DEPARTMENT OF THE INTERIOR, CANADA

FORESTRY BRANCH

ROLL OF HONOUR

Employees Enlisted for Active Service up to November 30, 1916.

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 Forest Reserve
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. Forest Reserve
A. E. Wyatt	Clerk	Indian Head, Sask.
R. H. Palmer	Chief Fire Ranger	Edmonton, Alta.
P. G. Leman	Forest Ranger	Bow River Forest Reserve
W. A. Delahaye	Student Assistant Survey Party	Alberta
G. E. Bothwell	Forest Assistant	Brazeau Forest Reserve
W. A. Lyndon	Forest Ranger	Crowsnest, Forest Reserve
G. G. Fuller	Forest Ranger	Bow River Forest Reserve
W. B. Campbell	Asst. Supt., For. Pro. Labs.	Montreal, Que.
L. L. Brown	Computing Engineer, 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 Forest Reserve
F. B. Robertson	Forest Assistant	Ottawa, Ont.
R. A. Spencer	Testing Engineer, For. Pro. Labs.	Montreal, Que.
J. W. Smith	Forest Ranger	Long Lake Forest Reserve
M. W. Maxwell	Testing Engineer, For. Pro. Labs.	Montreal, Que.
J. P. Alexander	Forest Assistant	Crowsnest Forest Reserve
W. J. Boyd	Forest Assistant	Ottawa, Ont.
R. G. Lewis	Forester	Ottawa, Ont.
T. Woodman	Forest Clerk	Lesser Slave Forest Reserve
C. R. McCort	Testing Engineer, For. Pro. Labs.	Montreal, Que.
D. C. Inman	Forest Ranger	Duck Mt. Forest Reserve
F. Haworth	Forest Clerk	Clearwater Forest Reserve
C. H. Morse	Asst. District Inspector	Calgary, Alta.
J. H. Vicars	Forest Clerk	Riding Mt. Forest Reserve
J. A. Hutchison	Acting Forest Assistant	Brazeau Forest Reserve
J. S. Holt	Forest Ranger	Sturgeon Forest Reserve
T. A. Millar	Forest Clerk	Brazeau Forest Reserve
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
R. Harvey	Dominion Fire Ranger	Winnipeg, Manitoba
L. C. Tilt	Forest Assistant	Winnipeg, Manitoba
S. J. Wade	Dominion Fire Ranger	New Westminster, B.C.
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.

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

REPORT

OF THE

DIRECTOR OF FORESTRY

FOR THE YEAR 1916

(PART VI, ANNUAL REPORT, DEPARTMENT OF THE INTERIOR, 1916.)

OTTAWA
PRINTED BY J. DE L. TACHÉ,
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1916

5305—1½

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REPORT OF THE DIRECTOR OF FORESTRY.

This report concerns the Forestry Branch for the year 1915-16 and the reports of the officials in charge of the outside divisions.

The conditions resulting from the war made it necessary to hold back the development of the work as far as the necessities of the case would permit. The protection of the valuable public property included in the forests cannot, however, be entirely set aside. Production from the forest is as necessary to the national prosperity as production of wealth from any other natural resource. Timber is required for the development of our own country. The needs for material for reconstruction in Europe after the war should be supplied to a large extent from Canada and correspondence from Europe indicates that that is the view taken there.

In this connection the following quotation from the report of a commission on afforestation in the United Kingdom submitted to the Imperial Government in 1909 is of interest:—

> Not only do the supplies of timber threaten to prove insufficient to meet the present demand, but it would appear also that the consumption per head of population in this and other countries shows a marked tendency to increase. So impressed are continental countries with the necessity of providing supplies, and so well satisfied are they with the social and financial results, that in most of them the tendency is to extend the wooded area. While your Commissioners are satisfied that under present conditions the forest wealth of northern Europe and North America is being exploited in such a way as to threaten the maintenance of supplies, with concurrent enhancement of price, we are not oblivious to the fact that civilized countries realizing the danger of the position are now giving increased attention to forest conservancy and to re-afforestation. In the United States and Canada, where immense destruction of timber occurs annually from forest fires, it is confidently anticipated that improved control will in future materially lessen this loss. Timber saved in this way will help to increase the supplies and to that extent will tend to diminish the gravity of the outlook. Something, too, may be hoped from the introduction of method into the re-afforestation of denuded areas, but how soon and to what extent such improvement will become effective it would be difficult to say. That the timber saved from fire and created by better methods of exploitation will have its effect on future supplies cannot be doubted; that it will in any sense overstock or even satisfy the market, your Commissioners do not believe.

The war has also affected the work of the Forestry Branch on account of the enlistment in the army of about thirty members of the staff whose names will be found in the Roll of Honour at the beginning of this report.

Lance-Corporal D. N. Trapnell, who was employed as an assistant in the Pulp and Paper Division of the Forest Products Laboratories and enlisted in 1914, was reported missing after the battle of St. Julien, and no more definite word could be obtained for a long time. Information has now been received that Mr. Trapnell after his unit had been reduced from 300 to 14 in the great fight started with his remaining companions to join the Canadians on their left. Having to leave their trench for the purpose, and while doing so, he was struck down by an enemy shell. He gave promise of being a very useful member of the staff of the Forest Products Laboratories and his loss is deeply regretted. Fortunately there have been no serious casualties among the remainder of the staff who are serving at the front.

The formal opening of the Forest Products Laboratories held on the 3rd of December, 1915, marks the final stage in the primary organization of the work of research in forest products. The interest in the establishment of the laboratories shown by the Lumbermen's Association, the Pulp and Paper Association, railway and construction companies, civil engineers and chemical engineers, indicates that they will fill an important place in the development of Canadian trade and industry and that such investigations have been begun at an opportune time, and when the need for the information they should furnish is being felt.

During the past year the weather has varied very much in different districts. The districts which usually have a light precipitation, such as the dry belt in British Columbia and southern Alberta and Saskatchewan, enjoyed a regular rainfall throughout the season. On the other hand districts where the precipitation is usually heavy, such as the coast district of British Columbia and the most northern parts of Manitoba, Saskatchewan and Alberta, were exceedingly dry and the danger of fire throughout the season was very great and the loss of timber considerable. The difficult fire situation in the coast district of British Columbia was well controlled and while the fire ran through considerable areas of timber slashings and settlers' clearings it was kept out of the green timber almost entirely, which demonstrates that a well organized and well managed fire patrol, with a reasonably adequate staff of rangers, can meet a very serious fire hazard successfully. On the other hand, in the northern parts of Manitoba, Saskatchewan and Alberta, the great extent of the country and the scarcity of population make the territory which each ranger patrols almost hopelessly large, while it is nearly always impossible to get sufficient help to cope with a fire of any size. As a result the loss of timber in these northern districts was considerable, although it is impossible to get an accurate record of it. The fires were numerous, many of them could not be reached and others in more accessible places were beyond the control of the men available before they were discovered. In such conditions the work of the rangers is mainly effective on its educative side. The main sources of danger from fire in the north are travellers including Indians. Indians generally have the reputation of being careful with fire but the occurrence of many fires at a distance from the regular routes of travel and on trails followed only by the Indians would indicate that they have not yet learned to take the necessary precautions. Railway construction is a great danger and this was specially demonstrated along the line of the Hudson Bay railway. The value of the timber is not sufficiently realized and its protection is not considered seriously enough by the public in general, or even by those charged with public administration in the districts referred to.

No additions were made to the forest reserves during the year. Considerable improvement work was done on most of the reserves, thereby improving the system of protection and making accessible natural resources of the reserves not previously available.

A stock of trees for reforestation has now been provided at the forest nursery and the reforestation of denuded lands in the reserves will be taken up actively in the season of 1916, and it is expected that an increased stock of trees will be provided from year to year, so that the re-stocking of the reserves will be carried out systematically. Reforestation has been delayed for two reasons: first, the necessity for providing adequate protection from fire before any large expenditure in making plantations would be justified; and, second, the growth of stock at the nursery station. The former difficulty is now fairly well provided against, and steps are now being taken to provide a regular supply of stock for planting each year.

The question of colonization in an open prairie country, where the soil is generally good, is a simple one, but in the northern parts of Manitoba, Saskatchewan and Alberta settlement is going into a country which is largely wooded, where there are considerable areas of poor soil (rocky or sandy), of high and broken land, and of muskeg and swamp not easily drained. In a country of such a character there

must necessarily be for its best development and for the support of the largest population, a good proportion kept permanently in forest. This branch has been endeavouring to approach the problem from the point of view of its special responsibility, and has been, by special exploratory surveys, locating the lands which it is considered should be permanent forest lands. For the best results in the development of the country, however, close co-operation of the agricultural, colonization and forest interests is necessary.

The more permanent the basis on which the development of the country can be built up the better. It is only where there is a basis of permanency that industries can be built up. There are many classes of industries that depend on the forest for their raw material, and on the permanence of the forest depends the establishment and continuance of such manufactures. The speculative phase of development will have to pass and give place to a rational system which has in view the permanence of industries and the security of homes dependent thereon.

While the necessity for setting apart the lands to be used permanently for timber production is obvious, a decision is sometimes difficult to reach as to the best use which can be made of a particular tract of land under the existing conditions, and even a decision reached on the existing conditions may have to be modified later by the changes resulting from the development of the country. As the development of agriculture and forestry are closely related and in many ways interdependent it has been felt that the assistance of agricultural experts would be of great value in determining whether lands are best suited for agriculture or forestry. Co-operation in this work has already been arranged with the agricultural colleges in Manitoba and Saskatchewan, and it is hoped to arrange for similar co-operation in the other provinces.

Dr. B. E. Fernow, Dean of the Faculty of Forestry of the University of Toronto, made a visit to some of the Dominion forest reserves in order to gain information in regard to the conditions thereon, so that he could better instruct the students who are passing through the forest school into the Dominion forest service in regard to the particular problems that they meet, and so that he might give some suggestions as to the work that should be carried out on the reserves. As a result of this inspection Dr. Fernow has submitted a report containing some suggestions for the management of the reserves. The suggestions are briefly as follows:—

All the forest reserves which have now a ready market for their materials or may be expected within a short time to come into the market should be prepared for technical management at once. By technical management is meant a proper location of areas in which cutting should take place and provision for replacing the harvested crop by another, either through natural regeneration or planting, or, in other words, introducing silvicultural practice.

For this purpose it is necessary to secure the data for a working plan and to elaborate the plan. This would involve a survey of sufficient accuracy and with sufficient topographic data to base thereon a fairly permanent subdivision into working units and to permit the locating of stands of timber of varying description and age; a descriptive area table giving an insight into the character of the different stands, especially those mature or near maturity and within reach of market; and an inquiry into market conditions for the various wood materials available. With such data it would be possible to determine a permissible cut with a view to guarding the future.

The most important need in addition is the development of silvicultural knowledge which can only be obtained by experiment and careful field study by very competent men. For this purpose in each of the forest reserves the biological conditions must first be examined to come to a conclusion as to what special problems are to be solved and a series of experimental areas or plots must be laid out on which to work out the best solution.

Several special problems, as indicated below, are pointed out for investigation as samples of the work required.

Photo. 10832. R. H. Campbell.

Ingenious lookout in the top of a tall spruce, being the East Lookout of the Porcupine forest reserve, Saskatchewan.

The aspen poplar covers a large area in a number of the forest reserves in Manitoba and Saskatchewan, its prominence being undoubtedly due to fires which have occurred in the past. Spruce is a more valuable tree and must be re-established in competition with the aspen. The chief difficulty in the way is the removal of the aspen. Aspen is useful in many ways; for fuel, pulp, flooring and lumber, small woodenware, boxes, crates and excelsior. Industries for the use of aspen in such ways might be established. A large proportion of the larger sized aspen is diseased and "punky" which makes its profitable removal a still more difficult question, and the utilization of such diseased wood requires special study. The chief difficulty in the reproduction of spruce will come from the dense underbrush, especially hazel, which is found on many of the reserves. It is so dense that it prevents natural seeding and would choke out the young growth if planted. Experiments are needed to determine the cheapest effective method of dealing with this problem.

The desire of the forester is to secure his crop, if possible, by natural regeneration; that is, to handle the mature crop so that the seeds falling from it establish the new

Photo. 10836. R. H. Campbell,

View looking westward from the East Lookout, Porcupine forest reserve, Saskatchewan.

crop before the seed trees are all removed; this in order to avoid the outlay for planting. But there are large areas in these reserves on which no old crop of desirable species is to be found, and it becomes necessary to establish such species by planting. The problem then is to find the most suitable species and the cheapest successful manner of propagation.

To gain an insight as to what species to introduce, trial plantations on a small scale are needed.

Not only in the forestless reserves and where desirable species are lacking, but also in the well-wooded ones, planting will be found often preferable to reliance on natural regeneration.

While the apparent economy in relying on nature's ability to establish a new crop is in favour of natural regeneration, avoiding the cash outlay necessary to start the crop by artificial means, sowing or planting by hand often proves the cheaper in the end.

To use nature as a planter requires not only knowledge, judgment and skill but also fortunate weather conditions, satisfactory seed production and favourable conditions of the ground for germination and growth of the seedlings. This combination of favourable circumstances does not occur frequently. On the other hand, by growing seedlings in nurseries where they can be given the best care, and setting out plants, success can be forced and time, especially, can be saved. Hence, early attention should be given to finding out the best materials and methods of planting.

The jack pine, which is the tree generally occurring on the sand lands throughout the west, is a useful one especially for posts and railway ties. It reproduces prolifically on such lands and forms very dense young stands, the density of which interferes with the development of the trees. Experiments in thinning with this species are desirable to see how the best production can be brought about. Experiments in thinning should also be made with other species.

The muskeg areas also present a special problem as the rates of growth in them are much retarded and they are in general a subject of special interest on account of their extent.

The disposal, profitably, of the fire-killed and fallen timber over a large area of the Rocky Mountain forest reserve is a special problem that requires study.

Dr. Fernow concludes his review of the situation as follows:—

> There are then a host of problems which it takes time to solve. Their solution should be attempted at an early date. This is possible by experiment on a small scale before the necessity of solving them on a large scale arrives. But it should be realized that the answers to these inquiries by experiment come as slowly, almost, as the crop itself for which they are made. In this connection, however, I may add that, apparently, the rate of growth in the prairie reserves is unusually rapid and hence the deterrent, long-time element is less obvious.

The rapid growth of trees on the forest reserves in the prairie provinces as noted by Dr. Fernow is specially gratifying and promising. It indicates that the results that can be obtained from the forests on these reserves are fully equal to the best results in the forests of Europe.

As was pointed out in the report of last year, and as is emphasized by the report of Dr. Fernow, a scientific study of the conditions and mode of development of Canadian forests is necessary for their proper management. Special studies of this nature have been found necessary in every country where forestry has been developed. The advisory committee, organized as referred to in last year's report to consider and recommend the special studies to be undertaken, have made a report suggesting some lines of investigation that require immediate attention, but the scarcity of men resulting from the war and the necessity for economy from the same cause have made it impossible to undertake any special organization for such work.

APPROPRIATION.

The appropriation for the year was $750,000. The expenditure was divided as follows:—

Salaries at head office	$ 13,703 17
" of officials on military leave	14,444 10
Travelling expenses	1,592 66
Printing and stationery	23,174 08
Miscellaneous expenses at head office	2,147 25
Statistics	5,867 16
Forest surveys	20,022 57
Fire ranging	193,911 98
Forest reserves	347,382 92
Tree planting	49,773 12
Forest Products Laboratories	61,018 22
War appropriation	10,528 07
Total	$743,565 30

(NOTE.—The item of $10,528.07 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	$107,168 38
Saskatchewan	137,244 23
Alberta	202,626 70
British Columbia (Railway Belt)	114,278 16
Total	$561,317 47

CORRESPONDENCE.

The letters received and sent out by this branch were as follows: Number of letters received, 25,265. Mail sent out: Letters, circulars, etc, 57,761; bulletins and reports, 35,729; parcels, 224. Total, 118,979.

LIBRARY.

The library of the branch is increasing in value as an assistance to the work of the branch. Seventy-three books and 658 pamphlets have been received during the year. Sixty-three periodical publications have been received, thirty-two of these by subscription and the remainder by exchange or gratuitously. As the number of publications on file increases the necessity is more and more evident of confining the library strictly to the literature of forestry proper and those branches of science having the most direct bearing thereon. A branch library is being arranged for the district office for British Columbia at Kamloops. Steps are also being taken to provide small libraries of a few necessary reference works in the subordinate field offices connected with the branch. The total number of photographs in the collection of the branch is approximately 8,150, an increase of some 1,550 during the past year. These are found very valuable to show the types of forest and the class of work which is being done and have been used to illustrate bulletins issued by the branch.

PUBLICATIONS.

In pursuance of the policy of the branch a printing and publications costs record has been established, by which the cost of each item will be instantly available, so that the greatest economy may be secured along with the greatest efficiency in this work. Each piece of printing, however large or small, is carefully gone over with the view on the one hand of eliminating any avoidable expense, and on the other of making the printed matter as suitable as possible for the duty it is intended to fulfil.

That side of the publicity work connected with daily and weekly newspapers and other periodicals has been fully maintained, the amount of information presented in circular form being somewhat reduced while that in the form of individual statements and articles was considerably increased. Canadian newspapers, as in the past, greatly assisted the branch in urging forest fire prevention and forest conservation upon citizens and in explaining the work done for Canadian producers by the Forest Products Laboratories of Canada.

During the year the following publications were issued:—

Bulletin No. 52.—Forest Products of Canada, 1913 (French Edition).
" No. 53.—Timber Conditions in the Smoky River Valley and Grande-Prairie Country.
" No. 54.—Forest Products of Canada, 1914. Pulpwood.
" No. 55.—Forest Products of Canada, 1914. Poles and Cross-Ties.
" No. 1.—Tree Planting on the Prairies (6th Edition).
" No. 10.—The Farmer's Plantation (2nd Edition).
Circular No. 1.—General Suggestions for the Preparation of the Soil for Tree Planting. (Reprint).
" No. 3.—Government Co-operation in Forest Tree Planting. (Reprint).
" No. 5.—Planning a Tree Plantation for a Prairie Homestead. (3rd Edition).
" No. 11.—The Relation of Forestry to the Development of the Country.

STATISTICS.

A distinct advance has been made in the work of collecting forest products statistics in the form of co-operative arrangements made with the provincial forest services. The arrangement entered into with the Quebec Forest Service has been in operation for two years and has proved highly satisfactory to both administrations. The returns received from the Forest Branch of British Columbia, unfortunately, were received too late last year to be included in the annual bulletins which were consequently compiled from reports received by the Dominion Forestry Branch. This year, however, the figures to be published for 1915 covering the province of British Columbia were all gathered by the staff of the provincial administration.

The study of the wood-using industries of Quebec has been completed and the bulletin based on the information gathered will be published some time during the coming summer. A study of the wood-using industries of British Columbia made by officers of the provincial organization is being compiled and edited at the Dominion Forestry Branch and will also be published in bulletin form.

The annual bulletin on pulpwood consumption for the calendar year 1915 which is now in the printer's hands, brings out the remarkably steady growth of pulp manufacture in Canada in the last eight years. In 1908, when forest products statistics were first gathered and published by the Forestry Branch, Canada exported in the raw state 889,409 cords of pulpwood and manufactured in her own mills only 482,777 cords. In 1915 the order was reversed, 949,714 cords being exported as compared to 1,405,836 cords made into pulp in our own pulpmills. The total cut of pulpwood was 2,355,550 cords in 1915, valued at $15,590,330, of which 59·7 per cent was used in making pulp in Canada and the remaining 40·3 per cent was exported to the United States in the unmanufactured state. It is estimated that 1,074,805 tons of air-dry pulp were made from wood in Canada in 1915.

The following is an estimate from the information available of the total value of forest products in Canada during the calendar year 1915:—

Lumber, lath and shingles	$ 69,750,000
Firewood	60,650,000
Pulpwood	15,750,000
Fence posts and rails	9,000,000
Cross-ties	3,500,000
Square timber exported	480,000
Cooperage	1,400,000
Poles	500,000
Logs exported	1,325,000
Tanning materials	170,000
Round mining timbers	680,000
Miscellaneous exports	175,000
" products	9,500,000
Total	$172,880,000

WOODLOTS.

There were a number of inquiries in regard to the care of trees and the management of woodlots received during the year and in a number of cases the properties were visited and suggestions made for the establishment or management of woodlots. There is an increasing interest shown in the possibility of obtaining value from such lands on farms as have no agricultural usefulness, and an appreciation of and desire for good forest management.

TREE PLANTING.

It is gratifying to know that the provision of larger nursery accommodation and a greater supply of trees for distribution for planting on the farms has been fully justified by the increasing demand. Although the number of trees distributed in the

Photo. 10247. B. R. Morton.

Planting on forest reserves. Taking two-year-old jack pine seedlings out of nursery beds.

Photo. 10231. B. R. Morton.

Planting on forest reserves. Planting four-year-old jack pine transplants.

spring of 1916 was 4,571,475 as compared with 3,730,375 in the spring of 1915, the average number which was given to each applicant in 1916 was only 877 trees, as compared with 1,078 trees in 1915, so greatly had the number of applicants increased. The applications for 1916 were 5,210 as compared with 3,459 in 1915.

The new forest nursery at Sutherland is now in good order and stock amounting to 1,142,000 trees was available for distribution in the spring of 1916.

The first part of the season was rather dry and unfavourable to the starting of plantations, and there were several late and severe frosts. In spite of these difficulties the plantations set out made satisfactory progress with the exception of those made from cuttings which were below the average.

It is interesting to note that the Government of the United States, after a careful examination of the work done by the Tree-Planting Division of this department, has decided to adopt a similar plan for supplying trees to the farmers of the western prairie states.

It has now been possible in the nurseries to provide stock for reforestation work on the forest reserves and planting will be done on several reserves in the spring of 1916. It is expected that this work will be gradually developed and extended.

FIRES.

The character of the season varied very much in different localities. The early part was dry in southern Manitoba and the whole season was unusually dry throughout northern Manitoba, Saskatchewan and Alberta. In the coast district of British Columbia the precipitation was light during a considerable portion of the season. Throughout the other districts the rainfall was sufficiently regular to keep the fire danger well in control.

Usually the most dangerous period for fires is in the spring months after the winter snow is gone and before the new vegetation has started. When warm weather comes early, taking off the snow, and is succeeded by cold which checks the new growth the danger season is prolonged and makes control very difficult. The danger comes from the dead leaves and grass of the previous year, which are highly combustible, and from the frequent and violent winds that prevail at that period. To show the extent to which winds may affect the situation a statement is given hereunder of the number of windy days in the months of April, May and June in several districts, as shown by the records of the Meteorological Service:—

	Number of Windy Days in		
	April.	May.	June.
Edmonton	25	24	24
Calgary	20	13	18
Battleford	25	24	23
Winnipeg	23	24	24

The number of fires reported in detail during the year was 1,455, of which 1,112 were small fires, and 343 large fires covering over ten acres each. The total area burned over was 905,828 acres and the quantity of timber destroyed 223,908,000 feet board measure, and of smaller-sized trees 2,415,921 cords. These totals do not include fires along the Hudson Bay Railway line or fires in the most northern parts of Manitoba, Saskatchewan and Alberta in regard to which detailed reports were not received.

The causes of fires were as follows:—

	Number of Fires.	Percentage.
Railways	123	8·46
Saw-mills and logging	34	2·33
Brush burning (other than by settlers)	10	0·68
Settlers	246	16·90
Campers and travellers	410	28·18
Incendiary	14	0·97
Lightning	60	4·13
Other causes	30	2·07
Unknown causes	528	36·28
Total	1,455	100·00

The chief known cause of fire was "campers and travellers" which emphasizes the fact that until care with fire becomes a universal habit, which can be brought about only by persistent education on the subject, danger will come from the carelessness of those travelling through the forests. In the previous year the chief cause was the clearing of lands by settlers and perhaps the relative position of these two causes this year was owing more to the fact that the districts where settlement is developing had a regular precipitation while those farther north traversed only by travellers were unusually dry. The railways hold third place and it is probable that this will be their relative position in the future for some years to come.

As I pointed out last year, outside of British Columbia, the legal provisions for the control of fire used in clearing land are entirely inadequate. Neither the provincial fire Acts nor the Dominion lands regulations give the fire ranger any control, even in the best timbered districts, of the setting out of fire, and unless the control is preventive it never can be fully successful.

The statistics of fires as given above are not complete, as the reports from the northern districts were not sufficiently definite owing to the great extent of country and the small number of rangers. Along the Hudson Bay railway there is no information as to the number of fires but an examination of the tracts over which the fires ran gives an approximate area of one million acres. In the McMurray district on the lower Athabaska river there were over one hundred fires reported, most of which were small. One large fire burned nearly one hundred thousand acres. Along the lower Peace river, lake Athabaska, Great Slave river and Mackenzie river there were a large number of fires owing to the specially dry season but it was impossible to reach or handle most of them owing to the large extent of country, the smallness of the patrol staff and the almost entire absence of permanent population. In such conditions the work of the fire ranger is almost purely educative and he can do little beyond.

The causes of the fires in the northern districts are campers and travellers, including prospectors and even surveyors. An unfounded report of rich finds of ore at the east end of lake Athabaska took a number of prospectors into that district. The Indians are usually credited with being careful with fire, but unless the Indians are responsible for them it is hard to understand the starting of fires during the past season far from the regular routes of travel and on trails that are frequented only by Indians.

FIRES AND RAILWAYS.

The fire patrol system on the railways under the authority of the Board of Railway Commissioners for Canada is becoming more thoroughly systematized from year to year, and the railway companies are generally taking their share of the responsibility in a more satisfactory way. The inspection of the patrols was carried on by four inspectors under the chief inspector, whose duty it was to see that the patrols were acting as ordered by the Board and had the necessary equipment. The patrols were from 15 miles to 35 miles in length and were covered by patrolmen with velocipedes or power speeders. The organization and the system of checking patrols has been specially well worked out on the Canadian Northern railway.

The locomotives were inspected regularly and were generally found in good condition to prevent the escape of sparks. In 255 inspections made only eleven locomotives were found defective.

The railway companies are observing the regulations requiring the clearing of the right of way of combustible material and the conditions on the right of way have greatly improved, but the slash resulting from tie cutting and other operations outside of the right of way is unfortunately still greatly in evidence and does much to nullify the good effects of the better protection on the right of way.

