

PART III

FORESTRY

REPORT OF THE DIRECTOR OF FORESTRY, R. H. CAMPBELL

This report covers the work of the Forestry Branch for the fiscal year 1922-23, ended March 31, 1923.

Continued depression in the great agricultural industry of Western Canada in common with other parts of the world reacted adversely on the general economic conditions of the country. The very small decrease in Forestry Branch revenue (\$2,405) is, under the circumstances, very satisfactory. It demonstrates the importance of the natural resources disposed of by this branch in fulfilling essential needs of the communities served. While the total number of permits to cut timber decreased, the quantity taken increased, particularly saw-logs and mining timber. The total number of stock grazed on forest-reserve ranges, as was to be expected, decreased about 10,000 head. Nevertheless, the number of individuals receiving grazing permits increased eleven per cent, indicating more widespread realization of the facilities available. It may be expected, therefore, that the amelioration of conditions in the stock industry will be reflected in increased use of forest range. Tree planting on prairie farms is rapidly assuming a new phase, namely, protection against soil-drifting, in addition to the original use in protecting buildings and beautifying surroundings.

FIRE PROTECTION

Manitoba and Saskatchewan had very favourable seasons from the standpoint of fire protection. In Alberta and British Columbia, on the other hand, the fire season was unusually severe. In Alberta the season was at least as bad as 1910, which has hitherto been considered the worst since the Forestry Branch established its fire-protection system. Since that year, though greater facilities exist for detecting and controlling fires, fire-hazards, especially those arising from settlers, campers, and railways, have greatly increased.

The total number of fires reported was 2,561; number of large fires, 575 (22.5 per cent of the total); total area burned over, 669,980 acres; area covered with merchantable timber, 187,364 acres; area covered with young growth, 200,099 acres.

FIRES WITHIN FOREST RESERVES

Cause	1922		1921		1920	
	Number	Per cent of Total	Number	Per cent of Total	Number	Per cent of Total
Unknown.....	60	11	32	11	43	20
Campers and travellers.....	51	9	28	9	28	13
Settlers.....	28	5	10	3	11	5
Railways.....	388	66	193	65	94	44
Lightning.....	12	2	9	3	27	12
Lumbering.....					2	1
Incendiary.....	34	6	23	8	2	1
Brush disposal other than by settlers.....	1		1		2	1
Other known causes.....	8	1	4	1	7	3
Totals.....	582	100	300	100	216	100

FIRES OUTSIDE FOREST RESERVES

Cause	1922		1921		1920	
	Number	Per cent of Total	Number	Per cent of Total	Number	Per cent of Total
Unknown.....	292	14	174	15	200	15
Campers and travellers.....	314	15	108	10	187	14
Settlers.....	705	35	329	29	106	8
Railways.....	486	24	370	33	596	46
Lightning.....	105	5	38	3	138	11
Lumbering.....	11		12	1	24	2
Incendiary.....	76	4	20	2	16	1
Brush disposal other than by settlers.....	32	2	37	3	16	1
Other known causes.....	30	1	46	4	33	2
Totals.....	2,051	100	1,134	100	1,316	100

TOTALS OF ALL FIRES ON DOMINION LANDS

Cause	1922		1921		1920	
	Number	Per cent of Total	Number	Per cent of Total	Number	Per cent of Total
Unknown.....	352	13	206	14	243	16
Campers and travellers.....	365	14	136	10	215	14
Settlers.....	733	29	339	24	117	8
Railways.....	874	34	563	39	690	45
Lightning.....	117	4	47	3	165	10
Lumbering.....	11		12	1	26	2
Incendiary.....	110	4	43	3	18	1
Brush disposal other than by settlers.....	33	1	38	3	18	1
Other known causes.....	38	1	50	3	40	3
Totals.....	2,633	100	1,434	100	1,532	100

AEROPLANE PATROL

Aeroplane patrols were continued in the Manitoba and Alberta districts. In Manitoba in two of the three fire-fighting districts the planes were used and a comparatively small ground force was required. All fires in these districts were promptly detected and put out, with one exception, a fire burning

SESSIONAL PAPER No. 12

in muskeg. In Alberta, the Rocky Mountains forest reserve from the International Boundary to the North Saskatchewan river was patrolled almost daily. The patrol sufficiently covered many parts of the reserves that are little travelled and difficult of access, and saved much of the rangers' time, which could, accordingly, be devoted to improvement work.

IMPROVEMENTS

In some districts, on account of the great amount of time spent in fire-fighting, improvement work was practically at a standstill. In others, good progress was made. The following is a summary of improvements:—

	Number		Miles
Cabins.....	5	Roads.....	$\frac{3}{4}$
Ranger Station Houses.....	3	Trails.....	230
Stables.....	7	Telephone lines.....	114
Lookout towers.....	12	Fireguards (cleared).....	52
		Fireguards (ploughed).....	127 $\frac{1}{2}$

TIMBER OPERATIONS

Alberta reports an increase of a million feet of saw-timber taken out (constituting an increase of some twelve per cent over last year's figures). Other provinces, however, report decreases. In Saskatchewan the cut of cordwood was the largest on record, and Manitoba also reports an increased cut of fuelwood. The cut of mining timber in Alberta showed a considerable decrease. In Saskatchewan a keen demand was experienced for railway ties. A striking feature of the timber operations in most of the provinces was the quantity of fire-killed and mature or overmature timber taken out, which will be a considerable aid to the better management of the forests. There has been close observance of the cutting regulations imposed by the forest-reserve regulations.

PLANTING ON RESERVES

During the year approximately 48 acres were planted on the various reserves. Some 138,090 trees, including 25,000 Scotch pine, 51,720 jack pine, 59,920 white spruce, 1,050 lodgepole pine, and 400 green ash were used for this purpose.

Approximately 50,000 of these trees were supplied by the nursery station at Indian Head, Saskatchewan, and the remainder were grown on small nurseries in various reserves. In addition, 114 pounds of jack pine and white spruce seed were used to sow about 36 acres.

GRAZING

The grazing industry has been passing through a period of depression, and consequently a decrease in the number of stock grazed is reported in all districts—that in Saskatchewan amounting to over 10 per cent. Conditions have been good in all districts, and cattle left the range in good shape. The benefits of co-operation as exemplified by the co-operative grazing associations are marked, and efforts are being made to make these associations still more beneficial by using this agency to encourage the breeding of better stock. Many inquiries are being received as to grazing possibilities in northern Alberta.

RECREATIONAL USES

The use of the summer resorts on the forest reserves is increasing. In Manitoba the Clear Lake summer resort in the Riding Mountain forest reserve had to be extended, and the demand for camping permits and summer-resort

lots in the British Columbia resorts was greater than could be met. In Saskatchewan one new summer-resort subdivision was opened for leasing. In order to take better care of the trout fishing on the British Columbia reserves a small hatchery was installed near Paul lake by the Department of Marine and Fisheries; varied success was obtained in the "planting" operations. In the Riding Mountain forest reserve, in Manitoba, the herd of elk is increasing (the reserve having been closed for big-game hunting for the past two years) and is now the largest elk herd in Canada.

RECONNAISSANCE

In Manitoba the reconnaissance of the country east of lake Winnipeg was continued, and included a detailed survey of the country along the Maskwa river and rapid reconnaissance of the country along the Little Black river. A survey and estimate of the Roaring River basin in the Duck Mountain reserve was started, and traverse surveys made of a number of roads in the Riding Mountain and Duck Mountain reserves.

In Saskatchewan detailed surveys were made of the Nisbet reserve and parts of the Pines, Pasquia, and Porcupine reserves, which gave information for an intensive forest-cover map.

In Alberta a grazing reconnaissance was made on the Crowsnest forest.

In British Columbia a forest-cover and topographical map of the Larch Hills reserve was made, together with a study of the different timber types.

TREE PLANTING ON PRAIRIE FARMS

Every year interest in tree planting on prairie homesteads is increasing. This is partly due to the efforts to establish field-shelters for the purpose of checking soil-drifting, partly to the desire of those who already have well-established shelter-belts to extend them. The number of such field-shelters planted this spring promises to treble those planted in 1922.

Weather conditions in the season of 1922 were generally favourable except for drought in certain parts of Alberta and Saskatchewan. Even in these latter areas the trees showed a very large proportion of survivals, due, doubtless, to the thorough soil preparations insisted on before planting. More detailed reports in regard to plantations were required of the promoters of tree planting in 1922. These showed that out of 832 plantations 71 per cent were good and 21 per cent fair. These latter, with a little more care for the next few years, can be put in good condition. Compared with plantations made under similar government schemes of co-operative planting in other countries, this showing seems quite satisfactory.

Conifer (evergreen) plantations have come through surprisingly well. This applies even to areas which have suffered severely from drought. Of lodgepole pine planted in central Alberta in 1916, the full 100 per cent has survived, and the average height attained is 7 feet 2 inches.

