

DEPARTMENT OF THE INTERIOR, CANADA
HON. CHARLES STEWART, MINISTER; W. W. CORY, C.M.G., Deputy Minister
E. H. FINLAYSON, Acting Director of Forestry

REPORT

OF THE

DIRECTOR OF FORESTRY

FOR THE FISCAL YEAR ENDED MARCH 31

1924

FOREWORD

DEVELOPMENT OF THE DOMINION FOREST SERVICE

As the year 1924 constitutes the quarter-century mark in the development of the Dominion Forest Service, a brief resumé of the history of the organization is appropriate. In 1899 an official having the title "Chief Inspector of Timber and Forests" was appointed "to inspect the already existing Timber Reserves, to visit timbered lands generally with a view of reserving suitable areas as Forest Reserves, and to look into the causes of forest destruction, especially by fire, and to suggest means of protection." In the appointment of this official the present Service had its origin.

Action was immediately taken to institute a system of fire protection on timber-lands controlled by the federal government; this work rapidly developed and at the present time is one of the most important functions of the Service. Another line of work inaugurated was the general examination of vacant Dominion lands with a view to segregating for timber production areas not suitable for agriculture but still capable of sustaining tree-growth. As a result, the first Forest Reserves Act was passed in 1906, setting aside an area of approximately 5,392 squares miles in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia—a total since increased, by successive Acts, to 34,440 square miles, of which there are roughly 3,906 square miles in Manitoba, 9,238 in Saskatchewan, 18,618 in Alberta, and 2,678 in British Columbia.

In 1905 a definite plan of forest surveys was inaugurated for the purpose of determining the extent and kinds of timber on the forest reserves. This work also has continued to the present time; while a great deal of ground has been covered, the surveys are still incomplete. Inasmuch as an accurate knowledge of timber content and timber quality is essential to the formulation of proper management plans, forest surveys constitute one of the most important fields of endeavour with which the service is faced.

Recognizing that the people throughout the country have an inherent right to enjoy at least some direct benefit from the forest policy, and viewing the bleak unsheltered conditions obtaining on parts of the western plains, the Department of the Interior inaugurated a system of tree distribution in 1901. Upon undertaking to follow a prescribed treatment in planting and caring for shelter-belts, settlers of the prairies have been provided with free trees. In 1904 the main nursery was established at Indian Head, Saskatchewan; beginning with only one quarter-section of land, this area has since that time been considerably expanded. In 1912 a subsidiary station was established at Sutherland, Saskatchewan, to permit of more advantageous distribution of tree stock in the more northerly districts. From both stations the annual distribution of trees has reached approximately five million, and during the entire history of the work some eighty million trees have been made available to the western farmers. The beneficial effects of such a policy are at once patent to anyone who has opportunity to witness the transformation which these plantations have brought about in a country otherwise destitute of tree-growth.

For the administration and protection of timber-lands coming under its control, the Service was in 1912 organized into inspection districts, one for each of the western provinces. District Inspectors have charge of all the work for their particular provinces, and under each Inspector is a complement of foresters and forest supervisors, who have charge of the individual reserves and forest districts.

Another line of activity lies in the conduct of the Forest Products Laboratories. The main laboratory was established in 1913 at Montreal, in co-operation with McGill University, and a sub-laboratory at Vancouver in 1918, in co-operation with the University of British Columbia for the purpose of handling local problems peculiar to the Pacific Coast. These laboratories conduct intensive research into the chemical and physical properties of wood and wood products, and are consequently of great service to the various timber industries.

A most important line of work lies in silvicultural research. This work involves complete study of the reproduction, growth, and yield of the various tree species under varying conditions. Only by intensive study and research is it possible to develop and apply in timber administration the fundamental laws which must be observed if perpetuation of the timber resources is to be obtained. For many years, owing to shortage of staff, but little attention could be given to this phase of forestry, but more recently greater development has taken place. On each of the forest reserves and at the forest nurseries some research is carried on, but in more recent years a definite Division of the Service has been organized. In 1917, by arrangement with the Department of National Defence, a forest experiment station was established at Petawawa, and in 1921, when the Commission of Conservation was abolished, several research projects instituted by that body were taken over by the Forest Service. Expansion has been recorded year by year, until to-day silvicultural research is being carried on at stations in Quebec, Ontario, the Maritime Provinces and on most of the Dominion forest reserves in the west.

In 1908 the Service instituted the collection of statistics regarding various classes of wood production, which work was rapidly developed until 1916, when by co-operative arrangement it was centred in the Bureau of Statistics.

The most recent development lies in the conduct of working-plan surveys on certain forest reserves in each of the western provinces, with a view to placing such reserves under definite scientific forest management. The aim of such plans is, of course, to perpetuate the timber stand — in other words, by applying the methods of cropping timber, to adopt the principle of sustained yield. Intensive work of this character may be economically undertaken only where there is sufficient assurance against losses from fire; fire protection, of course, must precede any plan of forest management.

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REPORT OF THE ACTING DIRECTOR OF FORESTRY

E. H. FINLAYSON

This report covers the work of the Forestry Branch for the fiscal year ended March 31, 1924.

The slight decrease in the revenue of the branch noted in my last (1923) report has proved, as anticipated, only temporary, and the revenue for the past fiscal year was the largest in the history of the branch, resuming the steady annual increase which it has shown for many years past. The depression in the live stock industry of the West was reflected to some extent in a diminution of revenue from that source, but the lessening of returns from this source is more than made up for by increases in every other item of the branch's income. Particularly is this true of the receipts from the disposal of timber.

In practically every respect the branch can report progress for the year. The forests under its control have suffered less from fire than for several years past. The work of forest research is increasing in scope and quantity and is becoming of greater interest each year. Investigation of forest statistics is being steadily pursued and the results are becoming more accurate and valuable. The co-operative tree planting on the prairies is well sustained and is entering new spheres of usefulness. The investigations of the Forest Products Laboratories in the industrial uses of wood are yearly becoming better known and more highly appreciated. In other divisions of the branch's work the same spirit of activity and expansion is noticeable.

FORESTRY CONFERENCES

During the year there were held two gatherings which bid fair to have a far-reaching effect on the status of forestry in Canada. The second British Empire Forestry Conference convened in Ottawa on July 25, 1923, and the sessions lasted until September 7, when the conference adjourned after its final session at Victoria, B.C. The greater portion of the time of the conference was devoted to actual investigations of forestry conditions in the various regions of the Dominion. Major General Lord Lovat, chairman of the Forestry Commission of Great Britain, presided. Delegates were present from Great Britain, the Irish Free State, India, Australia, South Africa, New Zealand, and many of the larger Crown colonies. The Dominion Forest Service, the various provincial forest services, and the forest industries were well represented. The forestry situation in Canada was considered in its chief phases, and the results of the deliberations were summed up in a series of resolutions which embody the recommendations of foresters of wide experience, and will be invaluable as a guide in formulating forest policy and procedure in treating Canada's forests.

As a sequel to the British Empire Forestry Conference, a conference on Forest Fire Protection was convoked in January, 1924, by the Minister of the Interior, and was attended by the provincial ministers charged with forest administration, together with their chief forest officers. The forest fire problem in all parts of Canada was exhaustively discussed, and the conclusions were summarized in a series of resolutions designed to serve as a basis for future action.

FIRE PROTECTION

The fire season of 1923 was a decidedly more favourable one than that of 1922, the total number of fire falling below that reported since the season of 1919. Fires reported in Dominion lands were less than half those occurring during the preceding season. In British Columbia, after a series of bad seasons, the fire season was about normal, with only a very short period of high fire-hazard. In April and May, dry weather in Alberta caused a danger season, which was later relieved by prolonged wet weather, though in northern Alberta the danger continued and many fires occurred during the summer. In Saskatchewan a period of somewhat high fire risk occurred during April and May. In Manitoba the season was generally favourable, though danger periods occurred in the latter part of May in southern Manitoba, and in June and July in northern Manitoba.

The total number of fires reported was 1,258; number of large fires 367 (29.2 per cent of the total); total area burned over, 439,361 acres; area covered with merchantable timber, 129,121 acres; area covered with young growth, 99,857 acres.

FIRES WITHIN FOREST RESERVES

Cause	1923		1922		1921	
	Number	Per cent of Total	Number	Per cent of Total	Number	Per cent of Total
Unknown.....	61	35	60	11	32	11
Campers and travellers.....	21	12	51	9	28	9
Settlers.....	43	24	28	5	10	3
Railways.....	30	17	388	66	193	65
Lightning.....	4	2	12	2	9	3
Lumbering.....	2	1	.....	.....	.....	.....
Incendiary.....	8	4.5	34	6	23	8
Brush disposal other than by settlers.....	1	0.5	1	.....	1	.....
Other known causes.....	7	4	8	1	4	1
Total.....	177	100	582	100	300	100

FIRES OUTSIDE FOREST RESERVES

Unknown.....	236	22	292	14	174	15
Campers and travellers.....	193	18	314	15	108	10
Settlers.....	298	28	705	35	329	29
Railways.....	203	19	486	24	370	33
Lightning.....	73	7	105	5	38	3
Lumbering.....	15	1	11	.....	12	1
Incendiary.....	26	2	76	4	20	2
Brush disposal other than by settlers.....	12	1	32	2	37	3
Other known causes.....	25	2	30	1	46	4
Total.....	1,081	100	2,051	100	1,134	100

TOTAL OF ALL FIRES ON DOMINION LANDS

Unknown.....	297	24	352	13	206	14
Campers and travellers.....	214	17	365	14	136	10
Settlers.....	341	27	733	29	339	24
Railways.....	233	18	874	34	563	39
Lightning.....	77	6	117	4	47	3
Lumbering.....	17	1	11	.....	12	1
Incendiary.....	34	3	110	4	43	3
Brush disposal other than by settlers.....	13	1	33	1	38	3
Other known causes.....	32	3	38	1	50	3
Total.....	1,258	100	2,633	100	1,434	100

AEROPLANES

Aeroplane patrols were continued in Alberta and Manitoba, and their work is highly commended by the officials in charge of these districts. The fact that aircraft can be used successfully in forest protection is now fully established. The only remaining step is to perfect organization and develop equipment which will ensure maximum efficiency at costs within the economic means of forest



PLATE 1.—A CUTTING WELL CLEARED OF BRUSH AND CUTTING DEBRIS. (Forestry Branch Photo No. 9895.)