The most unsatisfactory condition in connection with the railways was along the line of the Hudson Bay railway which, being a government line, is not subject

to the jurisdiction of the Board of Railway Commissioners, and over which the inspectors of the Forestry Branch could not exercise authority. The locomotives used on the road were in a defective condition, eleven out of twelve being found so on inspection. Sufficient care was not taken by the contractors in clearing the right of way to prevent fire spreading. With this situation, combined with a specially dry season, there was unfortunately a great deal of fire along the route with the result that some 1,000,000 acres which were mostly covered with trees of greater or less value were burned over. The best methods of protection for this line have been discussed with the Department of Railways and Canals, and a plan of co-operation has been arranged which it is hoped will result in better enforcement of the terms of the contract in regard to equipment of locomotives and prevention of fire and in more satisfactory conditions for the coming year.

FOREST RESERVES.

There are two requirements coming out more clearly with the development of the forest reserves as absolutely necessary to their proper administration.

The first is a staff who are qualified for and interested in their work. So much depends on the initiative and the energy of the forest ranger and he is for so large a part of his time, necessarily, working without immediate supervision that a merely perfunctory interest in the forest on the part of the ranger is disastrous. The plotting on the reserves of the fires occurring from year to year shows very clearly the rangers that are careless and the heavy and irreparable losses that result.

The second is organization and preparation. Fire-fighting is generally considered as something that may be dealt with as an emergency on the spur of the moment, but experience shows that such a policy accomplishes little. The facilities for reaching and handling fire must be provided beforehand, the methods by which it is to be fought must be worked out and the provision of men, equipment and supplies arranged for. If this work of preparation is not done effective results cannot be obtained when the emergency comes. No less true is it of forest management. There must be a planning and looking ahead that will keep the forest reproducing or greater expense will be required later to repair the damage done by careless operations.

Staff.—The permanent staff on the forest reserves is as follows: district inspectors, 4; supervisors, 9; forest assistants, 13; forest rangers, 79; office staff, 17; total, 122.

The inspection districts are arranged generally so as to coincide with provincial boundaries and each inspector is responsible for all work on the forest reserves and for the fire patrols in localities outside of the reserves in his district. The supervisor is in charge of one forest reserve, or in one case of a group of reserves, and in some cases is a technically trained forester and sometimes not. He must, however, always be a good administrator. The forest assistant is always a technically trained forester and gives special attention to the technical side of the work while gaining experience in administration. Each ranger has a district of the reserve, for the protection and management of which he is responsible under the instructions of the supervisor. The lack of winter work on the forest reserves, owing to the smallness of the timber operations and the fact that the operations on licensed berths are not under the supervision of the forest reserve staff, makes it necessary to keep the number of permanent rangers as small and the size of the ranger districts as large as possible, and to use temporary help largely during the summer when improvement work can be done and protection is required.

Photo. 10230. B. R. Morton.

Planting on forest reserves. Carrying jack pine transplants to planters close at hand.

Photo. 10248. B. R. Morton.

Planting on forest reserves. Heeling in two-year-old jack pine seedlings.

Improvements.—The necessary improvement work for the protection of the forest reserves has been continued during the past year. The following is a statement of the improvements and their cost:—

SUMMARY of Improvements and Cost.

Class of Project.	No.	Total cost.*	Average. cost.
		$	$
Ranger houses, new construction	13	16,164	1,243
" maintenance	24	1,503	63
Ranger cabins, new construction	48	11,644	242
" maintenance	30	1,502	50
Stables, new construction	35	6,599	189
" maintenance	17	610	36
Other buildings, new construction	18	1,279	71
Lookout towers, new construction	12	1,729	144
Bridges, new construction	10	800	80
	miles		
Telephone line, new construction	231	15,968	69
" maintenance	215	1,316	6
Fireguards cleared	66	3,106	47
" plowed	158	1,117	7
Roads, new construction	240	14,004	60
" maintenance	211	2,016	9
Trails, new construction	665	29,582	59
" maintenance	596	3,433	6
Other improvements such as fences, etc	.....	7,716	.....

*Including cost of ranger labour.

On some of the older reserves the system of improvements has nearly reached completion and on all except the most recently organized the plans are all now fully laid out. The roads and trails have been planned to connect the headquarters of each reserve with the ranger districts and to give access to all parts of each of such districts. The best lookout points have been located and made accessible. There now remains the provision of methods of communication, for the rapid conveyance of information is essential. For this purpose the telephone is one of the most reliable means and telephone systems are planned for all the reserves. The general plan for the telephone lines on the Rocky Mountains forest reserve, the most extensive of all, has been worked out and construction will now be steadily undertaken. The planning of this system has required a great deal of care and consideration as there are many factors to be provided for, if such a long and widespread series of connections is to work satisfactorily. Until the telephone system can be completed, and even afterwards as an auxiliary thereto, it is proposed to use a system of signalling by heliograph or otherwise, wherever it is possible and the rangers can be trained to its use.

Timber Operations.—The farmers in the West were in a better position last year to take out timber permits, but the heavy snow and severe winter weather interfered considerably with operations in the forest. The number of permits issued was 3,153, and the quantity cut thereunder was 4,475,493 feet board measure, 31,000 cords, 807,697 building logs, besides other products. The number of free permits was 1,973.

The number of sales of timber on which operations were carried on during the year was eighteen, five of which were made during the past year. These sales are of small quantities of timber, the regulations not authorizing the disposal of more than five million feet in any sale. The cut of saw-timber was 2,057,107 feet board measure, and of mine props 1,384,801 feet board measure and 632,938 lineal feet.

Both on permit and sale operations the disposal of debris has been carried out in some places remarkably well, in others only fairly satisfactorily. The thorough and careful manner in which low stumps have been cut and in which the debris of logging has been piled and burnt on some of the sales demonstrates the feasibility, financially and otherwise, of such an improvement in methods. Some of the operators go so far as to say that they consider the cost of disposal of the brush as nothing, as the advantage of having a clean floor on which to skid the logs compensates for the trouble of burning. The difficulty of having such an improvement in operations carried out arises from several causes: (1) lack of knowledge of what is required which can be removed only by education; (2) fear of the additional expense that may be involved, and (3) the idea that some operators start in with that what should be done is not to try to live up to the terms of the sale but to see how much they can get out of doing.

The danger from old slashings is the worst menace that the forests have and to perpetuate such conditions and increase the danger by allowing further slashings to accumulate is, in the present stage of development, almost criminal and would set back progress in forest management indefinitely.

Fires.—There were 205 fires in the forest reserves which covered a total area of 359,938 acres and damaged 70,554,000 feet board measure of timber and 1,072,000 cords of wood. Settlers are in the lead as a cause of fire, closely followed by "campers and travellers," and these two causes were responsible for nearly half of the fires.

The plotting of the fires on the reserves for several years shows that most of them occur on the edge of the reserve or come in from outside of it, so that more stringent regulation and legislation are required on the wooded lands in the immediate vicinity of the reserve. The incendiary fires, though small in number, indicate an unsatisfactory condition of public opinion in some districts, but this has been met by several prosecutions in such cases, and it is hoped will be remedied in time by education as to the value of the forest, to which special attention is being given.

Cause.	Number of Fires.	Percentage.
Railways	18	8·78
Brush burning	4	1·95
Settlers	49	23·90
Campers and travellers	44	21·46
Incendiary	12	5·85
Lightning	5	2·44
Other causes	2	0·98
Unknown	71	34·64
Total	205	100·00

Surveys.—On the Rocky Mountains forest reserve the surveys to locate the important trails and watercourses were continued and have now been sufficiently completed in the whole of the reserve south of the Athabaska river to make it possible to map and estimate the timber areas accurately. Reconnaissance surveys for this purpose can now be undertaken.

The marking of the boundaries of the Cypress Hills forest reserve was carried out and arrangements have been made with the Surveyor General for surveys of the boundary lines of other reserves where the location is uncertain.

Grazing.—The grazing regulations providing for the use of grazing on the forest reserves under yearly permit are on the whole working out satisfactorily. The total number of cattle grazed was 12,923 and of horses 1,870. This is a slight reduction from the total for the previous year, as although there was an increase in all the reserves except the Crowsnest there was a decrease of over three thousand head on that reserve, owing mainly to the inclusion of several of the grazing areas on the reserve in the extension of the Waterton Lakes park. There should be a steady increase from this time forward, however, as there is still a large amount of grazing land on the forest reserves which is not stocked to capacity.

The number of sheep grazed on the forest reserves in 1914 was over 12,000 and for the past year practically none. The sheep were grazed in 1914 in the Livingstone valley in the Crowsnest forest but considerable objection was raised by farmers living on the route by which the sheep were driven into the reserve, as it was claimed that considerable damage had been done to crops and grazing lands. In consequence of this and on the urgent request of the provincial authorities and the committee of the Provincial Legislature, it was decided that any permits for sheep granted in this forest in the year 1915 should be subject to the condition that the sheep should be taken in by railway. The stock owners did not care to take out permits under such a restriction. Consequently, no application for permits for sheep were received. An Act of the Provincial Legislature has since been passed regulating the driving of sheep, so that the restriction is not further necessary.

The organization of grazing permittees into stock associations to assist in the arrangement of the grazing in different districts has been helpful and has been carried out without difficulty, except in one or two cases where the situation has been misunderstood.

An investigation of the forage plants on the Crowsnest forest was made by the agrostologist of the Department of Agriculture and much valuable information obtained. It is important for the proper management of the grazing lands that many special investigations should be made, and at the earliest possible opportunity arrangements should be made for the appointment of a well-qualified man to deal with this matter.

The grazing regulations have not been put into force in the railway belt in British Columbia, owing to difficulties noted in last year's report, but the question has been discussed from time to time with representatives of the stock owners and others, and it is hoped that the difficulties in the way will be removed in time. The trails constructed on the forest reserves have made available grazing lands and hay meadows hitherto inaccessible and special methods of dealing with such lands are being considered.

Fish.—The reciprocal arrangement made with the Department of Marine and Fisheries in the interests of the protection of the fisheries in waters situated along the boundaries of the forest reserves has been continued. Under this arrangement certain Dominion fishery guardians are given the authority of forest officers, and certain forest officers are given the authority of Dominion fishery guardians, in order that they may be enabled to proceed beyond their ordinary bounds of jurisdiction in following up cases of infraction of the fishing regulations. The arrangement has worked out so satisfactorily that a larger number of officers will be appointed under its provisions during the coming season.

The regulations of the forest reserves relating to fishing have been found to work satisfactorily, except in a few minor particulars, which have already been amended. These amendments, made mainly in conformity with amendments to the general fishery regulations introduced by the Department of Marine and Fisheries, provide that British subjects may fish for the coarser species of fish within the province in which they reside without a permit, and that in British Columbia, where trout are the only prevailing sport fish, trout may be caught without a permit by resident British subjects. Owing to the fact that Paul lake in the Niskonlith forest reserve is situated at a lower altitude than other lakes in the British Columbia forest reserves the fishing season has been made to open one month earlier, though the season is still later than that provided by the Dominion fishery regulations for waters outside the forest reserves, which are nearly all at a lower elevation. Other changes have been made to meet the special requirements of the northern portions of Manitoba, Saskatchewan and Alberta, such as the continuation of net fishing in the larger bodies of water, where netting for commercial and domestic purposes

has been carried on for years past. In those reserves which lie closer to settlement, however, such changes regarding fishing tackle, size limit and per diem catch have been made as will conserve and improve the sport fishing without imposing unnecessary restrictions upon the legitimate sportsman. In the last regulations issued by the Department of Marine and Fisheries provision is made whereby a permit issued under the forest reserves regulations will entitle the permittee to fish in any waters in the province outside the forest reserve. This is a reciprocative measure following the provision in the forest reserves regulations by which permits issued under the Dominion fishery regulations to fish in waters outside the forest reserves are made to apply to waters inside the forest reserves. This will make it unnecessary for fishermen to take out more than one permit for the season.

Game.—Some changes have been made by two of the provincial governments in the boundaries of the game preserves established by them in forest reserves. In Manitoba such changes have been slight, only the Riding Mountain game preserve in the Riding Mountain forest reserve having been changed by the addition of four townships. In this forest reserve, as in others, the forest officers are co-operating with the provincial authorities in the work of game protection. Some idea of the extent to which the hunting territory in this reserve is used during the hunting season may be obtained from the fact that over seventy-five permits were issued during the year by the forest officers for the erection of hunters' cabins, besides a number of permits for the location of tents during the hunting season. In Saskatchewan some radical changes both in the Game Act and in the location and limitation of the game preserves have been made. The Saskatchewan Game Act formerly provided that all forest reserves established by the Dominion should automatically become provincial game preserves, but in the new Act this automatic feature is dropped and only those areas described in the Act are to be game preserves. With this change it is now possible for the provincial authorities to exercise some discrimination in creating game preserves in forest reserves, and the provision as it now stands is similar to the corresponding provision in the Manitoba Game Act. In the case of large forest reserves, which in the old Act were closed against hunting throughout their entire area, it is now possible to confine the game refuge within certain reasonable limits and to allow hunting in the remaining portions of the forest reserve. This is the course which is now followed in regard to several of the larger forest reserves in Saskatchewan. Two benefits amongst others will result, one is that the public will be afforded a good hunting ground in close proximity to a game preserve, the other is that, owing to the supervision which the forest officers are able to give, the game will be protected, as it has been heretofore, during the close season, and in the course of their ordinary patrols during the hunting season the forest officers will be in a position to see that the game laws are observed. These changes will have another desirable effect in that they will relieve a certain amount of opposition to the extension of the system of forest reserves on the part of those persons who were being deprived of hunting opportunities by the former legislation, which made it illegal to hunt on any part of any forest reserve at any time.

Reference was made last year to the fact that the Stony Indians of Alberta had at last been brought under the operation of the Game Act of the province. This was a step forward in the work of game protection on the eastern slope of the Rocky mountains. The next step will be to secure the observance of the law by the Indians, and while drastic measures are not desirable it is necessary that persistent efforts should be made to induce the Indians to be governed by the provincial regulations. The reports received do not indicate that there has been any appreciable diminution of illegal hunting by these Indians during the past year, and it is clear that only with the co-operation of the Department of Indian Affairs can these Indians be brought to change their lifelong habits of slaughtering game with utter disregard for the future

supply, and to be governed by laws designed to prevent the process of extinction and to increase the supply of game which will thus be available for the Indians as well as others.

Among the chief offenders are a number of Stony Indians who some few years ago located without authority in the valley of the North Saskatchewan river, on what are known as the Kootenay plains, in the Rocky Mountains forest reserve. Efforts have been made by the forest officers and by officers of the Indian Department to induce these Indians to remove from the forest reserve, but the exaggerated value placed by the Indians upon their improvements has made progress very slow thus far. It is hoped, however, that ultimately these Indians may be removed without hardship and without friction.

Reports have come in from different forests of serious damage done to young trees by rabbits. Particularly when the periodic large increase in the number of rabbits comes they swarm in the woods in such numbers that large areas of young pine, spruce, tamarack, etc., are damaged so as either to be killed or to grow in such distorted form as to be of little value. The report from one forester gives the opinion that the destruction caused by rabbits is greater than that caused by fire. This only repeats experience elsewhere. In Great Britain the rabbits form one of the most serious hindrances to the establishment of forest plantations. The methods of control required for dealing with this difficulty require thorough study.

FIRE-RANGING.

The fire-ranging in the timber areas outside of forest reserves was organised in twelve districts, each in charge of a chief fire ranger. The number of temporary fire rangers under their supervision was 189. On the whole the supervisory work by the chief rangers was good and those who have been in charge of districts continuously for several years have greatly improved the organization and efficiency of the service. A good proportion of the rangers, though only employed for the danger season in each year, are re-appointed from year to year and, with some exceptions, are giving good service.

The equipment for fire fighting has been brought up to a better standard and emergencies can be much better met.

Little expenditure can be made on permanent improvements in the territories outside of forest reserves, but in some places the rangers have been able to put in trails, bridges and lookout towers that have given much improved facilities for handling fire.

The fire ranging districts and the number of rangers employed are as follows:—

Manitoba inspection.—Southern Manitoba, 13; Northern Manitoba, 13; The Pas, 14.

Saskatchewan inspection.—Battleford, 14; Prince Albert, 16.

Alberta inspection.—Edmonton, 46; McMurray, 10; Slave, 3; Mackenzie, 4.

British Columbia inspection.—Coast 23; Revelstoke, 16; Salmon Arm, 17. Total, 189.

The number of fires (outside of forest reserves) with their causes, incomplete as previously explained, are as follows:—

Cause.	Number of Fires.	Percentage.
Railways	105	8·40
Saw-mills and logging	34	2·72
Brush burning (not settlers' clearing)	6	0·48
Settlers	197	15·76
Campers and travellers	366	29·28
Incendiary	2	0·16
Lightning	55	4·40
Other causes	28	2·24
Unknown causes	457	36·56
Total	1,250	100·00

FOREST SURVEYS.

During the year six reconnaissance parties carried on the exploration of public lands to classify the lands in regard to their suitability for agriculture or forest production, and also with the object of obtaining information of the timber resources of the country examined. The parties were located as follows: Manitoba inspection district, two parties; Saskatchewan inspection district, two parties; Alberta inspection district, two parties.

In Manitoba Mr. J. D. Aiken continued the examination of eastern Manitoba, covering an area of approximately 5,725 square miles on the east shore of lake Winnipeg between Manigotagan river and Poplar river eastward to the Ontario boundary. The country is of Laurentian formation and is fairly level with sandy and rocky ridges, seldom reaching a height of more than 100 feet above the general level of the country. The ridges are interspersed with muskegs covered with black spruce and tamarack. In the interior the soil is of glacial origin, being mostly sandy and rocky with boulders, and is unsuitable for agriculture. In places at the mouths of the rivers are deposits of blue clay, fine stratified sand or soil of a silty or clayey nature which is of agricultural value. The areas of good soil are very small, however.

Fully 70 per cent of the area examined has been burned over during the last thirty years, consequently not very much mature timber is found. The poplars and white spruce occupy the better soils while the jack pine occupies the ridges of the interior.

The main rivers draining the area examined are the Bloodvein, the Pigeon, the Berens, the Leaf and the Poplar. There is a general rise of about 350 feet from lake Winnipeg to the Ontario boundary. Near the lake the rivers are very sluggish, but in the interior they are much swifter, with numerous small falls not exceeding 30 feet in height.

The other Manitoba party under Mr. C. E. Maimann examined an area of 5,400 square miles between lakes Winnipeg and Winnipegosis from about township 29 north to the Saskatchewan river. The country examined is generally level, only rising between 100 and 200 feet above the level of the lakes; consequently, muskegs are large and numerous. Between the muskegs lie long ridges with a soil consisting of sand and gravel interspersed with small boulders. With the exception of a few small areas the soil is unfit for agricultural purposes. Along lake Winnipeg, on the drier areas, the soil is a calcareous gravel, with large boulders in places. Practically the same kind of soil was found along lake Winnipegosis. On the inland ridges the soil is sandy or light gravel, strewn with innumerable boulders. The muskegs are generally covered with wet moss from six inches to three feet in depth with an impervious clay subsoil strewn with small boulders.

The whole area examined has been burned over during the last eighty years and very few of the original mature stands are left. The best stands of spruce and poplar are found close to the lakes, while jack pine covers the ridges and black spruce and tamarack some of the muskegs. Other muskegs are open bogs.

In central Saskatchewan, Mr. G. M. Dallyn examined about 2,600 square miles of country in the vicinity of Candle lake, Montreal lake and Crean lake. The area examined, which is drained by the Churchill and Saskatchewan river systems, is moderately flat with numerous low knolls and a few prominent ridges. The soil varies from pure quartz sand to sandy clay loam. The subsoil varies from granite rock to gray sand, north of the 15th base line, and south thereof from sand to clay. Sandy subsoil is the rule, however.

White spruce comprises the only virgin timber. Some excellent stands of spruce and poplar are found east of the lower end of Montreal lake. Aspen is the most common species, but considerable jack pine and black spruce are found; also some tamarack. Merchantable timber covers only about 7·5 per cent of the area examined, while stands in the pole stage and brulé with reproduction cover about 65 per cent.

Muskegs with jack pine knolls cover about 20 per cent and lakes about 7·5 per cent. Most of the area examined is strictly forest land. The reproduction is good over practically the whole area, and if protected from fires this country would in time be covered with a great spruce forest, spruce being the climax tree on practically all the better soils in the region.

Another party in Saskatchewan was in charge of Mr. A. V. Gilbert, and the examination extended over 1,730 square miles of the country between townships 57 and 60, inclusive, and ranges 13 to 27, inclusive, west of the 3rd meridian in the vicinity of Makwa lake.

South of this lake the country is hilly, west and east thereof it is rather level except between Meadow lake and Green lake, where some hilly country with numerous sloughs is encountered. Most of the lakes and creeks are boggy. An exception is Makwa lake, which has high banks. The soil is mostly a clay loam with clay subsoil, but sand ridges covered with jack pine are found over the whole area. Some of the country examined has great agricultural possibilities, but other portions are strictly forest land.

Some good white spruce is found in places. This species has a very rapid growth in this region, eighty-year-old trees with a diameter of 22 inches being found. Poplar is the principal species found as far as quantity is concerned, but the spruce reproduction throughout most of the poplar area is most promising.

In Alberta, Mr. R. D. Jago examined an area of five townships around Buck lake which had been previously temporarily reserved on the recommendation of the Dominion Lands Surveys, it being reported that the area contained good timber. This land is described as being hilly and broken with numerous muskegs. The soil is sandy and stony with numerous ridges covered with jack pine.

Some very good timber is found in the vicinity of Buck lake, consisting of spruce, poplar and jack pine. With the exception of one township all the lands in the temporary reservation (or four townships) are recommended for inclusion in a forest reserve.

A considerable area of land surrounding the temporary reservation at Buck lake was also examined. Most of this land was found to be suitable for mixed farming, having a soil of clay or sandy clay covered with a good loam top-soil.

Mr. Jago also made an examination of the region in the vicinity of Christina lake on both sides of the Alberta and Great Waterways railway now under construction. These lands are, generally speaking, unfit for agriculture. They are rugged and hilly in places. Much of the land is low and wet with a good deal of muskeg, broken by narrow sand ridges covered with jack pine. Very little mature timber is left, the country having been practically all burned over some eighty years ago. The reproduction is good. Altogether 4,900 square miles were examined in this survey.

In the season of 1915, Mr. J. A. Doucet examined the Peace River Block in British Columbia, and a large tract of land situated in the province of Alberta and comprising the Birch hills, the plateau lying between Spirit river and Pouce Coupé, the larger portion of the Clear hills and lands in vicinity. The total area examined was 13,800 square miles. The survey was made at an average cost of 42 cents per square mile.

The country belongs partly to hilly land and partly to table- or plateau-land. The elevation of the hilly land ranges from 2,300 to 4,400 feet above sea-level. The table-land is found along the main streams and more particularly in the vicinity of Peace river, which is the main artery. The soil of the table-land although commonly rich clay loam is often an inferior whitish clay or even silt clay. Through the hilly land, agricultural soil is found in small tracts in the valley bottoms and on the lower hill slopes. In the Clear hills the soil is very poor.

Approximately 21 per cent of the total area examined bears a forest over fifty years old. Its stand is estimated at the round figure of 12,400,000,000 feet board

Photo. 10227. B. R. Morton.

Planting on forest reserves. Ten-year-old Scotch pine plantation on Spruce Woods forest reserve, Manitoba. Note remarkable growth made in recent years.

Photo. 10254. B. R. Morton.

Planting on forest reserves. Scotch pine plantation badly damaged by rabbits. In some years in certain districts rabbits do much damage.

measure and 19,500,000 cords (trees below 8 inches D.B.H.). Spruce and lodgepole pine form about 87 per cent of the stand, estimated in feet board measure. The pole forest area covers approximately 3,320 square miles and its age averages about 35 years. Its total production would be about 19,200,000 cords, in which poplar would represent about 73 per cent of the stand. The remainder is mostly spruce and pine. The total area of burned-over land is 4,540 square miles. Most of this land has been burned during the last four decades and about 50 per cent is restocked. The balance is mostly restocking or at the seedling stage.

The prairie, brush, and open grass land covers an area of 2,714 square miles, or about 20 per cent of the total. It is estimated that besides this land there is approximately 3,210 square miles of burned-over and wooded land which could be classified as land suitable for farming or grazing purposes. The prairie land is the result of repeated fires on good soil.

Of the total area examined, some 6,789 square miles are recommended for reservation. The area is comprised in eight different tracts. They contain approximately 80 per cent of the total sawlog and 50 per cent of the cordwood stands given above.

FOREST PRODUCTS LABORATORIES.

The regular work of the Forest Products Laboratories has been considerably interfered with by the number of the staff who have enlisted in the army and by the fact that some members have been devoting considerable time to investigations in connection with war munitions.

The divisions of timber physics, timber tests, pulp and paper and wood preservation are now organized and are doing investigation and experimental work of great value to the wood industries of the Dominion. The interest taken in the laboratories by those engaged in the manufacture of wood products, and the many requests for information received from all over the country, show that the work is proving useful and is appreciated. It was not proposed at the present time to recommend the organization of a division of wood distillation but the request from the Canadian Mining Institute for an investigation of the production, from Canadian woods, of oil for use in ore flotation has made it necessary to consider the establishment of such a division without delay.

The fluctuation in the staff as a result of enlistments, and one or two changes resulting from business opportunities offered by companies, have impressed early in the history of the laboratories the important bearing that permanency in the staff has on the continuity of investigations, and it is necessary to consider carefully the best plan that can be adopted to ensure permanency in the staff and to keep alive aggressive interest in scientific investigation. The work of investigation must be progressively comprehensive and efficient if it is to accomplish the purposes desired in the establishment of the laboratories.

WOOD BISON.

The patrol in connection with the wood bison has been continued and efficient service has been rendered in locating and extinguishing fires on the buffalo range. In spite of these efforts a considerable area was burned over, though not sufficient to threaten the supply of winter feed for the bison.

The matter of reducing these periodical fires to the minimum is important, as it is not difficult to imagine circumstances under which a series of such fires, spread over considerable areas, might reduce the quantity of available feed to a point where the welfare of the herds would be interfered with. An endeavour will be made, therefore,

during the coming year to strengthen the patrol to some extent, and it is intended to consider this matter of fires in conjunction with the Department of Indian Affairs, to see whether it is possible that united action in some form may be taken which will reduce this danger.

R. H. CAMPBELL,
Director of Forestry.

STATEMENT of Revenue, Fiscal Year, 1915-16.

