DEPARTMENT OF THE INTERIOR, CANADA

HON. CHARLES STEWART, Minister; W. W. CORY, Deputy Minister

R. H. CAMPBELL, Director of Forestry

REPORT

OF THE

DIRECTOR OF FORESTRY

FOR THE FISCAL YEAR ENDED MARCH 31

1922

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1923

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ILLUSTRATIONS

REPORT OF THE DIRECTOR OF FORESTRY

R. H. CAMPBELL

This report covers the work of the Forestry Branch for the fiscal year 1921-22, ended March 31, 1922.

Although the prevailing commercial depression throughout Canada, in common with the rest of the world, was reflected in many of the lines of activity of the Forestry Branch, the total effect was not so great as might have been anticipated, and some features of the work show a gratifying expansion, which indicates that the trend is now toward normal conditions. It is, perhaps, notable that while several kinds of forest products taken from the forest reserves show decreases there were increases in fuel-wood, building logs, and railway ties. There was an increase of about $2,500 in the revenue received, the total for the fiscal year being $146,266. Losses from forest fires were lighter than in the preceding year, chiefly owing to climatic conditions, but owing also, in part, to increased efficiency on the part of the fire-fighting organization and to additional equipment and improvements. Increased interest was manifest in tree-planting on prairie farms; and the work of forest research, both as regards forest reserves and utilization of forest products, shows steady progress.

FIRE PREVENTION AND SUPPRESSION

Viewing the area covered by the Forestry Branch as a whole, the season of 1921 was a favourable one from the standpoint of forest protection. The fire-hazard was very light in Manitoba and Saskatchewan and much greater in Alberta and British Columbia. In the two former provinces, as there was plenty of precipitation at the right time, only a few fires started, and these were easily controlled. In Alberta there were two periods of unusual fire-danger. In the southern part of the province there was plenty of rain in the spring and there were few fires, but in the autumn there was a period of dry, hot weather when fires were numerous. In the northern districts the weather was dry in early spring, resulting in many fires. The result was a total of over 842 fires, but only 35 of these developed to such an extent as to cover more than ten acres each. In British Columbia the season was one of abnormal fire-danger, but the danger area was restricted to the Salmon Arm fire ranging district and the reserves surrounding. In the Coast and Revelstoke districts there was good precipitation and few fires broke out. Though in the Salmon Arm district this was one of the worst fire seasons ever experienced, and though the total number of fires increased from 408 in 1920, to 455 in 1921, the proportion of large fires (that is, fires over ten acres in extent) was reduced as well as the total area burned and the total amount of timber damaged, as compared with the preceding year. The number of fires in the Railway Belt caused by railways increased from 90 to 214, due largely to the reversion to the use of coal as locomotive fuel in place of oil. At the same time, the acreage burned over by railway fires decreased. This was largely due to the improved patrol work on the part of the railways.

The year's record shows increased efficiency in the detection and suppression of fires. This was due not only to improved organization of the fire-ranging force but also to improved equipment, the use of portable gasolene fire-pumps, motor transport and gasolene speeders, the establishment of lookout stations, and also the use of

aeroplanes. Increased efficiency also came about from changes in the Fire Prevention Acts of Manitoba and Alberta, which gave Dominion forest officers greater powers in dealing with matters which come under provincial jurisdiction. In some of the provinces many fires were caused by the burning of brush contrary to the law, and probably more persons were convicted for this offence than in any previous year. The necessity for such action is regretted but the authorities in all the provinces are becoming seized of the importance of enforcing the laws which protect this great natural resource. The total number of fires for the season was 1,434, as compared with 1,532 for the preceding season. Of these 1,211 fell into the class of small fires, that is fires burning less than ten acres each, and 223 were large fires, burning areas of ten acres and over. Thus 16 per cent were large fires, a reduction from the figures of the previous year, when 27 per cent of the fires fell into the large class. The total area burned over was 121,788 acres, of which 23,853 acres bore merchantable timber; 19,356 acres, young growth; while the remainder was open or grass land. These totals represent a reduction from the previous year when the figures were: total area burned over, 485,500 acres; merchantable timber, 110,000 acres; young growth, 152,600 acres.

FIRES WITHIN FOREST RESERVES

Cause	1921		1920		1919	
	No.	%	No.	%	No.	%
Unknown	32	11	43	20	79	36
Campers and travellers	28	9	28	13	30	14
Settlers	10	3	11	5	26	12
Railways	193	65	94	44	46	21
Lightning	9	3	27	12	9	4
Lumbering	.....	.....	2	1	12	5
Incendiary	23	8	2	1	6	3
Brush disposal other than by settlers	1	*	2	1	5	2
Other known causes	4	1	7	3	7	3
Total	300	100	216	100	220	100

*Less than 1 per cent.

FIRES OUTSIDE FOREST RESERVES

Cause	1921		1920		1919	
	No.	%	No.	%	No.	%
Unknown	174	15	200	15	262	24
Campers and travellers	108	10	187	14	122	11
Settlers	329	29	106	8	212	20
Railways	370	33	596	46	372	34
Lightning	38	3	138	11	48	4
Lumbering	12	1	24	2	15	1
Incendiary	20	2	16	1	16	1
Brush disposal other than by settlers	37	3	16	1	18	2
Other known causes	46	4	33	2	28	3
Total	1,134	100	1,316	100	1,093	100

TOTAL OF ALL FIRES ON DOMINION LANDS

Cause	1921		1920		1919	
	No.	%	No.	%	No.	%
Unknown	206	14	243	16	341	26
Campers and travellers	136	10	215	14	152	11
Settlers	339	24	117	8	238	18
Railways	563	39	690	45	418	32
Lightning	47	3	165	10	57	4
Lumbering	12	1	26	2	27	2
Incendiary	43	3	18	1	22	2
Brush disposal other than by settlers	38	3	18	1	23	2
Other known causes	50	3	40	3	35	3
Total	1,434	100	1,532	100	1,313	100

THE USE OF AEROPLANES IN FOREST PROTECTION

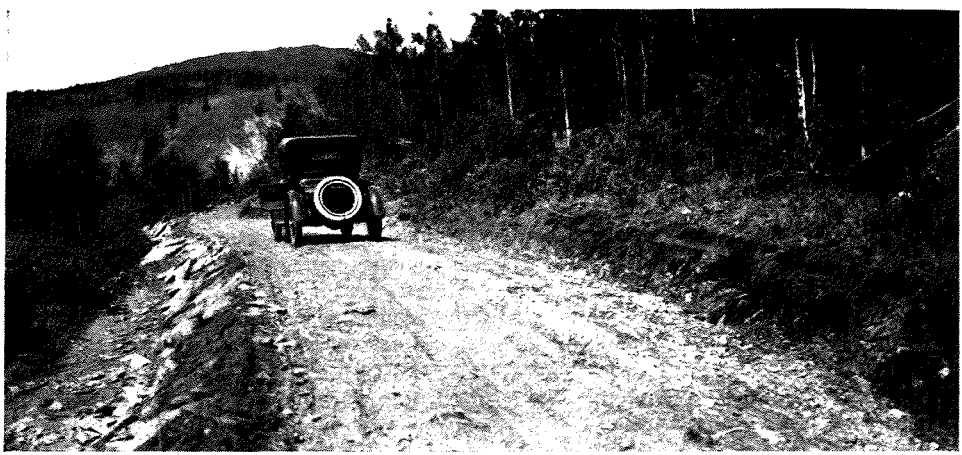
The season of 1921 was the second in which, by co-operation between the Air Board of Canada and the Forestry Branch, aeroplanes were used in the work of protecting the national forests in Manitoba, Alberta, and British Columbia. In each of these the work varied with the nature of the ground to be covered. In the forested area of Manitoba, where there are many lakes and rivers to form good landing-places, the most successful results were attained by the use of large planes capable of carrying eight or ten persons. When small fires were discovered, the airman and his helper landed and put them out. When the fire was a large one, the machine was flown to some trading-post or village and fire-fighters were carried quickly to the fire, along with the necessary tools and provisions. In Alberta, machines were used equipped with wireless telegraph apparatus. From the planes the news of the discovery of a fire was sent by wireless to the aeroplane headquarters whence it was telephoned to the ranger station nearest the fire. In this way fire-fighting crews were sent out within a few minutes after the discovery of a fire, with the result that very few fires attained large proportions. In British Columbia it was found possible to fly directly over the fires at low elevation and thus gain all necessary knowledge as to their size, direction, and the points from which they could be best controlled. Planes were particularly efficient on days when the smoke haze rendered it impossible to locate the fire exactly from the lookout stations.

In all the provinces in which the aeroplanes were used the moral effect of these patrols was most salutary. Campers, settlers burning bush, and holiday excursionists from the cities were all made more careful in handling fire by the passing of the aeroplane overhead. Cards printed with suitable messages were carried by the airmen and dropped over camps and picnic parties, etc., and in certain cases special trips were made to drop these messages over fairs and sports meetings.

IMPROVEMENTS

The successful conditions for combating the fire-danger in forest areas are: first, means of getting news of the fires quickly to headquarters, and second, avenues of communication by means of which men may be quickly transported to the fires in order to extinguish them. This means the construction of a number of permanent improvements on the reserves, and the more complete these are the better will be the fire protection afforded. Improvements on Dominion forest reserves are planned for a long time ahead. In the slack seasons when there are no fires, the protective forces are employed in erecting telephone lines, lookout stations, and in constructing roads, trails, bridges, etc. In years when the number of fires is large, little work can be done on improvements, but when the number of fires is small the number of miles

of telephone lines, roads, etc., is correspondingly increased. Except in British Columbia, where in one district there was a very heavy season of fire-fighting, the season on the whole was favourable, so that there was a good showing in regard to improvement work. The construction of improvements was rendered easier by the fact that the cost of materials was lower and that labour was easier to obtain. In all, the sum of $55,811 was expended on improvements and this, as explained above, was supplemented by the labour of rangers when not fighting fires. In addition to improvements on the reserves the rangers employed in the fire ranging districts out-



Road in an Alberta Forest Reserve. The work of developing the forest reserves includes the making of good road-systems so as to make possible easy communication and so facilitate fire prevention and general management. (Forestry Branch Photograph No. 15973).

side of reserves also improved the trails, portages, camp-sites, etc. This not only facilitates their own movements but also gains the co-operation of those who travel in the northern woods, which makes for greater protection. In addition to the construction of improvements given in the table below, all existing improvements were maintained in good condition. Some work was uncompleted at the end of the year and is not included. The figures are:—

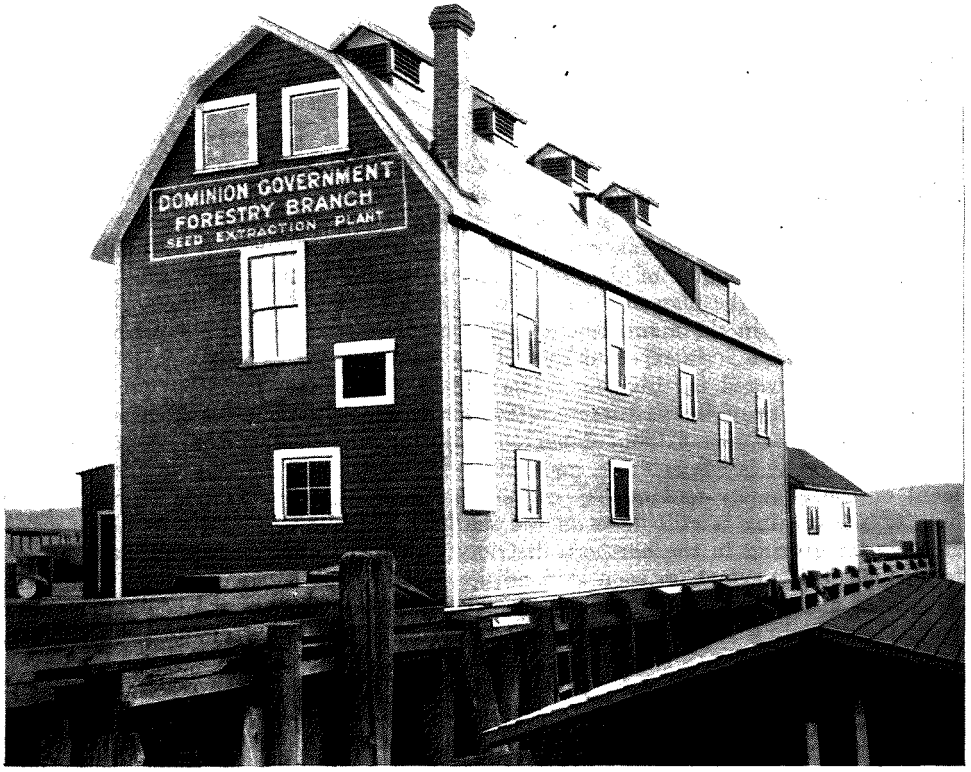
	Number		Miles
Cabins	18	Roads	49
Ranger station houses	6	Trails	239
Stables	14	Telephone lines	223
Lookout towers	10	Fireguards (cleared)	17
		Fireguards (ploughed)	260

SILVICULTURE

The comprehensive term "Silviculture" is used because it denotes better than any other the object kept in view in Forestry Branch timber operations on the reserves. That object is to provide the surrounding districts with as much building material and fuel as possible at the present time, while, at the same time, building up the reserve to its highest state of production for the future. Generally speaking, the object of silvicultural operations is to dispose of the old and inferior trees in order to give room for the young trees of the best kinds to grow as rapidly as possible. There are on some reserves considerable areas of timber killed by fire, insects, or disease. The aim is to dispose of this dead timber as quickly as possible, both to allow the new growth to come up, and to prevent the progress of those insects which multiply in dead timber and thus endanger the growing stand. Where the area of mature timber to be disposed of is considerable, this is done by means of competitive sales, the purchaser being required to cut all trees marked by the forest officer,

and to ensure the safety of the forest by the proper disposal of the brush left after the cutting. Where the quantities to be disposed of are small, this is done by means of permits at reasonable rates, granted to the settlers in the districts surrounding the reserves. The settlers usually cut the trees themselves, and in the case of building timber, it is generally sawn in small portable saw-mills specially licensed for that purpose. This is one side of silviculture; the other is the planting and sowing the seeds of desirable species in blank areas on the reserves in order to bring on the new crop as quickly as possible.

Owing to the depression in trade and industry there was a decrease in the amount of most of the kinds of timber taken from the reserves, both under sales and permits. The exceptions were fuel-wood, building logs, and railway ties.



Forestry Branch seed-extracting plant at New Westminster, B.C. This plant was erected particularly with the view of supplying to the Forestry Commission of Great Britain seeds for reforestation work. In 1921 there were extracted here and sent to Great Britain 7,500 pounds of tree seed, chiefly Douglas fir and Sitka spruce, with smaller quantities of western hemlock and other species. The total quantity of seed extracted was over six and one half tons—13,000 pounds. (Forestry Branch Photograph No. 15011).