PLATE 2.—A CUTTING WHERE NO BRUSH DISPOSAL HAS BEEN ATTEMPTED. (Forestry Branch Photo No. 13659.)

The proper disposal of the debris from cutting operations results in a tremendous reduction of the forest-fire risk. In an area such as that pictured in the lower of these two plates it can readily be seen how much easier it is for a fire to start, and how much harder it is to check and fight it, than it is in the upper picture, which shows an area on a National Forest where the debris has been properly disposed of. Fed by such debris as is shown in Plate 2 the fire may become so hot as to actually burn up the soil of the area, where this soil is thin, as it is in many forests; all the trees will likely be consumed, and so neither seed nor soil will be available for a second crop. On the cleared area, on the other hand, any seed that falls from the trees will find favourable soil, and a second crop will eventually spring up on the area from the seed of trees left for this very purpose.

authorities. The Royal Canadian Air Force and the Dominion Forest Service are bending all their energies to this end. The necessary practical experience and working knowledge of essential factors involved in reducing costs are being obtained through the operations in Manitoba and Alberta. These operations to-day serve a double purpose. They provide patrols for areas otherwise impos-

sible of protection, and at the same time serve as proving grounds in which organization and material can be developed suited to the needs of all forest-protective agencies.

IMPROVEMENTS

In Manitoba and Saskatchewan the favourable fire season enabled extensive programs of improvements to be carried on. In southern Alberta a very wet spring hindered improvement work, and later in the season much work had to be done in the repairing of flood damage. In northern Alberta, however, more new construction was carried on. In British Columbia comparatively little was done, owing to the fact that the work originally planned had been practically completed. The following is a summary of improvements:—

	Number		Miles
Cabins.....	15	Roads.....	29
Ranger station houses.....	3	Trails.....	182
Stables.....	16	Telephone lines.....	144
Other buildings.....	19	Fireguards (cleared).....	62
Bridges.....	2	Fireguards (ploughed).....	136
Lookout towers.....	9		

TIMBER OPERATIONS

The policy of the Forestry Branch in the disposal of timber is working out satisfactorily. The province of Saskatchewan reports the most active season so far in this regard, which was marked by the largest sale on record under authority of the Forestry Branch. Manitoba reports an increase in the number of permits for saw-timber and fuel-wood. Alberta, while reporting a diminished cut under timber sales, records an increase in the number of permits and in the quantity of timber removed. The policy of requiring the overmature, burned, and diseased timber to be taken first is being continued, with beneficial results to the forests. Experiments in regard to the cost of brush-disposal were carried on in each inspection district and a volume of useful data recorded. Studies in this most important subject must be continued before definite figures can be made public.

PLANTING AND SEEDING ON FOREST RESERVES

The experimental planting and seeding was this year extended. This work is being done with a view to determining the best methods of artificially restocking certain treeless or burned-over areas on the forest reserves. On the Cooking Lake forest reserve this year about 21 acres were planted with 65,478 young trees, of which approximately half were jack pine and the remainder white spruce. One and three-quarters acres on the Riding Mountain forest reserve were also set out with some 3,000 jack pine. In addition, 17½ acres in the Cooking Lake forest reserve were experimentally seeded with lodgepole pine. The policy of establishing small local nurseries on the reserves is being steadily developed and this year all the planting material used was produced in the local nurseries, except about 3,000 plants.

GRAZING

A continued decline in grazing on the forest reserves is reported from all the prairie districts. In all these districts, however, the stock left the reserves in good condition. The decline was in part attributed to the good supply of feed on private lands. In British Columbia a grazing policy was inaugurated during the year, and three co-operative stock associations formed.

PUBLICITY

Good results are accruing from the publicity work done in connection with fire protection—increasingly so as the work becomes more aggressive and intensive.

BOUNDARIES

By the provisions of the amendment to the Forest Reserves and Parks Act made during the year, a net addition of 106 square miles was made to the area of the Dominion forest reserves. One new reserve, the Sandilands forest reserve, in southeastern Manitoba, having an area of 187.75 miles, was added, and small areas, originally included in various forest reserves, were withdrawn on the ground of having been found to be suitable for farming.

TREE PLANTING ON PRAIRIE FARMS

A lively interest continues throughout the Prairie Provinces in tree planting; especially is this true with regard to the growing of fruit trees, for which, in these provinces, shelter is essential, and in the planting of field-shelters. The number of seedlings and cuttings distributed again exceeded five million. Great success has been obtained in the more recent plantations, of which 75 per cent of those inspected were reported as in a flourishing condition, 19 per cent fairly good, and somewhat less than 6 per cent neglected. Of old plantations, five years old and upwards, inspected, 75 per cent were in good condition, 15 per cent fairly good, and 10 per cent poor. Though no fruit trees are propagated at the nursery station for distribution, some kinds of fruit have been grown experimentally under the protection of shelter-belts, and these competed successfully with similar fruit grown in British Columbia. Evergreen plantations continue to thrive. Reports of injury to plantations indicate damage from snow-break and from the tent caterpillar. Nursery stock, both at Indian Head and Sutherland, made splendid growth. Collection of tree seed was made as usual.

FOREST PRODUCTS LABORATORIES

The Forest Products Laboratories again report an increase in the demand for their services. The requests for technical information and services were greater than in any previous year, and the amount of research and investigative work also increased. Of the major investigations carried out, a number were continuations of projects begun in previous years. This class of investigation included research on the manufacture of sulphite pulp from jack pine, freeness tests in mechanical pulp manufacture, chemical research on cellulose, and the refining of waste paper stock in the Division of Pulp and Paper. The Division of Timber Physics continued the investigation of kiln-drying and the preparation of the reference collection of microscope slides of woods. The Division of Timber Tests did further work on the determination of the mechanical and physical properties of Canadian woods, the investigation of the strength of glued joints, and the nail-holding power of woods, and the Division of Wood Preservation again pursued researches on the creosote treatment of Canadian hardwoods for top pins and the seasoning of hard maple ties. Major projects taken up for the first time included the development of methods of testing pulp for strength in the Pulp and Paper Division, an investigation of the physical properties of pulpwood with reference to deterioration in storage in the Division of Timber Physics, the effect of red stain and red rot on the strength of jack pine ties in the Division of Timber Tests, and work on the open-tank creosote treatment for preserving wood in the Division of Wood Preservation. A number of minor projects were also taken up. The laboratories also aided greatly in

the preparation of the timber exhibit for the British Empire Exhibition being held at Wembley, England. A number of addresses were given by members of the staff at various meetings, and several articles prepared for technical journals.

FOREST RESEARCH WORK

The work of the Research division has increased during the past fiscal year both in scope and quantity. Investigations were continued in Ontario, Quebec, New Brunswick, and on the Dominion forest reserves in the western provinces. The work is directed by the Division of Research at Ottawa, and is carried on at a number of points in the various provinces.

In Ontario this year's research work was confined to the Petawawa forest experiment station in the Ottawa valley. Many plots in the white pine-red pine type were thinned in the course of the study of the effect of thinnings on yield. Experiments in connection with the study of natural and artificial reproduction of desirable species were continued and tentative results were obtained. These will be substantiated by further work. Some of the results of earlier work are now becoming available as the first five-year period since the establishment of the first plots in 1918 is completed.

Much of the Petawawa reserve is either composed of abandoned farm lands or covered with undesirable and inferior species. This year the forest nursery was extended, some eighty seed-beds being made. The stock from this nursery will be used for experimentation with artificial reforestation of these lands.

In Quebec extensive experimental cuttings were made in co-operation with Price Brothers and Company, Limited. The various recognized methods of cutting were tried on large blocks in an attempt to find the best method of favourably influencing advance coniferous growth.

A small amount of work was done at the Lake Edward forest experiment station in the St. Maurice valley. The results of much of the work at this station are becoming available and will assist in planning future work in the district and type.

In New Brunswick, in co-operation with the Pejepsco Company, Salmon River, comprehensive studies of the contents of piled cords of various-sized trees were undertaken. The information thus obtained will be of great value in estimating the contents of stands in cords in connection with cruising on working plans.

Under financial aid from the Honorary Advisory Council for Scientific and Industrial Research, the New Brunswick provincial forest service has undertaken extensive experiments in reseeded burned areas. This division is co-operating in establishing permanent sample plots to study the results of the work.

The investigation of taper as a factor in the measurement of standing timber has been completed for five of the principal coniferous species. Volume tables in merchantable board feet and total cubic feet, based on this investigation, are now available for white pine (120 years and over), black spruce, white and red spruce, and balsam fir.

During the season a schedule of various studies undertaken or projected was made, and short reports prepared under each heading of the schedule. This report is in mimeographed form. It will be revised from year to year as the results of the earlier research work become available.

An interesting feature of the work of the year was the inauguration of experimental work in thinnings at the Indian Head Forest Nursery Station, the work being conducted in a one-acre Scotch pine plantation, aged 17 years. Work done in the reserves has centred in the selection and treatment of sample plots, experiments with methods of seeding and planting, and the care of the nurseries on the reserves. Cover and type maps have been made on a number of reserves.



PLATE 3.—A STAND OF WHITE AND RED PINE BEFORE THINNING. (Forestry Branch Photo 15287.)



PLATE 4.—THE SAME STAND AS IN PLATE 3 AFTER THINNING. (Forestry Branch Photo 15738.)

An important part of the investigations of the forest service at the forest experiment stations consists in the study of various species. The pictures above show the effects of thinning on a pine stand. The volume of the stand, that is, the actual quantity of wood calculated in board feet, cords, etc., was carefully computed before the thinning took place, and after the lapse of a certain period will again be computed so that the improvement in growth can be actually measured and eventually the conditions ascertained that will give maximum growth.

