties. I am of the opinion that the Government should go a step further in so far as appointment of forest officers is concerned and, following the procedure established in Europe, establish a vocational school to train returned soldiers for forest work. It is essential that only physically fit men be allowed to take such a course of instruction. From graduates of this school all necessary appointments could be made, so far as the number of men available would permit.

The routine work of the fire-ranging staff in this district during the past year was conducted in the same manner as detailed in previous reports. The generally favourable fire season, and close attention to work on the part of the rangers, resulted in very inconsiderable losses, as mentioned above.

In the Coast district, owing to the clearing off by lumber companies of several berths, resulting in the closing down of operations in the localities affected, it was found possible to reduce the number of rangers by two, leaving a total of twenty-one. Advantage was taken of favourable weather conditions to burn a large accumulation of logging débris, and to encourage and assist settlers in clearing up their slash. The Lookout Mountain lookout station, completed early in the season, gave first-class service and will undoubtedly be a great aid in preventing damage from forest fires.

Meetings of the rangers held in New Westminster at the opening and close of the fire-ranging season were productive of very interesting discussions and many practical suggestions for improvement in method.

In the Salmon Arm district it was necessary to increase the staff of rangers by two owing to the demands of the burning-permit business, bringing the number of men employed in the district up to eighteen.

One extra ranger was also employed in the Revelstoke district to provide an adequate protection to the great timber areas in the Spillamacheen River watershed, hitherto largely neglected.

In both these districts the settlers were co-operated with in the matter of burning brush. In most cases the ranger issuing the permit superintended the actual burning, a consideration which the settlers in general seem to have appreciated very much.

Publicity material distributed by rangers in all the districts has been of immense assistance in keeping the matter of forest protection constantly before the public.

A very enthusiastic ranger meeting was held in Revelstoke in October at which each of the rangers present contributed experiences and suggestions for the betterment of conditions in his particular district. Such meetings are of distinct value, not only in encouraging *esprit de corps* amongst the staff but also in providing a clearing-house for data, much of which is worked into the administration procedure in succeeding years.

RAILWAY FIRE-RANGING.

Co-operative work in the supervision of railway patrols, under General Order No. 107 of the Board of Railway Commissioners, was handled in the same manner as formerly, with excellent results. The railway companies concerned, namely, the Canadian Pacific Railway and the Kettle Valley Railway, gave the most careful consideration to all requests for action, and the only failures were due to labour conditions rather than to any disinclination on the part of the railway officials to conform with requirements.

The two suggestions made by myself to the Chief Fire Inspector of the Railway Board, which I consider would further increase the efficiency of fire prevention, have not been acted upon as yet, as he considers the time inopportune to lay further burdens upon the railway companies. They are, first, that all windows of smoking compartments of cars be screened to prevent the throwing of cigar or cigarette butts out of the train; and second, that when only one round trip per day is specified for section patrols that such patrol be performed in the afternoon. Records of the past few years show that an increasing number of fires are attributed to careless smokers on trains and, also, that most railway fires start or spread after mid-day. It is advisable that some action be taken along these lines in the future.

Co-operative work was also performed with the British Columbia Forest Branch in the supervision of railway patrols along the Canadian Northern railway, which was under provincial jurisdiction. Patrol measures were specified by myself early in the season and were carefully carried out by the company, as were also all suggestions for right-of-way improvements.

Thirty-three fires were attributed to railway causes during 1916, a reduction of 20 per cent from the preceding year. Of these about 80 per cent were set by coal-burning engines. No fires were reported as being set by oil-burning locomotives.

D. ROY CAMERON,
District Inspector of Forest Reserves for British Columbia.

APPENDIX No. 6.

This report concerns the progress of work in the Forest Products Laboratories of Canada for the fiscal year 1916-17.

Perhaps the most encouraging development during the year has been the widespread recognition of the place which scientific institutions must take in the systematic utilization of a country's natural resources. This, in turn, has been a stimulus to the Forest Products Laboratories in planning investigations on a comprehensive basis, and in organizing the division with more faith in the ultimate value of the work and with more confidence in the fuller co-operation which may be expected between this division of the Government service and the wood-using industries.