Forest Reserve.	Timber Fees and Dues.	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.
Turtle Mountain	81 95	2 50	760 75	191 25	95 00	0 75	.....	249 75	1,381 95
Spruce Woods	11 75	15 00	519 50	61 05	.....	.....	.....	.....	607 30
Riding Mountain	4,252 63	301 77	158 75	434 85	10 00	18 25	.....	.....	5,176 25
Duck Mountain	2,443 27	51 75	.....	71 60	200 00	1 75	.....	.....	2,768 37
Moose Mountain	235 00	132 90	236 50	200 40	15 00	.....	.....	.....	819 80
Beaver Hills	20 25	.....	154 55	200 20	.....	1 00	.....	.....	376 00
Porcupine-Pasquia	787 57	151 70	23 95	83 60	.....	52 00	.....	2 50	1,101 32
Fort à la Corne	299 50	91 43	.....	5 25	.....	.....	.....	.....	396 18
Pines	229 75	5 00	6 45	36 50	.....	.....	.....	.....	277 70
Nisbet	545 95	687 75	14 35	32 55	0 25	2 50	.....	.....	1,283 35
Big River	3 00	.....	.....	34 75	.....	1 25	.....	.....	39 00
Steep Creek	27 50	.....	.....	.....	.....	.....	.....	.....	27 50
Sturgeon	.....	.....	.....	41 85	.....	.....	.....	.....	41 85
Keppel	266 48	.....	28 50	13 70	.....	0 75	.....	.....	309 43
Manito	134 25	.....	294 10	28 05	.....	3 00	.....	.....	459 40
Dundurn	3 25	.....	163 20	10 05	.....	2 00	.....	.....	178 50
Seward	.....	.....	27 85	28 95	.....	0 75	.....	.....	57 55
Elbow	20 25	8 00	449 38	107 80	.....	2 75	.....	.....	588 18
Cypress Hills	763 41	36 50	.....	378 25	20 00	.....	.....	.....	1,198 16
Cooking Lake	10 77	.....	84 25	135 00	.....	.....	.....	.....	230 02
Crowsnest	3,862 55	79 84	1,585 12	30 20	48 70	23 75	.....	.....	5,630 16
Bow River	131 45	19 10	1,130 19	40 70	88 88	5 75	.....	.....	1,416 07
Clearwater	3,714 82	.....	12 75	.....	53 55	100 75	.....	.....	3,881 87
Brazeau	652 07	790 25	6 40	.....	.....	10 00	.....	.....	1,458 72
Lesser Slave	2 54	2,461 87	.....	.....	.....	0 25	.....	.....	2,464 66
British Columbia	234 45	.....	.....	14 75	77 40	18 00	.....	.....	344 60
Indian Head Nurseries	.....	.....	.....	.....	.....	46 00	1,619 85	312 91	1,978 76
Totals	18,734 41	4,835 36	5,656 54	2,181 30	618 78	291 25	1,619 85	555 16	34,492 65
Refunds	.....	.....	.....	.....	.....	.....	.....	.....	728 70
Net revenue	.....	.....	.....	.....	.....	.....	.....	.....	33,763 95

STATEMENT of Timber Permits, Fiscal Year 1915-16.

Reserves.	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	25	23	.....	.....	645	36,830	.....	208	.....	662	81 95
Spruce Woods	14	3	.....	.....	.....	15,250	.....	5,000	.....	195	11 75
Riding Mountain	187	390	450	2,400	20,437	1,778,801	.....	21,962	200	2,442	4,027 63
Duck Mountain	359	140	400	450	17,980	1,797,478	.....	218,447	.....	3,297	1,543 27
Moose Mountain	8	87	650	.....	3,800	.....	.....	5,000	555	130	235 00
Beaver Hills	81	.....	.....	.....	.....	194,250	.....	.....	.....	1,000	20 25
Porcupine-Pasquia	85	21	3,300	4,000	5,800	367,511	.....	2,400	.....	2,319	512 07
Fort à la Corne	140	23	7,300	2,000	12,297	119,503	.....	18,900	.....	2,274	174 50
Pines	37	26	1,700	500	3,550	4,450	.....	6,369	220	1,213	229 75
Nisbet	46	57	.....	.....	2,650	.....	.....	4,700	50	1,904	545 95
Big River	12	.....	1,130	3,500	1,100	9,250	.....	6,000	.....	210	3 00
Steep Creek	14	5	1,250	2,000	3,040	.....	.....	3,000	.....	318	27 50
Keppel	249	77	22,017	12,950	27,880	.....	.....	157,981	370	3,374	260 73
Elbow	81	.....	.....	300	1,140	.....	.....	.....	.....	1,043	20 25
Manito	68	53	4,975	22,900	14,325	19,250	.....	26,470	321	1,195	134 25
Dundurn	13	.....	.....	.....	960	.....	.....	.....	.....	207	3 25
Cypress Hills	353	205	132,780	153,115	94,510	132,920	.....	280,800	193	3,823	608 50
Cooking Lake	8	2	600	.....	200	.....	.....	1,000	.....	170	9 92
Crowsnest	132	47	3,568	4,050	11,771	.....	.....	28,212	.....	2,044	388 60
Bow River	30	16	4,950	2,350	5,000	.....	.....	13,800	.....	601	79 55
Clearwater	22	2	.....	.....	.....	.....	8,000	.....	.....	550	33 50
Brazeau	4	.....	.....	.....	.....	.....	.....	.....	.....	100	1 00
Lesser Slave	.....	1	.....	.....	.....	.....	.....	448	.....	.....	2 54
B.C. Reserves	5	2	100	.....	.....	.....	.....	7,000	.....	20	3 75
Totals	1,973	1,180	185,170	210,515	227,085	4,475,493	8,000	807,697	1,909	29,091	8,958 46

Timber Seizures, Fiscal Year 1915-16.

Reserve.	No. of Seizures.	Description and Quantities of Timber Seized.									Trespass Dues.	Collections account arrears and current seizures.
		Roof Poles.	Fence Rails.	Fence Posts.	Saw Timber.	Ry. Ties.	Telegraph Poles and Piling.	Building Logs.	Green Fuel.	Dry Fuel.		
					Ft. B.M.		Lin. Ft.	Ft. B.M.	Cords.	Cords.		
											$ cts.	$ cts.
Turtle Mount'n.	1								6	3	2 50	2 50
Riding Mount'n.	39	152	60	80	9,500			21,533			248 59	301 77
Duck Mount'n.	4				12,580			2,186		18	111 52	51 75
Spruce Woods.	1							550			15 00	15 00
Moose Mount'n.	20	1,178		145				200	34		81 00	132 90
Pines	1			5							5 00	5 00
Nisbet	3									428	133 75	687 75
Fort à la Corne	1				60,948						91 43	91 43
Porcupine-Pasquia	17			1,600	23,845		2,000			12	298 82	151 70
Elbow	1								5		8 00	8 00
Big River	1				19,889						119 33	
Cypress Hills.	2							920	5		36 50	36 50
Crowsnest	8		115		5,875			3,192		5	79 84	79 84
Bow River	3		515								19 10	19 10
Brazeau	1				7,500			5,000			29 00	790 25
Lesser Slave												2,461 87
Total	103	1,330	690	1,830	140,137		2,000	33,581	50	466	1,279 38	4,835 36

Grazing Permits issued, Fiscal Year 1915-16.

Reserve.	No. of Permits.	Number of Stock.				Dues and fees collected.
		Cattle.	Horses.	Sheep or Hogs.	Total.	
						$ cts.
Turtle Mountain	62	909	7		916	708 75
Riding Mountain	27	587	10		597	158 75
Spruce Woods	37	550			550	519 50
Moose Mountain	35	815	79		894	231 25
Porcupine-Pasquia	4	63	11		74	23 95
Pines	4	19			19	6 45
Beaver Hills	10	464	79		543	154 55
Nisbet	3	38	4	9	51	14 35
Keppel	7	86	1		87	28 50
Manito	33	657	293		950	283 60
Elbow	182	888	440		1,328	391 33
Seward	7	106	11		117	27 85
Dundurn	9	460	90		550	163 20
Crowsnest	58	4,115	433		4,548	1,585 12
Bow River	32	2,941	348		3,289	1,130 19
Clearwater	1		50		50	12 75
Brazeau						6 40
Cooking Lake	6	225	14		239	69 25
Total	517	12,923	1,870	9	14,802	5,515 74

Statement of Hay Permits, Fiscal Year 1915-16.

Reserves.	No. of Permits.	No. of Tons.	Dues and Fees.
			$ cts.
Turtle Mountain	107	1,645	191 25
Spruce Woods	38	443	61 05
Riding Mountain	175	3,141	434 85
Duck Mountain	38	566	66 00
Moose Mountain	51	1,611	182 85
Beaver Hills	56	1,862	200 20
Porcupine-Pasquia	16	522	64 10
Fort à la Corne	3	45	5 25
Pines	20	293	35 65
Nisbet	18	248	32 55
Sturgeon	5	202	41 85
Big River	8	327	34 75
Elbow	47	960	107 80
Seward	15	252	28 95
Manito	14	245	28 05
Keppel	10	112	13 70
Dundurn	2	62	10 05
Cypress Hills	124	3,521	378 25
Cooking Lake	26	1,003	135 00
Crownsnest	27	204	27 15
Bow River	14	372	40 70
B. C. Reserves	9	145	14 75
Total	823	17,781	2,134 75

Timber Cut on Forest Reserves under authority of Timber Sales, Fiscal Year 1915-16.

Reserve.	Previous sales still operating.	Sales made current year.	Saw Timber.	Mine Timber.					Dues collectable.
				Props.	Props.	Lagging.	Lagging.	Lagging.	
			Ft. B.M.	Ft. B.M.	Lin. Ft.	Cords.	Ft. B.M.	Lin. Ft.	$ cts.
Riding Mountain	1		40,895						122 41
Fort à la Corne		1	88,697						160 05
Pasquia		1							
Porcupine	1	1	35,659						106 98
Cypress Hills	1		78,581						117 86
Crowsnest	5	2	1,320,848	111,696	451,860		30,594		2,788 24
Clearwater	2		404,083	1,273,105	181,078	606			4,939 68
Brazeau	2								
Fly Hills	1		88,434						66 32
Total	13	5	2,057,107	1,384,801	632,938	606	30,594		8,301 54

STATEMENT showing the quantity of Timber Sold and Revenue Due during the Fiscal Year ending March 31, 1916, on License Timber Berths within Dominion Forest Reserves.

MANITOBA.

Forest Reserve.	Timber Berths.	Areas in Reserve.	Quantities Sold.			Revenue.		
			Lumber.	Laths.	Other Products.	Dues Payable.	Rent Payable.	Total Payable.
	No.	Sq. M.	Ft. B.M.	No.		$ cts.	$ cts.	$ cts.
Riding Mountain....	5	45	3,129,253	.....	.....	1,564 62	227 15	1,791 77
Duck Mountain.....	11	100	3,289,698	828,600	.....	1,939 03	499 90	2,438 93
Total.....	16	145	6,418,951	828,600	.....	3,503 65	727 05	4,230 70

SASKATCHEWAN.

Porcupine and Pasquia.....	49	1,039	34,839,913	6,810,050	1,781 fence posts	18,880 17	5,086 90	23,967 07
Sturgeon.....	12	178	13,455,225	2,088,500	.....	7,040 87	891 33	7,932 20
Big River.....	3	261	22,221,882	9,508,200	478 posts 489 cords	7,135 02	1,303 08	8,438 10
Nisbet and Pines....	5	117	.....	.....	411 cords 3,909 fence posts	141 97	173 15	315 12
Total.....	69	1,595	70,517,020	18,406,750	as above	33,198 03	7,454 46	40,652 49

ALBERTA.

Crowsnest.....	12	259	1,290,787	.....	.....	646 40	1,295 95	1,942 35
Bow River.....	16	374	14,464,373	279,075	3,257 fence posts 513 cords	7,234 76	1,860 95	9,095 71
Clearwater.....	4	378	.....	.....	.....	.....	1,887 80	1,887 80
Brazeau.....	12	226	1,255,428	.....	50,080 Ry. ties 33,060 lin. ft. piling.	1,544 22	1,131 30	2,675 52
Total.....	44	1,237	17,010,588	279,075	as above	9,425 38	6,176 00	15,601 38

BRITISH COLUMBIA.

	No.	Sq. M.	Ft. B.M.	No.		$ cts.	$ cts.	$ cts.
Total of all B.C. reserves.....	11	154	.....	.....	.....	.....	667 85	667 85
Grand total.....	140	3,131	93,946,559	19,514,425	.....	46,127 06	15,025 36	61,152 42

The Grand Total of Other Products comprises 9,425 fence posts, 1,413 cords, 50,080 railway ties and 33,060 lin. ft. piling.

APPENDIX No. 1.

The following report concerns the work of the Tree-Planting Division during the fiscal year 1915-16.

Climatic conditions prior to June 15 were somewhat trying. The spring opened up early but with rather less precipitation than usual. This condition, following a winter with practically no snow, left the soil dry; consequently, except on soils that were particularly well prepared, much of the newly planted stock had difficulty in surviving the shock of transplanting. However, on the whole the results of new plantations were very good indeed with the exception of the cutting stock, which, as might have been expected, showed a rather greater percentage of failures than is usually experienced. In the nurseries the dry spring caused more blanks than usual in the conifer transplant plots. During the early part of the season, too, exceptionally late and severe frosts occurred. In the nurseries seedling stock of ash suffered severely, in some plots from 35 per cent to 40 per cent of the small plants being killed outright. In the case of two-year seedlings the plants were badly cut back and although the subsequent growth was good most of them show a double shoot, owing to the terminal buds having been destroyed.

In the permanent plantations the ash were completely defoliated on two separate occasions, so that the growth of this variety during the season was practically nil and, no doubt, it will require a year or two for these trees to regain their normal growth.

The latter part of the season in the greater part of the prairies was exceptionally wet, although in one or two isolated districts conditions were exceptionally dry. Notwithstanding the extra amount of precipitation, which was of course particularly beneficial in the case of newly set out plantations, the growth on the older plantings was generally small. In some cases, where grass had been allowed to work in among the trees, individual specimens showed undoubted signs of suffering from lack of moisture. This is due to the fact that, following two exceptionally dry seasons, the subsoil was dried completely out and the rains, though heavy, were unable to penetrate deeply enough to reach the tree roots in poorly-cultivated land.

Injurious insects were particularly prevalent all over the west. The Manitoba maple was, probably, the worst sufferer, being attacked practically everywhere by enormous numbers of aphids, and in southern Manitoba and eastern Saskatchewan by the fall cankerworm, which apparently is rapidly increasing. Both these pests may be fairly well controlled if proper precautions are observed. Spraying, however, of old plantations is an expensive proposition, but while the trees are still young is not such a difficult operation, and it is hoped that such severe attacks will not occur again in the near future. In southwestern Alberta and western Saskatchewan the poplar leaf beetle appears to have been very prevalent and to have caused considerable injury to poplars and willows in the cultivated plantations.

Mention was made in my last report of the desirability of having all land for planting summer-fallowed during the previous season. From continued observations the very much better results in the growth of belts set out on summer-fallow, as compared with other forms of preparation, has been very strikingly demonstrated. The gradual working in and spreading of native grasses and especially brome grass, has been found to be the cause of practically every failure in old established plantations. This working in of grass can nearly always be traced to the original preparation of the soil, which in such cases has usually proved to be backsetting or garden land, or potatoes planted on new lands. No matter how well new land is cultivated it seems practically impossible to entirely eradicate the native grasses. Even if only one or two roots of sweet or couch grass persist these will very soon spread, and

Photo. 10240. B. R. Morton.

Planting on forest reserves. Planting jack pine seedlings in furrows.

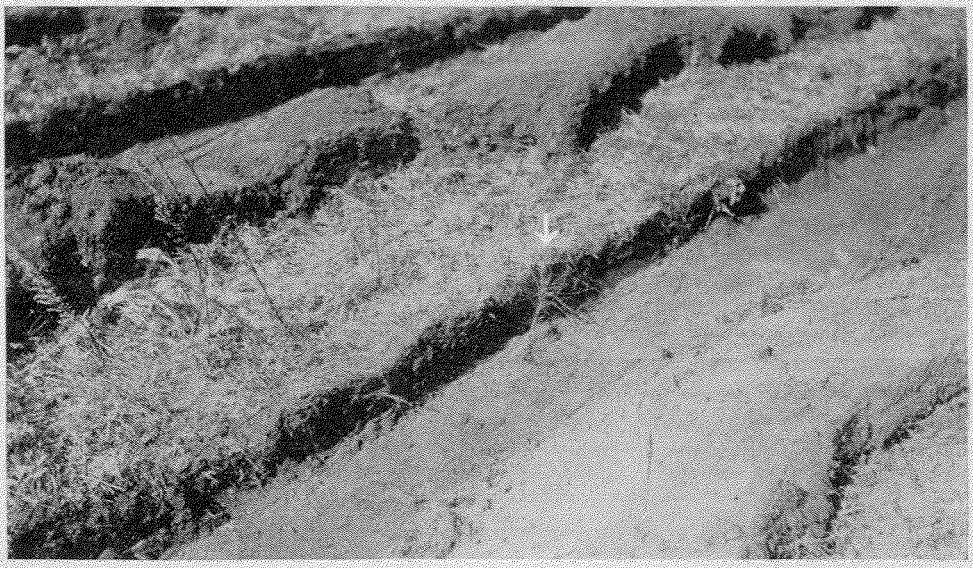

Photo. 10238. B. R. Morton

Planting on forest reserves. Two-year-old jack pine seedling planted in furrow. The arrow indicates the little seedling.

surface cultivation only helps to increase the evil, and in an incredibly short space of time the grass is found growing all through the plantation. For this reason it has now been decided as a definite policy that in future trees will be granted only when the ground has been prepared by a thorough summer-fallow. By following out this policy consistently the danger of grass spreading amongst the trees in later seasons will be practically eliminated, provided, of course, proper precautions are taken to prevent it working in from the edges. This can easily be done by keeping a well cultivated strip of four or five feet in width along the outer edges.

It is interesting to note that the Forest Service of the Federal Department of Agriculture of the United States has now inaugurated a system of tree distribution in their Prairie States practically identical with our co-operative system. Officers of their department were sent here both in 1914 and 1915 to investigate the details of our system, and from a perusal of the regulations which will govern this distribution it will be found that they are exactly similar to ours in all the main features. The growing of the stock and the actual distribution is to be carried on at the field station at Mandan, North Dakota.

An arrangement has been reached with the Provincial Department of Education at Regina with a view to further encourage tree planting on rural school grounds. The importance of this line of work has always been realized by the Forestry Branch, and special efforts have been consistently made in this direction. The general results, however, have not been encouraging and under existing conditions it seemed impossible to make any real headway without the active co-operation of the educational authorities. In dealing with the schools individually the chief difficulty lies in the fact that there is no permanent individual responsibility in preparing for, planting and subsequently looking after the trees. Teachers in the rural districts seldom remain at one school for more than one or two seasons, while the personnel of the school boards frequently changes; so that a teacher or a secretary who is enthusiastic and makes every preparation for planting may be followed by others who show no interest in the development of the belts and consequently the plantations are a failure. This, unfortunately, has been our experience in the great majority of school plantings. Under the new understanding with the Saskatchewan authorities the responsibility for seeing that proper care will be given in cases where trees are granted will rest entirely with the district school inspectors. All applications for school planting will in future be made to the Superintendent of School Agriculture at Regina and not to our office as in the past; and only in cases where the school inspectors are satisfied that proper preparations have been made, and arrangements for planting and caring for the trees provided, are the applications to be passed on to us to be finally dealt with. As considerable pressure can be brought to bear on the local school boards by the provincial authorities it is confidently expected that we may look for very much better results under this arrangement than has been our experience up to the present.

The following tables show in detail the districts covered by each inspector and other statistical information. It will be noticed that approximately 1,700 more applicants are to be furnished with trees in the spring of 1916 than in 1915, and that about 1,019 more names appear on the inspection lists for this summer than in 1915. About 2,400 more applicants were visited in 1915 than in 1914:—

TABLE 1.—Annual Distribution of Deciduous Stock.

——	1911	1912	1913	1914	1915	1916
Number of applicants receiving trees....	3,285	3,618	3,536	3,420	3,459	5,210[1]
Seedlings and cuttings distributed.....	2,636,100	2,729,135	3,495,375	3,685,455	3,730,375	4,571,475[2]
Average number per applicant.....	721	626	988	1,077	1,078	877
Number of applicants on inspection list..	8,036	7,375	6,987	7,169	9,570	10,589[1]
Number of new applications received...	2,656	1,649	1,899	1,559	3,693	2,587[2]

[1]Compiled March 15, 1916. Figures will be slightly altered when 1916 lists are completed.
[2]Supplementary to these figures considerable stock will be shipped to the Saskatoon Nursery, Manitoba Education Department and other Public Institutions.

TABLE 2.—Distribution of Trees in Relation to Districts, 1916.

District.	Number men on list.	Number to receive trees.	Number trees allotted.	Average number per applicant.
Central and Southern Manitoba.....	583	296	257,200	877
Central Saskatchewan and G.T.P. East of Saskatoon.....	714	310	274,350	893
Southeastern Saskatchewan.....	1,098	657	578,850	887
Central and Northern Saskatchewan Alberta and Manitoba..	914	493	422,000	865
Southern and Western Alberta.....	1,251	733	649,400	962
Central Alberta.....	1,204	684	602,525	892
Southern and Western Saskatchewan.....	1,386	760	669,100	900
Western Central Saskatchewan.....	1,246	622	543,600	852
Central Saskatchewan.....	1,174	655	574,450	870
Totals.....	9,570	5,210	4,571,475	881

The following is a tabulated statement of the planting plans prepared during the winter and the correspondence handled during the fiscal years 1914-15 and 1915-16:—

——	April 1, 1914, to March 31, 1915.	April 1, 1915, to March 31, 1916.
Planting plans prepared.....	2,628	4,441
Pieces of mail received.....	21,353	22,076
[1]Pieces of mail sent out.....	26,856 (inc. 2621 plans franked)	29,536 (inc. 4276 plans franked)
New files added.....	5,967	4,864

[1]This does not include bulletins, these being sent out from the head office at Ottawa.

NURSERY WORK.

The following areas were devoted to the various nursery crops:—

Broad-leaved stock.—Maple seedlings, 29 acres; ash seedlings, 1 year old, 24 acres; ash seedlings, 2 years old, 21 acres; Caragana seedlings, 5 acres; willow cutting stock, 3 acres; Russian poplar seedlings, 4 acres; total, 86 acres.

Coniferous (evergreen) stock.—Transplant plots, 10 acres; seed beds, ¾ of an acre; total, 10¾ acres.

Total of both broad-leaved and coniferous stock 96¾ acres.

Sown in the fall of 1915.—Ash, 21 acres; caragana, 8 acres.

Owing to the scarcity of maple seed it was not thought advisable, on account of the risk of losing seedlings by late spring frosts, to sow any of this variety in the fall, our entire stock which was collected in 1914 being retained for spring sowing.

The following is a list of stock available for distribution this spring (1916):—

Broad-leaved—		
Maple (1-year seedlings)	1,755,000	
Ash (2-year seedlings)	1,128,000	
Russian poplar (cuttings)	129,500	
Willow (cuttings)	372,525	
Caragana (1-year seedlings)	541,000	
		3,926,025
Coniferous (Evergreen)—		
Scotch pine (4-year transplants)	14,157	
Jack pine (4-year transplants)	42,927	
Lodgepole pine (4-year transplants)	26,153	
White spruce (5-year transplants)	163,528	
		246,765
Total stock		4,172,790

Collection of seed.—On account of the late spring frosts practically all tree seeds were a failure. It was impossible anywhere to obtain even small quantities of maple or ash. The following seeds were collected:—

	Pounds.
Caragana (collected on Nursery Station)	400
Scotch pine (collected on Nursery Station), 29½ bushels of cones, seed extracted	24
Jack pine (collected in Prince Albert region), 86 bushels of cones, seed extracted	44
White spruce (collected in Dauphin region), 44¾ bushels of cones, seed extracted	15

The Scotch pine cones were collected on the nursery in a plantation set out in 1906. The seed seems of excellent quality and we hope that in the future we will be able to supply our requirements from this source.

The spruce and jack pine cones were collected on forest reserves. There was, however, very little good seed in the spruce cones.

Seed distribution.—Having no maple or ash seed which could be spared for distribution caragana was the only kind sent out, and of this seed 156 pounds were mailed to various applicants in one-pound packages.

CONIFERS.

In the spring of 1915 we again set out a number of well-grown seedlings of the following varieties in the transplant plots:—

White spruce (5-year transplants)	151,008
Scotch pine	30,036
Jack pine	27,346
Lodgepole pine	36,592
Western larch	2,347
Russian white birch	2,000
Total	249,329

In the spring of 1915 the following numbers of evergreens were sent out under our usual conditions at a nominal cost of $1 per hundred:—

White spruce (5-year transplants)	66,300
Jack pine (4-year transplants)	14,200
Lodgepole pine (4-year transplants)	15,900
Scotch pine (4-year transplants)	28,900
Total	125,300

These were sent out in 588 separate shipments to Manitoba, Saskatchewan and Alberta. In addition to the above, 6,300 evergreens were distributed free of charge to experimental farms and forest reserves, including the Saskatoon nursery station. There is a very greatly increasing demand for this class of stock, and the success that applicants have had with these evergreens during the past three seasons is most encouraging. With but very few exceptions, which can generally be traced to improper handling, failures seldom go higher than 5 per cent to 8 per cent.

Seed beds.—New seed beds were prepared and sown as follows: white spruce, 1,900 square feet; Scotch pine, 650 square feet; jack pine, 780 square feet; lodgepole pine, 300 square feet; total 3,630 square feet.

The spring weather was particularly unfavourable for germination and artificial watering had to be resorted to. This we have never yet found to give satisfactory results and fortunately in average seasons we get plenty of rain in late May and June to ensure good germination. This year I am sorry to say the stands secured were, for the first time in our experience, very much below the average.

The area of the spruce and pine beds has been considerably increased over previous seasons as it is now proposed to commence propagating stock for future planting on some of the smaller reserves. About 2,400 square feet of additional seed beds were sown for this purpose besides the amount above noted.

PERMANENT PLANTATIONS.

Rainfall in this district was very light during the spring and summer months and following 1914, during which the precipitation was also less than average, the plantations did not show as large a growth as usual. The most striking feature of these plantations was the very much better growth of all the evergreen conifers as compared with the broad-leaved varieties, which very clearly demonstrates the adaptability of the former to drier conditions and their general superiority for prairie planting.

A Russian poplar plantation which was set out in pure sand in 1906 and which made a very rapid growth for several years is turning out rather a disappointment. The trees have become very badly affected by a canker or rot which always seems to attack this poplar sooner or later. The disease may have been hastened in this instance by the fact that in two seasons considerable pruning was done in order to secure cuttings. It is thought that the fungus may have gained access to the tissues through the wounds caused by the pruning some years earlier than probably would have been the case had no pruning been done.