Rather more than the usual amount of damage was reported from hail in 1922, but practically no winter-killing. Insect pests were reported quite generally. The Russian poplar is afflicted by an insect, lately introduced, a kind of borer, whose attacks may seriously affect the usefulness of the Russian poplar for prairie planting. The season of 1922 was favourable for propagating most kinds of trees. Young green ash at Indian Head, however, were smothered owing to the caking of the soil caused by excessive spring rains, and a fine stand of freshly sown white spruce was "burned off" just after germinating, owing to extremely dry, hot weather. The number of applicants who received broad-leaved stock was 4,064, and 254 received conifers. Over four and a half

SESSIONAL PAPER No. 12

million trees were distributed, and this spring (1923) nine and a quarter million are available for distribution. A considerable quantity of tree seed was collected and extracted; the supply of spruce, however, was extremely scanty. About fifty thousand conifer (evergreen) transplants were supplied for planting on the forest reserves, and experiments in direct seeding were continued on the Spruce Woods forest reserve in Manitoba.

FOREST PRODUCTS LABORATORIES

The fiscal year 1922-23 shows marked increase over 1921-22 in the number of requests for technical information and services, just as 1921-22 did over 1920-21, and the experimental paper-mill was employed more than in any previous year. The past year, too, has seen the largest and most varied research work of any year in the history of the laboratories. The chief problems under investigation included the making of sulphite pulp from jack pine, the making of wood-pulp from fire-killed spruce and balsam fir, the recovery of good paper stock from condemned paper currency withdrawn from circulation, the determination of the burning temperature of exposed chips in sulphite cooking, the feasibility of applying the freeness test as a control in ground-wood production, and the chemistry of cellulose. Of these the second, third, and fourth were successfully completed; the others are still under investigation. The Division of Timber Physics began a study of the built-up type of construction (plywood or laminated wood), especially as applied to sporting goods, kiln-drying, water storage of ground-wood pulp, and the decay of timber in buildings. In the last two studies valuable results were obtained. The preparation of the reference collection of microscopic slides of wood was continued. The Division of Timber Tests continued their work of testing the strength functions of Canadian commercial timbers, made further investigations in regard to the nail-holding characteristics of woods, and conducted research on the value of glues of various kinds for joint work and the strength values of Canadian woods for tie purposes. In the Division of Wood Preservation the major investigations were the creosote treatment of maple and aspen poplar for railway ties, and the treatment of Canadian hardwoods for top pins and pole brackets for use in connection with telegraph and telephone lines. Many other minor investigations were also carried on. A number of exhibits of forest products and articles derived therefrom were prepared. Many technical articles and brief newspaper items were prepared by the staff during the year.

FOREST RESEARCH WORK

The scheme of investigation as outlined in the report for the year 1921-22 was followed during the past fiscal year. Investigations were carried on in Ontario, New Brunswick and Quebec, and on the Dominion forest reserves in the western provinces.

In New Brunswick studies subsidiary to the work at the Bathurst experimental area were undertaken in co-operation with the New Brunswick Forest Service, and with Mr. P. Kingston, Wayerton, Northumberland county, and Mr. W. S. Anderson, Cain river, York county. At Wayerton a regeneration survey was carried on, and on Cain river preliminary arrangements were made for an experimental cutting.

At the Petawawa forest experiment station in Ontario, the work carried on consisted mainly of investigation of methods of handling young growth coming in after logging or after fires. This particular problem is of importance now and will assume greater importance as the present supplies of pine, spruce, and other softwoods decrease.

At the Lake Edward forest experiment station in Quebec, investigations of methods of handling severely culled pulpwood lands in the yellow birch or hardwood type were continued.

The work on methods of estimating standing timber for commercial purposes has now reached the stage when results can be applied to five of the main forest species in Eastern Canada. About fifty separate investigations on the majority of the main species have been carried on throughout the East and on the Dominion forest reserves in Western Canada. Measurements have been made on about 5,000 trees. The specific object of this work was to develop general data, applicable over wide regions, from which data local tables can be prepared to suit local conditions. The results obtained from these separate investigations have been co-ordinated, and it has been demonstrated that general taper tables can be applied to three species in the regions noted, namely: (1) balsam fir in Quebec, New Brunswick, and Manitoba; (2) white spruce, red spruce, and black spruce in Quebec, Ontario, New Brunswick, and Manitoba; and (3) white pine in Ontario.

From these general taper tables it is possible, subject to the collection of a small amount of local data, to develop local volume tables for any product, or to conform with any type of operation desired. The work on red pine, jack pine, lodgepole pine, and other species is in progress. There is every indication that successful results may be obtained for these species also.

Measurement and study of yield of the important Canadian species in the natural and thinned forests, as related to the problem of securing the highest production, was continued, this work being carried on simultaneously with the work on methods of estimating.

FOREST RESOURCES AND STATISTICS

The work of this division is being constantly broadened and extended, by co-operation with outside agencies and otherwise, in an effort to meet and serve the public needs most fully and satisfactorily, and especially with regard to providing fuller and more reliable information on the location and extent of Canada's commercial forest resources.

So far as forest conditions are concerned, two main considerations govern the framing of any Canadian forest policy, whether federal or provincial, which seeks to harmonize annual cut with annual growth, namely, for any given area, first, the acreage and quality of mature timber, and, second, the acreage and growth-rate of the reproduction.

To secure at least approximate answers to these two questions, the Commission of Conservation undertook to carry out a comprehensive forest survey of Canada, province by province; and, when the commission was disbanded in 1921, Nova Scotia and British Columbia had been covered and surveys in Saskatchewan and Ontario were well under way. This work was taken over by the Forest Resources and Statistics Division of the Dominion Forest Service, and the Ontario survey is now nearing completion. In this general forest inventory or stocktaking much the same methods are being employed as were successfully adopted in the survey of British Columbia. Through co-operation with the lumbermen and pulp concerns, estimates of their holdings are being secured and compiled. The mass of data in the hands of the Provincial Government is also freely available. The fullest co-operation, too, is being given by the banks, railways, and other persons or companies who may possess information of value. Finally, in order to relate these estimates, and check them where desired, it is necessary to do considerable direct field-work of a reconnaissance nature. It was at one time expected that this project would be rapidly advanced by the use of aeroplanes in co-operation with the Air Board

SESSIONAL PAPER No. 12

of Canada, and considerable information has been secured in this manner, especially through the co-operation of the Provincial Forestry Branch, which has carried on extensive aerial surveys during the last two years.

In addition to the above special investigation, all the available information concerning the forest resources of Canada is being compiled and the estimates of the total stand of merchantable timber in Canada are revised from time to time as more definite and authoritative information is secured.

During the fiscal year under review, considerable work was done in the matter of collecting and compiling statistics dealing with the use and manufacture of forest products, both in co-operation with the Dominion Bureau of Statistics and independently. This work involves revising of schedules and checking and editing of final reports. One such investigation made by this division covers the probable supply, utilization, and relative heating values of the different fuel-woods used in Canada as compared with mineral fuel, and in connection therewith a report was prepared and presented before the Canadian Mining Institute in Montreal. It was also published for distribution.

Inquiries are constantly being received by this division, asking for definite information in regard to the amount and location of supplies of timber for use in woodworking industries, particularly with reference to the rapidly expanding pulp and paper industry. This phase of the work now involves considerable correspondence, and it is felt that the information thus being made available to persons and companies seeking to locate new industries in this country is serving a most important and useful purpose.

PUBLICATIONS AND PUBLICITY

During the year the following new publications have been issued: Bulletin No. 72, "Success in Prairie Tree Planting"; Bulletin No. 73, "Tree-repairing"; Bulletin No. 74, "Distillation of Hardwoods in Canada"; Circular No. 14, "Commercial Forest Trees of Canada"; Circular No. 15, "Historical Sketch of Canada's Timber Industry". Monthly news-letters were sent to newspapers, and other means of publicity, particularly in regard to forest fires, were continued. Arrangements are also being made to have messages regarding forest fires broadcasted from some of the radio broadcasting stations.

THE LIBRARY

The preparation of monthly lists of accessions, which are mimeographed and circulated among the officers of the branch and a number of forestry officials, foresters, and others interested, and also of special bibliographies or reference lists has been continued. The subject index of photographs has been brought up to date, and now includes some 13,000 entries; a geographical list is also being prepared. During the year 573 books and pamphlets and 1,092 photographs were added to the library. Book loans totalled 673, and 2,857 cards were added to the index.