The progress of work in the laboratories has been considerably hampered by the absence of members of the staff on active service and the loss of others who have gone into munition work. The Division of Timber Tests has been at half strength, and the nucleus of the Division of Wood Preservation was disturbed by resignations for war work, without the opportunity of building up this division very far under present conditions. The Divisions of Timber Physics, and Pulp and Paper have been more fortunate. Important progress has been made in most of the lines of investigation

undertaken in the laboratories, and a special effort has been made to safeguard the basic organization and lay plans for more effective work when the pressure of war is relieved.

LIBRARY.

Library accessions during the year totalled 469, including books, pamphlets, government bulletins, etc. The total number of books on hand is 669, being an increase of 208 for the year. In addition to the above, 39 technical journals and periodicals have been received and indexed regularly. Progress reports of investigations are prepared monthly for the library and a number of special reports on tannins, potash from wood ashes, resinous wood distillation, wood flour, etc., have been filed. It is quite apparent that the library division has possibilities for increased usefulness in the way of carrying out literature studies, preparing concise reports on special subjects, working up miscellaneous articles for publication, and, in general, collecting information on forest products from all available sources and disseminating the same in proper form for the benefit of the Canadian public.

EXHIBITS.

During the year 36 trunk-bark specimens were prepared from logs of Canadian species for permanent exhibit at the laboratories. The preparation of sets of hand specimens has been going forward, about 600 specimens representing 11 species being finished by the end of the year. Suitable labels for 56 Canadian species have been ordered and it is the intention to distribute these labelled hand specimens of Canadian woods to schools and other institutions throughout the country. Process exhibits are in preparation to illustrate the raw materials, intermediate products, and final products in various wood-using industries. A set of specimens representing Canadian woods suitable for toy-making was prepared. A very fine collection of Canadian pulp and paper samples was placed in the care of the laboratories by the Canadian Pulp and Paper Association. The British Columbia Forest Branch has furnished an exhibit of western woods in finished form.

TIMBER PHYSICS.

A special bench for microscopical work, a large cabinet for storage of specimens, a work desk, etc., have given improved accommodation for this division. The equipment and supplies added during the year include microscope accessories, microtome knife, micrometer, electric drying oven, photographic supplies, and special chemicals.

The main work of this division has been the determination of physical and structural properties of the woods which have undergone mechanical test in the Division of Timber Tests. The special investigations discussed under "Testing Clear Specimens," "Drying of Wood," and "Fibre Measurements," show something of the scope of this work. Miscellaneous activities have included the working out and publishing of a new method of staining wood fibres, the replacing of celloidin by pyroxylin as an embedding material in mounting slides, the preparation of special reports on structural timbers, tannins, etc., and the distribution of 481 special slides of Canadian woods and fibres to 18 companies and other laboratories. The work of the division may be summarized as follows: Moisture determinations, 1,449; structural characteristics, 486; radial and tangential shrinkage, 75; specific gravity and volumetric shrinkage, 171; permanent microscopic slides, 379; duplicate slides, 1,448; temporary slides prepared and examined, 575; wood identifications, 108; fibre identifications, 119; fibre measurements, 12,680; special fibre mounts for use with lantern, 12; ordinary negatives, 159; photomicrographic negatives, 130; photographic prints, 1,218; copies, 114; lantern slides, 103.