FOREST RESOURCES AND STATISTICS

The most important feature of the work of this division during the year has been the preparation of a comprehensive report entitled "The Forests of Canada" for the British Empire Forestry Conference.

This report contains a description of the forest conditions and the systems of forest administration throughout the Dominion, a summary of the forest production and losses through fire, insects, etc., the exports and imports of forest products, and the estimated stand of merchantable timber. The information collected for this report is being kept up to date.

Bulletins have been prepared on the wood-using industries of Ontario and on those of the Maritime Provinces, and material is being collected for one covering Quebec.

The preparation of the report on the forest resources of Ontario has been delayed on account of the work in connection with the British Empire Forestry Conference, but is well advanced.

PUBLICATIONS

During the year a new series of circulars known as "Tree Pamphlets" was instituted. These circulars are designed to be popular in style and are illustrated. Each pamphlet deals with a single tree species and is printed in both the English and the French languages. Six of these tree pamphlets were issued during the year.

Other new publications are Circular 16, "Preservative Treatment of Fence-posts"; Circular 17, "Forest Investigative Work of the Dominion Forest Service," and a circular entitled "The Tree-planting Division: its History and Work." Bulletin 69 (Care of the Woodlot) was issued in French (*Entretien d'un Lot Boisé*).

An important part of the publication work of the branch during the year consisted of special publications issued in connection with the British Empire Forestry Conference. A series of pamphlets was prepared for the use of delegates, giving the program of the conference and an outline of the tours taken by the delegates. The report of the Dominion Forest Service delegates to the conference was printed as "The Forests of Canada." The Summary Report of Proceedings of the Conference was also published by this branch.

The pamphlet "Talking Trees" was reprinted. Other means of publicity employed were the distribution of whetstones, aeroplane cards for use particularly at western exhibitions, radio messages, etc.

THE LIBRARY

Six hundred and ninety-six books and pamphlets, 700 photographs, and 3,174 index cards represent the growth of the library during the past year. Ninety-five periodicals were received by subscription and exchange, and newspaper clippings numbered 6,334. The index to the photographs, which now number 17,000, has been brought up to date. The distribution of the "monthly list of accessions to the library" to the field staff, members of the forestry profession, and others interested continues to receive favourable comment. The publication of the bibliographies has been continued, twenty of these lists having now been issued.

STAFF

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

Head office.....	61
District inspectors.....	4
Assistant district inspectors.....	2
Forest supervisors.....	20
Foresters and forestry assistants.....	26
Forest rangers.....	87
Chief fire rangers.....	9
Promoters of tree planting.....	7
Forest Products Laboratories, technical staff.....	16
Outside clerical staff.....	35
Other classes.....	13
	280

APPROPRIATIONS

The appropriation for the fiscal year was \$1,088,400. The expenditure was divided as follows:—

Salaries at head office.....	\$	28,061 38
Travelling expenses.....		2,600 98
Printing and stationery.....		13,116 59
Miscellaneous expenses.....		12,954 53
Fire ranging.....		208,980 43
Forest reserves.....		526,854 09
Surveys and research.....		50,257 61
Tree planting.....		67,310 26
Forest Products Laboratories.....		94,326 49
Total.....	\$	1,004,462 36

The field expenditure in the western provinces exclusive of tree planting on prairie farms and the Vancouver forest products laboratory is divided as follows:—

Manitoba.....	\$	131,797 80
Saskatchewan.....		199,714 10
Alberta.....		264,914 74
British Columbia (Railway Belt).....		146,147 61
	\$	742,574 25

The above expenditure is the net amount after deducting the refunds of fire-guarding dues amounting to \$29,997.02.

THE TREE-PLANTING DIVISION

Norman M. Ross, Chief

Precipitation throughout the prairie regions during 1923 was in most districts above normal. The only district suffering from lack of rain was a very restricted area in southern Manitoba east of the Pembina mountains. Inspection indicated that conditions generally were very favourable both for new and older plantings. An average of 88 per cent of all stock sent out this season is reported as having started successfully. Individual inspection reports show that out of 5,152 plantations inspected 3,877 are in a flourishing condition, 969 fairly good, and 306 (approximately 5.9 per cent) more or less neglected. Of older plantations five years of age and upward 832 reports show 75 per cent in good condition, 15 per cent fairly good, and 10 per cent poor.

Increasing numbers of inquiries are being received in the office for information relative to tree growing generally, and the number of correspondents seeking advice in regard to fruit growing indicates that farmers are waking up to the possibilities in this line under prairie conditions. On the Nursery at Indian

Head over 1,400 pounds of plums were ripened and were of sufficiently good quality to sell locally at the same price as plums shipped in from British Columbia. Standard apples of six different varieties were also ripened at the Indian Head Nursery Station, over 250 pounds being picked. While fruit trees are not propagated for distribution, the small trial orchards here provide a most excellent demonstration to the hundreds of visitors who come to the nurseries during the summer months.

Greater interest is being shown in the establishment of field-shelters to control soil-drifting. In 1923 field-shelters to the number of 107 were set out, and about 100 are to be planted this spring.



PLATE 5.—TREE-BELTS WILL PREVENT SOIL-DRIFTING. (Forestry Branch Photo No. 15703.)

The illustration shows a field-shelter on a prairie farm five years after planting. The trees prevent the drifting of the soil just as they do the drifting of the snow.

Evergreens planted in 1923 have been very successful, and reports from older evergreen plantings indicate that this is the most valuable class of tree for prairie shelter-belts.

The plantations were this year reported as exceptionally free from winter-killing, but owing to the exceptionally heavy snowfall many older belts not protected by a snow-break suffered a good deal from the heavy drifts breaking down the trees.

The tent-caterpillar infestation was more widespread than last year. About two years ago a very bad infestation appears to have started from two centres, one in Moose mountains in Saskatchewan, the other in northern Alberta in the neighbourhood of Edmonton. Egg masses have been found in nearly all plantations in south-central Saskatchewan, and much injury is expected during the coming season both in natural poplar stands and in the cultivated belts. The caterpillars may be controlled on small areas by using arsenate of lead as a spray, and information to this effect is being disseminated. No other serious insect damage has been reported except where the poplar leaf-beetle was very numerous in Alberta in certain localized areas.

Nursery Work.—Owing to the abundant precipitation nursery stock made a splendid growth both at Indian Head and Sutherland. The maple stand was considerably reduced in numbers, however, as fairly large areas were drowned out, water lying in all the low spots for several days following heavy rains.

The ash sown in the fall of 1921, which should have been ready for lifting in the fall of 1923, was a complete failure, so that the actual number of seedlings produced is considerably less than planned.

The coniferous seed-beds all came along well, and seedlings of all varieties made an excellent growth.

Distribution of Broad-leaved Stock.—The figures with respect to the 1923 distribution of broad-leaved stock are as follows:—

Number of applicants receiving trees.....	4,326
Seedlings and cuttings distributed.....	5,100,680
Average number per applicant.....	1,175
Number of applicants on inspection list in 1923.....	8,791
Number of new applicants on inspection list for 1924 (approximately).....	2,500

The broad-leaved material (at Indian Head and Sutherland nurseries) heeled in ready for distribution in the spring of 1924 consists of maple, 605,000; ash, 164,000; Rusian poplar, 1,054,300; Northwest poplar, 17,150; laurel willow, 1,293,500; acuteleaf willow, 160,000; red willow, 36,000; caragana, 2,331,500, making a total of 5,661,450.

Distribution of Conifers.—Evergreen transplants were supplied to 285 applicants at a nominal charge as follows: White spruce, 20,400; jack pine, 15,300; Scotch pine, 10,135, a total of 45,835. In addition to these some 3,000 jack pine transplants were shipped to Dauphin, Man., for forest-reserve planting.

Collection of Tree Seed.—Three thousand pounds of Manitoba maple seed were collected at Dauphin, Man., and 318 pounds in the Qu'Appelle valley near Indian Head, Sask.; 2,053 pounds of green ash seed were also collected in the Qu'Appelle valley, and 716 pounds of caragana seed on the Indian Head Nursery Station.

Forty-one bushels of lodgepole pine cones collected in the foot-hills of the Rockies in Alberta were shipped to Indian Head for extraction and produced 11¾ pounds of cleaned seed, a very low yield compared to other conifers. One hundred bushels of jack pine cones collected in the Prince Albert district produced 52 pounds of cleaned seed, and 21 bushels of white spruce from the same source yielded 12½ pounds of cleaned seed. Spruce seed has been very scarce for the past two years. There was a fair crop of cones on the Spruce Woods reserve, but seed was practically all destroyed by a grub which bores into the cones.

A quantity of extracted but uncleaned spruce seed was sent in from Entrance, Alberta, and produced 50 pounds of good seed.

Seed Distribution.—Twenty-three pounds of maple seed, 6 pounds of ash seed, and 20 pounds of caragana seed were sent out to 52 applicants in the spring of 1923.

In addition the following amounts of coniferous seeds were shipped for experimental forest planting:—

To. Cooking Lake reserve.....	20 lb. spruce.
Prince Albert inspection office.....	15 " spruce.
Prince Albert inspection office.....	15 " jack pine.
Spruce Woods reserve.....	20 " jack pine.
Petawawa experiment station.....	10 " spruce.

Experimental Thinnings Begun.—The first thinning experiment was started on the Indian Head Nursery Station on February 28, 1924, in Permanent Plantation No. V. This plot comprises one acre set out to pure Scotch pine in 1906, set approximately 4 feet by 3 feet 6 inches. The growth has been consistently good, and growth measurements have been made every season. In 1923 the measurements showed the average height to be 23 feet 9 inches, the average

diameter at breast-height to be 4.64 inches, the maximum height to be 27 feet, and the maximum diameter at breast-height to be 6.08 inches.