On all the reserves a total of 23 acres was planted with about 70,000 transplants and seedlings of white spruce, jack pine, lodgepole pine and Scotch pine. Seeding operations covered 28 acres, and included the same kinds of trees with the exception of lodgepole pine. For the most part these sowings and plantations did well; in one instance, only, was there a heavy loss, due to excessively hot weather following the planting period. Nurseries have been started on several of the reserves in order to have a supply of planting material available locally, and additional supplies are also brought from Indian Head and Saskatoon nurseries.

An important part of the silvicultural work was the collection of tree-seed. This was mainly undertaken at the request of the British Forestry Commission, which

pays the cost of the collection of the seed and its preparation for shipment. The large amount of seed handled rendered necessary the erection of a modern seed-extracting plant at New Westminster, B.C. This was efficiently operated during the seed-collecting season, and the following quantities of seed were collected: Sitka spruce, 8,125 pounds; Douglas fir, 4,500 pounds; western hemlock, 440 pounds; and smaller quantities of other species. A total of 7,500 pounds was shipped to the British Forestry Commission, and the surplus at the close of the fiscal year was being disposed of to the forestry authorities in Canada, on this continent, and in different parts of the world. The plant at New Westminster, while probably not the largest of the kind, is one of the most fully equipped and efficient.

GRAZING ON FOREST RESERVES

Though there was a slight decrease in the number of permits issued for grazing on forest reserves and in the total number of stock grazed, this does not indicate any decline in the appreciation by farmers and stockmen of this use of forest reserves. It reflects the general depression in the stock-raising industry, due to the low prices which have prevailed in the past two years. With the return of higher prices and general prosperity in the industry there is no doubt that the grazing facilities of the reserves will be used to an increasing extent. While in some of the provinces the rainfall was rather light towards the end of the season, the pasturage continued good and the stock left the reserves in good condition. In all the reserves where there are grazing areas, great care is taken to divide the privileges fairly and equitably among the farmers and stockmen of the district served by the reserve. This work has been greatly assisted by the plan of forming local stock associations which co-operate with the forest officers in the management of the herds on the reserves. Grazing surveys were continued and it is expected that all the pastures on the different reserves will be eventually covered in this way. The object of these surveys is to ascertain the extent and quality of the pasturage, to fix the maximum number of stock which may be grazed on each area without danger of injuring the grass by overgrazing, and to decide whether it is advisable to undertake any betterments looking to the improvement of the quantity and quality of the pasturage. In the Prairie Provinces the bulk of the grazing is still done on the southern reserves and there are large areas suitable for grazing in the northern districts which will undoubtedly be made use of to a much larger extent, as soon as conditions and means of transportation improve. The total number of live stock grazed was 88,392, a decrease of about 2,000 head from the preceding year. This number was made up of 58,938 cattle, 18,502 horses, and 10,952 sheep.

RECREATIONAL USES OF FOREST RESERVES

Legitimate use of the forest reserves for recreational purposes is not injurious to the reserves but rather is an advantage, but the hunter or camper must be careful not to injure the forest, and in particular should not permit any damage to result from his careless use of fire. The advantage is that this practice enables many citizens to see the forests, and thus leads them to appreciate their importance and to co-operate with the authorities in conservation work. The use by citizens of all the western provinces of the forest reserves for recreational purposes is steadily increasing. This was particularly so during the fiscal year in Manitoba and British Columbia. A number of additional summer cottages were erected on the parts of the reserves designated for that purpose, and the number of visitors to resorts in the British Columbia reserves exceeded that in any previous year, and included, in addition to residents of the different provinces of Canada, visitors from the United Kingdom, the United States, South America, and Hawaii. In addition to the direct benefits brought by the visits there is the increasing spread of the knowledge of Canada's forest resources throughout the world.

TREE PLANTING ON PRAIRIE FARMS

Although in the fiscal year 1921-22 there was more interest shown in regard to tree planting, general conditions and unsettled markets made it impossible for many farmers who were anxious to do so to undertake any tree-planting work. Tree plantations, both as a means of preventing the bad effects of high winds on soil and crops, and also as improving the appearance and comfort of the farm home, are more highly valued than ever before, and when conditions become normal it is expected that tree planting on the prairie will receive a great impetus. At conventions and similar gatherings the value of tree planting in the West has been repeatedly and warmly commended.

From the standpoint of tree-growth, the season was a favourable one. No serious damage occurred from winter-killing in the winter of 1920-21. Not only did the different kinds of broad-leaved trees of which the belts are mainly composed come through the winter in splendid shape, but the same remark applies to the conifers (evergreens) sent out. In addition to this the reports indicate that fruit trees such as plums, standard apples, crabapples, etc., planted under the protection of the shelter-belts also wintered exceedingly well. In the Indian Head Forest Nursery Station heavy crops of plums and of eight varieties of standard apples were harvested, and the inspectors reported many instances where individual farmers had had good success with fruit trees. The Dominion forest nursery stations do not send out any fruit or ornamental trees, but farmers find that once they have a shelter belt they can grow fruit trees that would not otherwise thrive.

All classes of stock made good growth on nurseries, but it was not a good year for the collection of tree-seed. However, sufficient was secured for the requirements of the nurseries and there was some for distribution. The permanent plantations made very good growth, appreciably more than in the season of 1920. There was considerable distribution of coniferous seedlings for planting on such of the forest reserves as have no local nurseries. The weather during the shipping season was favourable, and the distribution of the planting stock was expeditiously accomplished. The number of seedlings and cuttings distributed increased by over 750,000 as compared with the preceding year, and the number of new applications for stock was over 400 more than in 1921.

FOREST PRODUCTS LABORATORIES

The fiscal year 1921-22 was a very successful one. The number of requests for information increased greatly over any previous year. The experimental paper-mill was in operation longer, the research and investigative work was greater than in any year since the opening of the war, and there were more than 200 visitors more than in any previous year.

A large number of investigations were under way, only a few of the major ones of which can be mentioned. These include the chemical composition of Canadian pulpwoods, the pulping qualities of fire-killed wood, water storage of pulp, use of hemp waste in papermaking, maximum strength of kraft paper. In the division of Timber Physics among the investigations undertaken were the decay of timber in buildings, bending of woods, kiln-drying, and wood identifications. Over 12,000 tests were made in the progress of the study of the properties of Canadian woods. The investigation of Nova Scotia mine-timber was completed, and other investigations in progress related to the strength of aeroplane timbers, the strength of joists, nail-holding characteristics of woods, and tests of fibre-board. The chief study under Wood-Preservation was that in regard to the preservative treatment of railway-ties, which subject is receiving a great amount of attention. Other investigations were the adaptability of maple and aspen ties to preservative treatment, tests of proprietary preservatives, treatment of telephone pole brackets, and the study of fire-

retardant treatment for wood. Good progress was made in all these investigations and all the other lines of work at the laboratories were carried on more actively than ever before. It is evident that the people of Canada, who have to do with forest products, are turning more and more to the laboratories for information connected with their work.

FOREST RESEARCH WORK

There are two general lines of forest investigative work which present themselves to forest authorities in Canada: first, investigation of forest resources, and second, investigation of methods of handling forest areas to secure the highest continuous production that is economically possible.

During the fiscal year 1921-22 the work on the first of these problems has been to a certain extent that of combining two lines previously carried on, namely, that of the Commission of Conservation and of the Forestry Branch. The Forestry Branch has completed a large number of surveys of forest resources of Dominion forest reserves and the work of getting this data for all the reserves is now in progress. It has also made preliminary surveys of large areas lying north of the settled parts of the Prairie Provinces. The Commission of Conservation had published completed reports on the forest resources of Nova Scotia and British Columbia and had commenced a survey of the forests of Ontario, which is being completed by the Forestry Branch.

In co-operation with the Air Board of Canada a beginning was made in 1921-22 in the investigation of the use of aeroplanes in extensive reconnaissance of forest resources, by mapping from the air and by air photography. This work was only begun in the fiscal year and is to be continued. Sufficient information was gained, however, to show the possibilities and to indicate the lines on which the best results are likely to be obtained.

The second problem, namely, that of the investigation of methods of handling forest areas to secure the highest continuous production possible, covers a very wide field and involves the study of methods of perpetuating forests of merchantable species, of replacing non-merchantable species by more valuable ones, of finding uses for trees at present unmerchantable, and study of the silvical and economic aspects of methods of natural and artificial reproduction. This last problem involves measurement and study of the yield we may expect from the different species. Work on yield requires a simple and accurate method of measuring standing timber and the development of some such method for commercial purposes, to take the place of the present system of preparing local tables for each species and locality, will be of very great value.

This widespread investigative work is directed from Ottawa and carried on at a number of points in Canada. There are, first, the forest experiment stations at Petawawa, Ont., in the Ottawa valley, and at Lake Edward, Que., in the St. Maurice valley, the latter in co-operation with the Laurentide Company and the Entomological Branch of the Department of Agriculture.

Experimental cuttings are being carried on in different parts of Canada, notably in co-operation with the Bathurst Lumber Company, of Bathurst, New Brunswick. Forest investigative work has been completed, or is being carried on, in different parts of the east, in co-operation with the provincial forest services and with the following private concerns:—

Ontario.—Spanish River Pulp and Paper Company, Algoma district; Abitibi Pulp and Paper Company, Abitibi district; Graves, Bigwood and Company, Sudbury district; McLachlin Brothers, Hawkesbury Lumber Company, and Gillies Brothers in Nipissing district; the Shroeder Mills and Timber Company, Parry Sound district.

Quebec.—Laurentide Company in the St. Maurice valley, and Riordon Company in the Rouge valley.

New Brunswick.—Bathurst Lumber Company, Gloucester county, and the J. B. Snowball Company, Northumberland county.

Arrangements have been made for the coming season to co-operate with the following concerns:—

Ontario.—J. B. Smith and Sons, Nipissing district; Eastern Lands Canadian National Railways, Poupore Lumber Company, and Hayward Lumber Company, Algoma district; Shevlin-Clarke Company, Fort Frances; Dryden Pulp and Paper Company, Dryden.

Quebec.—Price Brothers, Limited, Chicoutimi; Howard Smith Pulp and Paper Company, Gaspe.

New Brunswick.—Pejepscot Pulp and Paper Company, Kingston, Northumberland county.

The whole-hearted co-operation of the provincial forest services and of the various companies is appreciated.

The same lines of investigation are carried on by the staff on the Dominion forest reserves in Manitoba, Saskatchewan, Alberta, and British Columbia, and by the Dominion Forest Nursery Station at Indian Head, Sask.

A proportion of the work involves repeated measurements over a period of years, so that none of the main problems has yet been completed. Some of the individual studies have been finished for certain species, conditions and localities, but the general application of the conclusions drawn from these studies must be verified by further investigations in other species and localities.

The work on methods of estimating timber for commercial purposes is furthest toward completion. A number of volume tables have been prepared and are available to those requiring them.

Extensive work has been done on the conditions of growth that follow cutting operations and practical conclusions have been reached, for some localities, as to the proper method to adopt for handling pulpwood species. Promising experiments have been made in increasing the proportion of softwood in the mixed hardwood-softwood forest. Experiments in natural and artificial reproduction are under way and have met with a due measure of success. Measurements and study of yield of the important Canadian species in the natural and thinned forest are in progress, this work being carried on simultaneously with the work on methods of estimating.

Brush disposal is an established and successful practice on the Dominion forest reserves in the West and valuable information has been secured in regard to the practical possibility of applying silvicultural methods to timber sales.

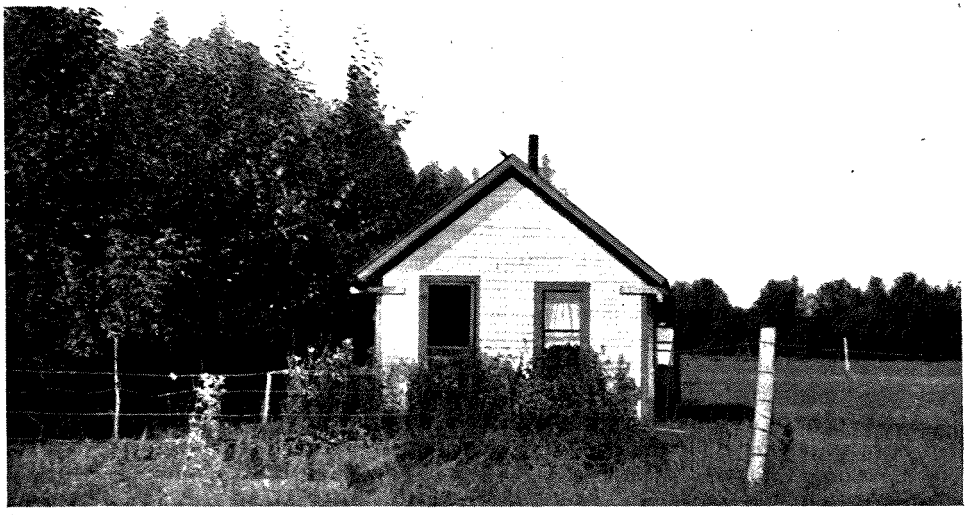
The work of developing uses for species at present unmerchantable is carried on by the Forest Products Laboratories, the report of which division forms part of this report.

PUBLICATIONS AND PUBLICITY

The publication and publicity work showed considerable expansion during the fiscal year. In addition to the annual report the chief documents in pamphlet or report form were: the ninth printing of Bulletin No. 1, "Tree-planting on the Prairies," which brings this to a total of 70,000 copies issued; Bulletin No. 71, "Canadian Sitka Spruce—Its Mechanical and Physical Properties," which is another in the series dealing with Canadian commercial woods; and Circular No. 13, "The Cascara Tree in British Columbia." A good deal of material in smaller form was issued and material for newspapers was prepared and distributed in greater quantity than ever before. Fire-warning posters and cards bearing concise notices for distributing to incoming tourists and for dropping from aeroplanes were increased in numbers and attractiveness. Warnings against careless use of fire in the forests were again placed on the cancelling stamps of a number of western post offices, through the co-operation of the Post Office Department.

THE LIBRARY

As the research work of the branch increases, the demand upon the library's resources correspondingly increases, and the tendency is for the library to assume a position of increasing importance in the work of the service. By securing loans from other offices—not only in Ottawa, but also in Toronto, Washington, New Haven, and other centres both in Canada and the United States—the work of the research staff has been facilitated and extended. The project, initiated last year, of preparing and circulating lists of references on certain selected subjects has been continued. Up to the present the lists have dealt with the tables of growth, volume, etc., in the library at this office; of these, seven have been sent out during the year. They have been sent, not only to officers of the branch, but also to a selected list of others to whom the lists are of interest and use, a number of whom have expressed their appreciation.



Tree planting on school grounds in central Saskatchewan. Trees were sent from Indian Head for this planting in 1911, 1912, and 1913. Photograph taken in 1922. The building shown in the picture is the teacher's residence. Contrast this with the unprotected buildings too often met with around prairie schools. (Forestry Branch Photograph No. 15648).

During the year there were added to the library some 500 books and pamphlets, and a total of 111 periodicals were regularly received—41 by subscription and 70 through exchange. Some 950 photographs have been added to the collection, making the total number of pictures now about 13,250.