STAFF

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

Head office.....	60
District inspectors.....	4
Assistant district inspectors.....	2
Forest supervisors.....	18
Foresters and forestry assistants.....	25
Forest rangers.....	93
Chief fire rangers.....	11
Promoters of tree planting.....	8
Forest Products Laboratories technical staff.....	26
Outside clerical staff.....	47

APPROPRIATIONS

The appropriation for the fiscal year was \$1,000,000; to this are to be added refunds from fire-guarding, etc., \$35,392.72. The total available for expenditure was thus \$1,035,392.72. The expenditure was divided as follows:—

Salaries at head office.....	\$ 25,595 90
Travelling expenses.....	3,809 29
Printing and stationery.....	2,771 34
Miscellaneous expenses.....	12,972 52
Statistics.....	4,427 50
Fire-rangin.....	287,480 81
Forest reserves.....	472,538 62
Surveys and research.....	66,120 11
Tree planting.....	71,368 25
Forest Products Laboratories.....	84,746 46
	<hr/>
	\$ 1,031,830 80

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

Manitoba.....	\$ 99,614 04
Saskatchewan.....	185,198 05
Alberta.....	291,570 43
British Columbia (Railway Belt).....	200,700 08
	<hr/>
	\$777,082 80

THE TREE-PLANTING DIVISION

Norman M. Ross, Chief

Generally speaking, the season of 1922 was favourable for tree-planting work over the greater portion of the three Prairie Provinces. Certain restricted areas suffered again from extreme drought, but with the exception of these comparatively small areas the rainfall was normal and in some districts even above normal, particularly in spring and early summer.

In the dry areas mentioned a summary of inspection reports indicates that early in the season the freshly set out plantations showed 94 per cent of plants living. Later, however, owing to the prolonged drought during the growing season, the plantations in these districts, especially those of cuttings, suffered, though the rooted seedlings held their own fairly well. The average of all the varieties in the plantations would be about 85 per cent living. This is considered a splendid showing under the conditions, and can be accounted for only from the fact that trees are supplied for planting only on well-prepared summer-fallowed land.

In the more favourable sections, which comprise at least three-quarters of the area covered by the branch's distribution the inspection of living, freshly planted stock showed 98 per cent of rooted stock and 90 per cent of cutting stock.

In the inspection district covering the southern and eastern portion of Saskatchewan 832 plantations varying in age from 3 to 15 years old are reported as 590 (71 per cent) good, 175 (21 per cent) fair, and 67 (8 per cent) poor. All the plantations reported fair can be put in good condition if the owners will give them a little more care during the next few years. These results compare favourably with those obtained in the northern prairie states as given in Bulletin No. 1113 of the United States Department of Agriculture.

SESSIONAL PAPER No. 12

General interest in tree planting is becoming keener each season. • From lists compiled to date it is evident that the total number of trees sent out will be over two and a half millions greater than the number set out in 1920.

Two things are particularly noticeable in the correspondence this spring: one is the very large number of farmers who set out small shelter-belts perhaps eight to ten years ago who are feeling the benefits of these earlier plantings and are now anxious to extend their plantations; the other striking feature of the work is the numerous inquiries received regarding field-shelters, to protect crops from soil-drifting. Until two years ago no demand was expressed for stock for other than shelter-belts to set immediately around the farm buildings and gardens. In 1922 stock was supplied for thirty-two field-shelters, and this spring over 100 farmers are arranging to set out field shelter-belts. These field-shelters consist generally of from one to four rows that have been planted, to start with, along the outside edges of the farms; later, secondary belts will be, and in some cases already have been, planted at suitable intervals across the cultivated fields. It is hoped that such belts will not only help to lessen loss from soil-drifting, but will tend to control the spread of such weeds as Russian thistle.

Extremely encouraging reports are received from every inspection district in regard to results with conifer (evergreen) plantings. The species sent out from the nurseries are white spruce, Scotch pine, jack pine, and lodgepole pine. During the past season very few of the newly-planted trees failed, and several reports show 100 per cent living. Even in the areas which have suffered drought the conifers are showing up splendidly, as the following figures covering plantings in central Alberta clearly demonstrate:—

White spruce, planted 1916, height 6 ft., 98 per cent living.
Lodgepole pine, planted 1916, height 7 ft. 2 in., 100 per cent living.
White spruce, planted 1918, height 5 ft., 97 per cent living.
Scotch pine, planted 1918, height 5 ft. 4 in., 94 per cent living.
White spruce, planted 1922, 96 per cent living.
Jack pine, planted 1922, 93 per cent living.
Scotch pine, planted 1922, 94 per cent living.

Undoubtedly these hardy conifers (evergreens) are particularly suited to prairie planting and, once established, seem to withstand all kinds of neglect, though they respond readily to good cultivation.

Rather more damage than usual was reported during the past season from hail, but no winter-killing was reported except in south-central Alberta, where maple, set out one or two years previously, was slightly cut back. Experience shows, however, that winter-killing seldom affects these trees after the third or fourth season.

Insect pests, such as canker-worm on the maple and certain species of aphids on poplars and willows, were reported pretty generally, but these can all be controlled with a fair degree of satisfaction by the use of insecticides ordinarily available. Very serious outbreaks of tent caterpillars were reported as doing a great deal of damage to native "bluffs" and poplar stands. These outbreaks were most serious in the Moose mountains, in southeastern Saskatchewan, and in an area south of Edmonton. No damage was reported from tent caterpillars in any cultivated plantations, but this insect may be found rather troublesome during the coming summer.

A new pest affecting young Russian poplar was reported in 1921 for the first time, but was found much more plentiful in 1922. The injury is caused by the larva or grub, apparently of a species of moth, which enters the stem of freshly rooted Russian poplars at a point level with the ground-line. It bores into the stem and develops there, weakening the plant to such an extent

that in the fall of the second season the stem breaks off at the ground-line. In some new plantations from 30 to 50 per cent of the young poplars were broken off from this cause. It is not known yet just what effect this will have on the injured plants, but it is being closely watched because if it proves to be a serious pest the result may be greatly to restrict the use of Russian poplar in prairie plantations.

Nursery Work.—The stock raised at both Indian Head and Sutherland nurseries was of excellent quality; the season was, on the whole, a very favourable one for the propagation of most species. Owing to continuous heavy rains in the early spring the soil in the plots sown to ash became so packed and hard that the young plants could not break through. The surface was so hard that the harrows had no effect on it. As a consequence, these plots were a complete failure and there will be no ash available from Indian Head nursery for 1923. A larger area of caragana was sown in the fall of 1922 to take care of this shortage. The only other crop suffering was freshly-sown white spruce. Just at the time these were germinating there occurred an intensely dry, hot period, and a beautiful stand of young plants was completely "burned off," as there were no facilities for watering. A pumping plant with an overhead watering system was installed later in the season, which will, it is hoped, prevent similar loss in the future.

Distribution of Broad-leaved Stock.—Shipping of broad-leaved stock commenced April 29 and was completed May 11 as follows:—

Number of applicants receiving trees.....	4,064
Seedlings and cuttings distributed.....	4,625,225
Average number per applicant.....	1,150
Number of applicants on inspection list, 1922.....	8,186
Number of new applicants on inspection list for 1923, approximately...	2,061

The following stock of broad-leaved material is available this spring (1923) for distribution at the Indian Head and Sutherland nurseries: Manitoba maple, 2,168,000; green ash, 2,280,000; Russian poplar, 854,000; red willow, 344,000; acute-leaved willow, 516,000; laurel willow, 582,000; caragana, 2,528,000; total, 9,272,000.

Distribution of Conifers.—Shipments started May 17 and were completed May 20. Applicants numbering 254 were supplied with conifer transplants, at a nominal charge, as follows: White spruce, 21,900; jack pine, 7,250; Scotch pine, 17,850; total, 47,000. In addition to these, 50,000 transplants were shipped for planting on the forest reserves, making a total of 97,000 conifers sent out.

Collection of Tree Seed.—Maple seed to the amount of 2,858 pounds was collected, mostly at Dauphin; 236 pounds of ash seed were collected in the Qu'Appelle valley, and 500 pounds of caragana seed were collected on the nursery.

Twenty-eight and one-quarter bushels of lodgepole pine cones collected in the foothills gave eight pounds of clean seed; 92 bushels of jack pine cones from the Prince Albert district gave 52 pounds of clean seed, and 5 bushels of white spruce gave 4 pounds of clean seed. This was not a seed year for spruce in any part of the country. The seed was all extracted and cleaned at Indian Head.

In the spring of 1922, 40 pounds of maple seed, 30 pounds of ash, and 65 pounds of caragana were distributed among 121 applicants.