Before thinning, the plot was divided into three equal parts; one portion is left as a check, one portion was thinned of all dead and suppressed trees, and in the third portion, in addition to dead and suppressed trees, a number of intermediate specimens were removed. All material thinned out which would measure down to $1\frac{1}{2}$ inches in diameter was cut up and piled. Three-fourths of a cord of wood was taken out of the lightly thinned plot and $1\frac{3}{4}$ cords from the more heavily thinned plot. The object of the thinning is to see what the effect will be on the growth of the remaining trees.

DOMINION FORESTS IN MANITOBA

H. I. Stevenson, District Forest Inspector

During the year 1923 the Porcupine No. 1 forest reserve was transferred for administration from the Saskatchewan to the Manitoba district, and a new reserve, created by Act of Parliament in southeastern Manitoba and named the Sandilands forest reserve, was added to this district. There is now a total of 2,551,965 acres in forest reserves in Manitoba.

Fire Protection.—Weather conditions during 1923 were generally favourable for fire prevention, with the exception of a period during the latter part of May in the southern and southeastern parts of the province and the months of June and July in the northern districts. The heavy snowfall of the preceding winter left the ground well saturated and low-lying areas flooded. The most critical period, during which the largest number of fires occurred, was the last fortnight in May. Strong winds and high temperatures rapidly dried out the dead herbaceous growth of the previous year, particularly on the higher lands. Fires were general over the whole southern area during this period.

A total of 186 fires was reported during the season; of these 69 (37 per cent) were fires burning more than 10 acres each. The total area burned was 103,269 acres, of which 32,453 acres were merchantable timber, 34,717 acres young growth, and the remainder grass land, marsh or muskeg. Of the total fires, 80 (43 per cent) originated from unknown causes, 31 (17 per cent) were caused by railways; lightning and settlers accounted for 26 (14 per cent) each, and the remaining 23 (12 per cent) arose from miscellaneous known causes.

In several cases during the season it was found necessary to prosecute offenders against the fire laws, and convictions were secured in some thirteen cases. Prosecution was resorted to only where the law had been maliciously and wilfully violated.

Every year a greater degree of assistance and sympathy is being received from the public in connection with fire-prevention work, and this co-operation accounts largely for the reduction in the number of fires in the province.

In 1923 the railway fire inspection work of enforcing the fire regulations of the Board of Railway Commissioners was placed under the supervision of the Manitoba inspection office. This arrangement has permitted better co-ordination of the work.

Aeroplane Patrol.—Seaplanes or flying boats, supplied by the Royal Canadian Air Force, were again used in fire-protection work in the northern and northeastern parts of the province. Only a skeleton ground force was left in the three fire-ranging districts to act as observers and to take charge of any fires which might occur. The seaplanes again demonstrated their value in this class of work in policing and detecting and in carrying fire-fighting crews and equipment for the suppression of fires. Unfortunately only three HS2L flying boats were available for the work, with no spare machines; it was possible therefore to give only partial protection by air patrols.

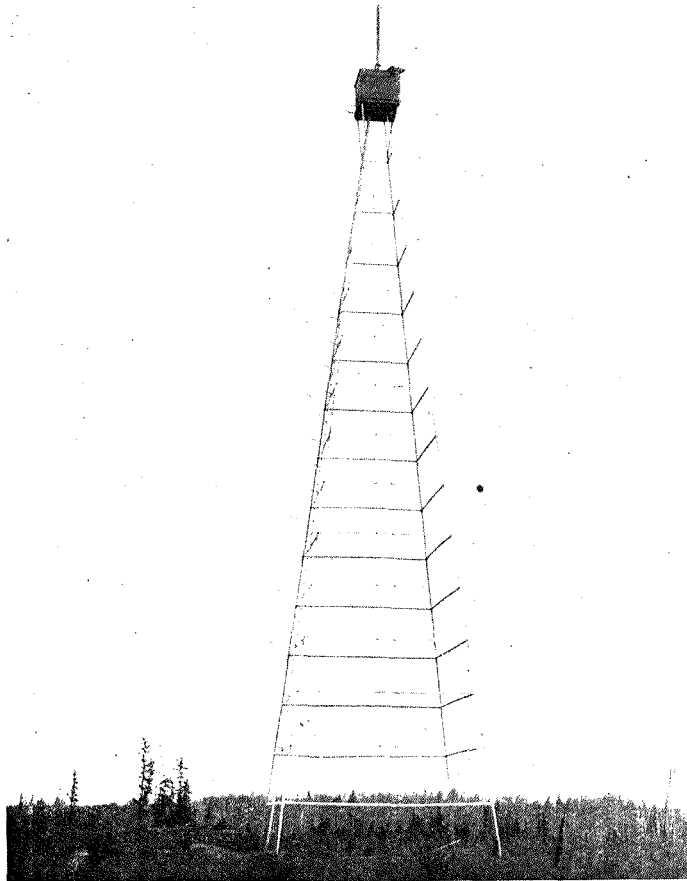


PLATE 6.—A STEEL LOOKOUT TOWER OF THE KIND USED ON THE LARGER RESERVES. (Forestry Branch Photo No. 12801.)

A comprehensive system of lookout towers from which an entire forest area can be overlooked gives probably the best form of protection from fire that can be provided for average forested areas. The steel towers are considerably higher than the wooden towers, and so the area which can be watched is greatly increased, compensating for the higher cost of the steel towers.

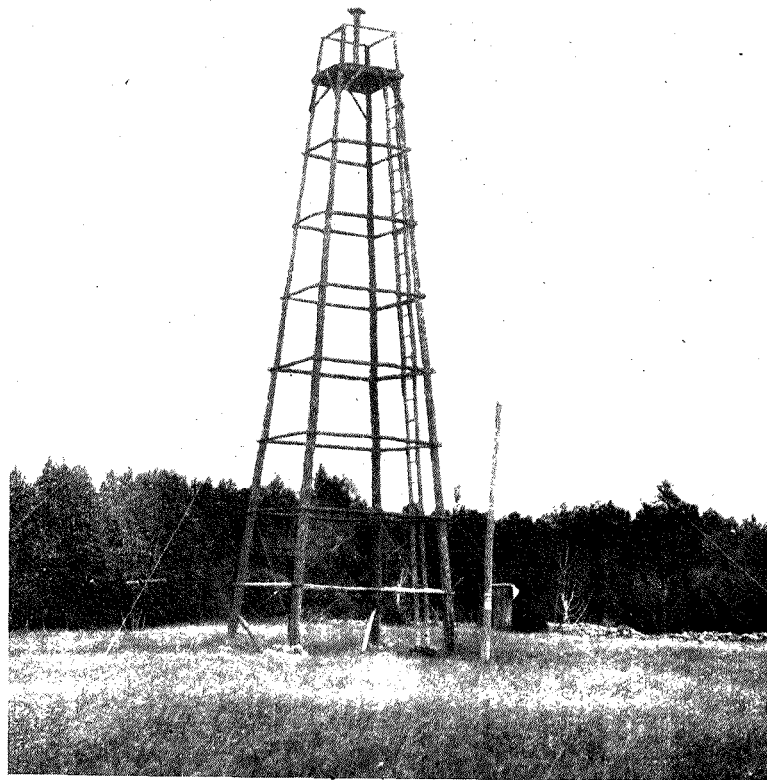


PLATE 7.—WOODEN LOOKOUT TOWER ON THE PETAWAWA FOREST EXPERIMENT AREA. (Forestry Branch Photo No. 16540.)

Forest protection is put in practice on the experiment forest as on the forest reserves. There are now seven towers similar to the above in the Petawawa forest. At the top of the tower is to be seen a fire-finder for use in locating fire. The tower is connected by telephone with the headquarters of the Station, and with compass readings from two neighbouring towers a fire can be located on the map in a short time.

In connection with flying operations the Royal Canadian Corps of Signals established wireless stations at Norway House, Victoria Beach, and Winnipeg. Continuous service was maintained between these points and the assistance given in this way enabled the air patrols to be carried out to the best advantage.

Improvements.—During the year extensive improvements were made to ranger headquarters. General repairs were made to 175 miles of telephone line; about 10 per cent of the poles were replaced, and the lines were put in good working condition. Approximately 250 miles of road were repaired and five miles of new automobile road graded. This work necessitated the building of 14 new bridges and 42 culverts of varying sizes. One hundred and sixty-eight mile of fireguard were reploughed and 38 miles of new fireguard cut.

Silviculture.—The past year has shown an increase over the previous year in the number of permits issued both for saw-timber and firewood, particularly the latter. This extensive demand for fuel has enabled the reserves to dispose of large quantities of burned timber and diseased aspen or poplar. In order to encourage the cutting of this diseased aspen and remove it from the reserves, areas have been set aside in certain localities where settlers may secure fuel-wood free from dues. This is an assistance to the settlers during the present period of financial depression, and the removal of this diseased wood is an advantage to the reserve.

The technical staff has continued the investigative work of previous years, and much valuable information has been recorded. Further experimental sample plots have been located and marked, and records secured for the study of site, density, growth, etc., of the different species.

A number of experimental areas were planted under different conditions of soil-cover, etc., all available stock from the Indian Head Nursery being used.

Particular attention has been paid to seeding by broadcasting, drilling, and other methods, and a large number of plots were seeded under different conditions this year. Encouraging results have been obtained.

Surveys.—Traversing roads and trails and locating and tying in various lakes and rivers occupied considerable time of the reserve staffs. This work has been necessary in order to correct the early maps of the various reserves and to establish permanent points and boundaries from which future work can be carried on. Part of the boundary of the new Sandilands reserve was surveyed and marked with permanent iron posts.

By sketching from seaplanes on their regular fire patrols an excellent map of some 1,200 square miles of country north of lake Winnipeg was obtained. Topographical features, forest-type boundaries, etc., were plotted with reasonable accuracy.

During the summer a detailed reconnaissance was made of a number of townships in the northern part of the Duck Mountain forest reserve, an estimate of timber in this area being required and also information for a new forest-cover map now being completed. Rapid reconnaissance surveys were also made of several new areas in the province by the regular staff.