STATISTICS

The collection of statistics relating to the annual production of sawn lumber, lath and shingles, pulpwood, wood-pulp, and paper in co-operation with the Dominion Bureau of Statistics was carried on as in previous years. Bulletins for the calendar year 1919 were issued for publication together with press letters and preliminary reports covering the calendar year 1920. The schedules containing the reports on which these publications were based were revised in the Forestry Branch, and the final reports were checked and edited before publication. Investigations of the wood-using industries of Canada were resumed.

STAFF

The total permanent staff of the Forestry Branch for the last year was as follows:—

Head office	54
District inspectors	5
Assistant district inspectors	2
Forest supervisors	19
Foresters and forestry assistants	23
Forest rangers	93
Chief fire rangers	11
Promoters of tree planting	8
Forest Products Laboratories, technical staff	16
Outside clerical staff	50
	281

APPROPRIATIONS

The appropriation for the fiscal year was $1,000,000 plus refunds from fire-guarding, etc., $23,579.99. Total available for expenditure $1,023,579.99. The expenditure was divided as follows:—

Salaries at head office	$ 18,754 90
Travelling expenses	2,497 37
Printing and stationery	18,978 27
Miscellaneous expenses	13,674 16
Statistics	4,067 50
Fire-ranging	258,630 95
Forest reserves	492,794 75
Surveys and research	45,189 44
Tree planting	71,548 35
Forest Products Laboratories	86,199 88
Total	$1,012,335 57

The field expenditures in the western provinces, exclusive of tree planting on prairie farms, were divided as follows:—

Manitoba	$ 128,302 07
Saskatchewan	203,828 86
Alberta	250,137 53
British Columbia (Railway Belt)	185,186 91
	$ 767,455 37

TABLE I—STATEMENT OF REVENUE, FORESTRY BRANCH, FISCAL YEAR ENDED MARCH 31, 1922

Reserve	Timber sales	Timber fees and dues	Timber seizures	Grazing permit and trespass dues	Hay permits and seizures	Surface rentals	Special uses	Nursery stock	Unclassified	Total
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Turtle Mountain		194 14	10 00	3,652 65	553 00	71 60	32 00			4,513 39
Spruce Woods		84 75		1,186 55	147 75					1,419 05
Riding Mountain		5,451 43	512 34	967 50	931 10	213 20	529 00			8,604 57
Duck Mountain		2,289 74	187 80	489 25	442 50	277 80	17 00			3,704 09
Moose Mountain		398 20	12 00	1,001 45	132 75	103 00	608 42			2,255 82
Beaver Hills		108 00	15 00	425 96	373 50	22 00				944 46
Porcupine	2,206 31	695 59	292 30	424 05	532 75		78 00			4,229 00
Pasquia	12,758 06	2,911 66		21 27	304 00		56 00			16,050 99
Fort à la Corne	247 34	624 50	12 00	2 65	12 00					898 49
Pines	50 00	1,605 25	58 91	658 02	72 75		31 00			2,475 93
Nisbet	160 50	3,740 97	171 10	203 86	86 25		58 00			4,420 68
Big River		227 02		205 78	405 50		30 00			868 30
Steep Creek		23 75								23 75
Sturgeon		379 05		282 14	108 50		5 45			775 14
Keppel		236 25		833 70			10 00			1,079 95
Manito		286 20		2,120 89	48 50		32 00			2,487 59
Dundurn		10 25		674 15	80 00		10 00			774 40
Seward				734 07	63 75		26 00			823 82
Elbow		33 60		852 70	726 00		100 00			1,712 30
Big Stick				6,369 76			61 00			6,430 76
Cypress Hills		1,557 11	53 90	5,292 12		30 05	11 00		138 45	7,082 63
Cooking Lake		27 00		998 79	235 25					1,261 04
Crowsnest	1,844 85	2,316 81	650 55	8,411 35	24 50	28 20	255 13		30 00	13,561 39
Bow River		2,918 43		6,596 21	31 00		69 15			9,614 79
Clearwater	16,063 98	253 20		179 86	31 75	23 00	221 60			16 773 39
Brazeau	8,244 66	1,934 50		45 30		560 14	340 00			11,124 60
Athabaska	1,633 00	17 32		58 31	11 25		81 00			1,800 88
Lesser Slave	10,991 66			23 78	88 79		21 00			11,125 23
British Columbia Reserves	6,667 55	133 45		12 25	77 75	337 90	198 32			7,427 22
Indian Head Nursery							3 00	1,528 50	471 15	2,002 65
Total	60,867 91	28,458 17	1,975 90	42,724 37	5,520 89	1,666 89	2,884 07	1,528 50	639 60	146,266 30

TABLE 2—STATEMENT OF TIMBER PERMITS ISSUED IN FOREST RESERVES, FISCAL YEAR ENDED MARCH 31, 1922

Reserve	No. of permits		Kinds and Quantities of Timber Authorized to be Cut								Dues and fees
	Free	Paid	Poles or rails	Fence-posts	Saw-timber	Railway cross-ties	Mine timber	Building logs	Fuel green	Fuel dry	
					Ft.B.M.		Lin. Ft.	Lin. Ft.	Cords	Cords	$ cts.
Turtle Mountain	109	22	.....	600	7,366	.....	.....	7,670	.....	2,791	194 14
Spruce Woods	64	10	80	400	.....	.....	.....	1,000	.....	1,035	84 75
Riding Mountain	196	565	1,716	22,228	1,424,868	.....	.....	15,436	544	5,847	5,451 43
Duck Mountain	192	157	3,345	14,130	606,336	.....	.....	17,461	4	4,773	2,289 74
Moose Mountain	.....	119	.....	6,175	.....	.....	.....	2,960	7	752	398 20
Beaver Hills	66	4	.....	600	.....	.....	.....	5,400	.....	653	108 00
Porcupine	25	31	600	5,104	189,196	.....	.....	23,350	.....	123	695 59
Pasquia	22	93	400	43,034	756,772	.....	.....	8,594	20	7,464	2,911 66
Fort à la Corne	67	87	850	8,185	117,823	.....	.....	10,324	25	1,803	624 50
Pines	60	109	3,150	3,093	21,350	3,000	.....	9,200	.....	5,320	1,605 25
Nisbet	175	220	2,225	6,450	15,668	3,036	.....	19,060	100	13,843	3,740 97
Big River	19	14	2,900	6,050	.....	.....	.....	13,240	.....	649	227 02
Steep Creek	2	3	.....	400	2,500	.....	.....	.....	.....	35	23 75
Sturgeon	1	7	.....	600	20,000	6,648	.....	2,080	.....	25	379 05
Keppel	36	44	.....	360	.....	.....	.....	250	56	302	236 25
Manito	36	86	7,800	5,750	.....	.....	.....	1,000	205	472	286 20
Dundurn	5	2	.....	.....	.....	.....	.....	.....	16	40	10 25
Elbow	21	4	.....	.....	1,000	.....	.....	80	.....	208	33 60
Cypress Hills	125	417	20,445	52,575	74,930	.....	2,000	48,178	1,022	2,500	1,557 11
Cooking Lake	23	2	.....	250	.....	.....	.....	.....	.....	476	27 00
Crowsnest	201	109	10,995	8,155	558,682	.....	30,000	137,447	10	1,036	2,316 81
Bow River	32	54	10,107	9,380	15,160	.....	1,050	288,468	.....	797	2,918 43
Clearwater	58	14	.....	.....	.....	.....	.....	12,670	.....	1,837	253 20
Brazeau	18	14	.....	.....	30,000	.....	285,864	194,666	.....	505	1,934 50
Athabaska	3	1	.....	.....	.....	.....	.....	2,664	.....	50	17 32
British Columbia Reserves	6	18	2,400	200	33,000	.....	27,375	4,458	21	63	133 45
Total	1,562	2,206	66,413	193,719	3,874,651	12,684	346,289	825,656	2,030	53,399	28,458 17

TABLE 3—STATEMENT OF GRAZING PERMITS ISSUED IN FOREST RESERVES, FISCAL YEAR ENDED MARCH 31, 1922

Reserve	No. of permits	Number of Stock				Dues and fees collected
		Cattle	Horses	Sheep	Total	
						$ cts.
Turtle Mountain	137	1,596	226	.....	1,822	3,644 40
Spruce Woods	56	1,257	171	.....	1,428	1,186 55
Riding Mountain	97	1,623	78	40	1,741	879 50
Duck Mountain	26	1,261	23	.....	1,284	489 25
Moose Mountain	94	2,071	281	.....	2,352	1,001 45
Beaver Hills	37	899	57	.....	956	425 96
Porcupine	41	994	77	.....	1,071	414 05
Pasquia	6	52	8	.....	60	21 27
Fort à la Corne	1	5	2	.....	7	2 65
Pines	32	1,457	118	.....	1,575	658 02
Nisbet	21	470	15	.....	485	203 86
Big River	6	497	32	40	569	205 78
Sturgeon	14	569	42	.....	611	282 14
Keppel	45	1,293	418	700	2,411	833 70
Manito	87	3,264	783	19	4,066	2,100 69
Dundurn	30	1,468	317	.....	1,785	674 15
Seward	18	387	319	.....	706	734 07
Elbow	85	1,290	562	550	2,402	852 70
Big Stick	103	8,625	2,797	6,650	18,072	6,342 76
Cypress Hills	97	6,119	3,881	.....	10,000	5,227 32
Cooking Lake	69	1,979	74	.....	2,053	998 79
Crowsnest	143	12,295	3,739	2,953	18,987	8,411 35
Bow River	179	9,367	4,143	.....	13,510	6,566 61
Clearwater	43	37	214	.....	251	179 86
Brazeau	3	.....	49	.....	49	45 30
Athabaska	8	6	55	.....	61	58 31
Lesser Slave	2	14	15	.....	29	23 78
British Columbia Reserves	6	43	6	.....	49	12 25
Total	1,486	58,938	18,502	10,952	88,392	42,476 52

TABLE 4—STATEMENT OF TIMBER CUT ON FOREST RESERVES UNDER AUTHORITY OF TIMBER SALES, FISCAL YEAR ENDED MARCH 31, 1922

Reserve	Previous sales still operating	Sales made current year	Sawtimber	Mine Timber		Telephone poles	Railway crossties	Poles	Dues collected
				Props	Lagging				
			Ft. B.M.	Lin. ft.	Cords	No.	No.	Lin. ft.	$ cts.
Porcupine	5	.....	1,031,057	158,188	100,357	.....	.....	.....	2,206 31
Pasquia	7	3	4,209,174	.....	.....	.....	.....	.....	12,758 06
Fort a la Corne	2	.....	291,077	.....	.....	.....	.....	.....	247 34
Pines	.....	1	.....	.....	.....	.....	.....	.....	50 00
Nisbet	1	.....	.....	.....	591	.....	.....	.....	160 50
Crowsnest	1	.....	38,705	.....	.....	.....	.....	.....	1,844 85
Clearwater	2	2	.....	85,887	105,090	.....	.....	.....	16,063 98
Brazeau	4	1	1,218,173	666,858	706,208	.....	571,405	.....	8,244 66
Athabaska	1	.....	405,834	.....	.....	.....	.....	.....	1,633 00
Lesser Slave	3	.....	2,279,846	.....	.....	.....	.....	.....	10,991 66
British Columbia Reserves	8	1	301,074	.....	.....	9,950	.....	73,315	6,667 55
Total	34	8	9,774,940	910,933	912,246	9,950	571,405	73,315	60,867 91

TABLE 5—STATEMENT SHOWING QUANTITY OF TIMBER SOLD AND REVENUE DUE, FISCAL YEAR ENDED MARCH 31, 1922, ON LICENSED TIMBER BERTHS WITHIN DOMINION FOREST RESERVES.

MANITOBA

Reserve	Timber berths	Area in reserve	Quantity sold			Revenue		
			Lumber	Lath	Other* products	Dues payable	Rent payable	Total payable
	No.	Sq. Mls.	Ft.B.M.	No.		$ cts.	$ cts.	$ cts.
Riding Mountain	4	42·43	398,651	.....	3,867	223 98	222 15	446 13
Duck Mountain	11	99·76	163,846	.....	.....	122 85	499 90	622 75
Total	**15**	**142·19**	**562,497**	.....	.....	**346 83**	**722 05**	**1,068 88**

SASKATCHEWAN

Porcupine and Pasquia	40	868·37	42,090,091	8,904,321	1,535,430	29,388 51	3,994 05	33,382 56
Big River	2	253·75	18,192,069	5,835,600	.....	14,742 04	1,286 75	16,028 79
Nisbet and Pines	4	80·69	.....	.....	10,073	2,238 05	173 15	2,411 20
Total	**46**	**1,202·81**	**60,282,160**	**14,739,921**	.....	**4,636,860**	**5,453 95**	**51,822 55**

ALBERTA

Crowsnest	11	254·94	5,666,163	1,836,650	1,457,981	7,539 88	1,374 70	8,914 58
Bow River	14	327·90	2,345,561	.....	1,943	1,246 51	1,825 60	3,072 11
Clearwater	4	371·52	.....	.....	191,596	7,633 84	1,887 30	9,521 14
Brazeau	11	163·85	692,756	.....	176,191	7,387 13	1,131 30	8,518 43
Total	**40**	**1,118·21**	**8,704,480**	**1,836,650**	.....	**23,807 36**	**6,218 90**	**30,026 26**

BRITISH COLUMBIA

Total	**11**	**133·57**	**1,041,965**	.....	.....	**940 26**	**667 85**	**1,608 11**

GRAND TOTAL

Grand Total	**112**	**2,596·78**	**70,591,102**	**16,576,571**	.....	**71,463 05**	**13,062 75**	**84,525 80**

*The figures in this column indicate the number of units in which the dues were calculated. They include 11,417 fence-posts, 2,661 cords of fuel-wood, 325 cords of pulpwood, 73,347 lineal feet of piling, 1,825,978 railway cross-ties, 5,926 rails, and 1,457,442 lineal feet of mine props.

APPENDIX No. 1

REPORT OF THE CHIEF OF THE TREE PLANTING DIVISION, NORMAN M. ROSS

Conditions affecting tree-growth and the setting of new plantations during the growing season of 1921 were on the whole very favourable. The inspectors all report a very much larger proportion of newly planted stock as having taken root and made satisfactory growth. In southwestern Manitoba and southeastern Saskatchewan there was a restricted area which experienced extreme heat and a period of drought late in July, which caused many young plants, which had started to grow earlier in the season, to dry out and die in late summer.

Although there is more general interest than ever before being shown in regard to tree planting, general conditions affecting agriculture in the West—principally labour and unsettled markets—make it impossible at present for a very large proportion of farmers, who are otherwise anxious to do so, to undertake any tree-planting work. These conditions will gradually become more normal and from all indications we may then expect that tree planting generally will be given an enormous impetus.

Practically no serious damage occurred from winter-killing in any section during

Superintendent's residence at the Sutherland Nursery Station near Saskatoon, Saskatchewan. Seven years before, the site of the station was bare prairie. (Forestry Branch Photograph No. 15498).

the winter of 1920-21. At the Indian Head Nursery Station the fruit trees came through in splendid condition and in addition to quite heavy crops of plums some eight different varieties of standard apples matured fruit of good size and quality. Inspectors also report many instances where individual farmers were having excellent results with plums and crabapples, where grown under protection of shelter-belts.