SESSIONAL PAPER No. 12

Planting in the Forest Reserves.—Stock for planting on the forest reserves was shipped as follows:—

Manitoba—						
Riding Mountain.....	1,800	spruce,	1,600	jack pine,	500	Scotch pine.
Duck Mountain.....	750	"	750	"	750	"
Spruce Woods.....	1,400	"	1,150	"	7,000	"
Turtle Mountain.....	1,050	"				
Saskatchewan—						
Nisbet.....			1,750	"	5,475	"
Dundurn.....			1,750	"	2,775	"
Beaver Hills.....	5,000	spruce,				
Alberta—						
Crowsnest.....	2,500	"	1,500	"	4,250	"
Bow River.....	2,500	"	1,500	"	4,250	"

For continued experiments in direct seeding on the Spruce Woods reserve in Manitoba, 50 pounds of jack pine seed were forwarded to be sown in the spring and 20 pounds to be sown in the fall of 1922. Previous sowing had been made principally broadcast, the seed-bed having first been disked in order to secure a certain degree of preparation of the soil. This season most of the seed was put in with an ordinary grain disk-drill without preparing the seed-bed in any way in order to test this method.

DOMINION FORESTS IN MANITOBA

H. I. Stevenson, District Forest Inspector.

The Manitoba inspection district office is charged with the administration and protection of the Dominion forest reserves within the province generally and with the protection of timber on Crown lands within the province.

Fire Protection.—The summer of 1922 was one of comparatively low fire-hazard. Rainfall was above the average for all parts of the province except the northern districts. Early frosts followed by high temperatures and strong winds culminated in a great danger period during the last week of September, which condition was relieved by general rains on October 4. By the end of October there was no longer any danger of fires running and patrols were discontinued for the year.

The total number of fires during the summer was 107. Of this number 27, or 25 per cent, burned over 10 acres. This shows an improvement over the preceding two years; in 1921 large fires (over 10 acres) formed 38 per cent of the 86 fires reported, and in 1920 the percentage was 54 with a total of 122 fires. This reduction in the percentage of large fires is due to improvements in organization and increased efficiency of the staff. These 27 large fires of last year burnt over 27,851 acres, of which a little over 2,000 acres contained merchantable timber and about 8,000 acres young growth, the remainder being old burns, grass land or muskeg.

The forest-reserve staff handled 15 large fires, of which 8 were outside the boundaries of the reserves. These 8 fires were on agricultural land and were started by settlers. They were fought by the reserve staffs in order to prevent their spread to the reserves. The volunteer fire-fighting organization inaugurated the preceding year amongst the settlers adjacent to the reserves has given satisfactory results.

Four additional fire pumps were purchased and sent to central points throughout the province. These proved most efficient.

The operation of the seaplanes and the handling of fires were greatly facilitated by the radio stations established at Winnipeg, Victoria Beach, and Norway House by the Canadian Signal Service. Messages were sent from Winnipeg to Norway House and replies received in a few hours—an exchange which formerly took weeks. This rapid means of communication enabled the inspection office to keep in close touch with the aeroplane operations and with the Manitoba North district.

Aeroplane Patrols.—In the fire-ranging districts patrols were carried out largely by the use of seaplanes. These machines did very efficient work while they were in operation but, owing to a series of accidents, not enough machines were available for the service, which in some localities had to be supplemented by canoe patrols. The Manitoba North and Manitoba South districts were patrolled by the planes throughout the summer, being supplemented by only a small ground force. All fires in the country patrolled by them were sighted before they had gained much headway and were easily extinguished with the exception of one at the outlet of lake Winnipeg. This fire was burning in muskeg and gave considerable trouble before it was finally put out. The planes have proved their usefulness in fire detection and suppression, but from the last season's operations the necessity of having a surplus of machines in reserve was strongly emphasized.

Improvements.—Portions of the Duck Mountain reserve are not yet easily accessible and considerable improvement work must be carried out here. On the other reserves lines of communication and transportation with the necessary buildings for the staff have been established and but little new construction will be required.

Silviculture.—Due to the continued financial depression, very little saw material was cut from the reserves during the winter, but there was an increase in the number and amount of permits taken out for fuel. Aspen was the principal species cut for this purpose, and as it covers extensive areas, is badly diseased, and is growing faster than it is being cut, this is a distinct advantage.

A number of plantations of an experimental nature were established on the various reserves, and as the season was very favourable for growth they are doing well. Many of the plantations made in previous years are showing gratifying results, and valuable information is being obtained from these plantations. Some sowing has also been done, but without satisfactory results to date. During the past winter the cutting of poplar on certain specified areas was permitted free of dues. These areas were clear-cut, and it is the intention to burn these broadcast and sow spruce seed. If a good seed-bed can be prepared by burning, these extensive poplar areas can gradually be converted into valuable spruce forests. Seed-beds of spruce and jack pine were established at a number of ranger stations.

The technical staff attached to the district have been carrying out various lines of investigative work. Work on the permanent sample plots previously established was continued and several new plots established. A preliminary report on the silvical conditions on the Riding and Duck Mountain reserves was prepared through the co-operation of this staff.

Surveys and Estimates.—The survey and estimate of timber started in 1921 on the east side of lake Winnipeg was continued. This year the country along the Maskwa was examined in detail and a rapid reconnaissance made along the Little Black river.

A survey and estimate of the timber tributary to the Roaring river in the Duck Mountain reserve was started. This work will be completed next year.

SESSIONAL PAPER No. 12

Grazing.—Owing to the general depression, grazing on the forest reserves has fallen off during the last few years. During the past year the number of permits issued and the number of head grazed were below normal. It is expected that with the revival of business the forest reserves will be used to a much greater extent than heretofore. The stockmen and farmers are now fully aware of the advantages of these reserves for summer feed and when the market justifies the building up of their herds numerous requests for pasturage may be expected. The co-operative grazing associations are growing in favour and are encouraged in every way. 120

Cattle on the range did very well last summer, and they were well conditioned in the fall. No loss of stock was reported from any of the reserves.

Recreational Uses of Forest Reserves.—Owing to the proximity of the forest reserves in this province to towns and villages they are being used more and more for recreational purposes. The summer resorts established at Madge lake in the Duck mountains and at Clear lake in the Riding mountains are growing in popular favour. At the Clear Lake resort it was necessary to extend the subdivision to a total of 129 lots. 95

Game.—The Riding Mountain reserve has, by a provincial Act, been closed for big-game hunting for the past two years and it is gratifying to note that the elk on this reserve are increasing under this protection. This herd of elk is the largest in Canada. Big game on the Duck Mountain reserve is on the decrease, and a close season on this reserve may also be necessary. 6

DOMINION FORESTS IN SASKATCHEWAN

C. MacFayden, District Forest Inspector.

It is estimated that south of the Churchill river in Saskatchewan there are 32,000,000 acres of forest land unfit for agriculture through being too broken, too light, too rocky, too wet, or for some other reason. This does not include most of the poplar lands in the northern part of the province, which are recognized as frequently of a very high agricultural value when cleared. Of this 32,000,000 acres about one-fifth (somewhat over 6,000,000 acres) has been set aside as forest reserves, and the administration of the timber and other resources on these constitutes a large part of the work with which this office is charged. In addition to the work arising out of the reserves this office is also responsible for the maintenance of a fire-protective organization on all Dominion lands carrying merchantable or potential timber supplies.

Very little land has been withdrawn from the forest reserves as being suitable for agriculture. On the whole the reserve boundaries as they now exist fairly divide the agricultural from the non-agricultural, or forest lands.

The department has in a number of instances during the year, at the request of the owners, given vacant homestead lands in exchange for patented lands within the reserves which had proved unsuitable for agriculture.

Fire Protection.—Like the preceding two years, that under review was, in this province, a very favourable one from a fire-protection standpoint. Owing to the spring being rather backward and drawn-out the dead vegetation of the previous year did not dry out before the new green vegetation came on, and this practically did away with the fire risk at this season. The latter part

of September proved very dry; for a short time numerous fires were running, and the situation became quite critical until again rendered safe by a fall of snow and rain.

During the year there were 107 fires reported, 60 per cent of which occurred on forest reserves. Fifty-four of these, or almost exactly 50 per cent, did not reach 10 acres in size, although the remaining 53 covered some 55,000 acres. It is gratifying to note, however, that only a small part of this (1,334 acres) carried merchantable timber, and more than half of it was grass land, muskeg, and old burn. The greatest loss was the 18,203 acres of young growth burned.

The clearing of land for settlement continued to be the greatest source of fires—almost 50 per cent of the total. Campers were next in order and were responsible for one-third of the total. The railways, which were at one time such a prolific source of fires in Saskatchewan, were in 1922 only minor offenders.

Improvements.—Very fair progress was made in the improvement plan of most of the forest reserves and fire-ranging districts during the year. A decided advance was made in the construction of fireguards, particularly on the smaller reserves and those adjacent to settlements. It is found that by far the greatest proportion of fires originate outside the reserve boundaries, and well placed fireguards reduce the damage to reserve forests and lessen the expenditure for fire-fighting. Eventually it is hoped to have a network of well arranged fireguards covering a number of the reserves, so that at the worst fires can be confined to comparatively small blocks. During the year there were 117 miles of guard ploughed for a width of at least 12 feet, and 52 miles cleared for a width of from 30 to 66 feet.