Recreational Uses of Forest Reserves.—Summer resorts already established in the different forest reserves continue to grow, necessitating the laying out of additional lots. Excellent cottages are being built, usually exceeding in value the minimum set in the forest-reserve regulations. The use of the forest reserve for summer-resort purposes is exceedingly popular and has become firmly established. Applications are continually being received from different localities to establish other summer resorts.

As the roads in the reserves are improved and made fit for automobile traffic, visits to the reserves for camping, picnics, etc., are becoming a regular habit of the people even from long distances, and this traffic is particularly heavy on Sundays and holidays.

Fish and Game.—Fishing on forest reserves provides an interesting pastime for campers and settlers in the vicinity of the reserves. The measures taken to restock and protect fish in the different lakes have been successful, and the majority of the lakes are well stocked.

Small game, such as prairie chicken, partridge, etc., has increased very rapidly in the last few years, and the reserves are now well supplied. Rabbits, which had practically disappeared in 1922, are now numerous, and, with their return, fur-bearing animals, which depend on them for food, are also returning and are plentiful. Unluckily the larger animals, moose, elk, and deer, are diminishing, owing to the encroachments of settlement.

Grazing.—The year 1923 again showed a falling off in the number of animals grazing on forest reserves, although practically the same number of permits was issued. Owing to the continued wet season the range remained in excellent condition, and all stock left the reserve in splendid shape.

Publicity.—Special attention has been given to publicity during 1923. It is realized that there is little hope of securing proper fire protection without the assistance and sympathy of the public. A campaign of education was therefore undertaken, and by lectures, distribution of literature, and posters an endeavour has been made to inform the public of the value of the forests and of the enormous annual fire losses. The advantage of this publicity campaign has already been observed, and it is felt that through it, to a large degree, the sympathetic interest of the public has been secured.

DOMINION FORESTS IN SASKATCHEWAN

C. MacFayden, District Forest Inspector

The year under review was one of the most generally satisfactory in the record of the work of the Forestry Branch in Saskatchewan.

Thirty-one sections considered suitable for agriculture were withdrawn from the Beaver Hills forest reserve. Applications for the withdrawal of certain quarters, sections, or blocks that are represented as of agricultural value continue to be made, though in lessening numbers. These lands are being examined and when found as represented are promptly withdrawn from reserve. At the close of the year a somewhat extensive tract lying between Hudson Bay Junction and Peesane is under review as to its agricultural value and the advisability of continuing its reservation, as are also several small areas.

Fire Protection.—During the winter and early spring the protection plans of the district were thoroughly gone over, revised and enlarged. The fire season opened in the middle of April and the fire-hazard grew steadily more severe until its culmination about May 23. After this date frequent rains occurred, removing all danger from fire. From the middle of April to the last week of May, the situation was critical, and for a week centering on May 23 bid fair at times to get beyond control.

There were altogether 178 fires reported—103 from the reserves and 75 from Dominion lands outside of these. On the reserves a total area of 103,000 acres was burned over, as against an average of 182,000 acres for the past ten years, although the fire-hazard in 1923 was abnormally severe. Of the 103,000 acres burned approximately one-half was open grass land, muskeg, or barren. The area (1,000 acres) of the average fire, high though it is, compares favourably with the average for the preceding nine years, namely 2,800 acres.

The 75 fires reported on Dominion lands outside of the reserve burned over 165,000 acres, fully one-half of which carried no merchantable timber nor valuable young growth.

All but two of the fires reported during the year occurred prior to the second week in June, bearing out the past experience that the period of greatest fire danger is from the middle of April to the end of May.

Improvements.—The improvement work accomplished during the year consisted very largely of increasing transportation and communication facilities and constructing and maintaining fireguards, lookout towers, and other improvements, more directly aiding in fire protection. The telephone system on the Big River, Porcupine, Nisbet, and Pines forest reserves was extended by the addition of some seventy miles of new line. Existing roads, mounting in all to 118 miles, were repaired and improved, and extensive improvements amounting almost to reconstruction made to several old roads that had fallen into an unserviceable shape or were poorly located.

Following up the work of 1922-23 more funds and time were spent on fireguards than ever before. Experience is showing that a very large percentage of the fires originating outside the reserves can be prevented from entering by a well constructed and well maintained fireguard. This applies particularly to ground fires in the early spring.

The lookout system covering the Pines and Nisbet reserves was further improved and gave such satisfaction that every effort is being made to inaugurate a similar system covering other reserves.

Grazing.—Owing to the general and marked depression in the live stock industry the use of the reserves for pasturage continued to fall off, as it has for the past three years. During the year 706 permits were issued, representing 26,223 head of stock. Owing to the abundance of moisture during the summer there was good feed everywhere and stock came off the range in good shape.

One hundred and ninety-seven permits were issued authorizing the cutting of 5,562 tons of hay, but this is a use of the reserves that is gradually disappearing.

Timber Sales and Permits.—During the year the timber-cutting operations on the various reserves were the most active on record. At the close of the year there were thirty-six timber sales in good standing, twenty-nine of which had been active during the winter. All products were in good demand, particularly saw-timber, railway ties, lathwood, and fuel. An outstanding feature is the demand for black spruce for the manufacture of lath, a fact that enhances the value of a species hitherto looked on as of little use in this district.

The largest sale yet made in Saskatchewan was consummated during the year and covered timber to the estimated amount of 16,000,000 feet. In connection with this sale it is interesting to note that brush disposal by burning is being carried out satisfactorily and without complaint from the operator.

Permits issued to settlers and others for the cutting of sawlogs, building logs, posts, poles, rails, and fuel numbered 1,092. By far the greater part of the material so cut, including over 19,000 cords of fuel, was fire-killed and its removal was encouraged as a means of reducing the fire-hazard. A careful study of the cost of brush disposal by burning was made during the year on both large and small operations.

Nurseries and Planting.—No planting was done during the year, but a very real effort was made to put the reserve nurseries into good shape. While this work is yet new, it is on the whole meeting with fair success and in a few cases most excellent results have been attained. No stock has yet been transplanted from the seed-beds, but the latter are estimated to have at least 750,000 seedlings.

DOMINION FORESTS IN ALBERTA AND BRITISH COLUMBIA

C. H. Morse, District Forest Inspector

ALBERTA

The work of the Forestry Branch in Alberta falls into three main divisions, namely, the protection and administration of the forest reserves, the protection of timbered lands not included in the forest reserves, and the protection, in co-operation with the Board of Railway Commissioners, of timber along railway lines. The second of these fields of activity is not limited to the province of Alberta, but extends into the Northwest Territories, and covers the main waterways, including the Athabaska, Peace, and Mackenzie rivers.

Fire Protection.—The winter of 1922-23 was quite mild, with but little precipitation. The spring opened up fairly early and during April and the first part of May there was a decided fire danger. By the end of May, however, wet weather set in which continued until the 1st September, with occasional very heavy downpours. After that date the weather was very dry; in fact there was practically no precipitation during the autumn. There were no fires reported in June, July or August on the forest reserves. In the north country the wet weather did not set in until about June 1, and the spring fire-hazard was longer than in the south. The summer rains were not so heavy in the north, and many fires occurred during each of the summer months, although the most favourable one was July. May was the worst month and October the next in fire-hazard.

A total of 36 fires was handled by the forest-reserve staff, the area burned over being 10,000 acres. Of these fires 20 were caused by railways, 5 by campers, 4 by hunters, and 2 by settlers. It should be pointed out, however, that of the 20 railway fires only one exceeded ten acres in extent, whereas 3 of the campers' fires exceeded that acreage.

In the Edmonton district the staff handled 635 fires, of which 73 were large (over ten acres) and 562 were small. Of the large fires in this district 16 were charged to campers, 16 to settlers, and 13 to railways; 14 were of unknown origin, 3 were incendiary, and 4 were caused by hunters. Of the small fires 214 were caused by settlers, 134 by railways, and 110 by campers; 6 were incendiary and 89 of unknown origin.

Aeroplane Patrols.—The system of aeroplane patrols, through the co-operation of the Department of National Defence, was continued during the fire season with excellent results. A few patrols were made during the spring fire season in the month of April. On account of copious rains in May, June, and July no forest patrols were carried on during those months. Patrols were resumed on August 30 and were continued through a dangerous autumn fire season up to November 28. The work carried out by the Air Service was most valuable. With aeroplanes on patrol the rangers were assured that the less accessible portions of the reserves were being constantly watched, and their own time could be devoted to areas of particular hazard or to other work of administration or forest improvement.

Improvements.—On account of the early summer rains, which became torrential in the south country, very little improvement work could be carried out until the late summer and autumn. In addition to this delay, floods caused a very great deal of damage to roads, trails, and bridges, and repairs had to be made at once lest a fire season should find the staff without means of rapid communication. Many of the trails and roads had to be wholly reconstructed on higher ground, although in other cases only short diversions around wash-outs were necessary. Flood damage was not so severe in the north, and much more new construction was carried on in that portion of the province.