The inspectors in all districts report on the very favourable results with the evergreens sent out from the nursery station. When once established these make very satisfactory growth and are certainly the ideal trees for permanent prairie planting.

NURSERY WORK

All classes of stock made good growth in the nurseries. Our caragana plots suffered from a severe wind storm just as the seed was germinating, and as a consequence about 50 per cent of the crop was lost. The evergreens, both new transplants and freshly sown seed-beds, came along well.

Distribution.—Shipping of broad-leaved stock commenced April 23 and was completed May 5. Evergreens were shipped May 10 and distribution completed May 12.

DISTRIBUTION OF BROAD-LEAVED STOCK IN 1921

Number of applicants receiving trees	3,603
Seedlings and cuttings distributed	4,083,975
Average number per applicant	1,092
Number of applicants on inspection list, 1921	7,561
Number of new applications for 1922, approximately	2,226

At the Indian Head and Saskatoon Nursery Stations the following broad-leaved material is available for distribution this spring (1922): Manitoba maple, 3,554,500; green ash, 347,000; Russian poplar, 1,176,000; red willow, 1,292,500; acuteleaf willow, 831,500; laurel willow, 308,775; caragana, 839,000; total, 8,349,275.

CONIFERS

Applicants numbering 240 were supplied with conifer (evergreen) transplants, at a nominal charge as follows: white spruce, 18,750; jack pine, 5,000; Scotch pine, 22,750; total, 46,500. In addition to these 57,000 pine and spruce seedlings and transplants were shipped for planting on the Manitoba and Saskatchewan forest reserves, making a total of 103,500.

Collection of Seed.—Owing to various causes this was a very poor season for the collection of maple seed. In most districts seed failed to set and later in the season, owing probably to a few weeks of excessively hot weather, what seed did set in

Cultivating tree seedlings at Indian Head Forest Nursery with small garden tractor. (Forestry Branch Photograph No. 15175).

certain localities did not fill. We were able to secure only 166 pounds of maple seed and 658 pounds of ash seed. About 450 pounds of caragana seed were collected at the Indian Head Nursery Station, and 150 pounds at the Saskatoon Station.

Of the coniferous species 267 bushels of jack pine cones yielding 104 pounds of clean seed were collected in the forest reserves in northern Saskatchewan and in the Riding Mountain reserve. The cones were shipped to Indian Head and the seed extracted and cleaned at the nursery station. Forty-four bushels of lodgepole pine cones were collected in the foot-hills of the Rocky mountains. These yielded only 7½ pounds of clean seed, the dry season probably having affected the filling of the seeds. It was not a seed year for white spruce in any part of the West. We were able to secure six bushels from a few trees at the Indian Head Nursery, from which 5 pounds of clean seed were extracted.

Distribution of Seed.—Fifty pounds of maple, 25 pounds of ash, and 100 pounds of caragana seed were sent out in March, 1922, to 105 applicants. For experimental work and nursery beds 10 pounds of spruce seed and 100 pounds of jack pine were sent to different forest reserves.

Permanent Plantations.—All the permanent plantations made very good growth, on the average considerably more than in the season of 1920. Measurements of growth were taken as usual in all the older plantations, which entailed measuring several thousand individual trees.

Injurious Insects.—The larch saw-fly appeared again in considerable numbers in some of the tamarack and larch plantations, but the trees were immediately sprayed with arsenate of lead and no very serious injury resulted. General reports from different districts show that the canker-worm and aphis on the maples were very prevalent especially in southern Manitoba. There were also several reports of the blister beetle affecting caragana, more especially in Alberta and western Saskatchewan.

PLANTING IN RESERVES

In *Spruce Woods* reserve 43,000 jack pine seedlings were set out covering fifteen acres of new planting; twenty-six acres were sown broadcast with 96 pounds of jack pine seed and half an acre with two pounds of spruce seed. Reports of the plantings on this reserve were very disappointing this season. Following three years of very scant rainfall the summer of 1921 appeared much more favourable, but in this particular district there were about two weeks of intense heat during July, which on the light, sandy soil practically burned up everything. Only a very small percentage of the newly planted stock survived and even the older plantings suffered very considerably. The areas which had been seeded showed some germination in the early summer but the young seedlings were apparently scorched up during the hot spell.

In *Cooking Lake* reserve about five acres of new plantation were set out in the spring of 1921, using stock raised on the local nursery, also a few small, experimental areas were seeded. At the end of October, 87 per cent of the stock planted was living.

In *Cypress Hills* reserve a total of about one and three-quarter acres of experimental planting was done, using small stock grown in the local reserve nursery.

VIDAL'S POINT

Forty-two permits were issued for camping privileges on the public park at Vidal's Point in the Qu'Appelle valley. This is the only available public property bordering on the Qu'Appelle lakes which can be used for general recreation and every season attracts an increasing number of holiday seekers. There is a limited area available for camping purposes and another portion with an excellent bathing beach and fairly well treed, for general picnicking purposes. The increasing use of this property by the general public necessitates certain improvements for sanitary purposes, also the erection of bathing houses, wharves, etc. The Forestry Branch having no appropriation for such purposes, this property was in October, 1921, established by Order in Council as a Dominion park, to be known as Vidal's Point park, and has been placed under the administration of the Dominion Parks Branch.

APPENDIX No. 2

REPORT OF THE DISTRICT FOREST INSPECTOR FOR MANITOBA, H. I. STEVENSON

The work of the Forestry Branch in Manitoba is the administration of the Dominion forest reserves, the fire protection of all timbered lands lying outside the forest reserves and the fire-guarding of the Hudson Bay railway, which is at present considered as being under construction.

The timbered lands outside the forest reserves are divided into three fire-ranging districts: (1) The Pas, comprising the northwestern part of the province; (2) Manitoba North, comprising the northeastern portion; and (3) Manitoba South, comprising the territory in the neighbourhood of lakes Winnipeg and Winnipegosis and the eastern portion of the province from the International Boundary to Berens river.

FIRE PROTECTION

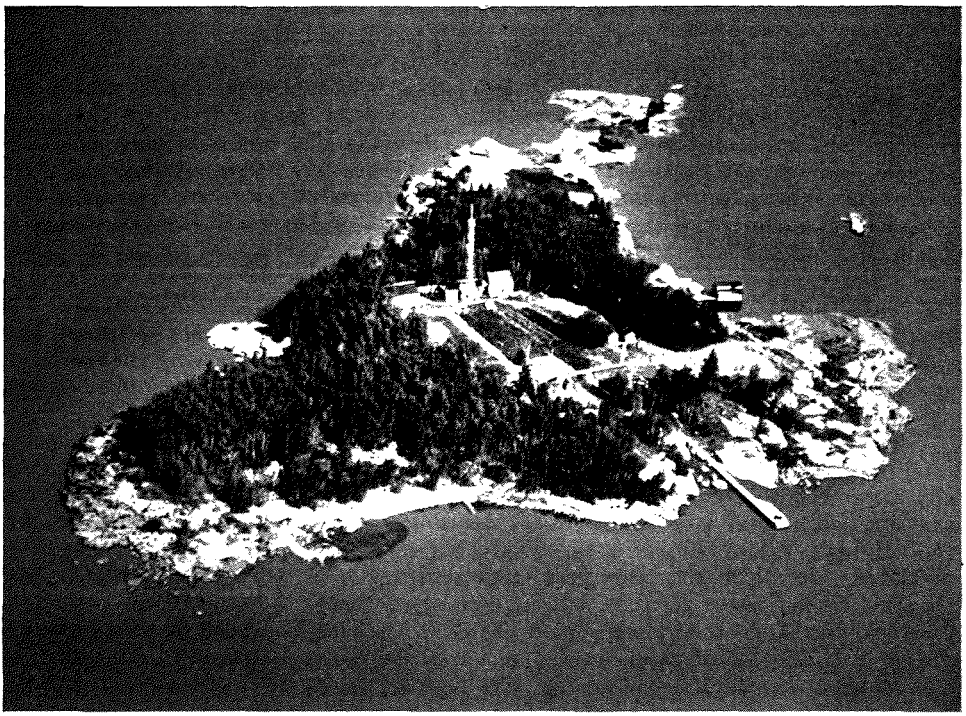
Fire protection in the forest reserves is carried out by means of mounted forest rangers, lookout men stationed in observation towers, and voluntary fire guardians in the surrounding settlements. On the forest reserves of Manitoba there is a very complete system of roads, trails, and telephone lines which enables forest officers to locate fires quickly and to reach them with fire-fighting crews and apparatus before they have burned over any great area.

Outside the forest reserves, patrolling is done almost entirely by canoes. The men work in pairs and travel through the different systems of waterways. These waterways provide the only means of travel in the northern part of the province, and patrols are laid out along the different rivers and lakes. Some of these patrols are from one hundred and fifty to two hundred miles long.

The season of 1921 was remarkably free from fires. During the early spring conditions were bad on the more open parts of the forest reserves. The ground dried out before the vegetation became green, and high winds prevailed. The result was that we had several large grass fires which destroyed some young poplar reproduction of little value, but no trees of valuable species or merchantable timber were destroyed. In all, fifteen large fires (those burning over 10 acres) occurred in and adjacent to the forest reserves, but, as previously mentioned, these fires were confined to grass lands and young poplar. Fires in the neighbourhood of forest reserves are, in the majority of cases, caused by the carelessness of settlers in clearing land and burning hay sloughs but greater care is being shown by the settlers each year.

Outside forest reserves eighteen fires were reported, four of which were located and extinguished by the use of seaplanes. These fires were also confined to grass lands, muskegs, and to scrub jack pine growing on rocky ridges. No valuable commercial timber was destroyed. These fires all occurred early in the spring and in practically all cases were caused by winter camp-fires. It is the habit of trappers in the northern districts to camp in the bottom of dense spruce muskegs during the cold weather, so that they may be sheltered as much as possible from the wind. These camp-fires burn down into the moss and peat, and in the early summer break to the surface and spread. During the past winter the endeavour has been made to warn trappers and travellers in the north of the danger resulting from these winter camp-fires, and it is hoped thus to lessen the number of fires from this cause. During the latter part of the season rainfall was abnormal and no fires were reported during August, September, and October. In addition to the above-mentioned large fires, fifty-three small fires were reported, these were suppressed without having done any damage.

During the spring of 1921 several amendments were made to the Manitoba Fires Prevention Act by the Provincial Legislature. One amendment gives police authority to Dominion forest officers and the right to question any man as to the route travelled by him, thus enabling them to keep a better check on persons travelling through the district, particularly in the northern areas. The second amendment makes it an indictable offence to leave a camp-fire burning, whether or not damage was caused by the fire spreading. The third amendment gives authority to take settlers any distance to a fire north of the fifty-third parallel. The fire laws of this province are excellent. Forestry Branch officers receive every assistance from the provincial authorities and Dominion forest and fire rangers are appointed special fire guardians to administer the Manitoba Fires Prevention Act. During the past season numerous prosecutions were necessary and fifteen convictions were obtained against settlers for burning brush without permits and refusing to assist in extinguishing fires.



An aerial view of Forestry Island in lake Winnipeg, near Norway House. Forestry Island is the headquarters of the fire protection work of the Forestry Branch in northern Manitoba. The view shows the lookout tower, the residence of the Chief Fire Ranger, storehouses, boathouse and other buildings belonging to the Forestry Branch. (Canadian Air Force Photograph F157, by courtesy of the C.A.F.).

Two gasolene-car patrols were maintained on the Hudson Bay railway, as it was necessary to follow each train over the road. A great many small fires were put out during the season by these patrols and the dangerous portion of the roadbed cleared when occasion arose.

AEROPLANE PATROL

During the summer of 1921 the Canada Air Board established a seaplane station at Victoria Beach to be used under the direction of the Forest Service. Three machines were stationed there (two F3's and one HS2L) and patrols carried out from the Winnipeg river to Norway House, observing the territory between lake Winnipeg and the Ontario boundary and territory adjacent to Norway House, Cedar

lake, lake Winnipegosis, the Waterhen, the northern part of lake Manitoba and lake St. Martin. In all, about eighteen million acres of timbered lands were constantly under observation by seaplane patrols. A number of fires were located by the planes. Crews, tools, and provisions were transported, and the fires suppressed. In addition to actual work done the seaplanes had a big moral effect on the people within the territory covered, and in all phases of the work fully demonstrated their value.

IMPROVEMENTS

Improvement work on the forest reserves was largely confined to the repairing of roads, trails, bridges, and telephone lines; also the general maintenance of buildings. Owing to the excessive rainfall during the latter part of the season, the ranger personnel was kept busy repairing washed-out bridges and culverts. During the summer 190 miles of fireguard were ploughed or disked, and approximately 25 miles of telephone line rebuilt on the Duck Mountain forest reserve. The telephone lines on all reserves were gone over and repaired, and approximately 250 miles of road were widened and repaired. The telephone lines in this district are now in good condition.

A 60-foot steel tower was moved from the old Roblin ranger district to a point near the Dauphin ranger station on the Riding Mountain forest reserve, erected in a good position and connected with the Central telephone line. On the Duck Mountain reserve a new steel tower was erected in the Pine River district on the Garland-Singoosh road. This tower commands a view of practically the whole eastern boundary of the Duck Mountain forest reserve and also the territory east of lake Winnipegosis.

Two new cabins for fire rangers were built, at small cost, on the Hudson Bay railway, one at Mile 42 and the other at Mile 185. There was a distinct decrease in the cost of labour and material this year, with the result that practically all improvement work was done at less cost than during the preceding year.

SILVICULTURE

There was a noticeable falling off in the number of permits issued during last season, not more than one-third the usual number of permits being issued. This was due to the extreme financial depression in the country, which practically stopped all building in the rural districts. While this fact results in a very great decrease of revenue it is in some respects an advantage, as the amount of merchantable timber on forest reserves is limited, and heretofore in order to supply the demands of the settlers we have perhaps been cutting more timber on the reserve than is consistent with good silvicultural practice. Another distinct advantage in this connection is the fact that it permits the giving of more careful supervision to the cutting being done.

During the summer a number of new sample plots were laid out, principally in jack pine; and thinnings made of stands of various ages to different degrees of density. Nine new plots were seeded or planted and blanks filled in the existing plantations. Owing to the very dry period at the commencement of the season a great many trees died in the plantations, in some cases from 30 to 40 per cent being killed by drought. A thorough study of reproduction on the Riding Mountain forest reserve was made by Mr. W. N. Millar, assisted by officers of the district, and a number of studies proposed which will be worked out this year.

A large area of jack pine on the Riding Mountain reserve, in the neighbourhood of the Swanson cabin, was surveyed and estimated for future sale.

SURVEY AND ESTIMATE

A survey and estimate was made of a part of the territory east of lake Winnipeg and north of the Winnipeg river, two parties being employed. These parties were assisted in their work by seaplanes and the work checked by aerial photographs. A

preliminary aerial reconnaissance by the officer in charge of the party enabled him to lay out the work to much better advantage than he could otherwise have done. This work will be continued next season.