The lookout system of the district was augmented by the addition of eight towers, two of these being of standard steel construction 80 feet high, and the other six being wooden towers erected by the rangers and varying from 40 feet to 60 feet in height. Several of the latter were erected in the fire-ranging districts. The city of Prince Albert granted authority for the use of the city's standpipe as a central control tower for the Pines and Nisbet reserves. This tower was equipped with an Osborne fire-finder and connected by telephone with each of six towers on the reserves.

During the year the telephone system on the reserves was extended by the addition of 81 miles of line. On Fort à la Corne reserve two five-roomed dwellings were erected during the year, both of these replacing old buildings erected years ago that had outlived their usefulness. In addition to the major projects mentioned, a great many small improvements were made or maintained by the ranger staff.

Grazing.—During the year there were 739 permits issued authorizing the grazing of stock on the different forests. These permits represented a total of 33,189 head of stock, a decrease of approximately 4,000 on the total of last year due to market conditions. The grazing of stock on the co-operative plan by small associations continues to grow in favour, and there are now about thirty of these associations in this inspectorate. Now that the principle is thoroughly established, the time seems ripe to encourage a more intensive application of it, particularly along the line of building up better herds.

Silviculture.—Timber operations under the authority of permits remained about stationary or with only a small decrease as compared with last year, when the volume of this business was the greatest on record. Altogether there were 1,358 permits issued and of this number 823 were paid permits, the dues on which amounted to \$12,890.12. The great bulk of material disposed of in this way was fire-killed in 1919, and its removal, besides benefiting the permittee and constituting a source of revenue, to an appreciable extent lessens the

SESSIONAL PAPER No. 12

fire-hazard. From the latter standpoint the removal of fuel-wood is proving the most satisfactory, as in these operations all sizes and species and a wide range of grades can be taken, and on many cutting areas nothing remains when the operation is completed but the young growth and green material. Cord-wood operations have been particularly encouraged for this reason and a new record was this year created when 35,228 cords were taken out. The cut of building logs, fence-posts, poles, and other material required for farm purposes remained about the same as in previous years, but the logs cut for sawing decreased by over one-half.

The past winter was active in operations on timber sales and the sixteen sales in good standing produced about 6,000,000 feet board measure, in addition to 2,000,000 lath and 2,600 ties. No difficulty was experienced in having the regulations regarding cutting methods and the disposal of debris, complied with.

Planting and nursery work, especially the latter, received very much more attention than heretofore. Small nurseries are now established on the Big River, Nisbet, Pines, Fort à la Corne, Pasquia, Porcupine, Beaver Hills, and Dundurn reserves. A number of these are showing very satisfactory results.

Approximately 90 bushels of jack pine cones were collected in the fall of 1922 and shipped to Indian Head for extraction.

Surveys.—An intensive cover-type survey was made of the larger part of the Nisbet forest reserve, and part of the Pines, Pasquia, and Porcupine reserves. The object here was to secure complete and accurate data on the conditions of the forests as a basis for formulating a timber-sale policy leading up to working plans. The information gained shows what species, age-classes, and mixtures or types exist, and inventories the amounts. It also adds very materially to existing information on the topography of the country covered.

Recreation.—The use made of the various forests as recreation grounds is becoming more general, although no great increase was noted during the year just past. No new summer resorts were laid out, but the Moose Bay subdivision in the Fish Lakes resort on the Moose Mountain forest was thrown open for leasing.

DOMINION FORESTS IN ALBERTA

C. H. Morse, District Forest Inspector

The work of the Forestry Branch in Alberta consists in the protection and administration of the Dominion forest reserves within the province and the protection from fires of forested Crown lands which have not yet been included in the reserves or taken up under homestead entry. In addition there is the enforcement of the fire-prevention requirements of the Board of Railway Commissioners of Canada on all railways within the province coming under their jurisdiction.

There are in this province eight forest reserves, covering an area of approximately 18,690 square miles, which have definitely been reserved for the production of timber and for their beneficial effect on stream-flow. It is the duty of the Forestry Branch to protect them from fire and insect and fungous pests and to administer them in such a way that the stands of timber may be improved and extended by proper silvicultural practice. Timber is sold in increasing quantities each year, but the larger part of such timber has been

fire-killed in previous years and the remainder is mature and over-mature green timber which by reason of its age should be harvested. Very little immature timber is being cut, and that only for silvicultural reasons, that is, for the benefit of the remaining stand. Although forest fires in past years have reduced the areas of mature timber to a very small percentage of the whole, there is reason to hope that present stands, both inside and outside reserves, will be sufficient to meet the demand until the large areas of immature timber at present on the reserves are ready for the market.

Fire Protection.—The past season must be regarded as being exceptional, both from the point of view of fire-danger and from the number and seriousness of the fires which occurred. There can be no doubt that it has been at least as bad as that experienced in 1910, and that year has always been considered as the worst since the Forestry Branch undertook fire protection in this province. In comparing the two years, however, it should be noted that the hazard was much greater in 1922 than 1910 because of the great increase, in the district affected, of settlement, railways, and backwoods travel, which constitute the chief sources of forest fires. Reports were also much more complete in the latter than in the former year.

Of the 1,758 forest fires which burned in Alberta during the season, only 170, or less than 10 per cent, attained a size of more than 10 acres or caused any expense or damage. The 1,588 smaller fires were those discovered and controlled in their incipient stage. That railway fires can be kept down by efficient patrol, engine inspection, and improved right-of-way conditions, is evidenced by the fact that 97 per cent of the 675 railway fires this season were less than 10 acres in extent and caused no damage to timber. The close co-operation which the railway companies have given made it possible to give the larger fires immediate attention so that few of them did any serious damage. The same does not apply to settlers' and campers' fires, however. These occur in remote and rather inaccessible places, are widely scattered, and are apt to attain to large size before fire-fighting operations can be started.

Seventeen persons were convicted during the year, under the provincial Fire Act, of causing forest fires. This has had a salutary effect and tends to build up the body of public opinion necessary for protecting the forest.

Forest Surveys.—The work of mapping the forest cover on Alberta reserves was continued last summer, and was completed on the Crowsnest and Bow River forests. A considerable amount of forest-cover mapping was also done on the Clearwater and Brazeau forests and the Lesser Slave forest reserve. The information already gathered shows that there is a comparatively small quantity of accessible merchantable timber remaining on these reserves. There are, however, large areas which will mature in from twenty-five to fifty years.

Seeding and Planting.—On the Cooking Lake and Cypress Hills forest reserves the seeding and planting work started four years ago has been continued. On these two reserves more than 86,000 spruce and pine seedlings were planted last year, and these, as well as previous plantations, are doing extremely well. This work is now past the experimental stage and it will soon be proceeded with on a much larger scale. Experiments started a year ago with direct seeding on partially prepared ground have been fairly successful, and it is proposed to continue this work until the most suitable method has been found. The seed-beds and nurseries on these two reserves have been doing well, and are now in a position to furnish in the vicinity of 150,000 seedlings a year.

Timber Sales and Permits.—Sales of timber under the authority of timber sales in this district amounted to 9,370,000 feet board measure and 685,000

SESSIONAL PAPER No. 12

lineal feet of mining timber. While the sales of saw material have increased by almost one million feet, the sales of mining timber have fallen off greatly owing to the long period of idleness in the mines caused by the strike during the summer of 1922. It is interesting to note that 2,950,000 feet board measure of the saw material and almost all of the mining material has been cut from fire-killed timber. The remainder of the year's cut was mature or over-mature spruce and pine timber.

Seventeen timber sales were in operation during the year, of which nine supplied small local mills; seven, mining timber for coal mines; and one, railway ties for the Canadian National Railways. The usual requirements of this branch with regard to close utilization and brush disposal have been very satisfactorily carried out in all cases.

Timber cutting under the authority of permits has brought in more revenue than formerly, but there were fewer permits issued than in the preceding year. A considerable quantity of fire-killed timber has been disposed of under permit at a reduced rate of dues, and it is satisfactory to note in this connection that most of the accessible fire-killed timber on the southern reserves has now been salvaged.

Aeroplane Patrol.—This branch has been greatly aided in fire-protection work by the air patrol maintained over the Crownsnest, Bow River, and Clear-water forests through the co-operation of the Air Board. Though the larger number of fires that have occurred in this area were in the more accessible parts of the reserves and were discovered almost at once by the ground patrol, in several instances aeroplane patrol was the detection medium, and in these cases very rapid control was made possible by the pilot's action. These fires would have attained large proportions but for quick action in fighting them.