Grazing.—During the summer season there were grazed on the forest reserves of Alberta 24,520 head of cattle, 7,447 horses, and 1,800 sheep, a considerable reduction as compared with the previous year's business. On account of the open winter of 1922-23 stock entered the reserves in a very fair condition. Fine weather was experienced in the latter part of April and the first part of May. Then summer rains set in which lasted until the middle of August. As a result

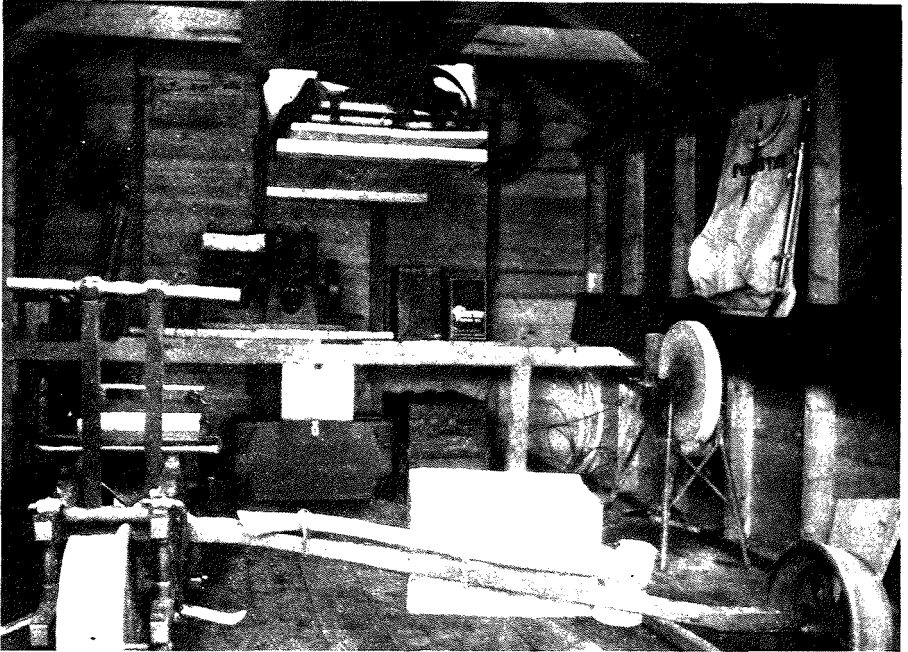


PLATE 8.—INTERIOR OF A SPEEDER SHED. (Forestry Branch Photo No. 17400.)

This picture is of interest as illustrating the many devices used in up-to-date forest-fire fighting. In the foreground is to be seen the railway speeder used by the ranger in patrolling along the railway. In the background is the gasoline fire-pump, which has proved of so much use in extinguishing forest fires. Placed at the source of water-supply, this pump can deliver a stream of water to a distance of half a mile or more, and by the use of "Siamese" connections three or four—even five—streams of water can be brought in play at once. On the right of the picture, hanging on the wall above the grindstone, is to be seen a hand-spray pump. This is attached to the large canvas bag beside it, which will hold some twenty gallons of water. The pump will throw a stream of water to a distance of forty feet or more.

Telephone connection is established between this station and the headquarters of the forest reserve. On occasion such a pump, together with 800 feet of hose and other necessary equipment for the operation of the pump, has been transported for a distance of twenty miles by rail and set up ready for operation, within the space of an hour. Besides the two men who came to the fire with the speeder, two other rangers, notified by telephone from headquarters, were on hand at the scene of the fire when the speeder arrived there.

the growth of grass was excellent. Considerable damage to range resulted in some districts from severe hail-storms. The latter part of the summer and the fall was extremely dry, but there was no lack of feed on the forest ranges. Stock left the forests in good condition.

Silviculture.—The mapping of the forest cover of the reserves was continued last summer. About eight townships in all were mapped on the Clearwater, Brazeau, and Lesser Slave forests.

On the Cooking Lake and Cypress Hills forest reserves the reforestation work which was started five years ago was continued last season.

There has been a decrease in the amount of timber cut under the authority of timber sales in the district. This is due in part to the fact that the larger and more accessible areas of fire-killed timber in the vicinity of coal mines have already been salvaged for mine-props, and large cuts are no longer being made. The larger part of this year's cut under timber sale has been mature and over-mature spruce and pine for saw-mill supply. Twenty-one sales have been in operation, of which 14 have supplied local mills, 5 provided mining timber for coal mines, and 2 furnished ties for the Canadian National railway. The operations have everywhere been satisfactory with regard to close utilization and brush disposal, and all the sales have been a success from a financial point of view.



PLATE 9.—USING THE FOREST RESERVE TO SUPPLY TIMBER. (Forestry Branch Photo No. 13351.)

The illustration shows a portable saw-mill on a Dominion forest in Saskatchewan. Such mills are used chiefly for cutting timber for the use of settlers in adjacent districts. A certain quantity of timber is allowed each settler free of charge, and further quantities in return for nominal payments.

There has been a satisfactory increase in the number of timber permits issued during the year, and also in the amount of timber removed under the authority of permits. The larger part of this business has been in connection with fire-killed timber for fuel and mine-props. As the larger areas of burned timber have been largely cut over under timber sales the smaller areas are now being handled under timber permits.

BRITISH COLUMBIA

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

Fire Protection.—The past season was unusually favourable, with only a very short period of high fire-hazard. No serious fires occurred other than one fire in the Coast district, which was confined to cut-over land and did very little damage to standing merchantable timber. Precipitation during the past season was very much greater than during any of the previous four years and was spread out over the growing season.

The number of fires fought and extinguished totalled 273. This was a decrease of 316 from the previous year and a decrease of 193 from the average

of the previous four years, also a decrease of 12 fires in comparison with the wet years of 1917 and 1918 when the reporting of all fires was not as reliable. The proportion of "large" fires for the season (fires which attained a size of ten acres or more, or caused any expense) was 32 per cent or a total of 85. Railways caused the greatest number of outbreaks, 70 (25 per cent of the total) being attributed to this cause. However, only 4 of these fires were classed as large fires, the remainder being extinguished in the incipient stage. Fires from natural causes (lightning) come second in number with 46, a percentage of 16.9. Other causes vary from 12 per cent for fires from causes unknown, downwards, and it is encouraging to note in this list of causes that incendiary fires total only 18 in number, less than 5 per cent against 101 fires the previous season or 17 per cent. The total area burned over was 7,983 acres, which included old burns, slash areas, and merchantable and young growth, compared with 109,474 acres in the previous season. The area of merchantable timber burned totalled 876 acres, and the area of young growth 1,085 acres. The remainder was old burn, slash, etc. A correspondingly small loss is shown in merchantable timber. Approximately 5,000,000 feet board measure was destroyed against 47,000,000 feet board measure in 1922 and 148,000,000 feet board measure in 1920. The small loss of timber this season in comparison with the total acreage burned over and with the figures for previous seasons is indicative of greater efficiency in fire control.

Improvements.—The improvement work for the British Columbia forest reserves was not very extensive during the past season in comparison with other years. This is due to the original program of permanent improvements being nearly completed. The work during the past season was principally maintenance work on existing permanent improvements. Many miles of trails were put in good condition, telephone lines gone over, and repairs made to buildings and fences. Good progress was made in clearing operations around headquarters sites for pasture purposes and for the raising of feed for government live-stock. Work was commenced on the building of the Joss Mountain lookout in the Salmon Arm district. This project constitutes the last primary point to be occupied in the district for fire-detection purposes.

In the Revelstoke district the lookout project started in the previous season on Cartier mountain was practically completed. This lookout is the highest of its kind in the Dominion, being at an elevation of nearly 9,000 feet.

Silviculture.—There has been a marked increase in timber-sale business during the past year, fifteen new sales having been awarded. The usual requirements of this Branch with regard to close utilization and brush disposal have been satisfactorily and willingly carried out in all cases by the operators. The timber-permit business also shows an improvement over previous years.

During the season a forest-cover map was undertaken of the Monte Hills reserve. Exhaustive studies were made for the areas covered of the various timber types. The work of establishing sample plots for the study of growth conditions and various silvicultural methods was continued, numerous additional plots being laid out. This inspectorate now has plots covering almost every condition under which timber of the various species grows in the district, and in future years very valuable information will be obtained from the data compiled on these plots. A great deal of experimental planting was also carried on under various silvicultural systems.

The past season was a fair year for the collection of seed. A large quantity of seed was collected and prepared ready for shipment both in the coastal region and in the interior. From the seed-extraction plant at New Westminster approximately 3,500 pounds of Douglas fir seed, 1,250 pounds of Sitka spruce seed, and 62 pounds of lowland fir seed was shipped to the British Forestry Commission. A shipment was also made to the New Zealand Government of

250 pounds of Douglas fir seed and a smaller amount of Western red cedar seed. From the interior-district seed collections, various small amounts of seed of numerous species were shipped to points in Great Britain, Holland, Finland, and the Irish Free State for use in experimental planting to determine which strains of species give the best results under climatic conditions abroad.

Grazing.—A grazing-permit policy for the forest reserves in British Columbia was inaugurated during 1923. Grazing regulations were not put into effect generally for all forest-reserve areas, but an attempt was made to bring before the ranching public the benefits and advantages of regulated grazing under the forest reserves grazing regulations. Several communities have organized themselves into local associations and have made request that certain range divisions should be brought under the regulations. Forage conditions on the reserves containing stock range were excellent. Permits issued during the summer season amounted to 20, covering 726 head of cattle, 50 horses, and 942 sheep.

Recreational Uses.—The forest reserves drew their usual number of tourists and summer-restorers, particularly at Paul lake on the Niskonlith forest reserve and Trout lake on the Long Lake reserve. Fishing conditions were good at Paul lake, but it will take a number of years to bring Trout lake back again to its original state. Increased use was made of the reserves for camping.

FOREST PRODUCTS LABORATORIES OF CANADA

W. Kynoch, Superintendent

The steadily increasing demand for the services of the laboratories, to which reference has been made in reports for recent years, was again in evidence during 1923-24. The number of requests for technical information and service dealt with was again greater than in any previous year. The amount of research and investigative work conducted was relatively greater than in the preceding twelve months.

A brief review of the chief problems investigated is given hereunder.

Sulphite pulp from Jack Pine.—Object: To develop a sulphite cooking process which will yield a pulp of good commercial quality from jack pine. Work was carried to a conclusion on a laboratory scale. A process yielding a pulp of good quality was worked out and findings confirmed by means of a series of check cooks. Commercial-scale trials, in co-operation with a pulp company, were pending at the close of the year.

Freeness as a Control Test in Groundwood Production.—Object: To determine the feasibility of applying the freeness test as a control in the manufacture of mechanical pulp. A considerable amount of experimental work was conducted and a material advance towards the objective made. Findings led to careful consideration of the subject by the Technical Section of the Canadian Pulp and Paper Association. This resulted in the appointment of a "Committee on Standardization of the Freeness Test," a member of the laboratory staff being appointed chairman.

Pulp Testing.—Object: To develop methods of testing pulp for strength suitable for adoption as standard. The investigation was directed along the line of determining the most suitable pressures to adopt as standard in the preparation of test sheets. Investigations as to the best equipment and procedure in the formation of test sheets were also conducted. Work under these heads was successfully completed for the various kinds of commercial pulp made in Eastern Canada. Work on the effect of drying factors on strength was begun in the latter part of the year.