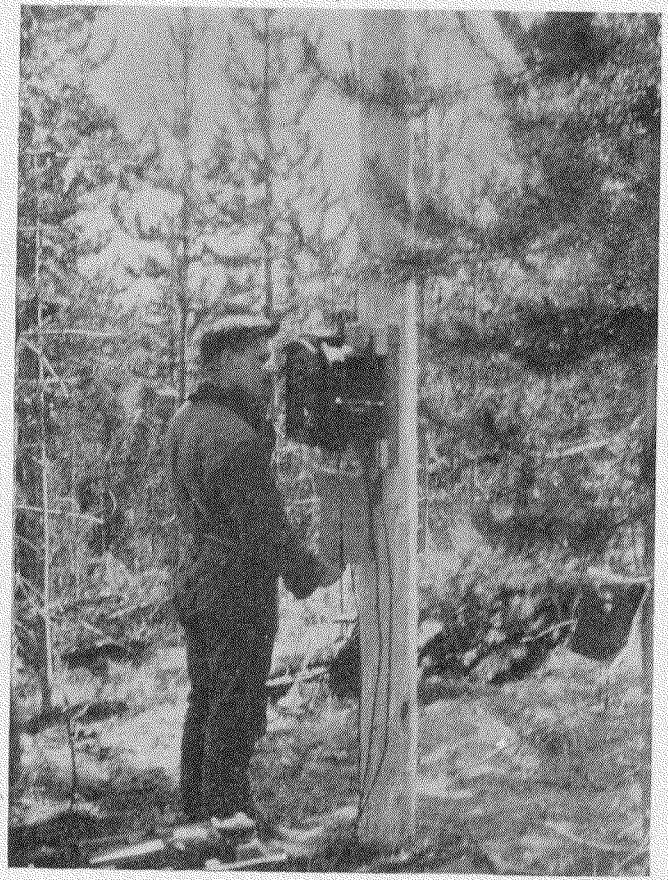

Photo 11204. F. Nelmes.
Telephone in use at Ridge mountain, Long Lake forest reserve, British Columbia.

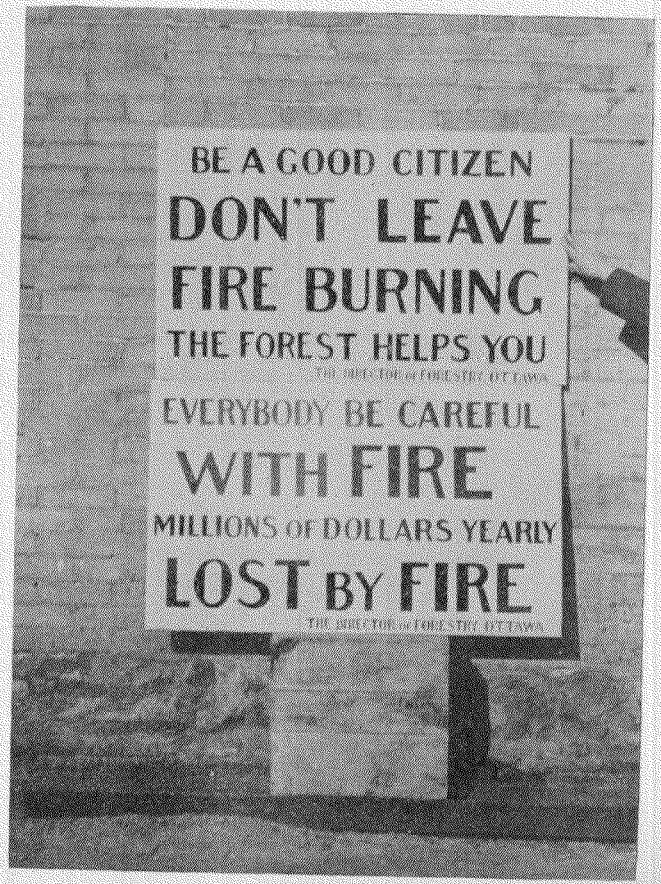

Photo 11406. Jas. Lawler.
Galvanized iron signs, four feet long by two-and-a half feet deep, for use on banks of northern rivers.

TIMBER TESTS.

The saw-mill has been transferred from the outskirts of the city to the yard of the laboratories. A new storage shed has also been built to relieve the congestion in the Division of Timber Tests as well as in the other divisions. One testing machine of the McGill laboratory previously available for our use has been taken over by the Imperial Munitions Board for testing war materials.