Two patrols were carried out almost daily during the summer, one going south over the forest reserves and Waterton Lakes park to the International Boundary and one going north to the North Saskatchewan river. These outgoing patrols were made in the morning, the machines landing at temporary aerodromes at Pincher Creek and Eckville for a few hours and returning in the afternoon to the High River aerodrome. Special photographic work for mapping of rivers, timber, and roads was carried out several times with very good results.

It is impossible to overestimate the importance of the daily aeroplane patrol maintained in this district. This lies in the fact that the area covered each day includes all the less accessible portions of the reserves, thus enabling the ranger staff to concentrate on the most dangerous points and attend to other work necessary to the proper administration of the reserve. The effect of the patrol on campers and fishermen, of whom there are large numbers on the area covered, is excellent. Leaflets containing a warning to the public concerning the danger of forest fires have been dropped over fairs and sports held in different parts of the province.

Improvements.—During the year considerable progress was made in completing the improvement programme on the forest reserves. The structures erected included cabins, barns, granaries, one lookout station, besides smaller buildings.

The trail system has been greatly extended during the past season, and a large area has been opened up for easier travel and more efficient patrol. In all, some 230 miles of trail were built, mostly on the northern reserves. About 33 miles of telephone line were constructed, the larger part of which was in the Bow River forest. Emergency landing grounds for aeroplanes were constructed

on the Bow River and Crowsnest forests, and about six miles of fireguard along dangerous sections of railway line.

Grazing.—By the application of forest-reserve regulations, attempts have been made with encouraging results to introduce proper range management. The effect of this, as worked out with the co-operation of the grazing associations, has been to considerably conserve the forage in recent dry seasons. Permits issued during the summer season amounted to 586, approximately the same number as in 1921, covering 26,062 cattle, 8,106 horses, and 1,197 sheep. Winter-grazing permits were issued for 1,790 cattle and 2,600 horses. Grazing during the winter is not encouraged, but was deemed necessary last season owing to local and seasonal conditions. Although the stock, in a great many cases, was put on the range in the spring in poor flesh, they left the reserve in very good condition.

Increased use will likely be made of the northern forests, as many inquiries are being received as to grazing possibilities in these more remote areas. The northern districts will support many thousand head of stock, and from a forestry standpoint increased grazing will have a decided effect on the reduction of the fire-hazard produced by unconsumed forage.

DOMINION FORESTS IN BRITISH COLUMBIA

D. Roy Cameron, District Forest Inspector

In British Columbia the area under the administration of the Dominion Forestry Branch is confined entirely to the "Railway Belt."

Fire Protection.—The Railway Belt was again subjected to a fire season of abnormal severity, probably the worst it ever experienced. For several seasons past very severe weather in the autumn has been followed by very light snowfall in the winter. These conditions resulted in rapid run-off in the spring, causing the forest floor to become extremely dry, with a resultant period of high hazard before the new vegetation appeared.

The number of fires fought and extinguished during the season reached a total of 589. This was an increase of 144 fires over the previous year, 167 over 1920, 181 over 1919 and 300 in excess of 1918. The protective organizations were very severely tried, but, despite the continued strain on both staff and equipment, every fire was successfully handled.

The proportion of "large fires" reached 55 per cent of the total. This designation includes any fire, no matter how small, where expense is incurred. The total area burned over was 109,474 acres, which included old burns, slash areas, and merchantable and young timber. The area of merchantable timber burned totalled 42,502 acres, the area of young growth, 54,735 acres; the remainder was old burn, slash, etc. The loss of merchantable timber also showed a considerable increase over last season, but was much lower than for 1920—47,447,000 feet board measure in 1922, against 13,956,000 feet board measure in 1921, and 148,000,000 feet board measure in 1920. The reason for the marked decrease in comparison with the figures for 1920 is that the protective organizations have been brought to a state of higher efficiency since that season.

It is a disconcerting fact that during the past season fires attributed to incendiary causes reached a total of 101 out of a grand total of 589 from all

SESSIONAL PAPER No. 12

causes. Railways, however, with a total of 204, contributed the largest number of fires for the season. The majority of these fires were small and many not over a quarter of an acre. The efficiency of fire protection along railways and of railway co-operation is shown by the fact that in all the large number of outbreaks only seven fires reached the proportions of ten acres and over.

Fires from causes unknown come third in number with a total of 82, or a percentage of 13.92. A large proportion of unknown fires occurred along railway rights of way. These totalled 53, and the unknown fires for other areas, 29. Settlers come fourth on the list with 66 fires, or 11.2 per cent, the highest since 1919. Fires from lightning were comparatively few, with only 55, or 9.33 per cent; these were chiefly confined to the higher mountainous regions of the Revelstoke district. The remainder of the fires were attributed to various causes, of which campers and smokers contributed the most.

Improvements.—To complete the work started during the season of 1921, two lookout stations were finished and put in operation. The reserve area is now completely under observation as far as primary lookouts are concerned, and any further work in this connection will be undertaken with the object of occupying positions which will overlook areas of extreme hazard and great forest values and make primary points still more effective. Maintenance work was carried out on trails and buildings at various reserve headquarters.

In the Salmon Arm fire-ranging district work was completed on the installation of a lookout on Mara mountain, elevation 7,201 feet above sea-level. This mountain is the highest point on the Hunter's range, and is reached by a new trail from Sicamous 15 miles in length.

Work was commenced on the installation of the first lookout in the Revelstoke district, which is located on the summit of Cartier mountain at an elevation of 8,623 feet above sea-level. It overlooks the entire lower Columbia River valley and adjacent country. With the ten miles of trail and the nine miles of telephone line completed the lookout will be installed ready for use early in the 1923 season.

In the Coast district the only improvement work undertaken was the reconstruction of part of the Chilliwack River telephone line. Other minor improvements were undertaken by the regular staff.

Silviculture.—During the season of 1922 a forest-cover and topographical map of the Larch Hills forest reserve was completed, and an exhaustive study was made of the various timber types. Many sample plots were laid out in various types and locations. A few plots were laid out on cut-over areas as a means of studying results from possible silvicultural systems of cutting timber.

Timber-sale business suffered considerably from the general economic conditions; but towards the close of the fiscal year many inquiries were received and a number of sales made. Timber-permit business was stationary.

The season of 1922 was a poor year for the collection of tree seed. From the surplus supply of 1921 a large amount of seed was shipped to the United States and smaller amounts were forwarded to various points in Europe, Australia, and New Zealand. Douglas fir seed seems to be in demand for American and European markets, as is also Sitka spruce to some extent. Shipments to the British Government were small owing to the curtailment of expenditure in the forestry activities in Great Britain.

Insects.—Operations were brought to a conclusion in what was known as the Spius and Prospect Creek insect control. The main stand of yellow pine in this area has now been gone over with the result that insect depredations have been reduced from epidemic conditions to an endemic state. About 550 trees, totalling some 250,000 feet board measure, were cut and destroyed.

Recreational Uses of Forest Reserves.—Both Trout lake and Paul lake again drew their quota of tourist and summer-resort patronage. The main attraction is, of course, the trout fishing and it is regretted that Trout lake shows a falling off in the number of fish landed. The catch in Paul lake increased. The main reason for this is that Paul lake has better spawning facilities and has a much better natural situation to withstand drought conditions. In co-operation with the Department of Marine and Fisheries a small hatchery was installed on the main stream flowing into Paul lake which it is expected will improve conditions. The demand for camping permits and summer resort lots was greater than could be met during the past season.

FOREST PRODUCTS LABORATORIES OF CANADA

W. Kynoch, Superintendent

The period now under review was marked, as was the year 1921-22 by a considerably augmented demand for the services of the laboratories on the part of the industries and the public. The investigative and demonstration work carried out in the semi-commercial paper-mill was more extensive than in any year since its installation, while the research and allied work of the laboratories generally was greater in variety and amount than in any previous year since their inception.

A brief review of the main lines of investigation is given below:—

Sulphite Pulp from Jack Pine.—Object: to develop a process of sulphite cooking which will yield a pulp of high quality free from resin. The attempt was first made to eliminate resin by the use of cymene as an extracting medium. The results were unsatisfactory and the problem was next approached by careful manipulation of the cooking conditions. A material improvement was effected in the quality of the pulp. Further laboratory work, however, remains to be done.

Freeness as a Control Test in Ground-wood Production.—Object: to determine the feasibility of applying the freeness test as a control in ground-wood production. The adaptability of this test to control work was investigated very thoroughly with promising results. The investigation included work under commercial conditions at a paper-mill and arrangements have been made to do similar work at three other mills with a view to substantiating results obtained.

Determination of the Burning Temperature of Exposed Chips in Sulphite Cooking.—Object: to determine the maximum temperature to which spruce and balsam fir chips may be raised, before being covered with acid, without injury to the chips. The critical temperature was determined and the work successfully completed.