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. Research on the chloral condensation products of cellulose yielded valuable information. An interesting minor result was the development of a delicate colour test for the presence of chloroform and chloral hydrate.

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 used on a commercial scale.

Work on a laboratory scale was completed and a washing apparatus of semi-commercial size was designed and constructed. An experimental wet machine was installed. A series of semi-commercial pulping trials was conducted at Ottawa in co-operation with the Department of Finance, and plans for the placing of the whole operation on an efficient producing basis were formulated. Action to put these plans into execution was pending at the close of the year.

Testing New Materials for Paper.—The use of Canadian talc in place of imported China clay as a filler for certain classes of paper was investigated and, with the co-operation of manufacturing and printing firms, was carried to commercial trials with most encouraging results. A blotting paper of good quality, made entirely from wood-pulp, was developed, further work on the subject, however, remaining to be done. Preliminary work on the utilization of straw for papermaking was carried out. Extensive papermaking trials, in connection with the above investigations were conducted and advances were made in the technique of paper-fibre analysis.

Preparation of Reference Collection of Microscopic Slides of Woods.—Object: To build up a collection of authentic microscope slides of the important commercial timbers of the world and of photomicrographs illustrative of anatomical features; to study the anatomy of woods. During 1923-24 slides of a number of important foreign woods were prepared, and a supply of duplicate mounts of native woods was also made with a view to exchange with timber-research organizations in other countries.

Kiln-Drying.—Object: To investigate the scientific principles involved in kiln-drying and to improve present kiln-drying practice. A detailed co-operative study of kiln operations was conducted at a number of industrial plants and assistance in the solution of various drying problems given.

Physical Properties of Pulpwood with Reference to Deterioration in Storage.—Object: To secure information as to the changes in the physical properties of stored spruce and balsam fir pulpwood which are brought about by decay; to ascertain the relationship between these changes and the pulping qualities of the wood. An extensive series of physical determinations on samples of sound and decayed pulpwood was made.

Mechanical and Physical Properties of Canadian Woods.—Object: To determine, by means of an exhaustive series of mechanical and physical tests, the strength functions of Canadian commercial timbers. During 1923-24 upwards of 8,000 tests and determinations were made.

Glued Joints.—Object: To investigate the value of glues of the various classes for joint work. Hide and casein glues received further attention, while blood-albumen glue was investigated in a preliminary way. Woods in common use in cabinet and furniture work were employed for the joints. The investigation included tests to obtain information on the effect of age on the adhesives. Over 800 tests were made during the year.

Nail-Holding Power of Woods.—Object: To ascertain the relative ability of various Canadian woods to retain nails. A number of woods of wide industrial use was employed while the nails were of various types. Over 1,300 tests were made and the work will be continued.

Effect of Red Stain and Red Rot on the Strength of Jack Pine Ties.—Object: To determine the extent to which red stain and red rot reduce the strength of jack pine ties. The investigation, as planned, was concluded. It became evident, however, that inquiry should be made into certain other phases of the problem, including the effect of steaming under pressure on the strength of the red-stained wood. Further work will therefore be necessary.

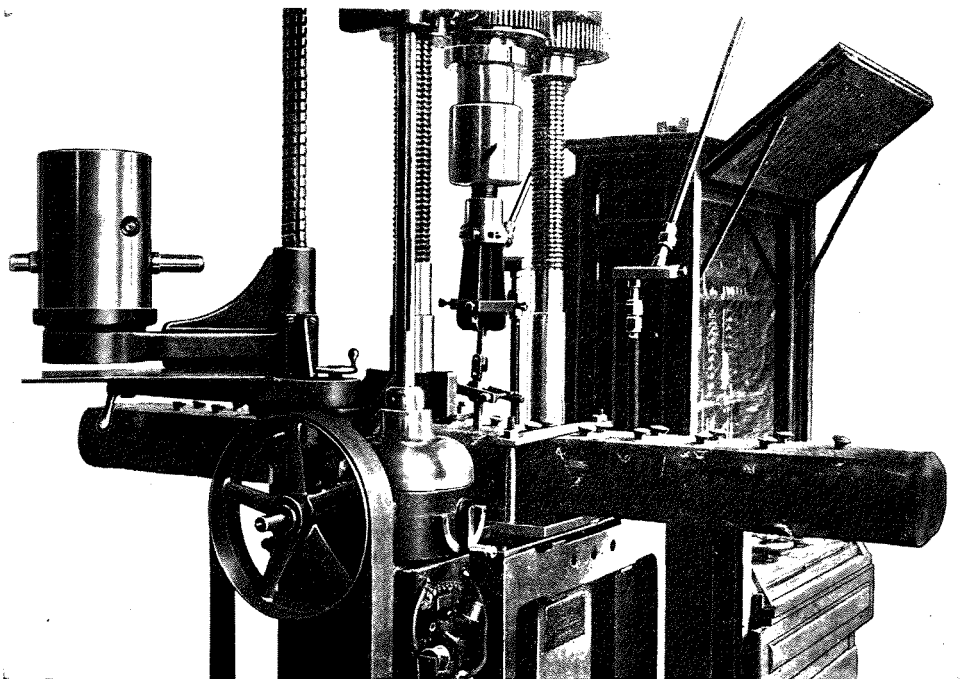


PLATE 10.—TESTING THE SPIKE-HOLDING POWER OF RAILWAY TIES.

In many lines of industry a knowledge of the ability of wood to retain nails and spikes is important. This is especially the case where the nailed work is subjected to shocks and rough handling, as in crates and containers for shipping, and in railway ties. The machine shown in the illustration was designed to make these tests, and a number of different woods have been tested with it at the Forest Products Laboratories of Canada (Department of the Interior), Montreal.

Wood Preservatives.—An analytical study of various proprietary wood preservatives was carried out with the object of securing information on their probable value for the treatment of timber. Considerable attention was given to analytical examination of creosote oils and refined tars for commercial use in creosote-tar mixtures. A portable post-treating plant for demonstration and other work was designed and constructed. Work on the open-tank creosote treatment of spruce for railway ties was done with the object of ascertaining whether or not such treatment would be likely to effect economy in maintenance in districts remote from pressure plants. Following on the work done last year further work on the creosote treatment of Canadian hardwoods for top-pins was conducted, attention being given to pressure treatment. Penetration tests

with creosote oils were made on red pine and yellow birch for use as pole-anchor planks. Further work was done in connection with a seasoning study on hard maple ties which had been previously made. The drying of green birch by treatment with hot waxes was investigated experimentally as also was the possibility of modifying the physical properties of certain Canadian woods with a view to rendering them suitable for pencil making. Further work on the colouring of yellow birch throughout by means of heat treatment with various materials also received attention.

Exhibits.—Early in the year the exhibit specialist was loaned to the Exhibition Commissioner for the purpose of giving undivided attention to the designing and preparation of the timber exhibit for the British Empire Exhibition to be held in London during 1924. The laboratories assisted by selecting and identifying wood material, making photomicrographs, preparing a collection of woods in the form of cubes specially surfaced for examination with the microscope by reflected light, and by preparing several thousand wood specimens labelled with name of timber.

In addition to the work for the British Empire Exhibition a small public exhibit previously prepared was revised and improved, and various additions made to the permanent exhibit at the laboratories, including collections of Brazilian and British Guiana woods. Requests from schools and institutions for authentic hand specimens of Canadian woods continued, and a number of sets was prepared and distributed in response.

In connection with the endeavour of the authorities to enlist the co-operation of the public in reducing the enormous monetary wastage occasioned by forest fires, the laboratories prepared one hundred "wall sets" for display at railway stations and other public places. These sets indicated, by means of actual wood specimens, the quantity of each kind of timber utilized and destroyed by the fire respectively in Canada each year.

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

Information Furnished.—The demand of manufacturers and others for reliable technical information relating to woods and products made or derived from woods is constantly increasing, and the supplying of such information is an important function of the laboratories. The study, research, and investigative work which has been in progress at the laboratories during the past ten years has yielded a large fund of information concerning Canadian timbers which is nowhere else available and which is at hand for reference in dealing with any inquiries received. The number of such inquiries given attention during the year considerably exceeded 500, a greater number than in any previous year.

General.—Since the establishment of the laboratories more than ninety articles, bulletins, etc., have been published and a substantial contribution to this total was made during 1923-24. A number of addresses was also given at meetings of technical and other bodies.

Free technical services, such as the identification of woods and the analysis of papers, are operated for the benefit of manufacturers and others, and were much in demand during the year.

The research and other activities of the laboratories involve a good deal of special photography and photomicrography for record and other purposes and a high standard in this work is maintained. The work of the year included a set of photomicrographs illustrative of the minute structure of Canadian timbers, for use at the British Empire Exhibition.