The main work of the division is covered under "Testing Clear Specimens" and "Nova Scotia Mine Timbers" in the discussion of special investigations. Other miscellaneous tests were made from time to time in order to provide data necessary to answer specific inquiries received, and in co-operation with the work of other divisions. A tentative outline was drawn up for a series of strength tests on Douglas fir timbers in structural sizes, in co-operation with the British Columbia Forest Branch.

PULP AND PAPER.

The paper machine room and chemical laboratory were greatly improved by constructing a tintometer room, paper-testing room, office, benches, experimental beater outfit, etc. Among the new equipment may be mentioned a measuring tank, pulp slowness tester, condenser, storage battery, mercury arc rectifier, hydraulic pressure pump, Ives tint photometer, water motor, pressure regulator, and chemical apparatus.

The main work of the Division of Pulp and Paper is covered under "Waste Sulphite Liquor," "Beating of Pulp," "Blotting Paper," "Pulpwood Measurements," "Chemistry of Wood," and "Sulphite Pulp," in the discussion of special investigations. Considerable time has been spent in perfecting the designs for the proposed experimental pulp-mill in co-operation with members of the Advisory Committee. A number of minor investigations have been carried on, mainly in order to make the unusual facilities of the experimental paper mill available to those working out special problems in this field. These include the comparison of steel and stone rolls for beating leatherboard stock, runs on paper sized by the "Waxine" process, the effect on pulp stock of long standing, the testing of a hydrated pulp and new paper filler, the bleaching qualities of certain pulps, the conversion of spruce planer shavings into sulphite pulp, the testing of absorbent paper for filtering oil, and the collecting of information on decayed balsam fir in pulpwood areas.

WOOD PRESERVATION.

In the laboratory for preservative treatment of wood the treating cylinder was provided with more condenser capacity, the steam and air lines were rearranged, recording instruments were installed, two storage tanks for oil were constructed, a large drying oven provided, and a number of miscellaneous items of equipment added. The pathological laboratory was improved by constructing a large cabinet for specimens, completing the fitting up of the fungus pit, etc.

The main work of the Division of Wood Preservation is covered under "Ties," "Paving Blocks," "Fence Posts," and "Durability of Wood," in the discussion of special investigations. Miscellaneous work has been done on the analysis of various preservative oils, impregnation of various woods with an emulsion of creosote oil and rosin soap, penetration tests with a special coal tar sample, the effect on flexibility of soaking elm in common salt, investigation of methods of accelerating the fruiting of wood-destroying fungi, examination of railway ties in the track to compare the relative importance of decay and mechanical wear, designing a new humidity apparatus, and collecting samples of wood preservatives and wood-destroying fungi.

MISCELLANEOUS WORK.

As mentioned in my last annual report, the problems concerning lumber deserve more attention than we can give them with the present staff, and a separate division should be established to deal with them. This industry is, of course, the largest con-

sumer of forest products, but being scattered throughout the country there is great difficulty in keeping in touch with its developments. The solution of its problems frequently depends to a very large extent on local conditions, and unless these can be studied by competent men on the spot proper assistance is impossible. The efficient utilization of many forms of wood waste, for instance, depends largely on an intimate knowledge of manufacturing conditions in all wood-using industries, which can only be obtained by first-hand investigation. Problems concerning the development of new lines of manufacture can only be studied in the light of accurate trade information. Some organization is necessary, also, to bring lumber dealers, and wood users generally, into closer touch with the information available to them in these laboratories.

Problems connected with the wood distillation industry have been prominently before us during the past year. Considerable work was accomplished in making available for cordite manufacture substitutes for acetone derived from the products of hardwood distillation. Part of the tar produced in this process has also been found of value as a substitute for imported pine oil used for ore flotation. As this tar creosote was previously burned for fuel the new use, if it works out as experiments indicate, will be of considerable advantage to both the mining and wood-distilling industries. The distillation of resinous woods, particularly red pine stumps and western yellow pine, has also received some attention but the work shows no prospect that this industry will become of early importance, since the yields of valuable products are low compared with those obtained from southern yellow pine.