GRAZING

Grazing is permitted on all forest reserves in the province and several different methods of handling stock are provided. On the southern reserves there are two large grazing enclosures where the Branch accepts the stock and pastures them, providing watering-places, salt, etc. There is a herder in charge, whose duty it is to look after the stock and enclosure. From three to four thousand head are grazed annually in these enclosures. In addition to this, open or fenced grazing is permitted on all reserves. In some cases stock associations are formed by the farmers in a district, who employ their own herder, build fences, etc., and, under direction, manage the range allotted to them. In other cases individuals take out permits for open grazing, or provide their own fences. It is expected that grazing on forest reserves will greatly increase after the present depression, as the methods of handling this part of forestry work have given excellent satisfaction. Stock grazed last season left the reserves in fine condition.

USE OF FOREST RESERVES FOR RECREATIONAL PURPOSES

There has been a decided increase in the demand for lots in the summer resorts in forest reserves in this district. A new resort, known as Benito Beach, was surveyed on the north side of Madge lake. Forty-seven lots were laid out and about one-third of these are already taken up. There is also a big demand for lots at Clark Beach resort on Clearwater lake, in the Riding Mountain forest reserve. All the lots originally surveyed have been taken up and applications have been received from a number of persons, which will necessitate laying out additional lots at once. There are now five summer resorts on forest reserves in this district and requests have been received for new resorts to be opened up on other parts of the reserves.

The whole of the Riding Mountain reserve has been closed to hunters by the province, which is responsible for the protection of game, as, owing to the accessibility of this reserve, big game, particularly, were being killed off. It is hoped this will save from extermination the large herd of elk on this reserve. Assistance was given by Forestry Branch officers to the provincial game department in protecting the game on this and other reserves.

APPENDIX No. 3

REPORT OF THE DISTRICT FOREST INSPECTOR FOR SASKATCHEWAN, C. MACFAYDEN

The work of the Dominion Forestry Branch in the province of Saskatchewan falls under two heads: first, that arising out of the administration of the forest lands established as Dominion forest reserves; second, that in connection with the protection from fire of all timbered lands prior to their being logged and brought under cultivation, or established as further reserves. The fire-protection work also includes that arising from the protection of forested lands traversed by railway lines, a special organization, co-operating with the officers of the Board of Railway Commissioners, being maintained for this purpose.

During the year under review, no major changes have been made in the status or area of the fifteen reserves within the province, although as may be expected, the work of administration increases steadily as the reserves are gradually brought under more efficient and intensive management. Compared with the preceding two years,

A skidway of spruce logs cut on the Riding Mountain forest reserve, Manitoba. An example from one out of many timber operations carried on in the Dominion forest reserves. (Forestry Branch Photograph No. 13298).

there were very few applications received to have lands withdrawn from the reserves for agricultural purposes, although there was a number of isolated sections, or parts of sections, recommended for withdrawal, when, upon a thorough examination, they were deemed to be of agricultural value. With the exception of a few cases that are yet pending, one of which involves a considerable area, it is believed that the established reserves are free of any but a negligible area of agricultural lands. On the other hand, the area of lands outside of forest reserves, on which the Forestry Branch maintained a fire-protective force was reduced to a considerable extent, in the belief that forest protection should not be extended to lands that must ultimately come under the plough, except insofar as fires in such districts endanger neighbouring forest lands, or carry a valuable stand of timber. It is not the policy to continue the protection of poplar lands removed from railway facilities, and which, when cleared, will fall to the agriculturist, but rather, to protect only those lands that should be kept per-

manently under a forest cover. For this reason, the tendency is for the fire-protection work to be each year crowded farther and farther north, until the northern line of future agricultural settlement is reached. Any lessening of the fire-protection work in this way is, however, offset by the necessity of increasing the protection given to the areas of strictly forest lands in the north, and those bordering the line of settlement.

FIRE PREVENTION AND SUPPRESSION

The year was an unusually favourable one in the number of fires occurring, and the expenditures made in their suppression. There occurred, in the forest reserves and the lands protected outside of these, nine large fires or fires covering ten acres or more, and forty-six small fires or fires of less than ten acres, requiring an expenditure of only $20.66 for labour outside of the ranger staff in extinguishing them. These fires were almost evenly divided between the forest reserves and the fire-ranging districts. It is particularly gratifying to note that less than one fire in six gained anything like large proportions, indicating efficiency on the part of the rangers charged with the detection and suppression of fire.

IMPROVEMENTS

Because of the very favourable fire season, it was possible to devote considerable time and funds to the construction of improvements required on the forest reserves and in the fire-ranging districts. During the year, the accommodation for the reserve staffs was increased by the construction of two standard frame ranger houses. One of these on the Sturgeon forest reserve, replaces an old log building no longer of any value, and the other is the commencement of a station to serve as the headquarters of the eastern half of the Porcupine forest reserve, and situated close to Birch river in Manitoba. Six log cabins were put up by the forest rangers on the northern reserves. These are so situated as to serve as bases from which to work on fire-fighting, or on trail, telephone, or fireguard improvements, and also as storehouses for fire-fighting equipment and emergency fire-fighting rations.

Two 80-foot steel towers were erected, one on the Fort à la Corne forest reserve and the other on the Nisbet forest reserve. The tower system on the latter and the Pines forest reserve is now complete, with seven towers all visible from a water-tower in the city of Prince Albert, which latter, with the co-operation of the city, is used as the central station. An Osborne Fire Finder, purchased for use on the latter tower, arrived too late in the season to be mounted and used, but is in readiness for next year. A number of temporary towers were erected of framed timbers during the summer, at suitable points throughout the reserves and fire-ranging districts; not so much as a part of a regular lookout system, as an aid to the rangers when on other work, and removed from telephone communication with the regular system.

Approximately forty-two miles of new roads were built during the year. This is exclusive of repair work done on existing roads or trails that were followed for part of the distance in each case. Eight and one half miles of road were added to the Caribou road crossing the Big River forest reserve from east to west, leaving approximately fifteen miles to be completed next year. Twenty-two miles were completed on the Fir River trail, connecting the headquarters of the Pasquia forest reserve with the Carrot River administrative station. On the Porcupine forest reserve, about ten miles of new road were constructed in improving an old trail from the Piwei cabin to the Swan River cabin. In addition to the foregoing work on new roads, a large amount of labour was expended in maintaining or improving all existing roads and trails, a large part of this being put on corduroying and the construction of culverts and small bridges.

During the year, the telephone systems on the northern reserves were added to by fifty-four miles of new line. The headquarters of the Big River forest reserve were connected with the Bodmin lookout tower, the wire being strung for a distance

of five miles on the Canadian National Railways telegraph poles. On the same reserve, the Caribou telephone line was pushed forward eleven miles to within thirteen miles of Gutches cabin, the proposed western terminus. Twenty-seven miles of new line were constructed on the Porcupine forest reserve, in connecting the system with the Swan River ranger station. The new headquarters of the Fort à la Corne forest reserve were connected with the reserve system by the construction of ten miles of new line. The same headquarters were given connection with the Glenmary Rural Telephone Company's system, so that the reserve can now be reached over the long distance lines from the inspector's office, a need that has been much felt in the past. All existing lines were kept or put into good repair, and at the end of the year a carload of wire was purchased for the coming year's work.

A rather ambitious programme of improvement work was laid down for the fire-ranging staff, especially in the northern districts removed from settlement, where it is believed that any improvements which facilitate travel will win for us the greater co-operation and sympathy of the resident and travelling population. As an instance of such improvements, it may be mentioned that on the Montreal river two canals were dug by the fire-ranging staff, shortening the river by about five miles. Such a work is not likely to go unnoticed or unappreciated by a traveller, especially should he be heavily loaded and travelling upstream. A special effort was made to clear, straighten, and widen all portages, so as to lighten the arduous work of carrying over from one waterway to another. In the belief that our northern watercourses are extremely bewildering to a traveller not perfectly familiar with them, due to the numerous lakes, bays, and channels, a start was made to mark the most frequented routes so plainly that they could be followed by even a novice. Signs of characteristic shape, and discernible at long distances, are being erected at all portages, outlets, and inlets of lakes and at suitable points along the route. On the rivers and lakes in low-lying country, where good camp sites are infrequent, suitable places for this purpose are being marked, and where necessary, cleared of brush and overhanging trees or bushes, so as to allow of ready access from the water. Inexpensive log cabins are being erected at strategic points, for the storage of fire-fighting equipment and supplies, and as more comfortable quarters for the ranging staff during stormy weather. The work of erecting lookout towers of framed timbers at suitable points was proceeded with as in former years, and each canoe route has now several of these scattered along it. These enable the ranger to get a clear view of a much greater part of his territory than he can see while travelling.

GRAZING

Owing to the abnormal conditions of the last two years existing in the stock industry, the number of permits issued and the number of stock grazed on the reserves during the past year show a decided decrease over last year. Unfortunate as the decrease in these numbers may be, it is very evident that it is not due to any opposition to the grazing regulations in force on the reserves, as there is a rapidly growing appreciation of these among stockmen using the reserve for grazing purposes. The decrease is fairly uniformly distributed over practically all of the reserves, and the percental decrease is probably no more than has taken place in the number of stock in the province as a whole. Approximately 770 permits were issued, authorizing the grazing of, in round figures, 35,500 head of stock as against 885 permits issued last year for about 43,000 head. The decrease applies to all classes, including horses, cattle, and sheep. For these reasons there was no increase in the use made of the large northern reserves, such as was expected. The great bulk of the stock continues to be ranged on the smaller reserves situated within the prairie settlements, but as pointed out in previous reports, there are much larger areas of grazing lands within the northern reserves, and with the return to normal conditions in the industry, it is natural to expect that these lands will be utilized and the tide gradually turn in favour of the northern reserves as far as numbers are concerned.

Two new co-operative associations were formed during the year, one on the Elbow forest reserve and one on the Nisbet forest reserve. This plan of grazing the stock of a district on a co-operative basis continues to grow in favour, and it is interesting to note has been recently followed in several districts in the province where stock is being run on lands outside of the forest reserves.

Range conditions during the year were most favourable, good forage being abundant in practically every district. Owing to the understocked condition of

Shelter-belt on a central Saskatchewan farm. The trees had been planted seven or eight years. Note the corn in the foreground. (Forestry Branch Photograph No. 15713).

many of the ranges, there is at the end of the year a plentiful supply of well-cured forage to care for the early grazing next year. Year-long grazing was, so far as possible, discontinued this year, with a view to increasing the summer capacity of the range and encouraging the growing of winter feed.

SILVICULTURE

Owing to the financial depression existing throughout the year, especially in the farming districts, the material cut from forest reserves under authority of permits, shows a small decrease in most classes, as compared with the previous year, although with this one exception, it is greater than any year previous, and this use of the reserves may be said to be steadily growing. The number of permits issued totalled 1,425, one-third of these being free of dues. A remarkable increase is noted in the number of railway ties taken out under permit, over 48,000 of these cut as against a record last year of slightly over 11,000. A considerable increase was also made in the fuel-wood taken, which amounted to over 35,000 cords, over two-thirds of which total was for sale. There is every indication that an increasing quantity of this product of the reserves will, each year, be cut, as the prairie population, more and more, take this means of securing their summer fuel. It is interesting to note that of the total amount of cordwood cut almost one half was taken from the Nisbet forest reserve, in the immediate vicinity of Prince Albert. This is due to the market for fuel in this city itself, and the comparatively short freight haul to Saskatoon which takes any surplus. Another reason was the plentiful supply of labour in this city during the past winter.

The increase in the material taken each year under permits is welcomed, in view of the fact that the large bulk of the material allowed to be taken under permits is fire-killed, and in this way the reserves are being cleared of what constitutes a fire menace to the remaining green timber. Brush disposal in conformance with

the regulations has also been most successful in these operations, and in the case of cordwood at least, it has been possible to have all material, regardless of its size and condition, utilized.

The timber sale business remained about stationary, except that fewer new sales were made than last year. The quantity of timber removed from the fourteen sales operating was approximately 5,250,000 feet board measure, as against a little over four million feet last year. Three new sales were made, involving altogether about 8,750,000 feet board measure. Brush disposal and other cutting regulations are being satisfactorily complied with and are increasingly easy to enforce.

Investigations and Planting.—Very little tree-planting stock was available for use on the forest reserves, and planting was limited to the Nisbet forest reserve, where 1,500 Scotch pine and 1,500 jack pine were set out in experimental plots. Owing to the rains before and following this planting, the stock did remarkably well, and at the end of the year hardly a single failure was noted.

In preparation for more extensive plantings, small nurseries were started on the Dundurn and Pines forest reserves, but the seed not being put in as early as it should have been, the results were not quite satisfactory, but were such as to encourage the extension of this work another year. From experience gained in experimental plantings, there does not seem to be any reason why this should not now be done on a larger scale with even better results, especially when the stock is grown on the reserves.

During the latter part of the year, studies were made of the form and taper in jack pine, spruce, and tamarack, to assist in the preparation of yield tables.

SURVEYS

A reconnaissance survey was made by a party of three, of the Bear lake and Mossy river country lying east of Montreal lake and west of Beaver and Cumberland lakes. The purpose of the survey was to correct and add to our existing maps, and to gain some idea of the types and amount of timber in that district. The information gathered shows only a comparatively small quantity of timber merchantable on to-day's standards.

During the year a start was made on a detailed survey of the types and amounts of timber standing on the different forest reserves. At the same time, all topographic features are being plotted. This work is being carried on by the reserve staffs. A survey was started towards the end of the year to define the area of a recently discovered infestation by bark beetles.

EQUIPMENT

In addition to keeping up the supply of ordinary tools, some special equipment was purchased. This included a motor-truck and two motor-cars, which were very useful in administrative and protective work; two detachable motors for use on row-boats used by river patrolmen; and two railway power speeders for running on railway lines through reserves.

APPENDIX No. 4

REPORT OF THE DISTRICT FOREST INSPECTOR FOR ALBERTA, C. H. MORSE

In the Alberta inspection district the Forestry Branch is responsible for the administration and protection of the Dominion forest reserves and the protection of timber on other public lands. We have, therefore, two rather distinct organizations, one concerned with the forest reserves or national forests and one concerned with the districts where fire protection is our only duty. The latter branch of the work includes co-operation with the Board of Railway Commissioners for the protection of timber along railway lines. There are three fire-ranging districts under the supervision of this office and these cover the wooded areas of the province not included in the forest reserves. They also include the important timber-lands of the territories to the north of the province of Alberta.

The forest reserves which cover an area of approximately 18,690 square miles have been definitely reserved for the production of timber and for their beneficial effect on stream-flow. It is the duty of the Forestry Branch, therefore, to protect the forests growing on them and to improve and extend the stands of timber by proper silvicultural practice. Unfortunately during past years repeated fires have reduced the mature timber to a very small percentage of the entire stand, but the remarkable regenerative faculty of our native tree species has provided fine young crops of timber, which will be extremely valuable in the not far distant future. Mature timber is sold, but only under conditions which make for safety from fire and which will ensure the permanence of the stand. The forest reserves and parks now comprise about 10 per cent of the area of this province. Recent surveys in the north have shown that there are other large areas of non-agricultural land capable of growing excellent timber which should be added to the existing forest reserves, thus increasing their area up to about one-third of that of the entire province. If these forests are properly administered and protected there is no doubt that the province will be assured of adequate timber supplies.