Pulping Qualities of Fire-killed Wood.—Object: to determine the effect of fire-killing and superficial charring on the pulping qualities of spruce and balsam fir. The work was concluded and indicated that the fire-killed material, of which large quantities exist in certain districts, can be successfully used for pulp manufacture by the sulphite process.

Chemical Research on Cellulose.—Object: to add to the knowledge of the constitution of the cellulose molecule and of the chemistry of the cellulose complex of Canadian woods generally. Attention was given chiefly to the investi-

SESSIONAL PAPER No. 12

gation of the chloral condensation products of cellulose on which a good deal of research work was done. The subject is a complex one and the investigation will be continued.

Refining of Waste-paper Stock.—Object: to develop the best method of recovering good paper stock from the condemned paper currency withdrawn from circulation by the Department of Finance, and to ascertain if this method can be profitably practised on a commercial scale. Refining of the stock produced under normal cooking conditions was carried out and, by the use of a special washing equipment, it was found possible to recover an absolutely clean pulp. The work will be continued on a commercial scale.

Preparation of Reference Collection of Microscopic Slides of Woods.—Object: to build up a collection of authentic microscopic slides of the important commercial timbers of the world and of photomicrographs illustrative of anatomical features. The work was continued from the preceding year and all Canadian timbers of any commercial importance have now been dealt with, together with a number of the more widely used foreign timbers. The work will be continued.

Ply and Laminated Construction.—Object: to extend the field of application of the built-up type of construction. Attention was first given to sporting goods of which large quantities are imported into Canada. A laminated ski and a built-up tennis racquet were developed, service tests of the former carried out and those on the latter begun. The results were decidedly encouraging and commercial production on a small scale is expected.

Kiln-drying.—Object: to investigate the scientific principles involved in kiln-drying and to improve present kiln-drying practice. A field study of kiln-drying practice at Canadian wood-working factories was begun and will be continued.

Water Storage of Ground-wood Pulp.—Object: to determine whether the decay which frequently occurs in stored pulp can be prevented by storage in water. Ground-wood pulp secured from various pulp-mills has been stored in water for periods varying from two to three years. Paper made from these pulps was tested and compared with paper made from similar pulps newly manufactured and the results demonstrated that pulp can be stored under water for considerable periods without deterioration. Commercial trials are to be undertaken.

Decay of Timber in Buildings.—Object: to secure exact 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 work has been in progress for some years, and expert technical knowledge on the prevention of decay has been secured as a result of decay studies in some hundreds of large buildings, a number of which were examined during the year. A special publication on the subject is being prepared.

Mechanical and Physical Properties of Woods Grown in Canada.—Object: to determine, by means of an exhaustive series of mechanical and physical tests, the strength functions of Canadian commercial timbers. Data have now been obtained for practically all Canadian timbers of any commercial value, but much work remains to be done before figures can be considered complete.

Glued Joints.—Object: to investigate the effectiveness of glues of the various classes for joint work. Some twenty-six commercial adhesives of the

hide and casein classes were investigated during the year, the work including both mechanical tests on joints and physical determinations on the adhesives. Ageing tests to secure information on the permanency of the adhesives were also undertaken.

Retention of Nails by Various Woods.—Object: to ascertain the relative ability of various woods to retain nails. Some six hundred tests were made with the specially designed equipment installed last year. Nails were of various types, such as cement-coated, barbed, etc. The work will be continued until all Canadian commercial woods have been covered.

Comparative Strength Values of Canadian Woods for Tie Purposes and Telegraph Top Pins.—Spike-retaining tests were made on cedar, spruce, and jack pine ties. The effect upon retention of driving into bored holes as compared with solid wood was carefully investigated, special attention being given to the effect of varying the diameter of the bored holes.

The strength of telegraph top pins of Canadian birch, beech, and maple was compared with that of top pins of imported woods. Results demonstrated that the Canadian hardwoods possessed ample strength for the purpose.

Creosote Treatment of Hard Maple for Railway Ties.—Object: to work out a satisfactory method of creosote treatment of this wood for tie purposes and to establish service tests in track. Maple proved to be a most erratic wood as regards penetrability with creosote oil, some material being very readily penetrable and some extremely refractory. Extensive work was done on treatment and a reasonably satisfactory method was finally worked out.

Creosote Treatment of Aspen for Railway Ties.—Object: to work out a satisfactory method of seasoning and of creosote treatment of this wood for tie purposes. The investigation is a preliminary one only, but it is believed that, by means of the incising process, the wood can be successfully and economically treated.

Preservative Treatment of Canadian Hardwoods for Top Pins and Pole Brackets.—A considerable amount of work was done both at the laboratories and at a plant manufacturing the accessories, and a satisfactory open-tank treatment was worked out.

Other investigations conducted included the determination of the sulphite pulping qualities of water-killed spruce; the development of a method of utilizing ground-wood screenings; the analysis of paper-fibres; the study of the relation of the rate of growth to the strength of several Canadian woods; the effect of red stain in jack pine; the chemistry and specifications of creosote oils, tars, and creosote-tar mixtures; and the treatment of woods to render them fire retardant.

Exhibits.—The collection and preparation of exhibits of forest products and articles manufactured or derived therefrom was continued and a number of additions made to the permanent exhibit at the laboratories. Exhibits were prepared also for the use of other Government offices and for display in public places.

There was a brisk demand for hand-specimens of Canadian woods. A new supply of sets was prepared, and a considerable number distributed in response to requests from educational institutions and others in Canada and abroad.

Library.—The reference library, which deals with the technology of woods, the products therefrom, and related matters, was materially extended and improved.

SESSIONAL PAPER No. 12

Information Furnished—The supplying of technical information in answer to inquiries relating to woods, their identification and to products manufactured or derived from woods is an increasingly important function of the laboratories. Well over five hundred such inquiries received attention during the year, a greater number than in any previous year.

Publicity.—A number of technical articles and news items were prepared during the year by members of the staff and published in Canadian and other periodicals or newspapers. The bulletin on the distillation of hardwoods, which was prepared last year, appeared in print and has been much in demand. A number of lectures and addresses were also given before scientific and technical societies.

TABLE I—STATEMENT OF REVENUE, FORESTRY BRANCH, FISCAL YEAR ENDED MARCH 31, 1923

Reserve	Timber sales		Timber fees and dues		Timber seizures		Grazing permits and trespass		Hay permits and seizures		Surface rentals		Special uses		Nursery stock		Unclassified		Total		
	\$	cts.	\$	cts.	\$	cts.	\$	cts.	\$	cts.	\$	cts.	\$	cts.	\$	cts.	\$	cts.	\$	cts.	
Turtle Mountain.....			290	30	54	78	2,608	20	571	00	77	60	18	00					3,619	88	
Spruce Woods.....			102	00			629	00	151	75									882	75	
Riding Mountain.....	246	00	6,790	57	277	15	536	35	843	50	491	40	669	00					9,853	97	
Duck Mountain.....			2,708	66	30	06	372	36	353	75	384	90	26	00					3,875	73	
Moose Mountain.....			549	55	16	00	573	60	356	75	131	00	585	25					2,212	15	
Beaver Hills.....			210	65	26	50	315	67	148	25			9	00		132	25		842	32	
Porcupine.....	1,382	60	1,274	47	66	75	699	83	464	50			280	30					4,168	45	
Pasquia.....	18,707	86	3,380	26			31	36	181	25			76	00					22,376	73	
Fort à la Corne.....	6,57	27	1,439	11	83	34							1	00					2,180	72	
Pines.....	67	20	2,495	95			513	30	62	75			39	00					3,178	20	
Nisbet.....			1,709	53	96	00	242	53	36	50			88	25					2,172	81	
Big River.....			39	15			808	95	341	59			45	00					1,234	69	
Steep Creek.....																					
Sturgeon.....			186	04	12	25	261	54	82	25			28	60					570	68	
Keppel.....			140	50	3	00	781	60	14	50			13	00					952	60	
Manito.....			371	40			2,394	74	71	25			49	00					2,886	39	
Dundurn.....			93	50			426	35	77	75			10	00					607	60	
Seward.....							610	64	45	75			26	00					682	39	
Elbow.....			40	50	5	00	982	55	48	00	83	32	47	00					1,206	37	
Big Stick.....							6,218	76					55	00					6,273	76	
Cypress Hills.....			1,992	78	95	54	3,884	07	3	50	34	95	17	00					6,027	84	
Cooking Lake.....			19	50			1,510	10	199	25			2	00					1,730	85	
Crownest.....	4,320	63	2,700	62	50	24	8,564	93	13	00	28	20	338	50					16,016	12	
Bow River.....			3,546	46	40	00	6,068	13	55	75			65	15					9,775	49	
Clearwater.....	5,054	97	208	63			424	72	12	00	560	32	198	00					6,458	64	
Brazeau.....	5,658	17	2,136	56	705	59	56	14			830	34	236	00					9,622	80	
Athabaska.....	5,001	19	2	00			75	76	31	00			148	00					5,257	95	
Lesser Slave.....	15,352	15					21	64	174	75			11	00					15,559	54	
British Columbia Reserves.....	515	00	120	60			15	50	123	00	225	25	147	00					1,146	35	
Indian Head.....															1,314	30	730	41	2,044	71	
Head Office.....	442	75																		442	75
Totals.....	57,405	79	32,549	29	1,562	20	39,628	32	4,463	34	2,847	28	3,228	05	1,314	30	862	66	143,861	23	