Some little attention has been paid to the tannin extract industry and it seems likely that the collection of more complete information in regard to Canadian conditions in this matter would be of value. It is expected that something in this connection will be done during the coming summer.

Considerable interest has arisen of late regarding the manufacture of wood flour of grades suitable for use in dynamite manufacture. Practically all the wood flour used in America is imported from Norway but there is no reason why its manufacture should not become a Canadian industry since the requirements are simply cheap power and clean wood waste, particularly of spruce and white pine.

Besides the regular work in the divisions now operating, members of the staff have kept in touch as much as possible with all phases of work connected with forest products, with the result that information is now available on practically every question which may arise.

SPECIAL INVESTIGATIONS.

Testing Clear Specimens.—This is a comprehensive investigation to provide reliable data on the mechanical, physical, and structural properties of all the important Canadian woods. Test specimens are of rather small sizes and are cut in such a way as to be free from defect. The mechanical tests are static bending, impact bending, compression parallel to grain, compression perpendicular to grain, hardness, shear, cleavage, and tension perpendicular to grain. The physical tests include moisture content, specific gravity, volumetric and linear shrinkage, per cent sapwood, per cent summer-wood, rate of growth, and microscopic structure. The extensive test results on Douglas fir were assembled for publication as Forestry Branch Bulletin No 60 "Mechanical and Physical Properties of Canadian Woods—Douglas Fir". During the year five shipments of material were tested: black spruce, the so-called "grey" spruce (really black spruce), and white spruce from Quebec province; and white pine and red pine from Ontario. The mechanical tests totalled 1,042, moisture determinations 1,163, structural characteristics 446, radial and tangential shrinkage 75, specific gravity and volumetric shrinkage 116. In general, black spruce is somewhat stronger, stiffer, and tougher than white spruce; red pine is much stronger, harder, stiffer, and tougher than white pine. Red pine has also proved to be stronger in most respects than black spruce.

Nova Scotia Mine Timbers.—The strength tests on 270 props and booms in the green condition were completed in the summer of 1915. The duplicate specimens which have been allowed to season are now being tested in the air-dry condition, 60 booms being finished by the end of the year. Props are tested in 6-foot lengths as columns, and booms are tested as beams on a 12-foot span. Half of the specimen logs were seasoned with the bark intact and half peeled. The comparative rates of seasoning have been determined and it is expected that the tests will provide interesting data as to the value of peeling mine timbers before storing in the yards. The species under examination are black spruce, red spruce, balsam fir, yellow birch, white birch and jack pine.

Drying of Wood.—Modified plans have been drawn up for a rather comprehensive study of the drying of wood. A start has been made towards determining the fibre saturation point of five coniferous woods. It is intended to study the relation between shrinkage and moisture content, the variation of moisture content with changing humidity of the atmosphere at different temperatures, the rate of drying, and other factors which play such a large part in the proper choice of wood species for particular purposes.