FIRE PROTECTION

The summer of 1921 was one of unusual fire-danger, although the fire damage was not greater than that which usually occurs in a normal season. Spring fires did not occur to any great extent in the south country as the season there was rather moist, but in the north the situation was decidedly different. In the Edmonton fire-ranging district 76 fires were reported during April and 121 during May. No serious fires occurred on the forest reserves during the spring or early summer months. The late summer period was unusually dry and when the grass was killed by frosts at the beginning of September the fire-danger became very acute. This peak was passed safely, except for one bad fire in the Crowsnest forest. In the north the September storms were lighter than usual and they were followed by a period of extraordinarily dry weather which made October the most dangerous month of the year. It was not until November 7 that general snow-storms disposed of the fire-danger for the year. October contributed 30 per cent, and May 22 per cent of all the fires.

The increase in the number of fires caused by settlers burning brush is remarkable. In the districts outside the forest reserves settlers caused 45 per cent of the fires and railways 26 per cent. Within the forest reserves railways were responsible for 80 per cent of the fires. It is only fair to state, however, that most of these were very small ones which were extinguished by railway patrolmen within a few minutes after they had started. There was an unusual amount of brush-burning by settlers

for clearing land in the fall of 1921. North of the Red Deer river the smoke was so dense during all the autumn that it was very difficult to detect new fires. Many settlers had crops and buildings burned by their own or their neighbours' fires, and even towns were in danger at times. In Edmonton the city fire department had to make repeated trips to the outskirts of the city to extinguish fires spreading from the brush country. It was found necessary in order to secure the observance of the law to institute a number of prosecutions for neglect of proper precautions. Eighteen persons were convicted and one offender received a jail sentence. It is hoped that these prosecutions will have a salutary effect.

Of the 842 fires reported by forest officers in this district, 215 occurred on the forest reserves and burned over a trifle less than one-fifth of one per cent of the forest reserve area. Most of the damage was done by two fires, one on the Crowsnest and one on the Brazeau forest. Fanned by extremely strong winds these fires spread out of control for one day, but after the organized crews reached them the fires made little or no further progress.

Aura Ranger Station, Bow River forest, Alberta, showing aerial patrol signs (Forestry Branch Photograph No. 15999).

During the year the Legislature of the province of Alberta amended the Provincial Fire Act. As this is the Act under which Dominion forest rangers work, who are employed outside the forest reserves, this new legislation is of the greatest importance to this branch. The most important feature of it is that Dominion forest and fire rangers are specifically named as *ex officio* fire guardians under the terms of the Act. The Lieutenant Governor in Council is empowered to declare certain portions of the province to be areas of special forest fire risk and to make regulations concerning them. The powers of fire guardians are considerably increased and the penalties for infractions of the Act are made more severe.

AEROPLANE PATROL

Last year it was reported that an air patrol had been established over the Bow River and Crowsnest forests by the co-operation of the Air Board. This patrol was put into effect in September, 1920, but was rather too late to be an important factor in forest fire protection that year. The usefulness of aeroplanes for our work was nevertheless clearly demonstrated and plans were made for a continuation of the

patrols during the season of 1921. A purely temporary aerodrome had been established at Morley, a village on the Canadian Pacific railway at the edge of the mountains, forty miles west of Calgary. It was found, however, that the winds at this point were too severe for safe landings and the soil was too gravelly to level without sacrificing all hope of establishing a new sod on it. After considerable study of the sites available the Air Board established a new aerodrome at High River. At this point four hangars have been put up to house aeroplanes, and several permanent buildings have been constructed. They consist of an administration building comprising offices, store-room and garage, a wireless building, and a workshop large enough to accommodate an aeroplane without dismantling. The wireless station is particularly powerful and has a steel mast, 190 feet high, for an umbrella aerial.

Two patrols were carried out almost daily during the summer, one going south over the forest reserves to the International Boundary, and one going north to the divide between the Red Deer and Clearwater rivers. Reports of fires were sent by wireless from the aeroplanes to the air station and from there by telephone to the rangers concerned. Forest officers also used the aeroplanes at various times to make a reconnaissance of a fire and determine the progress of fire-fighting operations. Leaflets warning the public concerning the danger of forest fires were dropped over towns during fairs and sports days.

IMPROVEMENTS

For the proper administration of a forest there must be provided telephone lines, roads, and trails; and, in order to have forest officers located at strategic points, it is necessary to have houses and cabins constructed. Trails, roads, and telephone lines are built by crews of labourers under the direction of the local ranger when he can be spared from his forest protection and administration duties. Cabins are built entirely by ranger labour during the winter months.

During the year considerable progress was made in completing the improvement programme for the forest reserves. On the Brazeau forest we constructed a house for the supervisor, a standard ranger station, and a small office building. On the same forest four miles of fireguard were built along a particularly dangerous stretch of railway. This fireline was constructed by clearing an extra sixty feet outside the right-of-way and plowing six furrows on the outer edge of this clearing. With such a fireguard the right of way and the extra clearing can be entirely burned over each spring without danger to adjoining stands of timber, and that particular section of the railway is then practically safe from fires. The importance of railway fireguard construction on the Brazeau forest is indicated by the fire schedule, which shows that out of 187 fires which occurred on the reserve during last season all but six were caused by railways. Next year it is hoped to construct fireguards along other dangerous parts of the 70 miles of railway under operation within the Brazeau forest.

On the Cypress Hills forest there were constructed 34 miles of telephone line to link up the supervisor's headquarters with the most remote ranger station. In building this line creosoted pine poles were used, for it has been found that untreated pine or spruce poles will not last more than about six years. The plan of applying preservative with a brush to the butts of seasoned poles has been tried, and while this treatment is fairly effective it has been found that the penetration of the preservative is not sufficiently uniform. In this case the butts of thoroughly seasoned pine poles were treated by the open-tank process. This consists of placing the poles in a tank of hot creosote oil until the wood is well heated and then transferring them immediately to a cold tank. By varying the length of time during which the poles are left in the tanks the degree of penetration can be controlled. It is expected that poles so treated will have a length of life about equal to that of cedar.

On the Bow River forest there were constructed fifteen miles of graded road leading to ranger stations from the forest reserve boundary. On the northern reserves no roads were built, but 176 miles of pack-trail were constructed. Most of this was

built on the Lesser Slave forest where a great deal of such improvement work is necessary to open up the country. On the same forest one lookout tower was built. At various other locations on the forest reserves there were built during the year five log cabins, two barns, two railway-speeder houses, a machine shed, a pump-house, and a storehouse. A great deal of maintenance work was also done to keep roads, trails, telephone lines, and buildings in repair.

SILVICULTURE

Timber Sales and Permits.—The amount of timber cut in this district under the authority of timber sales and permits shows considerable increase over previous years in spite of the depression which has been so general in the timber trade. Fourteen sales were in operation during the past year of which eight supplied saw-timber to local mills and six provided mine-props and lagging for Alberta coal mines. The year's cut under authority of timber sales alone totals about 8,500,000 feet board measure, 2,000,000 lineal feet of mine-props and 2,000,000 lineal feet of lagging.

A special effort has been made to utilize dead and fire-killed timber as much as possible, in order to conserve the supply of growing timber which is readily accessible to railways or settlements. With this end in view considerable work was done in locating and mapping out areas of fire-killed timber accessible to mines and railways and special inducements were offered to timber operators to use this material. As a result, the cut of mine material mentioned above is more than half fire-killed timber. In addition to this, about 750,000 lineal feet of mine-props and 550,000 feet board measure of saw-timber, as well as large quantities of dry cordwood, fence-posts, poles, building timber—all fire-killed timber—have been disposed of under permit.

The mining and lumber companies throughout the province have, as a rule, given us their hearty co-operation in our attempt to conserve so far as possible the green timber in the vicinity of their operations. They have willingly used all fire-killed and diseased material before cutting green timber and have also closely utilized all timber sold them. In very few cases has there been any difficulty in enforcing regulations concerning close utilization and brush disposal. This is particularly the case where the operator is more or less permanently located in the district.

Seeding and Planting.—On the Cypress Hills and Cooking Lake forest reserves, both of which are located on the prairies in poorly timbered country, nurseries have been started which are now in a position to supply yearly about 150,000 spruce and pine seedlings for plantations. Last year 13,700 lodgepole pine and 7,200 spruce were planted on these two reserves. In the case of the Cooking Lake reserve good results were obtained from planting seedlings direct from the seed-bed, thus saving the trouble and expense of transplanting.

Considerable work has also been done along the line of direct seeding, both by broadcast sowing on partially prepared ground, and also by sowing on small spots of prepared ground, spaced at definite intervals. At present this work is only in the experimental stage but the results obtained so far are quite satisfactory.

Investigative Work.—Investigative work of many kinds has been carried on under the direction of the staff of technically trained foresters assigned to the district. Growth of timber under different conditions is being studied by means of measurements made annually on trees in sample plots which are so chosen that the different conditions encountered in the forests are represented. This work includes also studies of fungus and insect damage, loss from wind-throw, and other related subjects. Studies have been made to determine the relative germinating qualities of seeds from different sorts of trees on different conditions of seed-bed, and also to ascertain the rate at which reproduction can be expected to come in after cutting the original stand to various degrees of density.

GRAZING

The forest reserve regulations are designed to allow the fullest use of the grazing resources of the forest reserves, consistent with the purposes for which they were created—the production of timber and the protection of water-sheds. Great care is taken to see that the privileges of forest grazing are divided as equally as possible among those entitled to them, and attempts are made to have grazing permittees work together in associations for the improvement of their herds and the conservation of the range.

During the summer of 1921, permits were issued to 587 permittees covering 26,961 cattle, 9,088 horses, and 2,953 head of sheep. No increase was made over the previous year in the number of stock grazed, the reason being that beef prices have been so low that ranchers have not yet brought their herds back to normal size. The winter of 1920-21 was rather mild and stock entered the forest reserves in the spring and early summer in very good condition. Although the rainfall during the summer was slight, the range did not suffer except in a few divisions where a pest of grasshoppers did rather serious damage. Stock left the reserves in good condition, but as the market has steadily declined for the past two years the prices realized by the permittees have been very low.

Practically all our grazing permits are issued for the Crowsnest, Bow River, Cypress Hills, and Cooking Lake forests. There are considerable areas of excellent forage on the northern reserves but they are as yet too far from the settlements to be attractive to farmers and ranchers. Later, when the country is settled up to the boundary of these reserves, they will support thousands of head of cattle during the summer months and will be the safer from fire by having the forage consumed. Even in the Bow River and Crowsnest reserves there are quite large areas of higher mountain range still unutilized which would do excellently for sheep.

During the summer a grazing survey was made of the Castlemount district of the Crowsnest forest. This work was carried on by a party of three forestry students, working under the direction of the grazing inspector. The object of the survey was to determine the location and extent of the grazeable areas, the character of the forage, and the carrying capacity of the ranges under a system of intensive management. Sufficient data were secured to enable the supervisor to put into effect a plan of grazing management for that district. A collection of forage plants was made by the party and a number of specimens was added to the herbarium at this office.

APPENDIX No. 5

REPORT OF THE DISTRICT FOREST INSPECTOR FOR BRITISH COLUMBIA, D. ROY CAMERON

The British Columbia inspection district comprises the Dominion forest reserves in British Columbia, and the Coast, Salmon Arm and Revelstoke fire-ranging districts, all situated within the Railway Belt of British Columbia.

FIRE PROTECTION

For the third year in succession this district experienced a fire season of abnormal severity. Conditions paralleled 1920 in that the danger was confined within restricted limits, roughly within the boundaries of the Salmon Arm fire-ranging district and in the forest reserves. In the Coast district, abundant and well-distributed precipitation produced unusually favourable conditions and a very successful season resulted. To a somewhat less extent the same conditions were duplicated in the mountainous area comprising the Revelstoke fire-ranging district. In both these districts, however, a good deal of credit is due to the protective organization for prompt suppression of all outbreaks.

In the Dry Belt and adjacent Shuswap lake area, conditions repeated the 1920 phenomena. A cool spring and rainy June were followed by drought and resultant high temperature during July and August, producing a fire-hazard fully as severe as that experienced during 1920.

Lightning fires, although attaining a considerable percentage in the district totals, were very much reduced in number in the area of high fire-hazard. This feature gave rise to more favourable conditions for control of outbreaks. Also better equipment, particularly gasolene fire-pumps, and adequate motor transport, for the first time available, enabled the field forces to cope with the situation arising far more successfully than was ever possible before. This combination of circumstances produced results as follows:—

Proportion of large to small fires, reduced from the 1919 and 1920 figures of over 50 per cent of the total, to 32 per cent;

Total area burned over, reduced from 64,336 acres in 1920 to 25,569 acres in 1921;

Loss of merchantable timber, reduced from 148,000,000 feet board measure in 1920 to 13,956,000 feet board measure in 1921;

Acreage young growth destroyed, reduced from 18,500 acres in 1920 to 8,866 acres in 1921.

These encouraging results were attained despite the fact that the total number of fires increased from 408 in 1919 and 422 in 1920 to 445 in 1921. A further index of the relative efficiency of fire control is shown in the figures for the percentage of fires whose cause was unknown. Of the 1921 fires 63 come under this heading, or 14·2 per cent of the total. But of these 63 fires 38 were fires reported along railway lines and confined to the right of way. The railways themselves are responsible for right of way fires, therefore, for purposes of comparison, these 38 fires should be eliminated from the general classification, "Unknown." This reduces the number of fires reported by our regular staff as "unknown" from 63 to 25, and the percentage from 14·2 to 5·6. This last figure constitutes a record in this district.

Of the causes of fires reported during 1921, railways head the list with 186 fires or 41·8 per cent. To these figures should be added, as indicated above, 38 unknown fires, confined to railway right of way, which will increase the percentage

of railway fires to 50·3, or over half the total number occurring during the season. Lightning fires assumed second place with a total of 37 or 8·3 per cent as against 39·1 per cent in 1920. Campers came third with 36 fires or 8·1 per cent, closely followed by settlers' fires with 34, or 7·6 per cent. An unfortunate feature of the 1921 situation was the prevalence of incendiary fires, of which 29 or 6·5 per cent were reported. The remainder of the total number of fires was attributed to various causes of which smokers with 16 fires, or 3·6 per cent, contributed the largest number.

Fires Within Forest Reserves.—Forty-seven fires were reported within forest reserves during the season of 1921, 35 large and 12 small. The percentage attributed to the main causes were as follows: Incendiary, 28 per cent; campers and hunters, 28 per cent; unknown, 17 per cent; lightning, 12·8 per cent; and settlers, 6·4 per cent.

Even at the risk of repetition, which may be considered unnecessary, attention should again be called to the important part which lookout stations play in fire protection both within and outside the forest reserve areas in this district. The important function of fire detection has practically been taken over by these stations within the areas which they serve. This allows concentration of suppression forces at strategic points during periods of emergency, with resultant reduction of time in getting work started on the fire lines following outbreaks. Four forest reserve lookout stations were in operation during the season and two more, namely, one on Porcupine ridge in the Tranquille forest reserve and one on Cornwall hills in the Hat Creek forest reserve were partially completed by the close of the field season.