TABLE 2—STATEMENT OF TIMBER PERMITS ISSUED IN FOREST RESERVES, FISCAL YEAR ENDED MARCH 31, 1923

Reserve	No. of permits		Kinds and quantity of timber authorized to be cut									Dues and fees	
	Free	Paid	Poles or rails	Fence-posts	Saw-timber Ft. B.M.	Railway ties	Mine timber Lin. Ft.	Lath Pieces	Building logs Lin. Ft.	Fuel green Cords	Fuel dry Cords	\$	cts.
Turtle Mountain.....	2	42		2,200	24,200				960		321	290	30
Spruce Woods.....		24									117	102	00
Riding Mountain.....	120	624		13,377	1,900,363				40,057	521	9,221	6,790	57
Duck Mountain.....	50	220	3,000	5,067	2,699,323				16,961	221	894	2,708	66
Moose Mountain.....		114		4,775					1,580	273	393	549	55
Beaver Hills.....	5	35							10,180	92	87	210	65
Porcupine.....	35	69	800	24,563	1,460,614				13,010	10	864	1,274	47
Pasquia.....	10	118		4,700	101,700		90	434,000	6,044	312	8,265	3,380	26
Fort à la Corne.....	45	185		13,088	142,480		70		27,267	27	5,431	1,439	11
Pines.....	5	135	3,050	17,764		2,800			10,496	100	7,159	2,495	95
Nisbet.....	16	227	6,330	9,790	11,000				6,180		8,304	1,709	53
Big River.....	6	4		200					9,455		74	39	15
Steep Creek.....													
Sturgeon.....	9	13	600	1,800	103,150				6,818			186	04
Keppel.....	4	42	270	400					5,800	52	97	140	50
Manito.....	18	103	1,550	5,685					6,780	256	211	371	40
Dundurn.....		22								133		93	00
Elbow.....		26								2	67	40	50
Cypress Hills.....	86	557	42,097	48,955	202,300				49,191	1,145	2,184	1,992	78
Cooking Lake.....	2	5		7,000					300		47	19	50
Crowsnest.....	108	223	17,179	7,966	921,000		300		265,085	3	2,579	2,700	62
Bow River.....	13	99	17,318	5,525	15,500				290,176		4,774	3,546	46
Clearwater.....	42	26			1,011	1,369			9,506		1,058	208	63
Brazeau.....	9	24			150,000		1,533,547		69,647		269	2,136	56
Athabaska.....	2										50	2	00
British Columbia Reserves.....	7	14	1,000	660		2,500			11,100	53	94	120	60
Totals.....	594	2,951	93,194	173,515	7,732,641	6,829	1,533,847	434,000	856,593	3,200	52,560	32,549	29

14 GEORGE V, A. 1924

TABLE 3—STATEMENT OF GRAZING PERMITS ISSUED IN FOREST RESERVES, FISCAL YEAR ENDED MARCH 31, 1923

Reserve	No. of permits	Number of Stock				Dues and fees collected
		Cattle	Horses	Sheep	Total	
						\$ cts.
Turtle Mountain.....	98	1,406	195	1	1,602	2,608 20
Spruce Woods.....	20	267	59		326	629 00
Riding Mountain.....	59	973	82		1,055	469 15
Duck Mountain.....	12	529			529	273 06
Moose Mountain.....	40	878	87		965	560 60
Beaver Hills.....	38	509	82		591	315 67
Porcupine.....	43	1,177	69		1,246	642 03
Pasquia.....	6	47	10		57	31 36
Fort à la Corne.....						
Pines.....	29	1,199	76		1,275	513 30
Nisbet.....	18	544	11		555	242 53
Big River.....	5	530	26		556	808 95
Steep Creek.....						
Sturgeon.....	15	456	56		512	261 54
Keppel.....	31	1,134	314		1,448	675 60
Manito.....	111	3,663	773	25	4,461	2,220 42
Dundurn.....	23	718	181		899	426 35
Seward.....	24	350	292		642	610 64
Elbow.....	108	1,464	605	500	2,569	982 55
Big Stick.....	253	9,169	2,336	7,700	19,205	6,070 76
Cypress Hills.....	148	4,961	2,215		7,176	3,842 57
Cooking Lake.....	114	1,245	1,219		2,464	1,427 60
Crowsnest.....	263	13,391	3,749		17,140	8,564 93
Bow River.....	126	8,608	3,368		11,976	6,068 13
Clearwater.....	49	305	242		547	424 72
Brazeau.....	12	7	89		96	56 14
Athabaska.....	7	6	75		81	75 76
Lesser Slave.....	1	38	4		42	21 64
British Columbia Reserves.....	5	50			50	15 50
Totals.....	1,658	53,624	16,215	8,226	78,065	38,838 70

TABLE 4—STATEMENT OF TIMBER CUT ON FOREST RESERVES UNDER AUTHORITY OF TIMBER SALES, FISCAL YEAR ENDED MARCH 31, 1923

Reserve	Previous sales still operating	Sales made current year	Saw-timber	Mine Timber				Railway ties	Telephone poles	Dues collected
				Props	Props	Lagging	Lagging			
				Ft. B.M.	Lin. Ft.	Cords	Ft.B.M.			
										\$ cts.
Riding Mountain.....		1								
Pasquia.....	4	3	7,853,394			477				28,480 43
Porcupine.....	3		1,066,849							4,333 64
Fort à la Corne.....		3	43,511							65 27
Pines.....		1								
Athabaska.....	1		1,516,458							4,928 49
Crowsnest.....	1	2	3,086,239							4,629 35
Clearwater.....	2	2	172,019	1,473,428		318	149,162			5,176 49
Brazeau.....	2	2	2,495,500	193,866			261,726			6,314 11
Lesser Slave.....	1		4,698,278							12,423 68
British Columbia Reserves.....	5	2							2,790	22 55
Totals.....	19	16	20,932,238	1,667,394		795	410,888		2,790	66,374 01

SESSIONAL PAPER No. 12

TABLE 5--STATEMENT SHOWING QUANTITY OF TIMBER SOLD AND REVENUE DUE FISCAL YEAR ENDED MARCH 31, 1923, 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....	2	22.75	.....	.....	.....	.....	227 50	227 50
Duck Mountain.....	11	107.59	.....	.....	.....	.....	1,075 90	1,075 90
Totals.....	13	130.34	.....	.....	.....	.....	1,303.40	1,303.40

SASKATCHEWAN

Porcupine and Pas- quia.....	41	850.22	48,777,908	17,339,788	2,991,093	45,676 45	8,502 20	54,178 65
Nisbet and Pines....	4	80.69	185,537	.....	5,445	1,559 36	173 15	1,732 51
Totals.....	45	930.91	48,963,445	17,339,788	.....	47,235 81	8,675 35	55,911 16

ALBERTA

Crowsnest.....	11	234.92	8,741,308	2,530,200	757,543	12,601 98	2,349 20	14,951 18
Bow River.....	13	275.99	5,724,024	.....	1,255	4,165 86	2,759 90	6,925 76
Clearwater.....	4	371.52	160,760	.....	139,337	8,310 98	3,715 20	12,026 18
Brazeau.....	11	163.85	.....	.....	77,797	5,597 62	1,638 50	7,236 12
Totals.....	39	1,046.28	14,626,092	.....	975,932	30,676 44	10,462 80	41,139 24

BRITISH COLUMBIA

Totals.....	11	128.32	6,788,694	189	6,818 97	1,283 20	8,102 17
-------------	-----------	---------------	------------------	-------	------------	-----------------	-----------------	-----------------

ALL DOMINION FOREST RESERVES

Grand Totals.....	108	2,235.85	70,378,231	3,972,659	84,731 22	21,724 75	106,455 97
-------------------	------------	-----------------	-------------------	-------	------------------	------------------	------------------	-------------------

* The figures in this column indicate the number of units on which dues were calculated. They include 8,757 cords of fuel-wood, 5,260 telephone poles, 150 cords of shingles, 334 cords of slabs, 754,306 mine-props, 239,226 railway ties, 15,267 fence-posts, 45 cords of pulpwood, 1,064 rails.