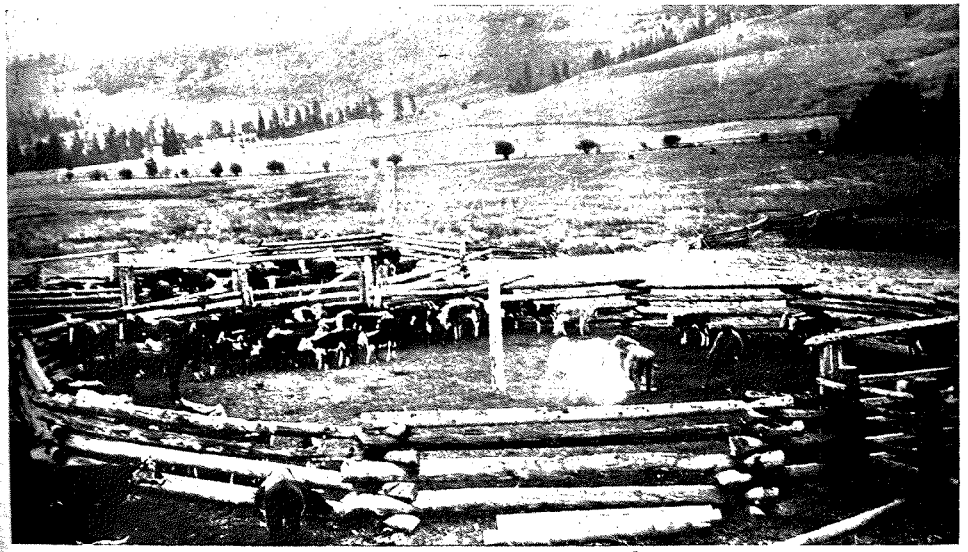

Photo 11258. D. W. Lusk.

Fall roundup of cattle, Niskonlith forest reserve, British Columbia.

Waste Sulphite Liquor.—No further experimental work has been attempted in this field but considerable time has been spent in making a literature study. By abstracting the technical articles which have appeared since work on waste sulphite liquor was first started, and classifying these in such a way that literature on various phases of this subject can be readily located, it is hoped that a publication can be turned out which will be a valuable reference for those connected with pulp and paper making, and which will also serve as a basis for experimental work that will be necessary in order to promote utilization of this enormous by-product.

Beating of Pulp.—A considerable amount of work has been done during the year in the study of the factors connected with the proper beating of paper pulp. Information has been obtained on the relation between peripheral speed, stock concentration, and horse-power consumption. Several methods have been investigated for determining the degree of hydration. Unfortunately progress has been hampered by inability to obtain foreign testing instruments and appliances.

Cross-ties.—The experimental work during the year has been confined to creosote treatment of jack pine and hemlock, which are two of the most important woods for railway cross-ties. Some 16 charges of jack pine and 4 charges of hemlock ties have received experimental treatment under different conditions of temperature, pressure, moisture, vacuum, etc. The sapwood of these species is penetrated by creosote fairly well, but the heartwood is very resistant to impregnation. Not much improvement is noticed by preliminary steaming and vacuum, but proper drying of the ties is important.

Acetone.—Reports and miscellaneous information have been submitted to the Imperial Munitions Board in connection with experimental and investigative work on acetone and substitutes as solvents in cordite manufacture. The new solvents proved successful, but there has not yet been need for using anything but pure acetone. The superintendent, as a representative of the Imperial Munitions Board, has been giving most of his time during the last half of the year to special work on acetone.

Blotting Paper.—A number of runs of blotting paper have been made under conditions found necessary in previous experiments, and a satisfactory grade has been made on the semi-commercial paper machine. Several thousands of these sample blotters have been printed and distributed by the Forestry Branch as forest fire protection notices.

Pulpwood Measurements.—Some further work has been done on the investigation of the feasibility of barking, chipping, drying and baling pulpwood for shipment to chemical pulp-mills. In view of the fact that saw-mills are at present burning slabs which contain raw material for good grades of pulp, data were obtained from saw-mills and a supply of slabs was carefully measured and chipped to determine the yield of chips per cord compared with rough or peeled round wood. The results are discussed in detail in a paper entitled "Pulpwood Measurements and some Factors involved in Chipping and Baling Pulpwood" published in the *Pulp and Paper Magazine,* December 15, 1916. Attention is being given to commercial tests on drying of pulpwood chips.

Potash.—No further experimental work was done, but correspondence and literature study were continued. A report on potash from wood ashes was prepared and copies were sent to interested parties. Recovery of potash is receiving a certain amount of attention commercially in Canada during the present shortage.

Chemistry of Wood.—Very satisfactory progress has been made on this project and this investigation has taken its place as a fundamental study of the chemical properties of Canadian woods, particularly in relation to pulp-making. A new method for the determination of cellulose has been brought out and other methods of wood analysis have been improved. Black spruce, white spruce, red spruce, balsam fir, and poplar have been studied to date.