The tamarack and European larch plantations did not suffer any injury from the saw-fly as we had secured a power spray pump and went over all the plantations very thoroughly with lead arsenate as soon as the first larvæ were observed after hatching.

The usual measurements were made in the fall of the year in the various plantations. Most of these plantings are still much too young to take anything but height measures and measurements of annual growth. These measurements, however, are interesting in showing the comparative rates of growth of the different varieties during the early stages.

The following table is made up from averages of hundreds of measurements taken annually in the plantations set out on this nursery during and subsequent to 1905:—

AVERAGE HEIGHT GROWTHS ON MEASUREMENTS.

The measurements show the average height of the plants in feet and inches at the end of each year up to the eleventh year since the plantations were set out.

Species.	1	2	3	4	5	6	7	8	9	10	11
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
Tamarack	2 0	3 1	5 8	7 5	8 9	10 4	12 10	14 0	16 0	17 6	19 0
Scotch pine	1 4	1 5	1 10	2 6	3 10	5 5	8 0	9 6	11 0	12 1	15 2
White spruce	1 6	1 7	1 10	2 4	2 8	3 0	5 6	7 2	8 10	10 0	12 0
Maple	2 0	2 4	5 4	8 0	10 1	12 0	13 2	15 0	17 0	18 0	.....
White birch	2 10	4 0	5 9	8 5	10 6	12 4	14 0	15 6	17 0	18 2	.....

GENERAL FARM WORK.

Outside of the general ploughing and cultivation necessary in connection with the nursery proper and permanent plantations, about 22 acres of new land were cleared of scrub, wolf willow and small poplar, and broken and backset.

Twenty-five acres of oats on summer-fallow and 30 acres on spring ploughing were put in to provide grain and straw for the horses.

Thirty acres were under hay (rye grass) and about 6 acres additional were seeded down. Eight or nine acres of this hay land were ploughed up and worked down after the crop was cut.

SASKATOON NURSERY STATION.

Regarding the work at the Saskatoon station, a considerable number of seedlings and cuttings are ready for distribution from this nursery. In order to equalize the distribution work of the two nurseries, and to expedite the shipping, about a million and a quarter of seedlings and cuttings will be shipped from here in bulk to the Saskatoon station for redistribution along the railroad lines radiating east and west from Saskatoon. Several trips were made to the Saskatoon nursery during the season and I was pleased to note that the superintendent, Mr. McLean, has the work well in hand and that the general development is very satisfactory.

It is the intention this season to erect a boarding-house on the nursery for the accommodation of labourers, and I understand that tenders for this building have already been called for.

Considerable inconvenience has been experienced here on account of the water supply having given out, but work is now in progress in boring a test well which it is intended to put down to a depth of 200 feet; and it is hoped to strike a good flow of water, as wells of about this depth in the immediate vicinity are giving good supplies.

PLANTING ON RESERVES.

Several small reserves have been established recently in Saskatchewan covering areas unfit for agricultural development. The soil on most of these reserves is almost pure sand and at present, with the exception of scrub willows and scattered poplar bluffs, is devoid of tree growth. In order to develop these areas it is necessary that artificial reproduction be resorted to. This, however, is a work of considerable magnitude and will have to be carefully planned before any large planting operations are undertaken. It is, however, the policy of the department to plant up these sandy areas as soon as practically possible, and in order to make a start, about four acres will be set out on each of the following reserves this spring: Elbow, Dundurn and Manito.

Photo. 10244. B. R. Morton.

Planting on forest reserves. Four-year-old jack pine and lodgepole pine in transplant beds before taking up.

Photo. 10228. B. R. Morton.

Planting on forest reserves. Taking up four-year-old jack pine transplants.

These plantings will be more or less of an experimental nature, partly to determine the best method of planting and partly to find out which are the best varieties and what aged plants give the best results. On the Spruce Woods reserve in Manitoba, from 15 to 20 acres are to be set out, the stock for this purpose has been grown on the reserve itself. The plants for the other reserves will be shipped from the Indian Head nursery, and in order to develop a supply for future plantings a considerably increased area of seed beds will be prepared and sown each season. The varieties which it is proposed to utilize chiefly are white spruce, native jack pine and Scotch pine, and it is thought that two-year-old seedlings of pine and three-year-old seedlings of spruce are likely to give the best and cheapest results. This supposition is based on trial plantings that were set out on the Spruce Woods reserve in 1903, 1904 and 1905. In these trials several methods of planting were tried and plants from one-, two- and three-year seedlings and transplants were set out. The result from sowing seed and using one-year seedlings was practically a failure. The two-year seedlings gave excellent results when planted in the bottom of plough furrows. These early plantations have made very encouraging growth, many of the trees now being 10 to 11 feet high. The variety used in these plantings was principally Scotch pine.

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 1915-16. This report includes the work on the Duck Mountain, Riding Mountain, Turtle Mountain and Spruce Woods forest reserves, and on the Manitoba South, Manitoba North, Pas and Hudson Bay fire-ranging districts.

SURVEYS.

During the past summer two reconnaissance parties were engaged as indicated below.

Eastern Manitoba Survey.—This party, consisting of Messrs. Aiken and Porteous, covered the country from the Wanipigow river north to the Poplar river and eastward to the Ontario boundary. This area of 5,725 square miles was found to be approximately 25 per cent muskeg, 25 per cent cordwood, poles, etc., and 50 per cent brulé, restocking in places. Jack pine is the chief tree found in this area, occurring on the rocky and sandy ridges which form so large a part of this area. White spruce and poplar are found on the better alluvial soils along the rivers, and black spruce and tamarack in the muskegs. The whole country may be briefly described as rocky ridges separated by muskegs, lakes and streams. Mr. Aiken recommends that the whole of this area be set aside as a forest reserve, being absolute forest land.

The country along the eastern boundary of the province of Manitoba has now been covered from the United States boundary up to township 44 and should be completed to the north end of lake Winnipeg as soon as possible.

Central Manitoba Survey.—The area covered by Messrs. Maimann and Webb includes that stretch of country between lake Winnipeg and lake Winnipegosis from lake St. Martin northward to Grand Rapids. Of this area of 5,400 square miles it was recommended that 75 per cent be set aside as a forest reserve. This area is approximately 25 per cent timber, cordwood, etc., and 50 per cent muskeg, the remainder being brulé, lakes, brushland, cut-over lands, etc. The chief difference

between this area and that to the east of lake Winnipeg is that this area has about double the amount of muskeg, and the predominating rock outcrop east of the lake is replaced here to a large extent by sand and gravel ridges. There are several areas described where grazing could be profitably carried on around Pickerel and Waterhen lakes. The area recommended for a reserve is that portion from township 34 northward to Grand Rapids, the part west of Waterhen lake not being included. Since this area has not the outstanding features of absolute forest soil that typical Laurentian country has, and also since the reconnaissance had to be wholesale to cover the country, a more detailed survey is to be made of the southern and western parts, the characteristics of which are more similar to those of an agricultural soil than the remainder of the area.

FIRES.

The past fire season has probably been the worst for a good many years in this province. The dry fall of 1914, with little snow in the winter, and a very dry spring with practically no rain until June made the whole country a veritable fire-trap. Even though we did have a number of fires, considering that the season was so dangerous, they were kept fairly well under control.

There is one source of fires which we are endeavouring to overcome and which will have to be controlled in the near future, that is fires crossing the reserve boundaries from outside. This is due primarily to the inefficient control of fires outside the reserves, which is in the hands of the municipalities, and secondly to the fact that our reserve boundaries are not cut out so well as they should be. We are constantly improving our boundaries and in a year or so will have them completed.

The Manitoba Fire Act, section 5, reads: "Any person who, wilfully or through gross carelessness, allows fire to run from his own land to that of another is liable, etc. . . . . ." It is not very difficult to secure a conviction against a man for carelessness, but "gross carelessness" is considerably different and it is a difficult matter to get a conviction. In spite of this, however, we secured three convictions, the fines being $20 and costs, on the Riding Mountain reserve last year and as the cases were published in several newspapers these convictions had considerable effect. It is also proposed to secure the co-operation of the municipal fire guardians, the appointment of whom has just been made compulsory by the Provincial Government.

If there continue to be as many fires from unknown causes, the majority of which are very difficult to trace, there will probably have to be some check kept on all persons entering the forest reserves. This might be in the shape of a free permit, a register to be signed, or a form to be filled out giving information about the intended trip. By some means similar to this it could be determined at any time who were on the reserves.

Duck Mountain Reserve.—The worst fire on this reserve last year was the "T. B. Fire," the cause of which was not determined although there were indications that it was incendiarism. The chief damage was to the timber within berth 986, the property of the Burrows Lumber Co. This timber was killed but not destroyed and was taken out by the owners during the past winter so it was only a partial loss.

There were also a considerable number of fires which were attributed to settlers and unknown causes.

Riding Mountain Forest Reserve.—The fire situation on this reserve last year was as critical as that on the Duck Mountain reserve. The chief causes were settlers and those classed as "unknown." I am safe in saying that the indications are that some of these were set intentionally to secure pay for extinguishing them and also to secure dry wood. It was on this reserve that three convictions were secured and I understand that practically all the people bordering on the south part of the reserve have heard of this, and that it has had considerable effect.

The "Whirlpool Fire" was the worst fire on this reserve and, I regret to say, was not handled by the ranger as well as it should have been. This fire came across the boundary, near the Whirlpool river, and worked northward, covering about 30 square miles. The largest part of this, however, was poplar scrub with considerable open land, so that although the damage to young poplar and spruce was considerable, the loss was not so great as if it had been merchantable timber.

At the northwest corner of the reserve there were three fires which killed over 200,000 feet board measure of spruce, but this was practically all removed on permits during the past winter so that it was not a complete loss.

Turtle Mountain Forest Reserve.—Although there were 10 fires on this reserve last year we were fortunate in keeping them well in hand, so that little damage was done. The greatest damage in any one fire was $132 and this only burned over 100 acres, the majority of which was grass land. A conviction on a charge of carelessness was secured and the accused fined $20 and costs. Under this charge of carelessness there should have been more convictions secured, but sufficient evidence could not be obtained.

The largest fire which occurred was on the west end of the reserve and this burned over 5,000 acres of grass lands. This was the hardest fire to fight, and indications were that it was intentionally set as a considerable number of small fires started in this vicinity where there was no reason for them.

The lookout tower near headquarters proves very useful as almost the whole of the reserve is plainly visible from it; and during the past season it was frequently used to locate fires.

Spruce Woods Forest Reserve.—There were ten small and ten large fires on this reserve, most of which did little damage. The one fire which was very difficult to fight was in the peat soil on a hay meadow. The cause of the fire was uncertain, but probably was due to a fire which had remained dormant in the peat from June 1 to August 15. Although the ranger passed this place several times it was smoldering so slowly that it was not noticeable until August 15 when it broke out and began to travel on the surface. It burned as deep as 3 to 4 feet into the ground in many places and before it was stopped had covered about 150 acres. The fire was finally stopped by trenching around it and building a dam on Pine creek which forced the water to run through the ditches and on to the fire, which was thus extinguished.

IMPROVEMENTS.

Riding Mountain Forest Reserve.—During the past year about 75 miles of roads have been constructed. About 40 miles of this followed the route of the old Thompson road and the Whirlpool road, which in some places was merely a trail; the remainder was new. The Thompson road was cut out about 15 years ago and since then the fire had run over part of the country, and the dead timber, falling, had completely blocked and in most places obliterated all signs of a road. The Kelwood-Whirlpool road, which is the eastern end of the Central road, was also completed. There were also minor improvements made on other roads, especially the grading on the Strathclair road at lake Audy and the building of a short branch road to the Whirlpool lookout tower.

The system of roads adopted for this reserve is the Central road, running east and west through the reserve from Roblin to Kelwood, and several roads running at right angles, as the Thompson, Strathclair, Birdtail and Gilbert Plains roads. Then there are, and will be, more branch roads opening up special parts of the reserve.

Forty miles of fireguards were cut within the past year. These were cut from 16 to 20 feet wide and the brush piled for burning and a part of it burned. There is still a considerable part of this reserve to protect with fireguard, and this is being done as fast as the appropriation will permit.

The chief telephone work carried on was the construction of the Dauphin line, a branch from the Central line 30 miles north, to the Dauphin ranger station. The poles were cut and distributed the winter before. The method of construction is very close to the standard of the United States Forest Service for a grounded circuit line. The other work carried on was repairing the present lines and cutting poles to make a pole line of the Kelwood-Whirlpool branch. The cost of telephone construction is increasing rapidly as the cost of wire has risen over 60 per cent in the last year, which has added $8 per mile to the cost of construction.

There were four cabins and stables erected during the past year to serve as stopping places, tool caches, etc. There are still two more of these to erect, after which it will not be necessary to carry a tent when travelling on this reserve.

There were two steel lookout towers purchased, one for the Russell district and one for the Whirlpool. The tower at the Whirlpool controls about ten townships and will no doubt prove very valuable in detecting fires over this area.

Photo. 8078. C. W. Wellman.

Protecting the forest. Burning brush left after cutting roadway, Duck Mountain forest reserve, Manitoba.

Duck Mountain Forest Reserve.—During the past season a decided start was made in the construction of substantial roads and telephone lines to open up the reserve. The primary part of this plan is the Central road and telephone line running north and south from Grandview to Minitonas ranger station and a road and telephone line running east and west across the reserve from the proposed Pine River ranger station site to the Kamsack ranger station at Madge lake. The secondary trails and telephone lines will then be branches from this primary system.

The Central road was built for 31 miles north from Baldy mountain. This will be produced north to the Minitonas ranger station during the present summer. The other piece was built from the eastern boundary west to Singush lake, 9½ miles. This totals about 41 miles of primary road, all of which can be travelled over by automobile after being used for a season. There were also 12 miles of secondary road built, as well as about 4 miles of pack trail which will probably be opened up as a road later on. Considerable improvement was made to existing roads. The 8 miles of fireguard on the eastern boundary was cut a rod wide and is very satisfactory.

The central telephone line, of which 27 miles were built, runs northward along the Central road. On this line green trees were topped and used for poles for the southern 6 miles; the remainder being an all-pole line. The Singush line, 9½ miles along the Singush road, is an all-pole line. Both lines are grounded circuit and are very satisfactory.

On the Central road northwest of Singush lake, the Central cache and stable were built at the end of the season. This cache is to be used to store fire-fighting tools, supplies, etc., and as a stopping place between ranger stations.

The improvements made during the past year on this reserve were well constructed and are very satisfactory, and when the plan now laid out to include roads, trails, telephone lines, ranger stations, cabins, fire lines and lookout towers, is completed the fire danger on this reserve will be materially lessened.

Turtle Mountain Forest Reserve.—On this reserve practically all fire lines act as roads and vice versa. The practice has been to clear the fire lines 40 feet wide and plough 24 feet of this; and, in the case of roads, to clear about 30 feet and plough about 12 feet, after which it is levelled with a disc and drag.

Twelve miles of new fire line and thirteen miles of road were cleared and ploughed. There still remain about twenty miles of fire line to clear around the boundary, and the fireguards in the interior will be cut so as to connect the numerous small lakes. Six miles of the north boundary fire line were widened.

The West Cabin, which is in reality a ranger station, was built during the past year.

The mainland dock was built to house the launch and for a landing place for small boats.

Spruce Woods Forest Reserve.—The only new construction undertaken was the ploughing of a fireguard south of the Military Camp at Sewell, to protect the reserve from fire. On a part of this six miles there was considerable brush to cut, the whole distance being ploughed one rod wide. The Scotch pine plantation was surrounded with a fence and the fireguard re-ploughed. The only other improvement work done on this reserve was the planting of shelter-belts of evergreens at Shilo headquarters and Brandon Junction cabin.

SILVICULTURE.

Riding Mountain Forest Reserve.—The number of timber permits issued on this reserve dropped off about 20 per cent, or from 750 to 606. Of these about 40 per cent were for fire-killed timber and the remainder for green timber. This reduction in permits is thought to be due partly to the effect of the war and partly owing to the hard winter.

Considering that this was the first year a very determined effort was made to secure proper brush disposal, a very good job was made. The permittees not being used to disposing of brush, as in most cases where a new idea is first tried, it took a considerable amount of time and patience to get them to do the work thoroughly. I was pleased to hear at the end of the season that several of the permittees had admitted that the proper disposal of brush is advantageous. The brush from green spruce was piled and burned in most cases as the cutting proceeded, while other brush was lopped and scattered.

There were no timber sales in operation, and only one mill-site which was let to an operator who was cutting on settlers permits and who complied with the regulations satisfactorily.

Duck Mountain Forest Reserve.—During the past year the timber permit work has been much more satisfactory on this reserve than during the preceding year or so, the majority of the brush being properly disposed of and stumps cut low.

The most satisfactory method of burning spruce brush, which was the prevailing species cut, was to build a small fire while "swamping" and throw the brush on to this, and so clean it all up as the work progressed and not have to come back later to burn brush. The cost by this method is estimated to be from 30 cents to 50 cents per thousand feet board measure.

There was only one mill operating, which was in the Durban district and at which about 300,000 feet was cut to fill permits.

With our success this year it is expected that we will have less trouble in the future with regard to brush disposal and other regulations.

Turtle Mountain Forest Reserve.—The great depth of snow affected the taking out of wood on this reserve more than on any other, the number of free permits being only 23 or a falling off of 70 per cent, while the paid permits fell from 26 to 5, over 80 per cent. The cordwood removed was all dead timber and only a small quantity was taken. As the supply of green timber is limited on this reserve it is advisable to confine the cutting to dry timber for a time.

Spruce Woods Forest Reserve.—Due to the severe winter there were only fifteen permits issued during the past season. This is only one-third of the previous year's issue. The only timber taken out here is dead timber, the large percentage of which is poplar. The small trees cut are thrown on to the sleigh or wagon, limbs and all, so there is no trouble about brush disposal.

Shilo Nursery.—The soil on the reserve has, after trial for several years, been found unsuitable for nursery purposes and it is considered advisable, after the transplants now growing have been set out, to discontinue this nursery and obtain the necessary stock from the Indian Head nursery station where, it is understood, arrangements are being made for growing a supply.

GRAZING.

The revenue received from grazing in 1915 was $1,400.75, of which $143 came from Riding Mountain reserve, $506 from Spruce Woods and $760.75 from Turtle Mountain, the latter increasing to this amount from $432.25 in 1914.

Turtle Mountain Forest Reserve.—The grazing on this reserve during the past season has become better known to the people and many more of the farmers have availed themselves of the opportunity of having their stock pastured for the reasonable sum of $1 per year. There has been an increase of over 40 per cent over the revenue from last year which brings the total this year to $760.75.

This brings the total number of stock this year up to 544 cattle and 126 horses in the enclosure and 246 cattle in the open grazing. During the past year only the north part of the enclosure was used but as the number increases both parts will be used. As there are over 23,000 acres in the enclosure it is not more than one-third stocked as yet and will pasture all the stock which will be available for some time. During the past season the grass, although not as heavy as in some years, was very plentiful on account of the enclosure being very much under-stocked. This, together with the fact that the flies were not as numerous as usual, made a very favourable season for the stock in the enclosure which were in fine condition during the summer and also when taken out in the fall.

The cattle in the open grazing area did not do as well as the others which is probably due to the fact that the corral into which they were put at nights, to prevent their being lost, was very small (about 15 acres), and consequently was soon cleared of all forage. During the coming summer either a larger corral will have to be built or the cattle will have to be allowed out at night.

Spruce Woods Forest Reserve.—The grazing enclosure at Brandon Junction, although only completed a year ago, has become so well known and so popular that during the past season there were 500 head of stock pastured.

During the early part of the season the stock did very well but later on, in August and September, they did not continue to improve but rather went back. This was no doubt due to the rather poor watering facilities. Arrangements have been made to improve the watering facilities by erecting a pumping windmill with storage tank which, together with the present plant, will furnish an ample supply of water for the stock. In addition to the enclosed grazing there were also 53 head of stock taken in for the open grazing on the east end of the reserve.

Riding Mountain Forest Reserve.—This reserve can, no doubt, support a much larger number of stock than the Turtle Mountain reserve, but it has not been advertised or brought to the notice of the public as much as the latter. Then, the country around the Turtle mountain has been settled longer and the farmers have gone in for stock-raising to some extent.

The chief areas of grazing land on the Riding mountain are in the vicinity of Clear lake, lake Audy, in the Birdtail valley and (in the west end) near the Roblin ranger station. From the information on hand the whole reserve will probably support in the neighbourhood of 10,000 head. During the past season about 400 head were grazed in the vicinity of Clear lake. This is the second largest area of continuous grazing land in the reserve, the other being in the Birdtail valley where about 80 head of stock were pastured last year. These two areas should support about 3,000 head each.

During the present season it is the intention to make a special study of the grazing facilities on this reserve to determine more definitely the number of stock which can be supported there, and also to take up the numerous other problems regarding grazing.

Duck Mountain Forest Reserve.—There has been practically no grazing on this reserve up to the present and the possibilities are not as great as on other reserves. There are several areas, however, where a considerable number of stock can be pastured, the chief of these being near Singush lake, Shell river and Boggy river and at the Durban ranger station. In all about 2,000 head can be grazed on this reserve.

USES OF LAND.

Summer Resorts.—During the past year there have not been as many summer resort lots applied for as was anticipated earlier in the season. In the case of Clear lake and lake Max this was largely on account of the financial stringency caused by the war.

The number of lots leased on the several resorts up to the end of the fiscal year 1914-15 was: Madge lake, 7; Clear lake, 2; and Max lake, 18. During the fiscal year 1915-16 there were leased at Madge lake 20 additional lots and at Max lake 4.

Madge Lake Summer Resort.—From the above it will be seen that the greatest activity in the leasing of lots was at this resort, and had there been more lots surveyed with a water frontage the number taken would have been considerably greater. As there are over fifteen miles of shore line this difficulty should be easily overcome. The practice of cutting out a road along the front of the lots greatly impairs the value of the lots. This road should be staked out as it is required by law, but it need not be cut out, and access to the lot could be obtained by a road cut out at the rear of the lots which would enable the lessee to improve his lot to suit himself, with, of course, the understanding that the roadway would not be occupied by buildings.

Clear Lake Summer Resort.—During the past year there have been no applications for lots at this resort. This is due to the war and probably to the location of the summer resort, which is on open prairie land. A more suitable location is being considered.

Max Lake Summer Resort.—During the past year only two lots have been applied for, though more applications will be made if the unsurveyed shore west of head-

Photo. 8075. C. W. Wellman.

Protecting the forest. Brush disposal, showing skidway and brush piles, Duck Mountain forest reserve, Manitoba.

Pohto. 8076. C. W. Wellman.

Removing fire danger. Brush burning, Duck Mountain forest reserve, Manitoba.

quarters is surveyed. This is a fine location for lots and a considerable number of people wish to secure these rather than on the Island, to which access can be obtained only by boat. Although there are only 22 lots leased, this should not be taken as a criterion of the popularity of the resort. During the past summer all those having lots occupied them for the greater part of the season, and on Sundays and holidays there were always several hundred people at the lake.

Hay Permits.—As in past years there has been a considerable business carried on in hay permits but, due to the very poor crop, it was difficult to secure sufficient hay to cover all permits. One feature of this, which is being taken in hand, is the burning of hay meadows by settlers who expect to cut the hay on the same. These meadows will be burned off under the supervision of the rangers early in the spring, and it is expected this will prevent a large number of fires.

Military Camp.—On the Spruce Woods forest reserve, adjacent to the Military Camp at Sewell, the military authorities have fenced in several square miles of the muskeg which is in the rear of the targets and which is used for rifle and artillery practice. They have also been granted the use of the whole western part of the reserve on which to train, and it is expected that this will be used during the coming season as there will be a large number of soldiers in training.

Muskrat Ranch.—There has been an application for a muskrat ranch to cover an area near the west end of Clear lake, on the Riding Mountain reserve. This area, consisting of about 300 acres, has been surveyed and an agreement drawn up which to date has not been closed. The idea of the lessee is to fence in a small slough-lake and raise muskrats for their skins.

Hunting Cabins.—The matter of issuing permits for hunting cabins was taken up on the Riding Mountain reserve, which is much more popular than any other during the hunting season, and over 75 permits were issued for locations for cabins at 25 cents each, and the timber used in their construction charged for at the regular rate of dues, the average on each of these cabins being about $5.

TRESPASS.

There were a few small seizures of timber cut in trespass by settlers. The only trespass of any account was made in February, 1914, by the Burrows Lumber Company. The timber cut was green spruce and was cut outside the boundaries of T. B. 986 and T. B. 1120. This case is in process of adjustment.

FISH AND GAME.

During the past summer the perch which were put into Max lake a few years ago began to take the hook, and were caught in large numbers by the hundreds of campers and visitors to the lake. Although these fish are not classed with the more "gamey" fish such as trout and bass, still they furnish an immense amount of sport for all who wish to fish for them. This is the first year that any number have been caught and since they could be caught all over the lake, and in great numbers, it is very likely that they are now very numerous and that there is no danger of them being fished out. So far no pickerel have been caught in Madge lake, but it is expected that during the next year or so they will have multiplied and grown large enough to be caught.

The Riding Mountain reserve is more popular than the Duck Mountain reserve during the big game shooting season. Besides the people who had hunting cabins, for which permits were issued on the Riding mountain, there were a great many who lived in tents, so that the total number who hunted big game, consisting of elk or moose on this reserve, it is estimated would be well over 500. The administration of the game is in the hands of the Provincial Government.

PUBLICITY.

During the week of July 1 to 8 there was held in Winnipeg an exhibition for patriotic purposes, which included an industrial parade. A forestry float was prepared for this and consisted of specimens of wood taken from the exhibit here, and also wood products as a bale of excelsior, miniature cord of wood, sections of railway ties, window frames, barrels, etc. All these were artistically arranged with evergreen on a platform built on a large freight lorry. Across the top of the float was a large banner on which was printed "Dominion Forestry Branch". After the parade this was placed in a tent at the exhibition grounds and one of the officers of the Forestry Branch was there to explain to the visitors the aim and purpose of the forestry organization. There were also a number of forestry bulletins, etc., distributed from here. While there were a large number of people in town during this patriotic week we had about 500 cards artistically printed with a few catchy remarks regarding fire protection. These were placed in the dining rooms of the leading hotels and in other places where they would be seen by the public, and attracted considerable attention.

During the year the exhibit of Manitoba woods at the Industrial Bureau has been of interest to numerous visitors.