TABLE I—STATEMENT OF REVENUE, FORESTRY BRANCH, FISCAL YEAR ENDED MARCH 31, 1924

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.....		381 00		1,812 00	203 25	67 75	67 00			2,531 00
Spruce Woods.....		283 80	4 50	238 00	121 25					647 55
Riding Mountain.....	1,090 00	10,097 77	939 20	305 50	486 75	448 45	596 80			13,964 47
Duck Mountain.....		4,074 72	96 28	178 00	257 75	301 47	39 00			4,947 22
Porcupine No. 1.....	106 75			16 36	15 00		5 00			143 11
Sandilands.....		132 25	4 00							136 25
Moose Mountain.....		353 21	20 00	566 20	141 00	124 60	17 00		741 00	1,963 01
Beaver Hills.....		122 90		184 05	120 00		11 00			437 95
Porcupine No. 2.....	2,898 32	1,840 51	25 00	112 86	283 25		219 30			5,379 24
Pasquia.....	32,036 20	2,739 26	75 00	46 64	344 75		106 50			35,348 35
Fort à la Corne.....	593 24	1,612 74	21 71		16 00		58 75			2,302 44
Nisbet-Pines.....	497 23	4,034 27	75 39	536 76	136 25		175 10			5,455 00
Big River.....	408 52	867 53	55 06	146 76	369 00		40 50			1,887 37
Steep Creek.....		4 80								4 80
Sturgeon.....	732 00	121 21		224 10	81 50		29 00			1,187 81
Keppel.....		29 25		361 58			8 00			398 83
Manito.....		265 88	6 80	2,187 72	36 75		47 00			2,544 15
Dundurn.....		139 50		398 40	65 25		10 00			613 15
Seward.....				1,041 62	37 25		30 00			1,108 87
Elbow.....		40 50		879 00	36 75		236 60			1,192 85
Big Stick.....				5,474 56	6 00		54 00			5,534 56
Cypress Hills.....		5,125 24	204.65	3,005 37	3 50	45 00	83 20			8,466 96
Cooking Lake.....		3 00		1,105 91	135 50		3 00			1,247 41
Crownest.....	328 15	2,407 82	142 00	8,749 48	2 25	36 86	417 50			12,084 06
Bow River.....	500 00	478 01		5,367 52	26 50		46 15			6,418 18
Clearwater.....	2,433 76	868 57		1,430 06	25 25	1,114 83	336 29			6,208 76
Brazeau.....	9,241 35	1,592 73		326 95		886 68	419 30			12,467 01
Athabaska.....	1,134 61	37 50		94 44	18 00		16 00			1,300 55
Lesser Slave.....	5,128 45	2 00		29 60	21 00		13 00			5,194 05
British Columbia Reserves.....	4,726 83	148 75	17 70	297 31	81 00	241 45	276 06			5,789 10
Indian Head Nursery.....								1,635 31	2,348 00	3,983 31
Total.....	61,855 41	37,804 72	1,687 29	35,116 75	3,070 75	3,267 09	3,361 05	1,635 31	3,089 00	150,887 87

TABLE 2—STATEMENT OF TIMBER PERMITS ISSUED IN FOREST RESERVES, FISCAL YEAR ENDED MARCH 31, 1924

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	Railway ties	Mine timber	Lath	Building logs	Fuel-wood		\$	cts.
										Green	Dry		
Turtle Mountain.....		35			7,500								
Spruce Woods.....		41		650	33,350				2,000			493	381 00
Riding Mountain.....	210	875	1,200	33,028	2,261,969	80,000			61,586	1,208		282	283 80
Duck Mountain.....	37	230	5,000	9,547	742,082				12,285	45		5,364	10,097 77
Sandilands.....		30		300					350			1,382	4,074 72
												163	132 25
Moose Mountain.....		80		4,483					7,290	242		73	353 21
Beaver Hills.....		29		250					5,380	99		12	122 90
Porcupine No. 2.....	40	140	11,700	10,650	403,154				24,720	19		1,665	1,840 51
Pasquia.....	23	115	400	22,825	9,616,946				392,392	37,026		21	9,124
Fort à la Corne.....	24	215	2,600	11,117	4,409,000				51,156	19		1,460	2,739 26
												19	1,612 74
Nisbet-Pines.....	14	405	12,343	23,420	16,972				30,634	110		2,610	4,034 27
Big River.....	8	42	5,000	4,000	101,000				19,992			2,804	867 53
Steep Creek.....													4 80
Sturgeon.....	4	20	700	1,900					6,808			24	121 21
Keppel.....	1	8										22	29 25
Manito.....	15	64	150	8,750					2,250	217		55	265 88
Dundurn.....	3	31								207			139 50
Elbow.....		21		450								84	40 50
Cypress Hills.....	18	489	56,265	27,748	394,788	686,000			703,446	399		1,466	5,125 24
Cooking Lake.....		1										2	3 00
Crowsnest.....	3	239	12,280	28,270		300,000			37,828	144		570	2,407 82
Bow River.....	19	49	18,830	6,590	900,000				41,410			365	478 01
Clearwater.....	1	101	4,180	52		1,000	100,143	100,000	138,956			461	868 57
Brazeau.....		42	957	4,342	250,000	7,680	883,398		63,435				1,592 73
Athabaska.....		2										71	37 50
Lesser Slave.....		2											2 00
British Columbia Reserves.....	16	14	39,075	1,221	260,000	95,000			6,504			149	148 75
Total.....	448	3,318	170,680	199,593	19,396,761	183,680	1,971,693	492,392	1,253,056	2,752		28,696	37,804 72

TABLE 3—STATEMENT OF GRAZING PERMITS ISSUED IN FOREST RESERVES, FISCAL YEAR ENDED MARCH 31, 1924

Reserve	No. of permits	Number of Stock				Dues and fees collected
		Cattle	Horses	Sheep	Total	
						\$ cts.
Turtle Mountain.....	82	1,142	79		1,221	1,789 00
Spruce Woods.....	10	107	23		130	238 00
Riding Mountain.....	32	451	99		550	305 50
Duck Mountain.....	14	342	20		362	178 00
Moose Mountain.....	56	1,182	89		1,271	566 20
Beaver Hills.....	27	305	55		360	184 05
Porcupine No. 2.....	8	192	52		244	112 86
Pasquia.....	12	68	10		78	46 64
Porcupine No. 1.....	2	30	2		32	16 36
Nisbet-Pines.....	38	1,074	129	1	1,204	536 76
Big River.....	7	320	8		328	146 76
Sturgeon.....	26	473	33		506	224 10
Keppel.....	42	561	176		737	361 58
Manito.....	114	3,315	872	25	4,212	2,154 44
Dundurn.....	13	567	274		841	398 40
Seward.....	66	895	436		1,331	1,041 62
Elbow.....	106	1,370	450		1,820	879 00
Big Stick.....	214	5,050	1,751	4,650	11,451	5,459 46
Cypress Hills.....	131	4,047	1,722		5,769	2,927 87
Cooking Lake.....	88	1,596	401		1,997	1,105 91
Crowsnest.....	164	9,151	2,410	1,100	12,661	8,749 48
Bow River.....	122	7,642	3,028		10,670	5,367 52
Clearwater.....	227	894	1,096		1,990	1,430 06
Brazeau.....	114	47	324		371	326 95
Athabaska.....	9	40	116	700	856	94 44
Lesser Slave.....	2	55	2		57	29 60
British Columbia Reserves.....	16	731	75	942	1,748	297 31
Total.....	1,742	41,647	13,732	7,418	62,797	34,967 37

TABLE 4—STATEMENT OF TIMBER CUT ON FOREST RESERVES UNDER AUTHORITY OF TIMBER SALES, FISCAL YEAR ENDED MARCH 31, 1924

Reserve	Previous sales still operating	Sales made current year	Saw-timber	Mine Timber			Railway ties	Telephone poles	Dues collected
				Props	Lagging	Lagging			
			Ft. B.M.	Lin. Ft.	Cords	Lin. Ft.	Ft.B.M.	Lin. Ft.	\$ cts.
Riding Mountain.....	1	1	18,650						50 00
Big River.....	2	2			150		3,820		104 92
Sturgeon.....	2	2							50 00
Fort à la Corne.....	3	3	288,771						396 24
Porcupine.....	2	2	223,186						1,762 48
Pasquia.....	5	16	11,765,985		387				9,368 25
Nisbet-Pines.....	1	1	14,214				2,895		236 00
Brazeau.....	3	4	4,240,522	47,672		23,184			3,378 42
Bow River.....	1	1							
Crowsnest.....	2	1	22,857						217 15
Clearwater.....	4		554,900	89,347					2,383 76
Athabaska.....	1								1,134 61
Lesser Slave.....	1	1							3,543 31
British Columbia Reserves.....	2	13	146,878	6,275			51,674	44,440	3,026 30
Total.....	25	47	17,275,963	143,294	537	23,184	58,389	44,440	25,651 44

TABLE 5—STATEMENT SHOWING QUANTITY OF TIMBER SOLD AND REVENUE DUE FISCAL YEAR ENDED MARCH 31, 1924, ON LICENSED TIMBER BERTHS WITHIN DOMINION FOREST RESERVES

MANITOBA

Reserve	Timber berths	Area in reserve	Quantity sold			Dues payable	Rent payable	Total payable
			Lumber	Lath	Other products*			
	No.	Sq. Mls.	Ft. B.M.	Pieces		\$ cts.	\$ cts.	\$ cts.
Riding Mountain.....	2	22.75					227 50	227 50
Duck Mountain.....	11	107.59	924,958			744 98	1,075 90	1,820 88
Total.....	13	130.34	924,958			744 98	1,303 40	2,048 38

SASKATCHEWAN

Porcupine and Pas- quia.....	41	850.23	28,317,474	15,747,533	42,488	42,317 34	8,502 20	50,819 54
Nisbet-Pines.....	4	80.69	62,299		7,007	909 06	173 15	1,082 21
Total.....	45	930.92	28,379,773	15,747,533		43,226 40	8,675 35	51,901 75

ALBERTA

Crowsnest.....	10	226.92	2,312,753	589,256	1,723,569	5,465 73	2,269 20	7,734 93
Bow River.....	12	266.73	3,260,016			2,490 50	2,667 30	5,157 80
Clearwater.....	4	371.52	52,180		319,444	20,222 13	3,715 20	23,937 33
Brazeau.....	10	126.40			166,512	6,183 94	1,264 00	7,447 94
Total.....	36	991.57	5,624,949	589,256		34,362 30	9,915 70	44,278 00

BRITISH COLUMBIA

British Columbia Reserves.....	11	128.32	1,377,118			1,377 11	1,283 20	2,660 31
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ALL DOMINION FOREST RESERVES

Grand Total.....	105	2,181.15	36,306,798	16,336,789		79,710 79	21,177 65	100,888 44
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* The figures in this column indicate the number of units on which dues were calculated. They include 1,120 posts, 7,621 cords of fuel-wood, 1,283 cords of slabs, 544 cords of edgings, 45 cords of pulpwood, 1,827,792 linear feet of mine timber, 417,646 railway ties, and 2,969 rails.