Paving Blocks.—An experimental investigation of the creosote treatment of red pine paving blocks has been planned for, but there has been no opportunity to carry forward the work. In the meantime the results of tests, specifications, and recommendations regarding treated wood-block paving in the United States and elsewhere are being analyzed, so that the laboratories can properly keep in touch with the Canadian situation.

Fence-posts.—Twenty-two Russian poplar fence-posts from the Forest Nursery station, Indian Head, Saskatchewan, were seasoned and treated with creosote by the open tank process. Determinations of rate of seasoning, moisture content when treated, absorption, and penetration were also made. The treated posts were shipped back to Indian Head for a service test in comparison with untreated posts set in the ground under the same conditions.

Oils for Ore Flotation.—A special investigation of Canadian wood oils for flotation of Cobalt and other ores was actively carried on during the greater part of the year in co-operation with the Mines Branch. By-product creosote and ketone oils now available commercially in the hardwood distillation industry have in some cases given promise of successful substitution for pine oil now imported from the Southern States, and the results are being checked up on a commercial basis at Cobalt. Various oils obtained by small scale distillation of Canadian resinous woods, including red pine and western yellow pine stumps, have also been tested, but the prospects for utilizing this waste material are not so promising. Valuable data have been obtained on the physical and chemical properties of the various wood oils and fractions thereof. The results have been summarized in two papers, "Flotation Experiments with Canadian Wood Oils" and "Canadian Wood Oils for Ore Flotation," by R. E. Gilmore and C. S. Parsons, for publication in the Bulletin of the Canadian Mining Institute.

Durability of Wood.—One hundred and two test pieces, representing 11 wood species, of which 7 were conifers and 4 hardwoods, were exposed in specially prepared fungus beds to determine the relative natural durability in contact with the important wood-destroying fungi. The results have confirmed the fact that conifers are more resistant to decay than hardwoods, but improved methods of test will have to be worked out in this difficult field in order to throw more light on the important subject of wood decay. About 100 test pieces of Douglas fir have also been exposed to various fungi under different conditions, in culture jars, to establish the characteristics of Canada's most important structural timber.

Fibre Measurements.—About 12,000 fibre measurements have been made during the year to establish the variation in fibre dimensions of the wood throughout the tree. The species under examination were Douglas fir, black spruce, white spruce, red pine, and white pine. The results on the first species have been summarized in a paper entitled "Douglas Fir Fibre, with Special Reference to Length," by H. N. Lee and E. M. Smith, published in the *Forestry Quarterly,* December, 1916.

Sulphite Pulp.—A start has been made on the investigation of the sulphite cooking process, which is the most important method of converting pulpwood into valuable chemical pulp. With the small scale apparatus available studies have been made on the penetration of the cooking liquor into the wood under various conditions, with special reference to the effect of moisture content of the chips. The preliminary results have been published in a paper on "Wood as a Raw Material in Papermaking," by Dr. B. Johnsen, in the *Pulp and Paper Magazine,* April 5, 1917.

PUBLICATIONS.

The following are the publications of the year:—

Forestry Branch Bulletin No. 59, "Canadian Woods for Structural Timbers", by H. N. Lee, copies of which were distributed to persons interested.

"Testing of Pine Oil for Flotation", by J. S. Bates (published in *Monthly Bulletin* of the Canadian Mining Institute, June, 1916).

"The Preservative Treatment of Timber", by W. G. Mitchell (published in *Canada Lumberman,* June 15, 1916).

"The Fibre Structure of Canadian Woods", by H. N. Lee (published in *Canada Lumberman,* July 15, 1916).

"The Staining of Wood Fibres for Permanent Microscopic Mounts", by H. N. Lee (published in *Botanical Gazette,* October, 1916).

"Douglas Fir Fibre; with Special reference to Length", by H. N. Lee and E. M. Smith, published in *Forestry Quarterly,* December, 1916).

"Pulpwood Measurements and some Factors Involved in Chipping and Baling Pulpwood", by O. F. Bryant (read before Technical Section of the Canadian Pulp

and Paper Association, November 25, 1916, and published in *Pulp and Paper Magazine of Canada,* December 15, 1916).