The practice of having forestry articles in the newspapers will have considerable effect in educating people in the work which the Forestry Branch is doing and this publicity should be encouraged as much as possible.

FIRE-RANGING.

The fire-ranging work outside of the forest reserves was divided among four districts as follows:—

Manitoba South District.—The Manitoba South fire-ranging district was under the control of Chief Fire Ranger A. M. McLeod, a staff of twelve rangers and two assistants. For a portion of the months of May and June two temporary rangers were employed in the lake Winnipegosis district. The staff on the whole was not by any means satisfactory, only about half of the rangers on the staff could be termed good fire rangers. More precaution should be taken in the selecting of good rangers as this is the most important point of the service.

The patrols were made both by canoe and on foot, the lake Winnipeg patrols being made by canoe, and in one district a large skiff, equipped with a sail, was used and proved very advantageous.

On account of the shortage of snow in the winter of 1914-15, and very little rain in the early spring, the country on the whole was very dry and the fire danger very grave at all times during the season, particularly the first three months.

In all we had nineteen large fires and seventy-five small fires, covering a total area of about 170 square miles, which is about eight-tenths of one per cent of the area under patrol. The cost of fighting fires was larger than in previous seasons on account of two fires on lake Winnipegosis, where an expenditure of over $2,000 was made. This was largely due to the fact that there were no patrols on the lake, and the fire had made great progress before men could be taken to the scene. Apart from this expenditure the cost of fire-fighting was normal, being in the neighbourhood of $700, which is most satisfactory, considering the weather conditions. The timber destroyed was principally young growth, there being very little merchantable timber killed. Some 2,000 acres were damaged, but not killed; the fire also ran over some 20,000 acres of old brulé, slash, grass land, etc.

On the whole the season could be termed fair, when one takes into consideration the weather and also the class of rangers we had in some districts. A patrol will be made of lake Winnipegosis which will look after that country, which has not previously been properly provided for. We should also have a steam tug on the lake Winnipeg patrol which would ensure us better protection as the present system of canoeing is very slow, and a fire could make too much headway before a ranger could get to it.

Manitoba North District.—This district has been for some time under the charge of Mr. J. T. Blackford, Chief Fire Ranger, with headquarters at Forestry island, near Norway House, and the patrol work, with the exception of Split lake, performed by Indians who were engaged locally and who had an intimate knowledge of the districts to which they were assigned. These men worked in pairs, making the trips by canoe, which took from a week to ten days.

Mr. Blackford had a power canoe, furnished him in 1914, for use in the waters accessible without portaging, and found it very serviceable. He made inspections of the outlying districts as frequently as circumstances would permit, accompanying me on one trip to Split lake. At Split lake a white man was appointed as ranger, but it was found that since the advance of the Hudson Bay railway the district could be managed to better advantage from Pas, and it was therefore transferred and Mr. Blackford was asked to take charge of the territory farther east than he had heretofore covered in lieu thereof.

The work in this district has been most satisfactory and while some drawbacks attend the employment of Indian rangers, it is not possible at the present time to engage white men. An improvement is looked for this season as the result of a special effort to secure the co-operation of the Indian chiefs of the district.

Pas District.—A number of fires occurred in this district but all, with one exception, were dealt with promptly. Rangers in this district were each provided with a helper and proved reliable officers. The patrols in this district are all made in canoes, except that covered by the chief ranger who operates the motor boat supplied two years ago. While this boat was most suitable at the time, it has, since the advance of the Hudson Bay railway provided a means of access to the north, proved rather large and expensive, and a smaller craft being thought now more satisfactory, if conditions are favourable, the boat will be transferred to lake Winnipegosis next year and a cheaper, smaller boat installed for the Saskatchewan river and tributary waters.

The season, especially in the early part, was most dangerous on account of dry weather with high winds, following a winter with light snowfall. The result was that the whole country was as dry as tinder and lent itself readily to what, we have reason to believe, was a pre-concerted action on the part of numerous unemployed who wished to obtain work. Rain, although delayed for some time, finally came and extinguished all fires. At least two of the fires were the result of camp fires left burning in the winter which, smouldering in the deep moss under the snow, broke out in the spring.

Hudson Bay District.—During the past summer there were a number of complaints regarding fires in the neighbourhood of Port Nelson but it has been impossible to secure any definite reports as to the damage done. From what I can learn little or no merchantable timber was destroyed but the destruction of cover for fur-bearing animals was serious.

During the past winter I made a trip to Port Nelson, travelling from Manitou rapids by dog train, and looked into the work done during the past year, at the same time making arrangements for this season's work. It is hoped that the two rangers selected, who have been highly recommended by the government officials there, will pay attention to their work and render good service. These rangers have been assigned to canoe patrols on the Hayes and Nelson rivers and their tributaries to a distance of 50 to 100 miles from port Nelson.

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

APPENDIX No. 3.

The following report concerns the Saskatchewan inspection district for the fiscal year 1915-16.

INTRODUCTION.

The greater portion of activities in this district were confined to the administration and field work on the fifteen forest reserves now established in this province, comprising some 6,579,974 acres. General supervision was given to the fire-ranging in the Prince Albert and Battleford fire-ranging districts, which cover most of the unsettled territory outside of the forest reserves between the North Saskatchewan and Churchill rivers. For the greater part of the season 1915 the majority of the staff were busily engaged in fire preventive work due to the early opening of the season and the dry condition of the north country during most of the summer. More time and money were expended on this branch of the work than during an average year.

The organization of the personnel on several of the reserves required considerable attention and adjustment.

The erection and completion of numerous ranger stations was successfully carried on and suitable living quarters thus furnished for many of the staff at convenient points in their districts. The greater portion of the living quarters for the men have now been completed and several of them connected with telephone lines. Road and trail construction was proceeded with and lookout towers were erected. Closer supervision of timber cutting operations was given than ever before and very satisfactory results obtained in brush disposal by permittees and on timber sales.

IMPROVEMENTS.

The improvements carried on during the fiscal year on the various reserves comprised the following:—

Porcupine and Pasquia Reserve.—The most noteworthy building project completed during the past season in the district is that of the headquarters on the Porcupine forest reserve. Very comfortable and convenient buildings were erected, all built of logs but finished with lumber. Four ranger cabins and five stables were constructed. Lumber and materials were purchased for one cabin and stable to be erected this spring.

On the Pasquia forest reserve two ranger cabins and two stables were completed and two new ones constructed. Material was bought and hauled for another one to be completed this spring.

Only slight improvement work was put on existing roads in order to make them passable: the same rule applied to trail work, which consisted mostly of ranger services and some new location. Fireguards were ploughed around the headquarters buildings and the Swan ranger station. Material was purchased and distributed for a telephone line sixty miles long between the headquarters and Hudson Bay Junction; this line to be constructed during the coming season. Four wooden lookout towers have been built and three are under construction. Most of these are from forty to sixty feet in height and are located in the vicinity of the ranger stations.

Big River Forest Reserve.—Two ranger cabins and barns were built in addition to the two stations already completed. A granary was built at Otter cabin. Fifteen miles of new road were cut, 25 feet wide. Ranger time was spent on improvement to some of the existing roads. A new trail was cut and opened up for some twenty miles. Pasture fences were built at two of the ranger stations and one eighty-foot steel lookout tower was purchased to be erected this spring.

Sturgeon Forest Reserve.—Two ranger cabins and stables were built and completed. Two-and-a-half miles of new road were cut 15 feet wide, and considerable ranger time was spent on clearing out existing roads and trails. Three small bridges were built by ranger labour and two wooden lookout towers erected. Material was bought and distributed for forty-five miles of telephone line to connect three of the ranger stations.

Fort à la Corne Forest Reserve.—One ranger cabin and stable were constructed. Four other buildings were completed. Forty-four miles of road were cut and opened up along an old trail. Two eighty-foot steel lookout towers were erected and one fifty-foot wooden tower. One well was dug and a pasture fence erected.

Moose Mountain Forest Reserve.—One teamster's cabin was built. Two miles of road were cut and twelve miles of trail, along which a telephone line is now under construction. Six miles of telephone line were completed, giving the headquarters connection with rural and long distance lines around the boundary outside the reserve. Two eighty-foot steel lookout towers were erected at the beginning of the fire season.

Beaver Hills Forest Reserve.—Fourteen miles of new fireguard were ploughed and four miles of old guard were re-ploughed. One eighty-foot steel lookout tower was erected at the headquarters. Two small bridges were built and maintenance work on the roads was done by ranger labour. Seven and a half miles of telephone line were completed. This line gives the ranger connection with a rural line outside the reserve, post office, telegraph office, etc.

Pines Forest Reserve.—A new stable was built and the ranger house repaired. Four small corduroys of a few hundred yards were well constructed. About one mile of fireguard was cut out and thirteen miles were ploughed. A new telephone line, nine and a half miles long, was extended from the existing line by running the wires on the railway telegraph poles, after an agreement had been reached with the railway company. This line gives connection between one of the ranger stations and the headquarters. Another eighty-foot steel lookout tower was erected on this reserve.

General.—On the Manito and Elbow forest reserves ranger houses have been constructed according to standard plans for this type of building. Material was purchased for the same class of buildings on the Dundurn and Keppel forest reserves and is on the ground, and they will be built this coming season.

Eighty-foot steel lookout towers were purchased to be erected at the ranger headquarters on the Dundurn and Elbow reserves.

Fireguard maintenance, brush disposal and the construction of pasture fences at the ranger stations were successfully carried on by the staff of the Nisbet forest reserve. This along with close supervison of the wood-cutting operations and fire prevention occupied the most of the time.

Now that most of the reserves have been provided with comfortable living quarters for the staff the next essential for the proper administration of the different reserves is telephone connection between the different stations, improvement of the roads and trails and the erection of more lookout towers. Close supervision of all improvement projects is necessary in order to obtain satisfactory results and the relation of each project to the general plan must be well considered before definite action is taken or money expended.

EQUIPMENT.

Fire-fighting tools such as shovels, spades, hoes, rakes, axes, mattocks, torches, etc., have been furnished to the different ranger stations. Ploughs, brush-mowers, hay-rakes, wagons, sleighs and road scrapers have been purchased for improvement work. Four teams of horses were purchased for work on general improvements and roads. A number of the ranger stations were supplied with sets of carpenter's tools required for the erection of buildings and repair work. Telephone equipment was supplied to the

different reserves and a food supply cache was placed in one of the isolated ranger stations for the use of a crew in case of fire. It is most essential that a sufficient number of tools be accessible within a short distance of the fire if efficient work is expected of the ranger and the crew he calls together. The distribution of tool caches in several places in each ranger district should be considered.

FIRE.

The season of 1915 proved to be the most disastrous of late years, due to the dry condition of the country the previous fall and the small amount of snow during the winter which disappeared early in the month of April. This was not followed by any precipitation for several weeks. Most of the sloughs, muskegs and small watercourses were dried up and, as no rain of any account fell during the month of May, the condition in the woods became very serious. Slight, misty showers passed over but they were of very little benefit, merely checking the progress of some of the fires and not extinguishing them. Fires smouldered in some of the muskegs for most of the summer.

The most serious fires took place in the vicinity of the Porcupine and Pasquia forest reserves, most of them being due to the carelessness of transient labourers en route to Pas for work on the Hudson Bay railway. Most of these men travelled along the railway right of way on foot and left camp-fires burning and set fires in many places. However, settlers were responsible to a considerable extent for the setting out of fires to clear their land and not taking the proper fireguarding precautions. A few large fires were reported in the northern part of the province but ran over mostly scrub country, old burns or muskeg and apparently the damage was not extensive. On account of their inaccessibility, remoteness of the region in which they occurred and the difficulty in getting men to fight them, the natural fireguards were their only check.

A disastrous fire occurred on the Sturgeon forest reserve and along its eastern boundary and although it destroyed very little merchantable timber the reproduction which was killed throughout was considerable. This fire spread very fast in the old logging slash which had been cut several years previous. If the brush had been disposed of in some suitable manner, either by piling or burning, the progress of the fire could have been checked much sooner.

The Beaver Hills forest reserve received a bad scorching of nearly its entire area. In the long grass, which had accumulated for a number of years, the prairie fires from the outside spread very rapidly, fanned by strong winds and coming in at several different points at one time. Not much timber was destroyed but considerable young poplar was fire-killed. An increase in the number of cattle grazing on this reserve is the most practical fire protection that can be secured.

On the forest reserves in this district during the year we had 67 large fires and 39 small fires, a total of 106, and a total area burned over of 228,163 acres. The size of the average fire was about 2,000 acres and cost $210 to extinguish, doing a damage of approximately $7,000. Thirty-four acres per thousand were burned over of the forest reserve area. These fires are attributed to the following causes: Unknown, 33 per cent; settlers, 32 per cent; campers, 20 per cent; railways, 10 per cent; lightning, 3 per cent; log drivers, 2 per cent.

Outside of the forest reserves in the fire ranging districts there were 37 large fires and 104 small fires reported. Bad fires occurred in the vicinity of Montreal lake and Ile à la Crosse, though the staff prevented any very great damage to standing green timber. A new patrol boat was built for service on the Saskatchewan river in the vicinity of Cumberland lake during the coming season. More supervision of fire rangers is essential and for the approaching season three sub-chiefs have been appointed, and each fire ranger with a canoe patrol is furnished with an assistant. Bordering the settlement and in country where roads and trails are available the rangers are required to use a horse on their patrols. New canoes have been purchased for the men in the north.

During the past season the lack of brush disposal by both large and small operators in the province has proved to be a very great menace to the remaining merchantable timber and also to the young stands. If it had not been for the large amount of débris in which many of the fires secured their headway such great effort would not have been required to check them. It is almost impossible to check a large fire in an old slashing when it is fanned by a strong wind. If the brush had been burned or even piled it would have left the old log roads or skid roads in many of the old logging operations as fireguards or points of vantage for fire-fighting crews to work from. The condition of these old cuttings with the brush scattered indiscriminately all over the area causes the flames to spread so fast that it is almost beyond human endeavour to check them.

Photo. 10838. R. H. Campbell.

Stand of poplar intermixed with spruce, Porcupine forest reserve, Saskatchewan.

SILVICULTURE.

The results obtained from the enforcing of the brush-burning regulations have been satisfactory. Some difficulty was experienced by the rangers at first. If a little demonstration is made of the proper method and the improvement thus secured is pointed out to the permittee, if he is at all reasonable he can see the advantage. Good results were obtained in the greater part of the settlers' permit cutting and likewise on the timber sale operations. It is most essential that the brush-burning be proceeded with immediately the trees are cut, for if the material is left for a few days in the winter it becomes covered with snow and the operation is thus made more expensive. The inconsistency of the different departmental regulations is very apparent on some of the reserves where the settler is required by forest reserve regulations to burn and dispose of his brush while alongside of him on Dominion lands or a timber berth, over which Forestry Branch officers have no jurisdiction, another man, possibly the settler's neighbour, may be slashing away with no regard to the height of his stumps or waste material and leaving his brush scattered in every direction. The forest officers have been confronted with just this situation numerous times, while they are doing all in their power to reduce the fire hazard and

improve the condition of the forest. It is discouraging to the rangers who have a proper appreciation of their duty and very unsettling to the public. Naturally the permittees follow the lines of least resistance and thus are creating year after year a great fire hazard along the boundary of the reserves as well as wasting and destroying more timber than they utilize. There is no attraction in a timber proposition on the forest reserve so long as such slack conditions exist outside; and the utilization of much mature and decaying timber is delayed while a large number of young, immature stands are being cut and a large percentage of the material wasted.

One timber sale on the Fort à la Corne forest reserve is worthy of note for close utilization. This operator has been cutting infected and burned jack pine, with 20 per cent of his logs running under 4 inches at the top and from this material he has been able to manufacture at least 2 x 4 studding. The tops from the former year's cutting and those which were too crooked to be utilized for lumber were sawn into shingles during the summer. This operator cut low stumps and made excellent disposal of brush by burning.

The extension of the time limit for a homesteader to obtain his free allowance greatly increased the demand for timber along the south boundary of the Porcupine forest reserve and a large number of logs were cut and sawn in this vicinity during the past winter. On the whole the demand for cordwood has not been as brisk as in previous years. Close supervision of timber sales and permittees' cuttings by the rangers is the only proper method to pursue to obtain good results, have the brush properly disposed of, waste prevented and trespass eliminated.

On the Pines forest reserve the nursery has produced some two thousand seedlings of Scotch pine, lodgepole pine and jack pine, as well as Norway spruce and white spruce, European larch and several other species. Severe frost during the summer killed off a considerable number, but some 6,500 seedlings were successfully transplanted. The most hardy of the species have proved to be the Scotch pine, rigid pine, yellow pine, lodgepole pine and white spruce. A bed of white cedar has progressed very well. Some 15,000 three-year-old seedlings are ready to transplant on some of the old "burns" this spring, around the headquarters.

Around the ranger stations on the Beaver Hills, Moose Mountain and Nisbet reserves small plantations of a few hundred trees were set out in the spring from stock shipped from the Indian Head nursery. These trees are growing very nicely.

GRAZING.

The number of stock on the various forest reserves has been considerably increased during the past year as the settlers are becoming aware of the simple method by which they may secure forage. Two new stock associations have been formed in addition to the ones already organized the previous year. The grazing has been most in demand on the Elbow, Manito, Beaver Hills, Dundurn, Keppel and Seward forest reserves, mentioned in their order of importance. The possibilities of the northern reserves have not become known very largely to the people as yet, but numerous inquiries are being received and before very long the abundant forage and hay resources of these areas will be utilized. Numerous fenced grazing permits have been applied for on the timbered reserves, while herding is practised to a great extent on the more open areas.

The fear of taxation by the provincial authorities of those holding fencing and grazing permits is causing a number to hold back and if this matter were definitely settled I feel sure that it would not be long before most of the grazing areas at least in the southern prairie reserves would be utilized.

FOREST SURVEYS.

Reconnaissance surveys were carried on by Mr. G. M. Dallyn in the country north of Prince Albert and in the vicinity of Montreal and Candle lakes during the past summer. Mr. A. V. Gilbert examined the territory north of Battleford in the vicinity

of Makwa and Meadow lakes. Most of the territory was found unfit for agriculture and most adaptable for forest growth, although some very promising agricultural land with good soil indications was noted.

GAME.

The extension of the forest reserve area in the province during the past five years automatically created vast game refuges according to the provincial law under which all forest reserves were declared game refuges. During the past few months new legislation has been enacted somewhat modifying the extent of the refuges and eliminating several altogether. Only small portions of some of the northern reserves have been retained for game protection and this will eliminate considerable opposition to the creating of further forest reserves.

On many of the northern reserves the Indians secured their living from hunting and trapping and it was creating some hardship to cut them off altogether from this pursuit. However, the close seasons should be strictly enforced by both provincial and Dominion officers.

Several of the reserves such as the Dundurn, Manito, Keppel and Elbow are suitably situated to have a portion of their area left as a refuge for prairie chicken or ducks to the advantage of the surrounding community and it is to be regretted that this has not been done.

E. H. ROBERTS,
Acting District Inspector of Forest Reserves for Saskatchewan.

APPENDIX No. 4.

This report concerns the Alberta inspection district for the fiscal year 1915-16.

INTRODUCTION.

In previous reports I have discussed the problems which confront us as a result of the fundamental system of employment now in force. It is not my intention to lay further emphasis on this all-important problem, beyond pointing out that if there has been one time in the history of every Canadian organization when the need for developing the greatest possible efficiency has been of the utmost urgency, it surely is the present. A change from the present system to one in which merit shall be the sole basis of employment and advancement in the staff of the Forestry Branch is one which, more than anything else, will provide for the development of a live fire preventive organization, and an organization which will be able to keep up effectively with the advance in administration.

BOUNDARIES.

No material changes took place in the boundaries or areas of the forest reserves in this inspectorate. Although at various times different tracts of land have been examined and portions thereof recommended for creation as forest reserves, no action has as yet been taken to definitely set them aside for this purpose.

One rather important piece of work consisted of the Cypress Hills boundary survey which was performed by Mr. A. Gorman and his party. The work consisted in completely retracing the boundaries of the western and centre blocks of the Cypress Hills reserve. Owing to the fact that the original survey of this country was made a great number of years ago, the boundaries had in a very great many places become almost obliterated, and in consequence it was a difficult matter to provide for an

efficient administration of the hay and timber permit business. At the same time that the boundaries were run Mr. Gorman retraced and marked a considerable number of the interior lines of subdivision. As a result of this survey the western and centre blocks of the Cypress Hills are provided with boundary and interior monuments which will be of the utmost value in conducting the business of the reserve. Owing to the limited staff which was available, it was impossible to provide for any boundary survey work in connection with the other reserves, except that done in connection with the ordinary reserve administration.

IMPROVEMENTS.

On all divisions of the Rocky Mountains reserve a severe rainy season set in about the middle of May and continued almost without interruption until well on into July. The precipitation throughout this part of Alberta was enormous, and resulted not only in much damage to cities, towns and public works of the province, but, also, caused great loss to our previously constructed improvements, and seriously interfered with the field improvement programme for the season. Bridges, culverts, corduroy and grades were washed out, making maintenance work on new and old trails both necessary and costly. In the mountain sections of the reserves it is necessary, in order to avoid enormous expenditures, to take advantage in many places of stream valleys for the location of trails. In a season like 1915, therefore, when practically every watercourse was flooded, the damage to trails so located was great. It may be said that on the whole, however, the trail system came through in fair condition when due consideration is given to these abnormal conditions.

Athabaska Forest.—The improvement programme previously laid down was carried forward by the new supervisor. It was hoped that both Lower trail and the Mountain trail projects, and also the Hay River trail, which was to join up these two, would be completed. Owing to abnormal weather conditions, and to difficulties in securing labour, the trail programme was considerably reduced. In all, 42·5 miles of primary trail were constructed.

Although it was the intention to construct three cabins on the Athabaska forest during the past season the very severe winter rendered impossible the transportation of a considerable amount of the materials necessary. The log construction of two cabins was completed, however, and materials for the completion of these two cabins, as well as for the third cabin have been provided. One tool cache was erected; also one lookout tower was under way at the end of the fiscal year.

Brazeau Forest.—On this reserve 34·5 miles of primary trail were constructed. The main Mountain, or Bighorn, trail was completed from the terminal point of last year southward for a distance of 18 miles, so that this trail is now completed to within one mile of the inter-reserve boundary between the Brazeau and Clearwater forests. Other trails were built from Coalspur to the Macleod river, and from Coalspur to the Grave Flats cabin. On all of these the construction is of exceedingly high class. In addition to the primary trails the North Brazeau secondary trail, 19·5 miles in length, was constructed from Grave flats to the forks of the North and Main Brazeau rivers.

A total of about 35 miles of telephone line was completed. The first section of this line consisted of 19 miles from the headquarters at Mountain Park to the Grave Flats cabin. The other section, which is a continuation of the same line and which when completed will extend to the Southesk cabin, embraced the construction of approximately 16 miles of line. On completion of the lines and installation of the instruments the lines worked very satisfactorily. A certain amount of maintenance work was also done in connection with the Pacific Pass telephone line which had previously been constructed.

On this forest, also, the very severe weather conditions during the winter months rendered impracticable a certain amount of building construction which had been contemplated. One cabin authorized in the previous fiscal year was started although it was not finished.

Clearwater Forest.—Twenty-three miles of primary trail and 139·5 miles of secondary trail were built. In addition to the construction of these new trails the exceedingly bad weather conditions made necessary the expenditure of approximately $1,000 in ranger service and labour on the maintenance of trails which had been seriously damaged by the floods.

In my previous report I referred, in connection with the drowning of one of our rangers, to the necessity of providing some means of crossing, otherwise than by fording, the Saskatchewan river during high water periods. A start in this direction was made during the past season in the construction of the Saskatchewan aerial ferry at the Wilson ranger station. The span between the towers which carry the one-inch steel cable is 258 feet, and the location of the ferry is on a straight stretch of the Saskatchewan, where very suitable banks were found for this type of construction. A large car was provided which will take care of any loads which it may be necessary to convey across the river. It is so designed that a man at either side of the river will be able to secure the car and to cross over himself by means of a continuous hauling rope.

Four new Class C cabins were constructed on the reserve and material taken out for two stables.

Bow River Forest.—The new trail construction on the Bow River forest was confined almost entirely to two main trails, one of which is the Lower trail from Morley southward, and the other, the Upper trail to the Red Deer ranger station. The former traversed country previously accessible by existing trails, which, however, were unsatisfactory for rapid transportation; the trail connecting the Aura and Red Deer ranger stations traversed country previously unprovided with any trail. In this latter trail, therefore, we have direct communication with the Red Deer valley, which up until last season was inaccessible except over inferior and lengthy trails. A total of 66 miles of primary trail was constructed. Owing to the bad weather conditions a large amount of time was devoted by the regular staff to the repair of previously existing trails. Destruction by floods was particularly evidenced in the Red Deer valley where two sections of the important Red Deer wagon road were entirely washed out.

The most important building project on this reserve was the construction of the Aura ranger station house which, in point of location, construction and cost, is one of the most satisfactory buildings in the district. At the same station a good-sized barn was erected with a stabling capacity for about ten head of horses or cattle. Another barn was erected at the Elbow ranger station. Other buildings consisted of one completed cache on the Sheep river and two other caches nearly completed.

Owing to the fact that a bridge over a steep canyon on the South Sheep road had fallen into disrepair, a new bridge was constructed having a total span of approximately 66 feet.

Crowsnest Forest.—Considerable progress was made in the provision of trail improvements on this reserve. Twenty-seven and a half miles of road were constructed, and thirty-nine miles of trail previously classified as approaching secondary were brought practically up to primary trail specifications. This work consisted of the improvement of the main north and south trail from Coleman to the Gap and Lynx creek, respectively. Nineteen miles of secondary trail were constructed, consisting essentially in new trail.

During the season thirty-five miles of telephone line were constructed, of which 15 miles consisted of a thorough overhauling of a previously existing line, while the remainder consisted of entirely new work. In addition to this numerous repairs were made on another previously existing line, so that now we have through telephone communication over all lines which have been built on the Crowsnest forest. Toward the close of the fiscal year a considerable amount of material was secured for further telephone work to be undertaken during the coming improvement season.

Although it was planned to construct a considerable number of caches during the winter, the exceedingly heavy snowfall made it impossible to erect more than one. The floods of last spring carried away one span of the bridge across the Livingstone river, which rendered necessary its thorough repair.