Fires Outside Forest Reserves.—As indicated above in this report the fire situation in the fire-ranging districts was fairly satisfactory during 1921. In the Coast district, losses were reduced practically to nil, only 8,000 feet of timber and twenty acres of young growth having been destroyed. In the Revelstoke district, losses were also negligible. Forest fires destroyed 150,000 feet of merchantable timber and ten acres of young growth. The Salmon Arm district did not fare so well. Within its borders was concentrated again the high hazard and large percentage of fires occurring during the season. During the month of July alone 55 fires were fought under trying conditions of drought and high temperatures. August proved even worse, being hot and dry with considerable wind. The cumulative effect of continued drought produced particularly adverse conditions from a fire-control standpoint. The occurrence of 68 fires during this month tried the resources of the organization to the utmost. These fires accounted for by far the greater proportion of the total damage incurred during the fire season.

Railway Fire-ranging.—The outstanding feature of the railway fire-ranging situation during the season of 1921 was the reversion to the use of coal by the Canadian Pacific Railway in all oil-burning districts excepting between Field and Revelstoke. This necessitated special attention to fire protection. The first year's operations showed an increase in the total number of railway fires from 90 during 1920 to 214 during 1921. Despite this increase, the season's totals of acreage burned over and damage resulting show satisfactory decreases from 1920. In a large part the credit for this is due to the railway companies themselves, who improved very considerably their patrol work. Particular mention should be made of the section patrol organization installed by the Canadian Pacific Railway, which functioned in a very satisfactory manner.

Of the 214 railway fires, 117 were extinguished before they had attained a size of a quarter of an acre, and of the remainder only 21 exceeded ten acres in area. The percentage of fires attributed to locomotives rose from 54·4 during 1920 to 74·2 during 1921, a direct result of reversion to coal as stated before.

Considerable improvement was effected in right of way conditions throughout the district, though additional work is required on branch lines of the Canadian Pacific railway and on parts of the Kettle Valley railway.

Locomotive inspection was carried out to a much greater extent than formerly, an additional fire inspector having been obtained, largely for this work.

The thanks of this service are due to the responsible officers of the Canadian Pacific Railway, the Canadian National Railways and the Kettle Valley Railway for co-operation in carrying out the provisions of General Order 107 of the Board of Railway Commissioners in connection with railway fire protection.

IMPROVEMENTS

Forest Reserve Improvements.—The close of the field season of 1921 was noteworthy in that it saw the final linking up of the remaining forest rangers' headquarters with the superintendent's office by forest service telephone lines. As a result of this work telephone communication can be had with all reserve units, a circumstance which will facilitate to a great extent hereafter, administration and fire protection on forest reserves in this district. The most important project was the construction of a telephone line from Kamloops to Pass Lake ranger station, thence by forest reserve trails to Criss Creek ranger station via Tranquille lake and Little Cariboo plateau. A spur line connects a proposed new lookout station on Porcupine ridge. The total length of this line is something over 37 miles, of which 12 miles is pole-line construction and the remainder tree-line. A telephone line ten miles in length connecting Salmon River ranger station with the public works department rural lines at Adelphi post office, and another line 13 miles in length, connecting the Amphitheatre ranger station with Ashcroft, were also built. From the last-named point a spur line four miles in length was constructed to the top of the Cornwall hills to provide connection for the lookout station to be installed on that summit. In all over 65 miles of forest telephone line were put in, constituting a record in construction for this district, for one season.

In trail construction the principal project was the South Boundary trail, 11 miles long, built through the Monte Hills forest reserve. In addition short connecting links totalling five miles were constructed at other points. This service in co-operation with the Provincial Roads Department completed during the spring a much needed improvement, in the construction of a cut-off road into the summer resort at Paul lake in the Niskonlith reserve, which eliminates a reverse grade over a hill some 300 feet high.

Maintenance work was carried out on buildings at various reserve headquarters, notably Louis Creek and Trout Lake ranger stations, to put our improvements in proper condition.

Fire-ranging Improvements.—A very important project was completed during the 1921 season in the Salmon Arm fire-ranging district, in the installation and equipment of a lookout station on Eagle Pass mountain, elevation 8,000 feet. This mountain is situated at the head of Crazy creek and affords direct view over the lower Eagle valley, a region of intense fire-hazard. This project involved the construction of 13 miles each of telephone line and trail, and the construction of a stone lookout cabin on the summit. A log cabin, half-way up the trail, was also erected for the convenience of the ranger packing in supplies to the lookout man.

In the Salmon Arm district, also, there were constructed at Sicamous a warehouse and boat-ways required for proper care of equipment, and a cabin at Cinnemousin narrows on Shuswap lake to be used as fire ranger's headquarters.

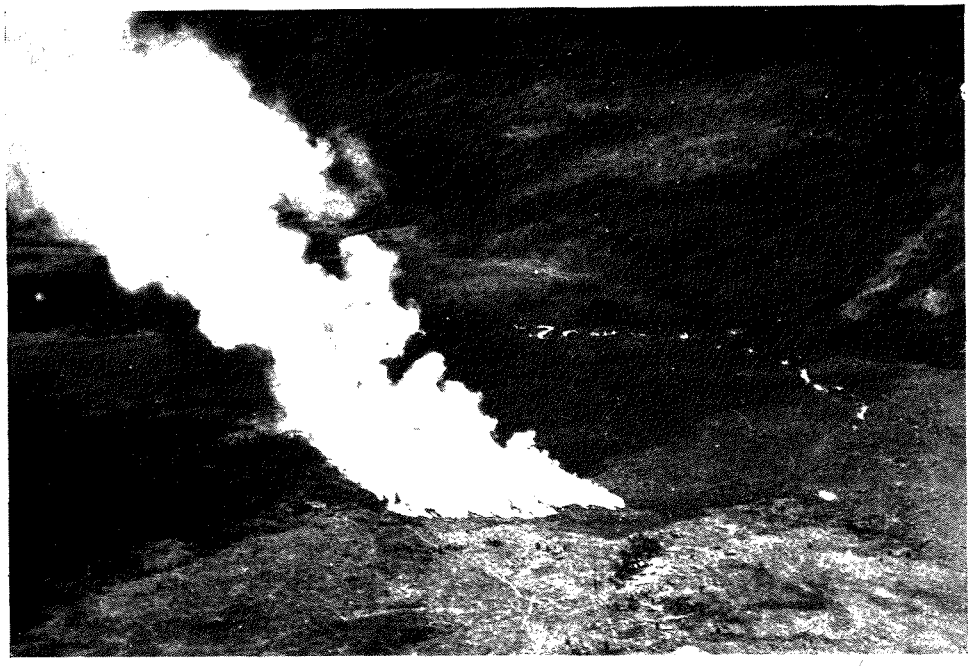
In the Revelstoke district four miles of the Big Bend telephone line were rebuilt. This was made necessary by the abandonment of the old Big Bend trail, along which the original telephone line was constructed, consequent upon the completion of a wagon road in a different location.

AEROPLANE OPERATIONS

The Air Board provided one HS2L flying boat from the Vancouver air station, which was operated, entirely without the usual and essential accessory facilities, from

the beach on the river front at Kamloops, in the same manner as was done during the preliminary experimental operations in the fall of 1920. This machine, and those which subsequently replaced it, were flown from Vancouver to Kamloops, thus eliminating the cost of shipment by freight, which accounted for a large percentage of the total cost incurred in the 1920 operations.

The first machine was delivered on July 12, 1921. It developed defects which although of a minor nature, caused extensive time losses. On August 16 it was replaced by another of the same type. This second plane functioned satisfactorily until September 2, when engine trouble developed. It was returned to Vancouver on September 12, and on October 8 the first machine, rebuilt, was brought back for photographic work. This plane returned to Vancouver on October 14, completing operations at Kamloops for the season.



View of a forest fire from the air. From a photograph taken by the Canadian Air Force on the Clearwater river, Alberta. (Canadian Air Force Photograph C304, by courtesy C.A.F.).

Seventy-one flights were made in connection with Kamloops operations, of which seven were delivery or return of machines from Vancouver air station. This feature alone accounted for 21 per cent of the total flying time of 100 hours. Flights for this service totalled 57 hours flying time, and an air mileage of 3,771. There were planes stationed at Kamloops for 74 days, on 38 of which, or 47·4 per cent, flights were carried out. These figures show that an air station equipped with one spare machine should be able to provide continuous flying.

An analysis of the work carried out for this service shows that 48 per cent of the flying time was utilized for fire patrol and fire reconnaissance. This is partly due to the fact that planes were in operation largely during the peak of the fire season, when this work was of the most pressing importance. Fire reconnaissance flights in particular gave the best results in time and money saved, of any undertaken. It was found possible to fly at a comparatively low elevation directly over fires burning. Observations were made of the direction in which fires were heading, the timber values menaced, the location of natural strategic points for control, the best ways of getting

men on to the fire-lines, etc. Fire rangers given preliminary flights over fires under their charge were able to obtain this essential information with practically no loss of time.

Exploration and timber examination flights accounted for 19 per cent; administrative work, including improvements, investigation, and inspection, and observation flights for forest officers occupied 13 per cent; photography 9 per cent, and miscellaneous purposes 8 per cent, of the flying time.

Besides operations based on Kamloops, a considerable amount of flying was done for this service from the Vancouver air station, in connection with the Coast fire-ranging district. Altogether twenty flights were made, totalling approximately 2,000 miles. Forty-eight per cent of the flying time involved was used in fire-patrol work; 28 per cent in photographic experiments; 16 per cent in timber reconnaissance, and 8 per cent on administrative work.

The fire-patrol work consisted of week-end flights, mostly on Sundays, covering the lakes and rivers frequented by fishermen and city dwellers holidaying in the woods. The psychological effect of aeroplane patrols produced a very favourable reaction in the public mind, as evidenced by newspaper articles and reports from forest officers coming in contact with people in their districts. It is certain that, as a preventive publicity measure, these week-end patrols have been of immense importance and benefit to the service, in forest protection in the Coast district.

SILVICULTURE

Forest Reserve Operations.—A party of forestry students, to which was attached a technical forester, completed during the field season of 1921, an exhaustive study of the lodgepole pine type as developed on forest reserves in the Dry Belt. Detailed yield figures will be available shortly as a result of this work.

Timber sale business slackened off greatly, due to general adverse economic conditions. Only one small sale was awarded during the year under review. Timber permit business was also stationary.

Tree Seed for Great Britain.—Continued requests by the British Government for large quantities of seed of Sitka spruce and coast-type Douglas fir and hemlock, for use in reforestation work in the British Isles, made necessary the construction of a modern and completely equipped seed-extraction plant at New Westminster. This plant was started September 1 and commenced operations October 15, 1921. Cone collections made by this service totalled 3,237 sacks of Sitka spruce, 3,646 sacks of Douglas fir, and 353 sacks of Western hemlock. The above yielded seed on extraction as follows: Sitka spruce, 8,125 pounds; Douglas fir, 4,500 pounds; and Western hemlock, 440 pounds. Excess yields over estimates due to improvements developed in the operation of the extraction plant, produced a considerable surplus of seed over the British Government's requirements. Arrangements for the disposal of this surplus are under way at the present time.

Insects.—Operations designed to control bark beetle infestation of Western yellow pine in Prospect valley, British Columbia, were continued during the spring of 1921, along the lines outlined in my annual report for the fiscal year 1920-21. The 1921 operations resulted in the cutting and burning of over 1,300 trees, scaling approximately 500,000 feet board measure. From present indications it is figured that one more year's work, during the spring of 1922, will finally control this outbreak.

RECREATIONAL USES OF FOREST RESERVES

The popularity of forest reserve summer resorts at Trout lake and Paul lake increased tremendously during 1921. Visitors were registered from the United Kingdom, from the Hawaiian islands, from South America, and from most of the states of

the United States and provinces of Canada. Fishing conditions at Paul lake were better than for several years past, but Trout lake continued rather poor. Steps were taken by this service in co-operation with the fisheries office for this district to restock Trout lake. During the season 30,000 fry of Kamloops trout were obtained from Paul creek and placed in Trout lake. Sixty thousand fry were transferred also from Paul creek to Paul lake.

During 1921 a record system was installed whereby fishermen registered their catches in Trout and Paul lakes. The records show that 717 fish, totalling 1,271 pounds, were taken from Trout lake, and 4,769 fish, totalling 11,444 pounds, from Paul lake. These figures indicate the extent to which this sport is being pursued in this district.

EQUIPMENT

Motor transport facilities were increased by two trucks and one delivery wagon. A truck was purchased also for use in the Coast district. Seven additional portable gasolene fire-pumps, purchased at the beginning of the year, brought the total available for the 1921 fire season to nine. These two mechanical aids to fire protection gave greatly increased efficiency and, to their use is due, to a considerable extent, the more favourable results secured in fire-control work during the 1921 season.

The Sicamous warehouse mentioned above in this report is located at the centre of the area of greatest fire-hazard in the Railway Belt. In the warehouse was kept a reserve of fire-fighting equipment of all kinds including specially devised emergency tool-chests and mess-kits ready for shipment to any point at a minute's notice. These pre-arranged facilities had also a tremendous effect in improving fire suppression and control operations.

APPENDIX No. 6

REPORT OF THE SUPERINTENDENT OF THE FOREST PRODUCTS LABORATORIES OF CANADA, W. KYNOCH

Although the reorganization of the staff was not quite complete at the end of the period, in many respects the year 1921-22 may be justly regarded as a very successful one. Requests for technical information and service dealt with far exceeded in number those received in any previous year and outnumbered those of the preceding fiscal year by more than two hundred. The paper-mill (of semi-commercial size) operated, on research and demonstration work, to a greater extent than in any year since its installation. The number of visitors to the laboratories was greater than in 1920-21 by nearly one hundred. Several entirely new and valuable features were introduced. With a view to wider and more rapid dissemination of technical information resulting from our researches, a publicity service was established, items of general interest being distributed weekly to the leading Canadian newspapers and technical and trade journals, as well as to some of those abroad. Frequent use of these items was made. The Technical Service series was inaugurated. This is a series of circulars announcing certain services which the laboratories are in a position to give (such as the analysis of pulps and papers, the identification of woods, etc.). The circulars were widely distributed to industries and persons likely to be interested. The many requests for service received as a result indicate that the technical services are a useful facility to the industries. Finally the research and investigative work was considerably greater in amount and variety than that carried out for some years and compared very favourably with that conducted at the laboratories in any year since their inception.

A brief review of the activities of the various divisions is given below.

DIVISION OF PULP AND PAPER

Three major investigations were carried on by this division during the year. In addition the division gave invaluable co-operation in a fourth major investigation conducted by the Division of Timber Physics. Brief particulars regarding each of these researches and the progress made follow.

Comparison of Rate of Growth and Chemical Composition of Canadian Pulpwoods.—The object is to determine the effect of the rate of growth upon the chemical composition of pulpwoods with special reference to the percentage of cellulose present. Extensive preliminary work, which consisted of the development of special methods of analysis, was completed.