"The Pulp and Paper Industry in Canada", by O. F. Bryant (published in *Pulp and Paper Magazine of Canada,* January 4, 1917).

"Wood as a Raw Material in Papermaking", by B. Johnsen (read before Technical Section of Canadian Pulp and Paper Association, January 31, 1917, and published in *Pulp and Paper Magazine* of Canada, April 5, 1917).

During the year a number of unpublished papers have been prepared by members of the staff for presentation before various societies, a list of which is as follows:—

"The Forest Products Laboratories of Canada", by J. A. Coderre (read before Chambre de Commerce, Montreal, April 5, 1916).

"Canada's Work in Forest Research", by W. B. Campbell (read before Canadian Forestry Association, Ottawa, January 15, 1917).

"Dry Rot in Buildings", by W. Kynoch (read before Canadian Lumbermen's Association, Toronto, February 6, 1917).

"Results of Strength Tests on Canadian Black Spruce, White Spruce, White Pine and Red Pine", by R. W. Sterns (read before Canadian Lumbermen's Association, Toronto, February 6, 1917).

"Utilization of the Raw Material from our Canadian Forests", by J. S. Bates (read before St. James Literary Society, Montreal, February 15, 1917).

"Acetone as a War Material and its Relation to the Hardwood Distillation Industry", by J. S. Bates (read before Ottawa Foresters' Club, March 7, 1917).

"Flotation Experiments with Canadian Wood Oils", by C.S. Parsons and R. E. Gilmore (read before Canadian Mining Institute, March 8, 1917).

PUBLICITY AND CO-OPERATION.

During the year several hundred visitors interested in wood-using industries and conservation have come to the laboratories to see the work which is being carried on.

More and more stress is being laid on co-operation with scientific societies, trade associations, and the wood-using industries in general. Co-ordination of the government scientific branches with the various industries of the country is really necessary in order to eliminate a great deal of overlapping and waste effort, to carry out investigations with a thorough understanding of Canadian conditions, and to achieve the practical commercial results which represent the ultimate benefit of such work to the country as a whole. The superintendent has served again as Chairman of the Technical Section of the Canadian Pulp and Paper Association, member of the Committee on Uses of Wood in Building Construction of the National Fire Protection Association, member of the Committee on Publicity of the American Wood Preservers' Association, and member of the Council of the Society of Chemical Industry. Members of the staff have attended meetings and taken an active part in the work of various associations and societies, and have visited industrial plants, etc., in different parts of the country in connection with collecting or furnishing information.

The general Advisory Committee to the laboratories has held three meetings during the year and has given valuable assistance in matters of general policy. Last fall the laboratories secured the active co-operation of the pulp and paper industry by the appointment of a special Advisory Committee to the Division of Pulp and Paper from the Technical Section of the Canadian Pulp and Paper Association.

INFORMATION FURNISHED.

The answering of inquiries regarding woods and their uses has become a more and more important function of the laboratories, as the public have become aware of this governmental source of information. About three hundred such reports were prepared during the year.

The information desired was mainly on the following subjects: strength of various species of wood; suitability of species for particular uses; uses of various kinds of wood waste; identification of wood specimens; technical methods of examination of wood; botany of trees; characteristics of wood fibres; production of tannin, gums and oils from various species; weights of various species; warping and checking of lumber; the moisture content of wood for certain uses; the processes of preservation applicable to various woods for various purposes; the distinctions between rolls of different materials in the beating of paper pulp; method for the determination of fermentable and non-fermentable sugars in waste sulphite liquor; the manufacture of wood flour; the "souring" of pulp when allowed to stand; uses of grasses in paper making; the chipping and baling of pulpwood; tests for pulp and paper; utilization of paper- and pulp-mill by-products; possibilities of hardwoods for mechanical pulp; recovery of pine oil from the sulphate process; durability of railroad ties; fungus attack on mine timbers. Besides these a host of minor inquiries from all parts of the country have been answered.

JOHN S. BATES,
Superintendent, Forest Products Laboratories of Canada.