Lesser Slave Reserve.—During the past year an excellent beginning has been made in providing the reserve with proper transportation facilities. Approximately 95 miles of primary trail were constructed, much of the construction being good enough for wagon travel. Five-and-a-half miles of heavy maintenance work was done on the Grizzly trail. In addition to this, a total of 35 miles of previously existing trail was improved by ranger labour, with the result that the country traversed by these latter trails is now very accessible to saddle and pack-horse travel. As the result of last year's work it will be possible during the coming season to extend the trails westward to the western boundary of the reserve, now difficult of access.

A good beginning has been made in providing cabin and ranger station accommodation on this reserve. A station and stable have been erected on the Swan river, and one cabin at Martin mountain.

Cypress Hills Forest.—Owing to the fact that this reserve has an adequate trail system no work of this character was undertaken during the past year, but it will be necessary that a certain amount of repairs be undertaken during the coming year. Although it was expected that some work would be done on the Cypress Hills summer resort, this was not undertaken owing to the fact that the financial depression has resulted in very little use being made of the resort.

One of the most important improvement projects undertaken on this reserve was the construction of a telephone line from the headquarters on Battle creek to the western end of the reserve connecting the headquarters with the Battle Creek and Spring Creek ranger stations. This line is about seventeen miles long and is erected on poles throughout its entire length. It gives direct telephone communication between the supervisor's house and the stations of two of the rangers, and is of great advantage in the control of the reserve administration.

Other projects completed were the erection of a house and barn at headquarters and the erection of a house at Spring Creek station. Materials were purchased for stables at Spring Creek and at Battle Creek stations. Sixty-four miles of fireguard were ploughed.

With the progress during the last two years great strides have been made in the provision of proper facilities for the administration of the reserve. The end of the next fiscal year should see the reserve practically provided with all the necessary buildings, and thereafter it should be possible to devote most of the time to the development of the telephone system and to a more intensive administration of the reserve along forestry lines proper.

General.—In summarizing the improvement work for the individual reserves of the district, it may be stated that a total of about 330 miles of primary trails and roads, and approximately 210 miles of secondary trails were constructed, which, added to the large amount of trail maintenance work done on each reserve, the extensive work in the location of future trails and the construction of auxiliary trails which are not reported as specific projects, indicates that a distinct advance was made in providing one of the fundamentals for any fire protective organization—a good trail system. There was considerable variation in cost, due to the varying conditions met with and due also to the varying interpretations given to the specifications by the different men having charge of the work. Realizing that it is necessary that the work should be more closely standardized throughout the district, this matter was fully discussed at a meeting recently held at my office.

A serious endeavour is also being made to compile figures which will give a thorough idea as to the costs of various details entering into trail construction. Owing

to the extremely varying conditions under which we work, it will probably never be possible to provide estimates for trail or road construction such as is possible in the city or in the farming country. Nevertheless it is our intention to go so far as possible in this direction, as it is realized that the proper keeping of cost data should have a very direct bearing indeed upon the cost of further trails.

In summarizing the telephone work of the district it will be found that altogether approximately 88 miles have been constructed, 15 miles of which consisted of very heavy repair work.

In summarizing the work on buildings it will be seen that one supervisor's house and office and two Class A ranger stations have been constructed; three Class B cabins were started; nine Class C cabins were built and nearly completed; and a total of four barns and stables completed and four others well under way. In view of the progress made during the last few years it will not be long now until at least some of the reserves are pretty adequately provided with stopping places. In order to more definitely show the classes of buildings which are being constructed, to make the records more complete and to have on hand definite building plans which may be used for further construction we are arranging to have a complete set of building plans of typical buildings for the district prepared.

FIRE PROTECTION.

On all divisions of the Rocky Mountains forest reserve there was superabundant precipitation, starting early in the season and continuing into the summer, so that the reserves were almost entirely protected by natural agents during what is usually the most dangerous period. After the rains ceased there was still sufficient moisture in the woods to prevent any great danger from fire. The conditions on the Cypress Hills reserve, situated in the southeastern portion of the province, were somewhat similar. On the Lesser Slave reserve, however, conditions were different. Although there was considerable precipitation on this reserve, it did not extend over the same periods, nor was it as heavy as on the Rocky mountains. The Lesser Slave reserve was the only one on which fires occurred during the month of June and, with the exception of one reserve, it was the only reserve where fires occurred during the month of May. The total number of fires reported on reserves for the whole inspection district was sixteen, five of which occurred on the Clearwater, four each on the Lesser Slave and Brazeau, two on the Bow River, one on the Crowsnest and none on the Athabaska and Cypress Hills reserves. These figures indicate that the Clearwater had the largest number of fires, and in this connection it may be pointed out that in the valley of the Saskatchewan there is, during the winter months, comparatively little snow. The result is that if a dry hot spell is experienced in the month of April fires are exceedingly liable to break out, particularly where any of the customary agents in the source of fire are present. This was exactly the state of affairs on the Clearwater, where in April a dry spell was experienced when there was practically no snow on the ground. Moreover the four fires which occurred in that month were all in the immediate vicinity of the town of Nordegg. Due to the fact that operations at the mine were somewhat slack, a large number of the miners resident in the town were continually making little picnic trips into the woods, with the result that the danger from camp-fires was great, and some of these fires were due to this cause. The total area burned over on the reserves of the district was approximately 2,030 acres. On only about four acres was merchantable timber destroyed; approximately nine hundred acres of the fire-killed area was young growth; approximately one thousand acres was in old "burn," and about one hundred acres grass-land. The total estimated damage to merchantable timber and young growth was approximately $2,350. These figures clearly indicate the very slight amount of damage done by fires.

Owing to the fact that the season was such an unusual one there is comparatively little to be learned from a comparison of the fire statistics for this district. It may be stated, however, that two agents—railways and careless campers—were the most important of the known factors in the cause of forest fires. For 25 per cent of

Photo. 10820. R. H. Campbell.

Wasted forest wealth. Fine spruce trees killed by taking bark to make shelters during railway construction, Lesser Slave district, Alberta.

Photo. 10819. R. H. Campbell.

Wasted forest wealth. Stumps cut high and sound butt logs left to rot, Lesser Slave district, Alberta.

the fires which occurred the causes were not determined. On all the reserves, with the exception of the Athabaska and Cypress Hills, where no fires occurred, most of the fires started during the month of April. In this particular month we were rather anxious as to what the results of the approaching season would be, for numerous fires started in April and conditions looked very much as though they might become very serious. Shortly after, however, the rains set in and we were relieved of further worries for practically the entire season.

SILVICULTURE.

During the year only two new timber sales were actually made, one of which was an exceedingly small sale of saw-timber, the other also being a comparatively small sale of mining timber. Both of these sales took place on the Crowsnest forest. Three other sales were inaugurated, of which two fell through and the details of the third have not as yet been completed. It will be realized that under the present financial conditions there is but little opportunity for much development along the lines of new timber sale work. A very considerable amount of work was done, however, in connection with sales already in operation and, generally speaking, it may be stated that considerably greater attention has been devoted to this phase of the work both by the reserve offices and this office, and efforts have been made to increase the efficiency both in the administration of old sales and in the development of new ones. The most important sales under operation at the present time are those to the mining companies. We have every indication that the coal mines of the province, present and future, will continue to offer the main outlet for a product which the forests of the Rocky Mountains reserve are eminently in a position to provide. Although one would naturally expect that, in the Crowsnest pass, where there are so many mining operations, we would have considerable sale for mining timber, it so happens that the majority of sales which have been effected on this reserve are for saw-timber. This is due to the fact that by far the greater proportion of the merchantable timber in the Crowsnest pass is held by private corporations, and, in the second place, very heavy competition is offered to the sale of mining timber by timber operators in the Crowsnest pass on the British Columbia side. In addition to this, our regulations have not until recently made provision for the quick sale of small amounts of timber, the result being that few operators on the Alberta side had gone into the mining-timber business. For this reason an amendment to the regulations was proposed whereby small operators will be enabled to purchase without competition small amounts of dead timber. Generally speaking, there is but a small proportion of this dead timber which is at all suitable for sawlog purposes, but there still remains on the areas adjacent to the Crowsnest pass large amounts of fire-killed timber which is perfectly suitable for utilization in the various mines. The disposal of such timber under the amendment proposed will, therefore, serve two purposes; in the first place it will rid us of extensive supplies of timber which will soon become unmerchantable, thereby effecting to a certain extent a cleaning-up of some areas of the reserve, and, in the second place, it should make possible the development of a considerable number of small mine-timber operations, thus offering to a certain extent a new field of work for such residents of the Crowsnest pass as desire to engage therein. It is unnecessary to state that when there is so much dry mining timber in the Crowsnest pass, it is hardly reasonable that it should be necessary to import mining timber by rail from British Columbia.

On the Bow River forest no timber sales have up until the present time developed, this being due to the fact that the larger proportion of the merchantable timber on this forest is embraced within licensed timber berths, and as numerous mills are established, for which the supply of timber is obtained from timber berths and permit berths, both inside and outside the forest reserve, there is but small demand for timber sales which would include saw-timber. Besides there are no operating mining com-

panies in this forest, so that there has been no development in the mine-timber business. On the Clearwater reserve the only sale in effect is that of the Brazeau Collieries, although small amounts of timber are handled under permit to the Saunders Creek Coal Company. On the Brazeau reserve one sale only is in operation, the company concerned being the Mountain Park Coal Company. Although there are three other mining companies having extensive holdings in this forest, two of them are at the present time not operating, while the third is provided with its own supply of timber and, consequently, has not up to the present time required timber from the forest reserve. On the Athabaska and Lesser Slave reserves there are no mining companies in operation nor are there any saw-mills, consequently there is no market for either class of materials. On the Cypress Hills reserve there is one small saw-mill outfit operating a very small sale under agreement with this branch; on this reserve, however, there is little merchantable timber and that which is being taken out at the present time consists of rather an over-mature stand of jack pine and spruce.

In the appointment of a well qualified forest assistant to the Clearwater forest opportunity was offered for a very close study of timber sale work as applied to mining timber. The Brazeau Collieries timber sale on that forest has been in operation for several years and still has about five years to run. Moreover, the operation is in close proximity to one of the most important administrative points of the reserve. The long period through which this sale is operative and the size of the operation offer particular advantages for a comprehensive study of all the operations, and I may say that close attention has been paid to marking, close utilization and to brush disposal in connection with this sale. As a result of the attention given to this sale we shall soon have a comprehensive report giving detailed information with regard to the procedure adopted and the results obtained. It may be stated generally, however, that all timber to be removed was marked by the forest officers, all merchantable timber suitable for mine-props or lagging was removed and utilized, low stumps were required and a very satisfactory disposal was made of all brush resulting from the operations. On other sales in operation throughout the district different methods were followed, but in connection with each one the timber to be cut was either marked or definitely designated, close utilization enforced and a good brush disposal secured. It is perhaps unnecessary to say that the reasons for these rigorous measures being applied to the disposal of timber is that they are indispensable measures in any place where it is desired to give proper attention to silvicultural developments of the forest and sufficient recognition to fire protection. In contradistinction to timber sales under operation by this branch we have also inside the forest reserves large areas of licensed timber berths. Although financial conditions have to a very great extent curtailed operations on such timber berths, there are a few cases where limited operations have been conducted, in none of which have there been proper requirements with regard to brush disposal. It is easy to see that it is impossible to obtain recognition of any silvicultural principles when operations are conducted in this manner. Also, when no attention whatever is given to brush disposal, a very great increase takes place in the fire hazard on the reserve. Such of these timber berths as have in previous years been cut over now constitute one of the most serious fire hazards with which we have to deal. In view of the strides which have been made in certain parts of the country, it seems to be a rather unfortunate and unsatisfactory method of procedure to allow cutting of this nature to be conducted, and, in these days when the very great necessity for husbanding the natural resources of this country is being emphasized in all directions, it is most disconcerting to see conditions of this kind allowed to continue, whereby the fire hazard on the forest reserves is increasing.

The timber permit business continued much along the same lines as described last year, although efforts have been made to pay greater attention to the matter of brush disposal on the permit areas. The greater part of the timber permit business is confined to the Bow River and Crowsnest forests in the Rocky mountains, and the Cypress Hills forest reserve in southeastern Alberta. On the latter two forests the

timber permit business reaches considerable dimensions, owing to the fact that the country immediately adjacent to the reserves is practically dependent on the reserves for timber supply.

GRAZING.

As it was not possible to provide additions to the staff for the purpose of further developing the grazing administration, there was no very great development in this line of work. The intensive administration of grazing was, therefore, confined for the most part to the Crowsnest and Bow River forests, on which reserves there is the greatest demand for the range. On the Clearwater forest several permits were issued, but it cannot be stated that this reserve has been definitely organized for grazing. On the Brazeau reserve there is comparatively little range; also, owing to the fact that the country to the east of the reserve is comparatively unsettled, there is little or no demand for grazing at the present time. Practically speaking, therefore, there is no grazing administration on this forest. On the Athabaska forest there is probably a little more extensive range than exists on the Brazeau, but in the case of this reserve, also, there is but little settlement adjoining the reserve and consequently there is practically no demand for grazing by outsiders. There are, however, two or three different outfits located inside the reserve and, consequently, it will probably be necessary to make arrangement for the issuance of permits this year. On the Lesser Slave reserve there is considerable range available, yet up to the present time there has been little or no demand for range and no grazing administration has been effected. On the Cypress Hills reserve the conditions with regard to grazing still remain in a rather unsettled state. During the past season, however, a report with regard to the fencing situation was prepared in connection with the boundary survey work, so that, if it is considered necessary to adopt this measure of control, we have secured considerable information upon the basis of which operations can be started.

At the beginning of the season several grazing divisions of the Crowsnest forest were in rather poor condition, owing to the fact that there had been a certain amount of over-stocking in the previous year. In all divisions of the Rocky mountains we experienced a very wet season and as a result of this there was, on some reserves, a most luxuriant growth of forage plants, while in other localities there was altogether too much precipitation for the successful growth of forage. It is unnecessary to point out, also, that in a season like last year, when practically all low-lying lands were flooded for a considerable length of time, meadows and sloughs, which in the average year offer some facilities for grazing, were almost entirely cut off from utilization of this sort. The only places where any over-stocking occurred during the past season consisted of two separate areas on the Clearwater forest. On the remainder of the Clearwater and on the Bow River and the Crowsnest forests the range came through the season in exceptionally good condition, and at the end of the grazing year conditions were very satisfactory.

The total number of stock grazed on the Crowsnest forest was 4,377 head, consisting of 3,914 head of cattle and 463 head of horses. On comparison with the figures given for last year it will be noted that there was rather a startling reduction in the amount of stock handled under permit. In the fiscal year 1914-15, 12,000 head of sheep were grazed in the Livingstone valley. Owing to difficulties which occurred in trailing these sheep from the southern part of the province stringent measures were adopted to prevent a recurrence of the same. It was expected use would be made of the range by stockmen who would transport the sheep by rail but plans to this end fell through, nor were strenuous efforts toward this end for the coming season more successful. This, therefore, accounts for the reduction of 12,000 head in the total number of stock grazed on the forest. In addition to this, it should be pointed out that owing to the large increase in the size of the Waterton Lakes park, and the consequent decrease in the forest reserve, several grazing divisions were cut off from our administration, which was the cause of a reduction of at least 3,500 or 4,000 head of stock. Making the necessary allowance for these two features, therefore, it would appear that

there has been a slight increase in the horses and cattle grazed on the various divisions of the present Crowsnest forest. On the Bow River a total of 2,345 head of stock was handled, consisting of 1,802 head of cattle and 543 head of horses. This indicates a very small net increase in the total number of stock. The number of cattle grazed was reduced, while the number of horses increased. No sheep were grazed on this reserve. On the Clearwater forest 62 head of horses and 15 head of cattle were grazed under permit. No permits were issued for the other reserves. The above figures would indicate that a total of 6,799 head of stock was grazed throughout the district and it may be pointed out that this was divided amongst a total of 94 permit holders. This would indicate an average of about 73 head of stock per permittee. Although in numerous cases the number of stock owned by the individual was considerably greater than this, it would appear that one of the objects of the grazing administration, namely, to encourage the stock industry amongst the small owners, is receiving thorough recognition.

In effecting an efficient grazing administration the anomaly with regard to grazing on timber berths still presents the difficulties which were referred to in my last report. It is greatly to be desired, therefore, that suitable steps should be taken whereby some readjustment of this question may be obtained. Last year I referred to the necessity of providing a capable man to make a special study of the grazing administration who could give considerable time to the study of range conditions and experiments for range improvement. Up to the present time we have not secured a man to specially take over this line of work.

Through co-operation with the Department of Agriculture, however, it was possible for us last year to make a beginning with the study of range conditions. Dr. Malte, the expert of the Department of Agriculture, was accompanied by Assistant Inspector C. H. Morse and Supervisor R. M. Brown of the Crowsnest forest, and during an investigation extending over two weeks a representative collection of about 270 species of plants was made. This was very satisfactory from the standpoint of the systematic botanist and placed us in possession of valuable information with regard to forage plants. This work, however, requires to be supplemented by that of someone who has made a special study of range problems and who can advise us in regard to the solution of grazing problems. Particular attention was paid to the poisonous plant situation in the Crowsnest forest, owing to the difficulties which had arisen as the result of considerable loss of stock by permittees. It was found, however, that although numerous poisonous plants existed in the Crowsnest forest, practically all the losses which had taken place should be attributed to the presence of larkspur which, particularly in the southern part of the Porcupine hills, is somewhat prevalent. Two or three plants, which had commonly been regarded by grazing permittees and ranchers as extremely poisonous, have no poisonous properties whatsoever. As a result of this investigation an illustrated circular has been prepared and issued dealing with the conclusions reached with regard to poisonous plants and also embracing useful information with regard to preventive and curative measures.

SURVEYS.

In my last annual report I indicated that there still remained, on the Clearwater reserve, a considerable amount of work to be done before the traverse survey of that reserve would be completed. A party was started early in May, in charge of Mr. A. Gorman, and, in spite of the very unfavourable weather conditions, excellent progress was made, and at the beginning of August all the work for that reserve was completed. A total of approximately 200 miles of primary traverse was run, supplemented by approximately 190 miles of secondary traverse work. The Saskatchewan valley was traversed from the mouth of the White Goat river southwestward to the mouth of the north fork of the Saskatchewan. Returning to the Wilson ranger station at the mouth of White Rabbit creek, the survey was carried up that stream to its head, tying on to a previously established monument on the headwaters of the Ram river.

Photo. 10664. W. N. Millar.

The forest fire demon. View showing a fireproof building in the centre of Cochrane, Ontario, after the fire of July 1916.

Photo. 10675. W. N. Millar.

In the path of a forest fire. Remains of village of Nuska, northern Ontario, after the great fire of July 1916.

The survey was then continued southward to the Clearwater river, and thence down the Clearwater to a previously established monument at the Parks ranger station. From a point on this latter course a traverse was run southward to the summit between the Clearwater and Bow River forests. The main traverse was then carried up the Clearwater river to its head, and thence into the Pipestone pass; on the summit of which another monument was established, indicating the boundary between the Bow River and Clearwater forests. The main traverse was then projected down the Siffleur river to its mouth, closing the loop at the Wilson ranger station. The party then returned to the mouth of the White Goat river from which point the main traverse was carried up that river to the summit between the Brazeau and Clearwater forests. A traverse was also made of Coral creek to the summit between these two reserves. With the completion of this work we have now definitely established several monuments on the inter-reserve boundaries between the Clearwater and the Bow River on the south, and the Clearwater and the Brazeau on the north. The secondary traverse work involved a rough survey of the important creeks and waterways tributary to the main valleys through which the primary traverse was run.

It was hoped that the survey of the Athabaska forest could also be commenced, but, owing to the fact that the trail programme for that reserve had not sufficiently advanced, it was considered inadvisable, with the small amount of time still at our disposal, to start work on that forest.

USES.

During the year there have been no unusual developments in the uses of the reserves. No additional mining companies have commenced operation and, therefore, no new townsite locations have been applied for. Financial conditions have retarded development work of this nature and it will probably be some time before any extensions are necessary for this purpose. The same conditions interfered to a very great extent with the development of the summer resort on the Cypress Hills forest reserve. Although a large number of lots were applied for some time ago, and although, in order to give applicants better opportunities to complete their agreements, time extensions were made, there has been practically no development in this resort, and a large number of agreements have been cancelled.

TRESPASS.

The introduction of a closely supervised permit system in the disposal of timber naturally led to the discovery of numerous cases where people were removing timber from the forest reserve without having taken the steps required by the forest regulations. Quite a number of such cases have been dealt with during the past year, some of which have been settled on the basis of payment of double dues. In other cases, however, where the trespass has been more flagrant, we have found it necessary to confiscate the timber and dispose of it by private sale as provided by the regulations. Still further, in one or two cases, it has been considered advisable to prosecute the persons concerned in the trespass, for the reason that the trespass in question was committed clearly in defiance of the forest regulations. Such cases, in addition to giving the persons prosecuted a clear idea as to what is required of them, have had an exemplary effect on the settlers resident in the district where the trespass occurred. Similarly there have been numerous cases where the regulations with regard to hay disposal have not been observed, resulting in quite a number of seizures being made by the forest officers. Prosecutions have also been successfully undertaken in a few cases where the fishing regulations were not properly observed.

FISH AND GAME.

Owing to the abnormal flood conditions existing for a considerable part of the last fishing season there was a notable decrease in the number of fishermen who

resorted to the forest reserve for recreation. Now that we are provided with our own fishing permits it is a good deal easier to control the situation so far as the reserves are concerned, and the results obtained are much more satisfactory. Taking, for instance, the Brazeau forest, where formerly but little attention was given to fishing regulations, last season eighty-one permits were issued by officers or agents of the branch. At Nordegg in the Clearwater forest, also a town situated inside the reserve, a considerable number of permits were issued. In the case of both these reserves the towns from which the fishermen came are entirely inside the reserve. The Crowsnest forest, on the other hand, does not contain any towns or villages but it has, closely adjacent to its boundaries in the Crowsnest pass, a very considerable number of towns and villages, and from these points people go for short fishing trips. There were several cases in the district where it was necessary to prosecute offenders against the regulations. While it is not desired to carry prosecutions to the extreme, it will be recognized that there is not much use in having regulations unless some action is taken to enforce them, and it is hoped that with a few examples there will be a more thorough appreciation by the public that it is both necessary and advisable to conform to the regulations. It would appear that some waters of the district are becoming fished out. A very great decrease in the number of fish to be obtained is noted in the Crowsnest pass and, also, on the north fork of the Highwood. The very heavy fishing season of 1914 exhausted to a great extent the fishing resources of that river. Jumping Pound creek, which was formerly an exceedingly good fishing ground, has also become somewhat depleted. It will probably be necessary in some such places as these to extend the close season for the entire year in order to give the streams an opportunity to restock. In general it may be stated that the co-operative arrangement between the Department of Marine and Fisheries and the Forestry Branch is one which should prove mutually beneficial.

It is again necessary to emphasize that Indians and half-breeds are the primary agents in the killing of the big game of this province, particularly as applied to forest reserves. In fact, the depredations of the various bands of these Indians are so serious that, unless vigorous steps are taken to curtail their activities, there is a great liability that certain portions of the province, up to the present time considered as about the best game areas in the country, will be entirely cleared of game. Of the Indians, by far the most serious group with which we have to deal is the Stony tribe. Numerous reports have already been submitted with regard to the depredations of that branch of the Stony tribe which located some years ago on the Kootenay plains of the North Saskatchewan. These Indians yearly organize big hunting expeditions and penetrate northward into the Brazeau country, and during other portions of the year hunt more or less locally in the country tributary to the Saskatchewan valley. Exceedingly large numbers of deer, mountain sheep and mountain goat are annually disposed of by this small band of Indians. Another band of the Stony Indians appear to travel southward each year, and during the past fall they visited the upper Livingstone country with the result that this particular area was practically cleared of deer, and large numbers of other game animals were killed. In addition to these two bands, large numbers of Stony Indians leave their reserve at Morley at various times of the year for the purpose of securing meat and hides.

At Grand Cache, on the Smoky river, a band of Cree half-breeds have established themselves, and their hunting expeditions into the surrounding country are of such a nature and extent as to cause very grave fears that, unless vigorous action is taken, this wonderful game country will also be depleted. The third case where Indians are seriously affecting the game situation is on the southern part of the Lesser Slave reserve. To this country considerable numbers of Indians from the Lake St. Ann country go in search of meat and hides.

The above refers more particularly to big game. However, there are numerous places in the province, particularly on the northern reserves, where great carelessness

is exhibited with regard to the law as applied to the hunting and trapping of small game. This is not only on the part of Indians, but also there are numerous white trappers whose operations should be carefully watched in order that greater attention to the game laws of the country may be enforced. The Rocky mountains of Alberta, and also some other portions of the province, offer some of the finest big-game country which probably is to be found in Canada, and as such there is no doubt as to its very great value as a national asset. At the present time the greater part of this country is inaccessible to the great majority of the people. Nevertheless, with the development of the country as a result of the incoming of railroads and as a result of the large extensions which are being made to the trail systems in the Rocky mountains by this branch, this country will ere long be readily accessible. While all these developments are taking place, however, we have these Indian tribes, which in the total consist of a comparatively small number of men, making periodical depredations upon the game in districts where it has been most plentiful.

EQUIPMENT AND SUPPLIES.

In my last report I indicated that the fire season of 1914 had shown that adequate provision had not been made for the purchase and storage of sufficient fire-fighting equipment. During the past year an effort has been made to rectify this state of affairs, and a large amount of emergency fire-fighting outfit has been secured and stored at headquarters, ranger stations and in numerous cases at outlying caches.

I think that, perhaps, it is desirable that I should make reference to the new portable telephone which has been devised. We have every indication that this new instrument, which weighs about one-third as much as the old style of portable telephone, will entirely replace the older instruments. Not only are they much more portable, but with a reasonable amount of care in packing they are, in my opinion, less susceptible of injury than is the old style of instrument. Moreover, they are considerably cheaper than the old ones, and as a result of this there is little reason why they should not be generally adopted.

Although no definite standardization of equipment has as yet been effected steps in this direction are being made, the result being that the classes of equipment used are more and more approaching definite standards, and we shall soon be in a position to prepare memoranda which will definitely outline the various classes of equipment which may be purchased and used on the forest reserves.

EDUCATION AND PUBLICITY.