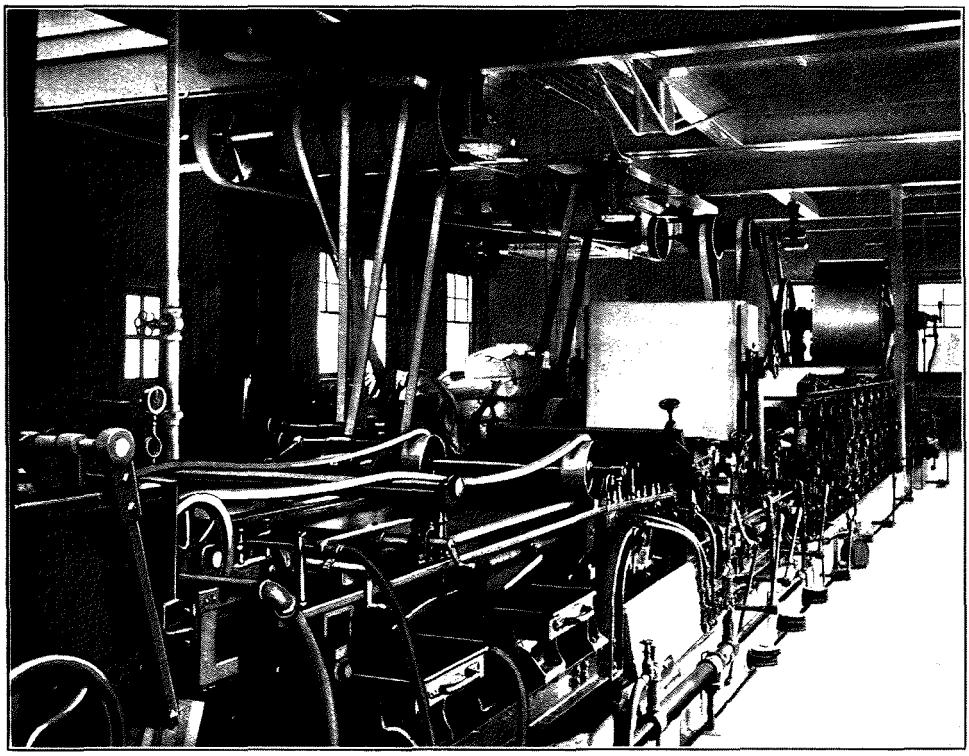
Determination of the Burning Temperature of Exposed Chips in Sulphite Cooking.—The object is to determine the maximum temperature to which a digester charge of spruce, jack pine, or balsam fir chips may be raised, before the charge is completely covered with acid, without injury to the chips. The actual temperatures for spruce and jack pine were determined.

Pulping Qualities of Fire-killed Wood.—The object is to determine the effect of fire-killing, superficial charring, and subsequent fungal attack upon the pulping qualities of spruce, jack pine, and balsam fir. The work on spruce, both green and fire-killed, was completed. Work on all these investigations will be continued.

Water Storage of Ground-wood Pulp.—The object of that portion of the project undertaken by the division is to determine the quality of the pulp after having been stored in water under various conditions for a year and a half. The work was com-

pleted so far as the quantity of material available was concerned. Results were such as to justify semi-commercial trials of water storage which will be made during the following year. (See also under Division of Timber Physics.)

A considerable number of minor investigations was conducted including research on hemp hurds as a paper-making material, determination of the maximum strength that can be developed in paper made from kraft pulp, work on the standardization of methods of testing pulps for strength, utilization of ground-wood screenings, etc.



Experimental Paper Machine at the Forest Products Laboratories. This is a reproduction, on a somewhat smaller scale, of the regular paper machines used in the paper mills, and does exactly the same work. On it was made the first blotting paper ever made in Canada. The Laboratories have devoted much attention to problems arising in paper manufacture, and have solved a number of questions of interest to that industry.

Other minor investigations unrelated to pulp and paper but necessitated by demands made upon the Laboratories were also carried out by the chemists of the division. These included the development of an efficient method of bleaching eel grass without destroying its natural resiliency, and further work on the chemical properties of certain woods for separators in storage batteries.

DIVISION OF TIMBER PHYSICS

Three major projects were conducted by this division. Particulars follow:—

Wood Sections.—The object of this work, which was continued from last year, is the building up of a collection of authentic microscope slides of the important commercial timbers of the world. Such a collection would be invaluable for research purposes, as an intimate knowledge of the minute structure of woods is the key to innumerable problems encountered in their industrial use. Considerable progress

was made during the year, some 1,400 permanent slides being prepared, together with a large number of photomicrographs of woods and fibres. Practically all the Canadian woods of commercial importance have now been dealt with.

Water Storage of Ground-wood Pulp.—The object of this investigation is to determine whether the decay which frequently occurs in stored pulp, and is a cause of serious monetary loss, can be prevented by storage in water, and, if so, whether the pulp thus stored is otherwise adversely affected for paper manufacture. Ground-wood pulp was stored in water under certain conditions and at the end of a year and a half was found to be entirely free from attack by moulds and wood-destroying organisms.

Decay of Timber in Buildings.—The object of this investigation, which has been in progress for some years, is to secure exact and detailed information as to the conditions which facilitate the action of various wood-destroying fungi on woods used for interior construction in mills, factories, etc., and to work out procedure and methods by means of which the decay can be prevented. The monetary losses which result from such decay, particularly in large manufacturing buildings, are very much greater than is usually supposed. At the same time wood, apart from decay, is an eminently suitable material for mill construction. Expert technical knowledge of this subject has been acquired at the Laboratories as a result of careful decay studies in some 300 large buildings and, if made use of in time, makes possible the prevention of such decay. During the year further publicity was given to various special phases of the decay problem by means of periodical articles and addresses. The preparation of a bulletin on the control of decay in buildings was practically completed by the Pathologist.

A number of minor investigations was conducted by the division, including work on the bending of woods, particularly for the manufacture of certain sporting goods, and studies of pulp attacked by moulds and fungi, submitted by manufacturers, with a view to devising control measures. A special feature was an extensive study of the theory of kiln-drying, supplemented by practical studies at commercial plants. This was undertaken as a preliminary to the carrying out of research and demonstration work in this important subject at the Laboratories. A considerable number of wood identifications was made in response to requests from firms and individuals. Extensive photomicrographic work was carried out under the direction of this division.

DIVISION OF TIMBER TESTS

Three major investigations were conducted by this division during the year. Particulars follow:—

Mechanical and Physical Properties of Woods Grown in Canada.—The object of the work is to produce authoritative and complete data regarding the strength, specific gravity, shrinkage, etc., of Canadian woods of both actual and possible commercial importance. The obtaining of reliable data covering different conditions of growth, etc., involves the making of a large number of tests on each species of timber. Over 8,000 tests were made during the year, while at the Vancouver branch laboratory nearly 4,000 were made. This number considerably exceeds that of any previous year since testing was begun. Sixteen species were tested.

Glued Joints.—The object of this investigation is the determination of the strength and permanency of joints made with various glues and wood species with reference to the glue, treatment, and age. Material of a large number of different glues was collected and testing was begun on the hide glues. The work will continue during the ensuing year and attention will be concentrated on determining the efficiency of a number of commercial glues for joint work using the chief woods employed in cabinet and furniture manufacture.

Nail-holding Characteristics of Woods.—The object in this case is to investigate the properties of woods in relation to the driving and pulling of nails under various conditions of seasoning. A considerable amount of testing with specially designed equipment was done during the year, different types of nails and the green material of eleven different species of wood being used. The work will be continued.

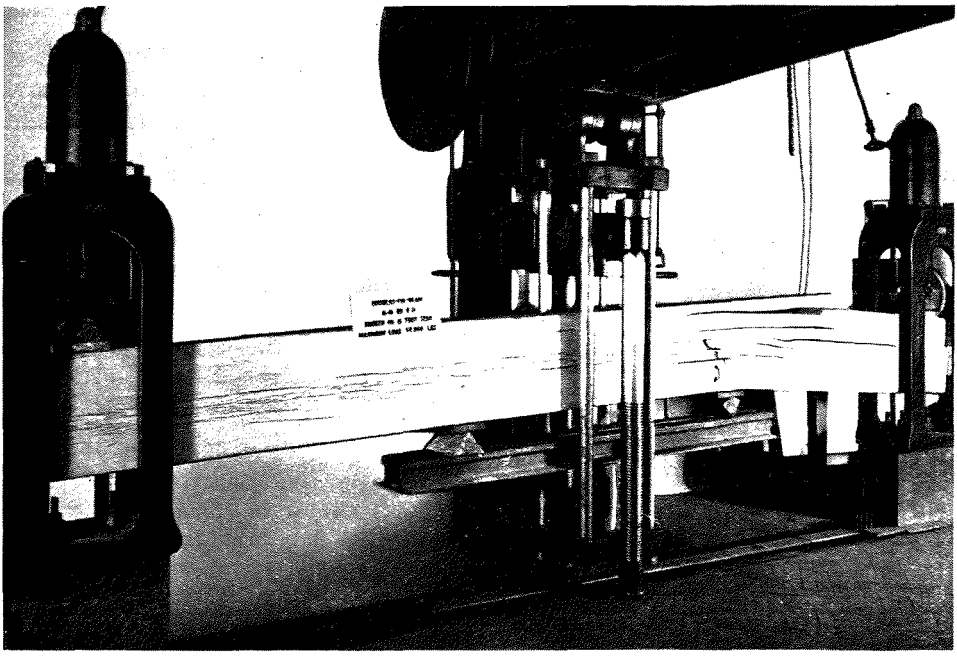
In addition to the above a synopsis of the results obtained in a project completed in a previous year, namely, "Nova Scotia Mine Timbers," was completed and copies forwarded to the mine operators interested.

A variety of minor investigations was also carried out by this division. These included work on the strength of aeroplane members with special reference to the question of deterioration with age and use, strength of paper cores of different designs, strength of joists, further tests on fibre-board, etc.

DIVISION OF WOOD PRESERVATION

The various major investigations under way in this division during the year all dealt with the preservative treatment of railway ties, work being conducted on two woods, namely, hard maple and aspen. Particulars are as follow:—

Adaptability of Hard Maple Cross-ties to Creosote Treatment.—The object of the work is (*a*) to determine the rate of seasoning of hard maple ties and to ascertain the length of seasoning period necessary to bring them to "treatable condition"



Testing structural timbers on the 200,000-pound Wicksteed testing machine at the Forest Products Laboratories. The results of these tests give architects and builders accurate and exact information as to what weights timbers of specified size and species will sustain, information needed in building construction.

and (*b*) to determine the influence of the various factors of treatment on absorption and penetration of creosote oil in hard maple and to ascertain the conditions of treatment which give the most satisfactory results. The seasoning study (*a*) was completed. Extensive work was done on (*b*) a number of charges of test pieces being treated and results analyzed by special methods developed at the Laboratories. A satisfactory treatment had not been worked out at the close of the year and the investigation will be continued.

Adaptability of Aspen Cross-ties to Creosote Treatment.—The objects of the investigation are the same as in the case of hard maple. Large quantities of aspen occur in certain parts of Canada, and in portions of Alberta much aspen is found contiguous to railway lines. Little if any use is made of this timber. If it can be satisfactorily creosoted, however, and its natural perishability thus overcome, it should become of considerable value as a tie material. A number of aspen logs shipped to the Laboratories from Alberta by the Canadian Pacific Railway were sawn into No. 1 half-ties and standard test pieces. A seasoning study on the half-ties was begun, determinations of rate of seasoning being made periodically. The test pieces were piled for seasoning and work on treatment will be begun as soon as they are sufficiently seasoned.

The other work of the division included a number of minor investigations. Work was done on the development of a suitable fire-retardant treatment for wood. Such a treatment would be of the greatest value for interior woodwork in buildings and elsewhere. Existing processes appear either too expensive or subject to other serious objections. Material progress had been made by the close of the year. The chemistry of wood preservatives received a good deal of attention. Proprietary preservatives to a considerable number were carefully analyzed and tested by special method in order to compare them with good grades of creosote oil. Samples of tars, tar-creosote mixtures, and creosotes submitted to the Laboratories for examination as to suitability for use in preservative treatment of ties or other timber were analysed, tested, and reported upon and recommendations as to specifications made. Many samples of treated wood were also submitted for examination as to efficiency of treatment, etc., and recommendations and suggestions made for improvement in procedure in many cases. Treatment of telephone pole brackets received special attention.

EXHIBITS

The collection and preparation of exhibits of forest products and articles manufactured therefrom was continued and a number of additions made to the permanent collection at the Laboratories. Such work included the making of cabinets to contain such additions. Exhibits were prepared also for the use of other Government offices and for display in public places. In September the Department of the Interior occupied space at the Seventh National Exposition of Chemical Industries at New York and an exhibit was prepared at the Laboratories to illustrate some of the possibilities of Canada as a field for chemical industries requiring electrical power or products of the forest. Large wall maps showing the distribution of water-power and of the pulp and wood-distillation industries in Canada were displayed and a variety of products was shown in a manner which attracted considerable attention to Canadian resources.

The demand for hand-specimens of Canadian woods continued during the year and necessitated the making of a fresh supply.

The work of collecting various products which are not subjects of research by other divisions (e.g. lumber by-products, resins, gums, extracts, distillates) has enabled the Exhibit Specialist to undertake the task of replying to inquiries concerning such products and their manufacture. Work on exhibits is, in fact, so closely allied to the publication of information that it has included the preparation for the newspapers of items of technical information and announcements of technical service already referred to as having been instituted during the year under review.

LIBRARY

The library of references, which deals with the technology of forest products, the manufactures therefrom, and related matters, was considerably enlarged and improved. Literature bearing on every phase of the subjects mentioned has been collected for the past eight years and the reference library thus accumulated has proved invaluable to the technical staff in their research and other work.

INFORMATION FURNISHED

The furnishing of technical information in response to inquiries relating to timber, forest products, and derived products is a most important function of the Laboratories. This work involves a careful study of the available data on the subject in question and, in some cases, tests or investigations, the final step being the compilation of a report which is forwarded to the inquirer. Inquiries numbering 427 received attention during the year—a considerably greater number than in any previous year since the establishment of the Laboratories. The growing demand, on the part of the wood-using industries, for the services of the Laboratories is clearly indicated by the continually increasing number of technical inquiries received. A feature worthy of mention also is the expressions of appreciation of the assistance given which are frequently received.

GENERAL

A number of technical articles was prepared during the year by members of the staff and published in Canadian and other periodicals. An exhaustive bulletin dealing with hardwood distillation in Canada was a special feature. This is expected to appear early in 1922-23. Several lectures and addresses were also delivered before scientific, technical, and other societies.

The research and other work of the Laboratories involves a considerable amount of special photographic and photomicrographic work and a high standard in this connection has been reached. Worthy of mention is a series of photomicrographs of wood structure, fibres, etc., prepared by request for Volume 3 of " The Manufacture of Pulp and Paper " a standard textbook issued by the pulp and paper industry of the United States and Canada.

It is noteworthy that increasing activity in forest products research is to be seen in several countries in which the forest resources and the wood-using industries are much less important commercially than with us. In Canada these industries are, in the aggregate, second in importance only to the agricultural industries and the economic possibilities of research in this field are each year becoming more clearly evident.