I am sorry that I am not able to report much progress under this heading, owing to the fact that the administration and improvement work of the district has been so extensive as to require the attention of the administrative officers for practically the whole time. Although efforts are made to advise the public with regard to the purposes of, and administrative features in connection with, the Forestry Branch, it has not up to the present time been found possible to do so by means of any extensive publicity campaign. There is no doubt whatever that where a greater amount of time can be devoted to the giving of lectures and the preparation of newspaper reports, the results would be such as to make the general public much more familiar with the principles in recognition of which our organization exists, and the results which we are endeavouring to secure in the administration of the forest reserves. During the recent supervisors' meeting at my office we discussed this matter of education, and I emphasized the importance and necessity of each man taking every possible action to make known the work of this branch. Various methods by which we can draw the attention of the public to the necessity for fire prevention

were discussed and we have already taken some steps for putting a few plans into operation by which it is hoped to catch the eye of the public. I have also definitely in view an educational propaganda for the next fiscal year, but whether it will be possible to carry it into effect will depend on the time which may be available. Every effort will be made to give at least some time to this important problem.

RAILWAY FIRE PROTECTION.

The personal inspection of the railway work in Alberta continued under the direction of Divisional Fire Inspector T. McNaughton. I desire, however, to make a few general remarks with regard to the situation of railway fire protection in this province. The railways with which we have to deal are the Grand Trunk Pacific and the Canadian Northern from Edmonton westward to Jasper park, including the branches; the Canadian Northern from Edmonton to Athabaska, and the Edmonton, Dunvegan and British Columbia railway from Edmonton to the end of construction in the Peace River country. In addition to the work carried out under Mr. McNaughton's supervision a certain amount of railway work is under the direction of the forest officers on the Crowsnest and Clearwater forests.

Although the past season was certainly not one in which any fire fighting organization was put to severe test in the railway work it is felt that considerable progress has been made. The organization for the detailed inspection of railway work was similar to that described in my last annual report, namely, that one inspector devoted his entire time to the Edmonton, Dunvegan and British Columbia railway, and another spent his entire time in the inspection of the Grand Trunk Pacific and Canadian Northern railways from Edmonton west, including the branches. Other inspections were carried out in connection with the reserve organization from time to time as occasion demanded.

The Canadian Northern patrol organization continued throughout the past season as an efficient and well organized system of fire patrol. I previously pointed out that the success which has been attained by this railway company must primarily be attributed to the fact that they had given definite recognition to the necessity of a separate fire protection department, the result being that one man was entrusted with the development and supervision of this organization. Owing to the fact that the company did not do a great deal of work on the line west of Edmonton it was rather difficult to make a proper provision for the thorough cleaning up of the right of way. Although this was assuredly necessary it happened that, with the very favourable condition existing last year, no very serious fires occurred nor was much damage done.

The Grand Trunk Pacific, on the other hand, has been in operation west of Edmonton for some years and, although a great deal of attention has been given by this company to the establishment of a clean right of way, the railway patrol organization has been entirely unsatisfactory. I attribute this directly to the fact that this company, in particular, have not given sufficient recognition to the necessity of definitely organizing for fire protection work, the result being that although a certain number of patrol men were appointed, provided with the necessary speeders and set to work on the line, the amount of supervision given to them was so small that results obtained could not in any sense be termed satisfactory. The method of patrol on the Grand Trunk Pacific has been by motor-speeder and, as through four years of operation the company have never provided an adequate or sufficiently systematic patrol, strong representations were made to the Railway Commission, with the result that the latter body has required the company to establish a systematic patrol by means of velocipedes. It is felt that as a result of this action it will be possible to provide for considerably increased efficiency in the patrol organization.

In my last report it was necessary for me to speak rather forcibly with regard to the utter disregard on the part of the Edmonton, Dunvegan and British Columbia

Photo. 10691. W. N. Millar.

View in a northern Ontario forest after the great fire of July 1916.

Photo. 337.

Sheer waste of vital resources. Scene after a bad fire in a northern Manitoba forest.

railway of the fire protective requirements of the Board of Railway Commissioners; as a result of the hearing before the Railway Commission in November, 1914, however, I am glad to state that this company has shown conclusively that it can and will provide an efficient fire protective organization. A thoroughly efficient patrol organization was effected during the past year and also very considerable progress was made in regard to right of way clearing. Although the company's organization was by no means put to any severe test the records would indicate that any fires which did start were successfully controlled. Furthermore, there has been a most notable difference in the conditions of the fire protective appliances on the locomotives of the company.

FIRE-RANGING.

The fire-ranging organization to cover that part of this province outside of forest reserves, was divided into four districts, namely, Edmonton, McMurray, Slave and Mackenzie River. Previous to last season no special organization had been provided for the last named district, although a certain amount of very general oversight had been given to fire protection matters by the Government agent at Fort Simpson. Of these four districts the Edmonton district is by far the largest and the most important. Major R. H. Palmer, chief fire ranger of the district, enlisted for overseas service toward the latter part of the previous fiscal year and the work of supervision was taken over during his absence by Mr. Geo. B. Campbell. To assist in the detailed supervision of the staff of about forty rangers employed during the season four subchief rangers were appointed. In past years patrol was made by steamboat on the Athabaska river as far north as Grand Rapids. This was necessary, owing to the heavy freight traffic on the river. Owing to the construction of the Edmonton, Dunvegan and British Columbia railway freight is now sent by rail to Peace River Crossing, and traffic along the Athabaska greatly reduced. The steamboat patrol was, therefore, discontinued and the patrol carried on as in other districts.

Owing to weather conditions, particularly in the northern part of the Edmonton district, the loss from fire seems to have been small. Our data with regard to fires is meagre, but it would appear that only eight fires attained a size of over ten acres in extent and that the total area burned over by such fires was approximately 4,000 acres. In the northern parts of the district conditions were considerably drier and, although we have no reports of many large fires having occurred, I am inclined to the opinion that if all data were available the figures would swell to greater proportions the area indicated above. Also a considerable number of small fires occurred which were extinguished by fire rangers or others. Apparently the number of such small fires would aggregate well over 100. During the fiscal year it has been found that considerable portions of districts formerly assigned to rangers consisted essentially of agricultural land and an effort was, therefore, made to withdraw, so far as possible, such land from the area of actual patrol. In the arrangement of districts for the coming season this point is being given a still further consideration than was possible during the operating season last year.

The McMurray fire-ranging district, which lies to the north of the eastern part of the Edmonton district, was manned by a staff consisting of a chief fire ranger and twelve rangers and assistant rangers. Patrol in this district is essentially by means of canoes, although in the southeastern portion of the district a certain amount of pack-horse travel is resorted to.

The fire situation in this district was more serious than in other parts of Alberta, due to the fact that spring set in very early and the reports would indicate that the weather was hot and dry pretty steadily from April until August or September. Eighty-one fires are reported; thirty-nine of which were started by campers, twenty-four by railways, six by settlers, six by surveyors and six by causes unknown. In the

north country there is, of course, much moving about on the part of the population. Most people, at some time or other, resort to travel by canoe or pack train, with the result that many camp fires are necessary for cooking and warmth. Carelessness in connection with camp fires was the most prolific source of fires. The Alberta and Great Waterways railway is now being fast extended to McMurray and, as is generally the case, numerous fires took place on this line. It would appear, however, that the majority of them were well controlled and my information is to the effect that there has been comparatively little fire damage as a result of the construction of this railroad. It is unfortunate that we have to note six fires as being started by surveyors. If there is one class of men who should be perfectly familiar with the awful destruction which may result from a little carelessness with a camp fire, it is surveyors, for they, in working in widely separated parts of the country, particularly the newer parts, have only to look about them to see the results of previous fires. There have been numerous cases, however, where they or their employees have not been sufficiently careful with regard to the use of fire. While I presume that the main difficulty lies with the employees on such surveys, some means ought to be taken whereby all would be sufficiently under the instructions and oversight of the surveyor in charge to obviate any danger of fires spreading from their camps. It would appear that the total area burned over in the McMurray district approximates one hundred thousand acres.

My information with regard to operations in the Slave and Mackenzie River districts is very meagre indeed. It might be stated, however, that in the Slave district patrol was effected by means of steamboats, one of which operates above Smith Landing, embracing the waters of lake Athabaska and the Slave river, the other operating from Fort Smith northward on the Great Slave river to Great Slave lake. In charge of each patrol boat was a chief ranger who was provided with a crew consisting of an engineer and deck-hand and such additional help as might be necessary from time to time under the varying circumstances. In the Mackenzie River district the staff consisted of four men operating under the direction of the Government agent at Fort Simpson. Patrol in this district appears to have been almost entirely by canoe. On a river the size of the mighty Mackenzie but little progress can be made in fire protection by men operating in canoes, and what is really needed for that district is an efficient fire patrol by means of one or more steamboats properly provided with the necessary equipment for extinguishing fires. It is useless to undertake the large expenditure which is necessary in the operation of steamboats, however, until adequate provision is first made for a proper supervision of the work of the district. Although the Government agent at Fort Simpson appears to have given considerable attention to the fire-ranging work, it is only necessary for one to glance at a map of this portion of Canada to see that the enormous size of the country is sufficient warrant for the appointment of a staff of fire rangers in charge of a man specially qualified and specially appointed for the exclusive work of fire protection.

Speaking generally with regard to the fire-ranging organization I would point out that it will probably never be possible to develop a highly efficient fire-preventive organization under the present methods. Although the number of fires which are extinguished by the ranger staff at present provided justify, in potential dollars and cents, the expenditure made, it is certainly quite true that no really highly specialized organization can be developed under the present system. The fundamental reason for this is that, when this branch has no administrative control over lands embraced within the fire-ranging districts except in so far as fire protection is concerned, it is impracticable to consider the provision of adequate transportation facilities and other improvements, upon all of which any successful fire protective organization is absolutely dependent. The best policy which can be pursued, therefore, is a continuation of the policy of the department for the past few years in greatly extending areas

of the forest reserves. By this I do not mean that lands which are suitable for agriculture or other such purposes should be set aside as forest reserves, but that land which is essentially forest land, and which can never be more profitably devoted to other pursuits, should be definitely reserved for forest purposes. When such action is taken it will then be possible to formulate definite administrative plans for such areas, which would include a comprehensive plan of improvements which are necessary if a high-class organization is to be developed. It may further be stated that it is in the fire-ranging organization that the difficulties of the present system of employment are emphasized. Under the present organization in fire-ranging districts, it is necessary that a man should be left to himself a considerable part of the time, and, if effective service is to be obtained, it is very necessary that the man so appointed should be of the very highest character and qualifications.

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

APPENDIX No. 5.

This report concerns the work in the British Columbia inspection district for the fiscal year 1915-16.

FOREST RESERVES.

Personnel.—The forest reserves staff was further depleted during the year by the enlistment of the Forest Supervisor, Mr. W. L. Scandrett and one ranger. No new appointments were made to replace these officers.

Proposed extensions.—In my report of last year I mentioned that the work of delineating boundaries of proposed extensions of the area under forest reserves in this district was completed. No action has been taken to date to establish new reserves as recommended in the reports of these surveys, although the policy of increasing the forest reserve area as soon as examinations are made has received the strongest endorsement of the Commission of Conservation and the Canadian Forestry Association. The recommendations for additional reserves in this district may be divided into two classes: (1) areas within the Dry Belt required for the protection of watersheds of streams used in irrigation; (2) forest areas in mountain regions where the land is unsuited for the production of any crop other than timber.

It is my opinion that to ensure the future of our agricultural and fruit growing area steps should be taken as soon as possible to include at least those areas under class one in forest reserves, since in no other way can adequate protection of watersheds be secured. The following are areas of this class: (a) addition to Hat Creek forest reserve, 178 square miles; (b) addition to Larch Hills forest reserve, 30 square miles; (c) Nahatlatch forest reserve, new, 935 square miles; (d) Petee forest reserve, new, 747 square miles.

GRAZING.

The administration of grazing in this district is still in abeyance. I have talked matters over with a good many of the ranchers in the district and am inclined to believe that the objection to the proposals of this branch for handling the grazing on forest range is decreasing. Were it possible to find a good man to go into the whole question during the coming season it is probable that an understanding could be reached satisfactory to all concerned.

During the year many inquiries were received at this office regarding the possibility of securing leases on hay meadows situated far back in the reserves on the summit plateaus, for the purpose of cultivating them and feeding stock on the ground.

Photo. 7395. J. J. Wadman.

Modern forest protection. Ranger communicating with central office by means of a portable telephone, Revelstoke district, British Columbia.

Photo. 10812. R. H. Campbell.

A fire protective improvement. Corduroy on trail, Fly Hills forest reserve, British Columbia.

After discussing the matter with the director, proposed regulations were worked out to cover these meadows and the matter submitted tentatively to the leading ranchers by means, in the first instance, of a circular letter. This letter pointed out that according to the best informed ranchers the problem of development of the stock industry in this district depended upon winter feed, as there was ample summer range for twice the number of head of stock raised at present if they could be carried over the winter. It was stated that the Dominion forest reserves in the Dry Belt comprised mostly high level or rolling plateau areas which contained many natural meadows. Owing to their elevation and inaccessibility these meadows were not suitable for homesteads and at present were not put to any use. A small expenditure in draining these lands and sowing them to clover or other suitable grass would render them very productive. A study of the local conditions showed that in nearly every case it was impossible to get the hay out and that, therefore, the stock must be driven in and fed at the meadows. The trail system, it was pointed out, was so nearly complete that but little expenditure would be required to fit the trails for the driving of stock to the meadows.

The absence of suitable regulations to cover such conditions had been a drawback, since the draining of meadows and building of fences and shelters required an expenditure which must be met by a reasonable security of tenure, and hitherto the Forestry Branch had not granted leases. To meet this condition, the letter stated, it had been proposed to make regulations granting a permit for five years, renewable for two other periods of five years each, provided the conditions had been faithfully carried out. The conditions proposed were that the permittee would bring the meadows up to full bearing capacity and would maintain stock thereon at the ratio of one head of horses or cattle, or five head of sheep, for every two acres for the first three years, and the same number of stock for each acre during the succeeding years. The fees proposed were 5 cents per acre per year for the original permit, 10 cents per acre per year for the first renewal, and 15 cents per acre per year for the second renewal.

These proposed regulations have been discussed with the executive committee of the Interior Stock Association and the Nicola Valley Stock Association and have been approved by them. They have also been discussed with prominent ranchers throughout the district. The general trend of opinion is that they are workable and suitable to conditions but in order to prevent any possibility of future dissatisfaction it is intended to submit the whole matter for discussion at the general meeting of the Interior Stock Association to be held next June. Future action by the department should be guided by the recommendations of this meeting.

AGRICULTURAL LANDS.

The principal objection made to the establishment of further forest reserves in this district has been the fear of the possible inclusion of agricultural lands. This fear is the result of a statement made some two years ago that the development of the country was being retarded by the tying up of areas of agricultural lands within forest reserves. This matter has been discussed in my reports of previous years and mention made of the recommended eliminations of land of possible agricultural value. Unfortunately, owing to the war, statutory action has not been taken as yet in accordance with such recommendations, so that a somewhat anomalous condition exists with regard to such lands.

The present method of requiring action by Parliament to withdraw agricultural lands found to be included in forest reserves causes considerable delay which it would be well to obviate.

It seems reasonable to expect that, so far as lands valuable only for the production of hay are concerned, the proposed amendments to the regulations with reference to hay meadows mentioned above will afford the best solution of the utilization of such lands. Observations of the degree of development attained in cultivation of lands of

this class by settlers and squatters on and adjoining forest reserves shows that in the majority of cases the outlook for these people is well nigh hopeless. Now that government work has been largely discontinued, owing to the necessity for economy in expenditure, the unequal struggle has forced many to abandon such claims and seek a livelihood elsewhere. This condition of affairs is evidence of the truth of the statement made by myself previously that the extraneous support given by government work was all that enabled settlers on such lands to remain, and that the lands themselves cannot be considered as suitable for homesteads in the true sense of the term; namely, that they enable a settler to obtain a decent living from them alone.

When we consider that at the same time there are many settlers adjacent to the reserves on lands of a better class who can make a living but are hampered from developing as they ought by the lack of adequate feed and range for their stock it seems to me self-evident that the best use for forest reserve hay meadows is to render them available for use as adjuncts to these bona fide homesteads, thus ensuring to the settlers a chance to get ahead. In this way the community can obtain one man in fairly comfortable circumstances and an asset to the district, instead of having two men both barely able to exist.

There are, however, lands within forest reserves, other than hay lands, about which there can be legitimate doubts as to their value for agricultural purposes. With the introduction of improved methods of agriculture, especially with reference to dry farming, and following the impetus given by the "back to the land" movement which is bound to come on the termination of the war it may be expected that there will be a very insistent demand for a chance to use lands within forest reserves which possess any potentialities whatsoever agriculturally. The need of preparedness for this eventuality leads me to believe that we can no longer delay consideration of the introduction of a "Forest Homestead" amendment to the Forest Reserves Act, applicable at least to British Columbia, which will provide for the disposal of agricultural lands within forest reserves in a similar way to the Act of June 11, 1906, with reference to national forests in the United States.

Two basic provisions of this amendment should be: first, the delimiting of such lands by a metes-and-bounds survey, or at least by subdivision down to 25-acre blocks, irrespective of section lines, so as to grant only bona fide agricultural lands, and, second, a regulation that upon abandonment or cancellation of any forest homestead the land in question should revert to the ordinary status of forest reserve land.

Once some definite basis for the administration of agricultural lands in reserves is arrived at I am certain that any difficulties in the way of co-operation in the carrying out of the policy of conserving our natural resources in timber and water in the best way, viz., by the creation of forest reserves, will be eliminated.

In connection with the proposed new reserves I do not think action should be taken towards establishing them pending a decision on the agricultural lands question. When this has been properly provided for a joint inspection of boundaries as proposed by the original forest surveys should be made by the Lands Branch and the Forestry Branch to ensure the correction of any mistakes made. Upon such inspection reports reserves could be established with a fair degree of certainty that they would be permanently satisfactory

FIRES.

The season of 1915 on the reserves in this district was very satisfactory from the fire standpoint. Ample and well distributed rainfall throughout the season reduced the hazard very materially. Added to this the fact that the rangers are becoming well acquainted with their districts and the settlers therein, and more efficient in the carrying out of their duties as they get experience in the actual business of forest administration, and we can account for the fact that only six fires occurred last season costing $29 to fight. The causes of these fires were as follows: settlers clearing land, 2; brush burning, 1; campers, 1; incendiary, 1; lightning, 1. The total area burned over by

these fires amounted to 106 acres. Eight thousand feet board measure of timber were destroyed and 10,900 feet board measure damaged. Thirty cords of wood were also burned.

SILVICULTURE.

Timber sale 38 was completed during the year, the whole operation having been carried out by the operator in a very satisfactory manner. Brush piling was well done and the resultant expense of burning the brush by ranger labour was therefore small, amounting to 54 cents per acre and 2 cents per thousand feet board measure.

Inquiries were received from certain parties *re* a sale of timber on the northern slopes of Chuwhels mountain in the Long Lake reserve, but owing to the financial stringency caused by the war it was found impossible to go through with the matter.

The permit business on the reserves in this district as in previous years is very

Photo. 10814. R. H. Campbell.

Stand of alpine fir and spruce, Fly Hills forest reserve, British Columbia.

light, due to the presence of quantities of accessible timber on Dominion lands near the settlements or on the lands of homesteaders themselves. Some little demand occurred for cedar on the Niskonlith reserve and most of the permits were issued for this class of timber.

During August last I made an inspection trip through the Yoho forest reserve and was much impressed with the quantity of over-mature timber in the Vermilion River valley which is in very poor condition silviculturally. The stand of timber comprises a mixture of lodgepole pine, Engelmann spruce and mountain balsam at an average mixture of 50 per cent pine, 49 per cent spruce, and 1 per cent balsam. This percentage, however, varies according to site conditions from an almost pure pine stand to an almost pure spruce stand. The average run per acre would be about 5,000 feet board measure, the timber cutting out in about the same proportion as the stand occurs on the site. The stand is, on the whole, over-mature and shows little marks of fire for a long time past. The pine, being the shorter-lived tree, is rapidly deteriorating, thereby causing a considerable percentage of dead timber in the stand. This per-

centage varies from 5 per cent to 25 per cent of the total stand. The cause of this dying off of the pine is probably due in the first event to the natural completion of the life cycle of the tree. Superficial inspection indicates strangulation by lichens and inability to compete with the spruce for light and moisture at maturity. Specific diseases through fungus or insects were not noted. Observations in the Ochre and Tokum Creek valleys, where better site conditions prevail, point to the conclusion that the climax forest is spruce and that the occurrence of pine is a temporary phenomenon due to forest fires in the past.

The reproduction is composed solely of mountain balsam although this species in the stand may not comprise 1 per cent. Localities where windfall has taken place show this balsam to be replaced by spruce reproduction of a healthy character. In "burns" it is replaced by lodgepole pine. The presence of balsam reproduction alone in the mature stand is due to the greater tolerance of that species. Proper light conditions being provided, reproduction of spruce can be obtained without difficulty even though clean cutting should be practised over considerable areas. The brush from logging operations will have to be piled before burning as broadcast burning would probably give rise to a crop of lodgepole pine reproduction.

Silviculturally the stands on the Vermilion river and tributary valleys are in a very decadent state and a further crop of spruce can be secured only by removing the present stand as soon as possible under proper silvical conditions.

The fire hazard is increasing year by year owing to the toppling over of dead pine in increasing numbers, thereby adding to the debris on the forest floor. The presence of moss and lichens on both spruce and pine also causes a very high fire hazard. The poor and comparatively valueless stand of lodgepole pine to be seen very soon after crossing the divide of the Vermilion pass on the Alberta side shows what unfavourable conditions will naturally arise in the next crop unless the fire hazard is removed. From the point of view of good forestry it is therefore imperative that cutting operations should be encouraged and carried out as soon as possible. Any timber sales awarded in this district should include a clause providing for the utilization of the dead standing pine as firewood. Owing to the scattered occurrence of this dead standing timber a charge of 25 cents per cord would be ample remuneration to the Government.

The only logical objection which could be advanced to the cutting of this timber would be possibly the marring of the scenic attraction of the Banff-Windermere automobile road. Personally I do not feel that this should have sufficient weight to prevent the proper harvesting of the present crop, especially as cutting under regulations would not leave the ordinary unsightly slashing and subsequent "burn" seen under unregulated logging conditions.

USES.

Summer Resorts.—The summer resort at Trout lake in the Long Lake forest reserve was much improved by the construction of a road along the front of the lots giving direct access to the cottages and the water front for the whole length of the site. One new cottage was erected and the grounds of several of the residences have been cleaned up and improved in a most commendable way.

FISHING.

The requirement of a permit to fish was eliminated last season, a proceeding which gave considerable satisfaction to the public without detracting to any extent from the efficiency of the control by this branch.

Further investigation of Paul lake in the Niskonlith reserve showed that owing to its low altitude (2,100 feet) it was not necessary or advisable to prohibit fishing to so late a date as June 15, as all spawning is over a month before that date. Permission was obtained to permit fishing in the lake after May 15, and a great deal of use was made of the lake by residents of Kamloops.

IMPROVEMENTS.

A large amount of improvement work was carried out during the summer season. The construction of telephone lines was an important departure in improvement work. Three lookout stations and two rangers' headquarters have been connected with this office and each other through the medium of the Public Works Department Telephone Service, whose superintendent, Mr. W. H. Stevens, has given us every assistance in his power.

One ranger's headquarters house was finished, one new one built and another partly constructed. Nine ranger's cache cabins were also constructed at strategic points on the reserve.

Trails constructed totalled 191½ miles; trails repaired 140 miles; telephone lines erected 38½ miles.

With the exception of a few projects yet incomplete and one or two not yet started but which will be undertaken next year the improvements necessary for proper protection from fire of the reserves at present established are practically completed. We should now be in a position to reap the benefit of our capital expenditure in reduced cost and increased facility of administration in the future.

SURVEYS.

The work of taking an inventory of the resources of the reserves in this district was continued during the winter season of 1915-16 by a reconnaissance party under the direction of Forest Assistant K. G. Wallensteen. The work during the past winter was confined to the Niskonlith reserve. Despite the intense cold only one day's time was lost, a very creditable record. I am informed that there is an even larger area of fine spruce and balsam timber on this reserve than was found on the Fly Hills reserve the winter before. That there are at least three hundred million feet of timber on this tract is probably a conservative estimate.

EDUCATION AND PUBLICITY.

Owing to the extreme shortage of officers on the staff of this district occasioned by the departure of the supervisor and a forest assistant to the battle front, it has been necessary to confine the energies of the remaining staff to routine work with the result that opportunities for bringing the work of the branch before the public have been few. Nevertheless some good results have been obtained by personal conversations with responsible citizens and by the writing of several newspaper articles on affairs connected with work here from time to time.

EQUIPMENT AND SUPPLIES.

During the year a large amount of fire-fighting equipment has been purchased and distributed at various points throughout the reserves, principally at headquarters and in ranger's cache cabins. It is believed that tools are now available for fighting fires occurring anywhere in the reserves with the minimum delay in transportation.

FIRE-RANGING OUTSIDE FOREST RESERVES.

Weather conditions during 1915 were rather abnormal, generally dry weather being the rule; although, except in the Coast district, rains occurred at intervals just proportioned to reduce a fire hazard rapidly becoming dangerously high.

The total number of fires occurring in the Railway Belt during the season was 459, of which only 20 or approximately 4·3 per cent caused expense.

The causes of fire were:—Unknown, 125 fires, percentage of total 27·2; campers, 124, percentage 27; settlers, 62, percentage 13·5; lightning, 44, percentage, 9·6; rail-

ways (unspecified), 32, percentage, 7; logging equipment, 30, percentage 6·6; and the following, all of which were less than 2 per cent each of the total: brush burning, 7 fires; sparks from engines, 6; cigarettes, etc., thrown from trains, 6; other known causes unspecified, 5; tramps, 4; came across international boundary, 4; incendiary, 3; Indians clearing land, 3; careless section men, 2; right of way clearing, 1; sparks from stove, 1; total, 459 fires.

The list shows that the percentage of fires whose origin is unknown is noticeably decreasing. Railways formerly responsible for the great majority of fires are credited with only 8·5 per cent, a tribute to the efficiency of the work carried out by them under the orders of the Board of Railway Commissioners, which work is supervised in the field by officers of this branch.

Following is a statement of the total losses caused by forest fires in the railway belt during the summer of 1915: Timber, $1,336.35; young growth, $2,241.50; property, $6,465; cost to extinguish, $5,632.01; total, $15,675.16.

Coast District.—A particularly trying season was encountered on the coast owing to a combination of prolonged drought and unemployment caused by hard times, which turned the attention of many to the advantage of forest fires as a means of gaining a few dollars. Great credit is due to the Crown Timber Agent, Mr. E. W. Beckett, supervisor of fire ranging in the coast district, and to his assistants, who by judgment and energy prevented dangerous situations from developing into conflagrations.

There were 295 fires; the area burned over, including merchantable timber, young growth and cut over lands was 14,738 acres, and the total damage to timber and young growth was $3,327, and to private property, logging equipment, etc., $6,325.

Fortunately, I was in a position to give a great deal of personal attention to the work in the field, and invariably I found that, after some advice, the assistant rangers were capable of coping with the situation. The chief ranger was indefatigable in his efforts to supervise the various fires, but notwithstanding his earnestness, he found the situation difficult, largely owing to poor transportation, which in the coast district might be materially improved if he were provided with a runabout automobile, enabling him to go from point to point without the delay of awaiting trains, etc.

Improvements.—During the season we completed the following telephone lines: (a) Chilliwack River line to connect with the line to Chilliwack, 13½ miles; and (b) Cultus Lake line to connect with Chilliwack, 3 miles.

The advantage of connecting these two remote districts with the outside world was apparent during the season, particularly in the case of the latter, through which prompt assistance was secured in time to prevent a serious loss of timber.

The following improvements are under way at present:—

Lillooet Lake telephone line, connecting Lillooet lakes with Port Haney, at which point assistance can be secured in time of need; distance 12 miles.

Kronin Trail, districts Nos. 17 and 18; 4 miles.

Completion of Gold Creek trail, district No. 17; 3 miles.

Dewdney Creek trail, district No. 3; 4 miles.

Yale and Spuzzum trail, district No. 1; 9½ miles.

Lookout station, trail and telephone, Chilliwack River, districts Nos. 6 and 8.

We hope to be able to complete all the above before the beginning of the season 1916, and great benefit is expected from these important projects, particularly that of the lookout station situated on Lookout mountain on the edge of the Chilliwack valley at an altitude of 6,200 feet above sea level, and affording an unobstructed view of the surrounding country in all directions.

During the season we continued to have the cordial co-operation of the Provincial Forest Branch, and a system of reciprocity has been established between the two branches, from which each must benefit.

We held two very beneficial and successful meetings of the fire rangers in the months of May and September; and our fall meeting in particular was most interesting, being attended by several mill men and loggers, whose interest is identical with that of the department.

Salmon Arm District.—This district, in which such heavy losses were encountered during 1914, escaped with an easy season this year, due to the occurrence of rains at opportune intervals and to the taking to heart by settlers and rangers of the lesson learned in 1914. Two new rangers were added to the staff bringing the total to 16.

Fifty-two fires were reported of which 12 caused expense to extinguish. It is of interest to note that lightning was the largest single cause of fire in this district, being responsible for seventeen fires. The loss of timber was very small.

Some improvement work was undertaken, principally in the opening up of trails along creeks whose watersheds contain areas of valuable timber. Altogether some 27 miles of trails were construed. A cabin was erected on the north shore of Little Shuswap lake and a marine ways constructed for wintering the fire patrol launch *Shuswap.*

A ranger meeting was held on October 5, in Salmon Arm, the principal feature being an address by the Director which was very much appreciated, as was the opportunity afforded of coming into personal contact with the head of the branch.

Revelstoke District.—Dominion Land Agent, T. J. Wadman, continued to supervise the fire-ranging work in this district in his capacity of chief fire ranger. The splendid record in fire-ranging work made in this district is largely attributable to his organizing ability and attention to details.

One new district was established in the timber berths west of Golden on the Columbia river bringing the total number of rangers to 16.

Altogether 86 fires were reported during the season, only three of which caused expense. These were extinguished before any damage was done. Twenty-six fires were caused by lightning. The large percentage of fires from lightning, approximately 31·9 per cent, shows the difficulties of adequate fire protection in this district.

The provincial regulation requiring the securing of permits by settlers before they are allowed to burn off their "slashes" is productive of good results. The chief fire ranger attributes much of this to the securing of the co-operation of the settler. He states that the effort on the part of the rangers to secure this co-operation met with most gratifying results. When the time came for the settler to burn off his brush, the ranger for that locality superintended the operation, with the result that the escape of fire into the forest was prevented and the settler reciprocated whenever possible. The chief ranger believes that the only way to secure the co-operation of the settler is to assist him on such occasions and he reports that he intends to extend this policy in the coming season. The education of the general public in the district he believes to be one of the most important and most effective parts of the work and he devotes considerable attention to it.

A large amount of improvement work was completed during the year, including the construction of 16 miles of new trail and the clearing out of 60 miles of old trail. Special attention was paid to cutting trails to convenient lookout points, four of which are now accessible and are proving very useful.

The Big Bend telephone line was put in order early in the season.

Two cabins were erected each of which serves as headquarters for two rangers. These cabins add to the facility with which the rangers can cover their respective districts.

About 600 acres of slashings were burned under the supervision of the chief ranger, eliminating some very dangerous hazards. This burning was done in the spring. Later, during the dry weather, the ranger in one district had some difficulty with fires

breaking out in the area burned, from smouldering cedar logs and debris, especially material used by the operator as "fills" in skidding roads. All outbreaks were promptly controlled but the experience gained points to the advisability of fall burning when possible.

A very instructive rangers' meeting was held in Revelstoke at the close of the season on October 9, 1915. The experiences of the season were gone over and points of value in the work correlated therefrom. A discussion on fires caused by lightning showed that a recurrent cycle of phenomena could be traced for electric storms in each district, from a study of which protective plans could be evolved. Wind directions and the conditions giving rise to dangerous fire winds were also discussed.

Ranger Hugh Smythe of Revelstoke produced a collection of seeds of native trees of the district to be forwarded to France to be planted by the graves of fallen Canadians. In connection with this collection the following resolution was passed: "This meeting respectfully requests the Director of Forestry to forward the collection of seeds of Revelstoke trees collected by Ranger Smythe to the Minister of Militia with the request that these be forwarded to the proper persons in France who will undertake to plant them on the graves of Canadian soldiers fallen in the defence of the Empire."

RAILWAY FIRE-RANGING.

Supervision of railway patrols under Order 107 of the Board of Railway Commissioners was continued in 1915 with the same staff as formerly. The good results obtained under this order show forth in the reduced proportion of fires mentioned above as charged against railways. This is due, first, to the use of oil-burning locomotives through timber districts; second, to the splendid way in which the rights of way have been cleaned up, and, third, to the care exercised by railway employees in fulfilling their duties with regard to fire prevention as outlined by the Board.

Patrols were established on the Kettle Valley railway under authority of Order 107 on July 21 and proved effective.

A study of conditions along the Canadian Northern Pacific railway was made last fall and recommendations made to the Railway Board of the patrols necessary as soon as that railway should come under the jurisdiction of the board.

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 year ending March 31, 1916.

INTRODUCTION.

The basis of organization of the laboratories and their early development were discussed in last year's report. A good deal of time has again been spent in fitting up our buildings for laboratory work and in the installing of apparatus. However, there has been a decided improvement in the way of getting down to more regular experimental work, which is the most important activity of a government office such as this. The effect of the war has been keenly felt in the way of absence of men enlisting for active service, difficulties in procuring apparatus and supplies, uncertainty and changes in the industries with which we make an effort to co-operate. On the other hand there has been a very marked change in attitude towards scientific work on the part of the Canadian public and the experience of the war will no doubt considerably hasten the development of industries on a sound technical basis.

Photo. Special.

Exhibit of fire-fighting and forestry methods and of work of the Forest Products Laboratories of Canada made by the Forestry Branch at the meeting of the Canadian Lumbermen's Association and the Canadian Forestry Association Ottawa, January 1916.

Library accessions for the year totalled 656 including books, pamphlets, clippings, reports, government bulletins, etc. The total number of books on hand is 461, being an increase of 216 for the year. In addition to the above, 34 technical journals have been received and indexed regularly. The McGill library is relied on for general reference works and we are not attempting to duplicate to any extent. Improvements in the library filing system have been made and an order covering the details has been prepared. Special attention has been given during the year to the referencing of current literature and standard works on pulp and paper, wood distillation, timber tests, cellulose, tannins and a number of other subjects. Systems of indexing photographs and exhibits have been worked out.

A favourable start has been made on the exhibits of forest products. One large room has been remodelled for the purpose and a few special cases and shelves, etc., have been provided. A considerable number of specimens have been collected, illustrating wood-destroying fungi, wood treated with preservatives, timber test specimens, materials used in the pulp and paper industry, etc. A number of forestry pictures have been framed with a variety of Canadian woods. Some fifty-seven Canadian tree species have been procured in the form of logs which are being used for the preparation of wood specimens for exhibit and for distribution. Considerable attention has been given to the working out of best methods for preparing these specimens. An exhibit was prepared for the annual meetings of the Canadian Lumbermen's Association and the Canadian Forestry Association at Ottawa in January.

TIMBER PHYSICS.

Improved accommodation has been provided for this division. In the draughting room a special bench has been installed for the determination of physical properties of wood, a small room has been fitted up for microscopic work and the photographic room has been equipped with benches, drawers, etc. The chemical laboratory has also been supplied with extra benches, shelves, desk and other fittings and a storage room for chemical apparatus has been provided.

The new equipment added during the year includes two electric ovens, photographic apparatus for printing and miscellaneous apparatus and supplies for microscopic, photographic and chemical work.

The attention of this division has been devoted mainly to the determination of physical and structural properties of wood which has undergone mechanical test in the Division of Timber Tests. This work is discussed in more detail elsewhere. The miscellaneous work done by this division includes a preliminary study of "rotholz," new selective stain for pulp fibres, examination of discoloured birch, identification of fibres and wood submitted by outside parties, the preparation and distribution of 183 special fibre slides, the study of fibre dimensions of Douglas fir, examination of wood for fungus, etc. The work of the division may be summarized as follows:—

Moisture determinations, 4,254; structural characteristics, 1,646; shrinkage (radial and tangential), 373; specific gravity and volumetric shrinkage, 422; permanent microscopic slides, 579; duplicates of above, 2,052; temporary slides prepared and examined, 560; wood identifications, 67; fibre identifications, 39; fibre measurements, 2,900; photographic prints, 1,021; lantern slides, 317; negatives, 524; (including copies, 203; photomicrographs, 144; ordinary photographs, 177.)

TIMBER TESTS.

A wood-working shop has been fitted up in the building adjoining the experimental paper-mill. This provides good facilities for general carpentry work and the preparation of specimens. A small shed for the seasoning of specimens has also been constructed. In addition to the above there is available an office, draughting-room, the university testing laboratory, a storage and seasoning yard and a small saw-mill for handling logs.

New equipment installed during the year includes thickness planer, surface planer, saw table, borer, lathe, grinder, trimmer, swing cut-off saw and coring machine in the new wood-shop. The university Riehlé testing machine has been fitted with new motor and gears thereby adding another unit for timber testing.

Most of the time during the year has been spent in the testing of Douglas fir and Nova Scotia mine timbers. These topics are discussed under separate heads. A certain amount of miscellaneous testing has been carried out to compare the relative strength of green and kiln-dried wood, to determine the relation of moisture content to strength on a series of Douglas fir specimens, and to get an idea of the strength of wood showing "rotholz." These miscellaneous tests totalled 164 in number.

Some attention has been given to the planning of future work. There is a call for test data on Douglas fir in large structural sizes. It would be of interest to the railroads to know more accurately the strength of ties and bridge timbers treated with preservatives. When time permits, a series of runs will be made to study the effect of rate and method of loading specimens in the testing machines on the strength values recorded.

PULP AND PAPER.

The experimental paper-mill was placed in better working order during the year by the installing of further equipment and the making of a good many improvements. The upstairs laboratory was fitted with balance room, draught closet, extraction chamber, benches, laboratory table, special racks, etc., for chemical work on wood and pulp.

Among the new items of equipment may be mentioned a 47-inch pulpwood chipper, chip screen, pulp-drying oven, two gas-fired steam boilers, electric meters in connection with the beaters, autoclave for making soda pulp, small digester for making sulphite pulp, miniature beater, soda liquor tank, gauge tester, drum washer for beater, plunger stuff pump, suction pump, chemical balance, two electric ovens and various testing instruments.

Progress has been made on the special investigations of waste sulphite liquor, beating, blotting paper, pulpwood measurements and the chemistry of wood and pulp. These subjects are discussed elsewhere in this report. The first sheet of paper was run over the experimental paper machine on May 27, 1915, and the paper-making equipment has been operated at intervals during the year. The staff has been called upon to carry out miscellaneous tests such as the beating of leather-board stock, the examination of pulp fibres submitted, bleaching tests, testing of Canadian china clay. Further attention has been given to the design of semi-commercial pulp digesters and the lay-out of an experimental pulp-mill, so that this equipment can be added when conditions permit.

WOOD PRESERVATION.

The laboratory accommodation for the Division of Wood Preservation has been greatly improved. The preservation laboratory has been provided with concrete floor, chemical benches, office and fairly complete equipment for the study of wood preservatives and the preservative treatment of wood on a large experimental scale. In the pathological laboratory one small room has been put in shape for the study of wood-destroying fungi and the adjoining room has been altered to serve as a fungus pit. This division also has an office and storage rooms.

Considerable time was spent in the designing and installing of apparatus for experimental work, including a cylindrical retort, 2 by 10 feet, with oil working tank, motor-driven circulating pump, high pressure feed pump, air compressor, air receivers, condenser, etc. There is also a small retort, 13 by 18 inches, with the necessary attachments. Other apparatus added during the year includes open treating tank, chemical apparatus, incubating oven, inoculating cabinet, electric oven, etc.

There has not been an opportunity for very great progress in experimental work during the year. The special investigations of railway ties, paving blocks, fence posts and durability of wood are discussed under separate heads. Miscellaneous work has included distillation runs on various creosotes used as wood preservatives, the examination of decaying timber in factory buildings, the collecting of fungus specimens, the study of technical literature and experimental work on the effect of fungus attack on wood.

MISCELLANEOUS WORK.

The subject of lumber continues to be one demanding a great deal of attention, and I again urge the establishment of a separate Division of Lumber at the earliest opportunity. There are many problems confronting the wood-using industries in connection with logging and sawing of lumber, the disposal of wood waste, the proper balancing of finished products and the development of new lines of manufacture. Some attention has been given to these questions by members of our staff and many inquiries have been answered to the best of our ability. There is an urgent need for a better understanding by lumber dealers and wood users of the proper methods of handling wood to prevent decay and improved methods of constructing buildings to cut down the fire risk.

Among our miscellaneous activities it may be interesting to note that an attractive "sugi" finish has been produced on Douglas fir by charring the surface with gas flame and scraping with wire brush, the results comparing favourably with the widely advertised "sugi cypress."

Hardwood distillation has been greatly stimulated by the war demands for acetone and other products. Our staff has been called upon to answer a large number of inquiries regarding this industry. Available literature on the subject has been reviewed and some important foreign works translated. The distillation of resinous woods is attracting a good deal of speculative interest in Canada, and there have been calls for more accurate information concerning experience in other countries and possibilities for developing the industry in Canada.

Along with regular work in the four technical divisions now operating, the members of the staff have given such time as possible to keeping in touch with miscellaneous industries and developments in the field of forest products. Among these may be mentioned the recovery of tannins from bark and wood, the production of cedar oil and other essential oils from leaves and wood, the manufacture of wood flour, production of rosin and turpentine, etc.

SPECIAL INVESTIGATIONS.

The following is a brief summary of the special investigations which have been undertaken:—

Testing Clear Specimens.—This is a comprehensive investigation to provide reliable data on the mechanical, physical and structural properties of wood and is designed to include ultimately all the important Canadian tree species. 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. In addition such physical properties as moisture content, specific gravity, volumetric and linear shrinkage, per cent sapwood, per cent summerwood, rate of growth, fibre length and microscopic structure are determined.

The testing of Douglas fir from three localities in Alberta and British Columbia was completed some months ago. In the course of the work on this species there have

been made 3,694 mechanical tests, 405 shrinkage determinations, 4,099 moisture determinations and some 1,794 determinations of sapwood, summerwood, rate of growth, etc. During the fiscal year 1915-16 the mechanical tests numbered 2,663 and the other tests were in approximately the above proportions. It appears that Canadian-grown Douglas fir has substantially the same properties as that grown in the United States and that Douglas fir, particularly from the Pacific Coast region, holds one of the highest places among structural timbers. The results of this investigation are now being worked up for publication in the form of a Forestry Branch bulletin.

Our forester has collected the necessary logs for the testing of four eastern species; black spruce (including the so-called "grey spruce") and white spruce from Quebec province and white pine and red pine from Ontario. Owing to the pressing demands from lumbermen, architects, engineers and others for authoritative test results on the various Canadian woods suitable for building construction, it has been thought best to shorten the programme of testing so that each species can be finished in from one to two months, until reasonably accurate average strength values have been obtained for the more important Canadian wood species.

Nova Scotia Mine Timbers.—A general investigation of the use of wood in the mines of Nova Scotia has been carried on co-operatively by the Forestry Branch and the Mining Department of McGill University. The Forest Products Laboratories have been engaged in the mechanical testing of the timber, the study of fungus attack, the consideration of preservative treatment, etc.

The testing of a preliminary shipment of 288 props and booms of commercial sizes from the storage yards of one of the eastern mining companies was completed early in 1915. It became apparent that in commercial operations rotting of timber in storage is quite prevalent and it was found that some of the material affected by fungus attack was as much as 30 per cent weaker than the sound sticks, even though decay was not evident from the general appearance of the timber. Additional shipments of some 540 props and booms which were cut from sound trees by our forester were received later and of these 270 were tested green last summer. The remaining 270 have been seasoning in our yards for a year and will be tested in the air-dry condition during the coming summer. The species covered are black spruce, red spruce and balsam fir which are now being used in the coal mines of the east, and yellow birch, white birch and jack pine which have been suggested to supplement the supply. Props were tested in 6-foot lengths as columns, and booms were tested as beams on a span of 12 feet. In addition 307 tests were made in compression parallel to grain on small clear specimens cut from the booms after they had been broken. The booms showed the following descending order as to strength: yellow birch, white birch, black spruce, red spruce, jack pine, balsam fir. The prop tests indicate that crooks and defects have more to do with the strength of individual props than has the species to which they belong. The results will appear later in a Forestry Branch bulletin.

Vapour Pressure and Shrinkage.—Plans were made some time ago for studies of the variation in the moisture content of wood due to changing humidity of the atmosphere at various temperatures and the relation between shrinkage of wood and change in moisture content. Special apparatus was designed and procured and some preliminary experiments were made. The investigations had to be postponed owing to the enlisting of technical men for active service.

Waste Sulphite Liquor.—Research work was started last summer by Mr. J. A. McRae at Queen's University on the chemical characteristics and composition of waste sulphite liquor. This is a very difficult field of research and it appears that more ample provision will have to be made if results are to be expected which will point to a satisfactory utilization of this pulp-making by-product. An extensive set of abstracts of the technical literature has been prepared.

Beating.—The object of this investigation is to study the factors connected with the proper beating of paper pulp. During the year the single and double experimental beaters have been put into shape and plans have been made for carrying out the work. Progress was delayed by the assignment of several members of the staff to special war work and other duties.

Ties.—This investigation is intended to cover the problems relating to preservative treatment of railway ties under Canadian conditions. The plans include experimental treatment of tie timber and service tests of treated ties in track. A considerable amount of preliminary work has been completed during the year and the problem has been taken up in co-operation with officials of the Canadian railroads.

Acetone.—Several of the chemists on our staff have devoted considerable time during the past months to the study of acetone which is required in such large amounts for war purposes. We have co-operated with the hardwood distillation companies and the cordite manufacturers in producing and testing new solvents. Most encouraging progress has been made and the results have been submitted regularly to representatives of the British War Office.

Blotting Paper.—Some attention has been given to the manufacture of blotting paper, as only small quantities of the cheaper grades are at present made in Canada. Samples of blotting paper from various foreign sources have been examined. A satisfactory procedure was worked out for the treating of cotton and linen rags and very good grades of blotting paper have been produced on the experimental paper machine. Several thousand of these sample blotters have been printed and distributed as fire protection notices through the Dominion forest reserves and other parts of the country.

Pulpwood.—The object of this investigation is to study the feasibility of barking, chipping, drying and baling pulpwood near the logging operations and shipping the bales to the mills for the manufacture of chemical pulp. In connection with this work it was necessary to determine such data as average weight, green and dry, of a cord of rough pulpwood, loss on rossing, weight of a full cord of peeled wood, volume of solid wood per cord, yield of good chips from a cord of pulpwood, weight of chips loose and packed per cubic foot, weight of air-drying of chips, shrinkage on drying, etc. This information should be of practical interest to the pulp and paper industry.

Preliminary baling experiments have been made and this problem together with the commercial drying of pulpwood chips is in the hands of one of the companies with whom we are co-operating.

Potash.—Owing to the cutting off of German supplies of potash for fertilizer and industrial purposes, attention has been turned to the old process of recovering potash from wood ashes. Information has been obtained and a number of analyses have been made. The total amount of potash in the wood ashes produced throughout the country is not very great, but several firms are taking the opportunity for recovery during the present period of high prices.

Chemistry of Wood and Pulp.—The object is to study the chemical characteristics of Canadian pulp woods with special reference to their pulp-making qualities. A special laboratory has recently been provided. The work up to the present has been along the lines of comparing methods of analysis and devising new methods for the determination of cellulose, lignin, resin and other constituents of wood and pulp. Studies are being made of pulp produced in small digesters, special attention being given to spruce and balsam fir.

Paving Blocks.—The merits of treated wood-block paving for city streets and factory floors and the abundance of raw material in Canada point to a greatly extended use of wood for paving purposes in the future. These laboratories have in mind a

continuous investigation of this subject, involving experimental preservative treatment of wood-block material and service tests of treated blocks. Considerable information has been gathered and a general discussion was given in Forestry Branch Bulletin No. 49, "Treated Wood-block Paving." A number of inspections have been made of wood pavements in Canadian cities during the past year. A supply of red pine has been procured for laboratory tests on this promising species.

Fence-posts.—Preservative treatment of fence-posts promises to be of considerable importance in some districts of Canada where local post material is limited in supply and inferior in quality. The proposed work of these laboratories will cover the investigation of simple, cheap methods of treatment which can be applied by farmers and other consumers of post wood. This subject is of chief interest to the Prairie Provinces and it is intended to co-operate with the forest reserve officials. A small supply of Russian poplar posts has been secured for test purposes.

Oils for Ore Flotation.—The mining interests recently requested the co-operation of these laboratories in the production of Canadian wood oils which may be suitable in the new and important flotation process for treating low grade ores. The Mines Branch has arranged to make flotation tests on oils submitted. Plans are being made for the study of resinous wood distillation and other processes which may yield oils on a commercial basis for flotation purposes.

Durability of Wood.—The lack of definite information regarding the natural durability of the important commercial species of Canadian woods is a handicap in selecting timber for various structural purposes. Plans are now in hand for a study of the relative durability of a few Canadian tree species. This work will include accelerated rotting tests of wood specimens and other laboratory studies to determine susceptibility of untreated woods to fungus attack.

PUBLICATIONS.

Forestry Branch Bulletin No. 49, "Treated Wood-block Paving," was printed and distributed early in the year.

The following articles by members of the staff appeared during the year:—

"The Chemistry of Paper-making Fibres," by J. S. Bates (read before Technical Section of Canadian Pulp and Paper Association and published in Pulp and Paper Magazine of Canada, July 1, 1915.)

"Structure of Wood and some other Fibres as related to Pulp and Paper," by H. N. Lee (read and published as above.)

"The Work of the Forest Products Laboratories," by J. S. Bates (published in Canadian Forestry Journal, July, 1915.)

"Report on the Forest Products Laboratories," by J. S. Bates (published in the Proceedings of the Royal Society of Canada, 1915.)

"Chemical Analysis of Wood Pulps," by B. Johnsen (read before Technical Section of Canadian Pulp and Paper Association and published in Pulp and Paper Magazine of Canada, December 1, 1915.)

"Wood as a Paving Material," by W. G. Mitchell (read before Canadian Lumbermen's Association and published in Canadian Engineer, March 9, 1915.)

"Coal Tar and Oil Tar Creosotes," by W. G. Mitchell (published in the Canadian Engineer, February 24, 1916.)

"The Experimental Wood Preservation Laboratory of the Forest Products Laboratories of Canada," by W. G. Mitchell (Wood-Preserving, April-June, 1916).

Articles on preservative treatment of timber and on paper-making fibres, etc., were also prepared late in the year for publication in technical journals. It is planned to give more attention to publication of bulletins and articles during the coming year. A committee on publications has recently been appointed.

PUBLICITY.

The formal opening of the Forest Products Laboratories of Canada took place on December 3, 1915. Over fifty guests were present including government officials, university representatives, lumbermen, pulp and paper manufacturers, engineers, foresters and others. The various departments were open for inspection and the formal exercises were conducted by the Honourable W. J. Roche, Minister of the Interior.

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

About fifteen lectures and addresses have been given during the year by members of the staff. These have included discussions of the experimental work being carried on in the Forest Products Laboratories, and the reading of technical papers on wood fibres, pulp and paper, wood preservation, timber testing, anatomy of bark, dry rot in timber, Canadian tree species, etc.

A good deal has been accomplished in the way of co-operation with railroads, wood-using industries, trade organizations and scientific societies. The superintendent has served as chairman of the technical section of the Canadian Pulp and Paper Association and has been appointed member of the Committee on Uses of Wood in Building Construction of the National Fire Protective 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 of various associations and societies in Montreal and elsewhere.

INFORMATION FURNISHED.

An important function of the laboratories has been the answering of inquiries regarding woods and their uses. About two hundred such reports were prepared during the year.

In the field of timber physics these covered such topics as identification of fibres and wood, shrinkage of mine timbers, resin content of wood, relative weight of woods, sugar in various maple species, physical properties of woods, and fibre characteristics; in the field of timber tests strength values of various Canadian woods, test results on Douglas fir, working stresses of wood species for structural purposes, effect of creosoting on strength; in the field of pulp and paper the bleaching of ground-wood pulp, uses for barker wastes, cost data on pulp manufacture, processes for making chemical pulp, by-products of pulp manufacture, the chipping and baling of pulpwood; in the field of wood preservation the creosoting of fence-posts, treating silo timber, sources of creosote oil, preservative treatment of poles, cross-arms, mine timbers, paving blocks and wharf timbers, the protection of lumber in storage, fire-retarding paints, dry rot in export lumber, decay in factory floors, kyanizing process, specifications for paving blocks.

There have also been calls for information on hardwood and resinous wood distillation, tannins from bark of various species, cedar oil, producer gas from wood waste, poplar for box shooks, potash from wood ashes and other subjects.

JOHN S. BATES,
Superintendent.