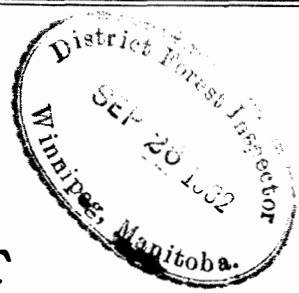
DEPARTMENT OF THE INTERIOR, CANADA

HON. THOMAS G. MURPHY, Minister — H. H. ROWATT, Deputy Minister

E. H. FINLAYSON, Director of Forestry



REPORT

OF THE

DIRECTOR OF FORESTRY

1930-31

(FISCAL YEAR ENDED MARCH 31, 1931)

OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1932

FORESTRY

REPORT OF THE DIRECTOR OF FORESTRY, E. H. FINLAYSON

The fiscal year 1930-31 was signalized by a fundamental change not only in the history of the Forest Service, but also in the development of forestry in Canada, consequent upon the completion of the transfer of natural resources from the Dominion to the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia. By the transfer, the Forest Service was relieved of its responsibility for the protection of forest lands and the administration of national forests, these functions being taken over by new provincial services organized for the purpose. As indicated in the report for 1929-30, the future activities of the Forest Service will be concentrated largely on investigation, research, and experiment in the more technical and scientific aspects of the Canadian forestry problem, particular attention being paid to those phases the solution of which will provide the maximum possible assistance to the forest industries.

By arrangement with some of the provinces, the Forest Service continued its work of fire protection until the close of the fire season. The remainder of the year was largely occupied in details of the transfer and in staff reorganization and plans for the development of work on the new basis.

The forest fire situation in Canada during the 1930 fire season equalled in severity that of the previous season. The total number of fires reported was 6,721—slightly greater than that for the previous year. Total damage and loss, including fire-fighting costs, likewise showed an increase of one and one-half million dollars for 1930-31. The area chiefly affected was again that portion of Canada extending from western Ontario to the Pacific coast. This region, on account of a serious lack of snowfall for three consecutive winters and a corresponding deficiency of spring and summer rains, presented a forest fire problem of the first magnitude.

While the western area suffered heavily, the 1930-31 statistics would indicate that the forest authorities in this region more than held their own in keeping the fire situation in hand, in view of the fact that in spite of the increasingly aggravated weather conditions which prevailed last year, a slight improvement over 1929 is shown.

The increase in the total number of fires for Canada, and likewise in the damage and loss, are due in a large measure to the increase in the number of fire outbreaks in Eastern Canada, particularly in the Maritime Provinces, which experienced protracted periods of extremely hot, dry weather such as had not occurred for many years in these areas.

The following table, compiled by the Forest Service from returns made by the different forest authorities, gives in detail the figures of forest fires in Canada for the year, as compared with the average for the five-year period 1926 to 1930, inclusive:—

Item	Year 1930	Average per year 1926-1930 inclusive
Total number of fires	6,721	5,392
Total area burned over (acres)	2,667,545	2,470,170
Merchantable timber—		
Area burned (acres)	746,127	465,448
Timber burned (M Ft. B.M	542,425	364,434
Timber burned (Cords	2,307,859	1,947,818
Estimated stumpage value	$4,607,430	$ 2,488,968
Young growth—		
Area burned (acres)	575,814	547,001
Estimated value	$1,451,798	$ 1,080,544
Cut-over—		
Area burned (acres)	427,230	220,459
Estimated value	$ 275,523	$ 165,707
Non-forested—		
Area burned (acres)	918,374	1,276,548
Other property burned—		
Value	$ 506,777	$ 402,914
Actual cost of fire-fighting	$1,135,907	$ 737,973
Total gross damage and loss	$7,977,435	$ 4,876,307

National Forest Inventory

Work along the lines formulated by the 1929 conference of Dominion and Provincial forest authorities has progressed steadily. It will be remembered that the work undertaken by the Department of the Interior as its part of the scheme included the making of the forest inventory in the Prairie Provinces, the collation of the reports sent in by the various provinces, and general co-operation with the provincial authorities. The reports, when completed, are to show data as to the tenure on which the forests are held (whether privately owned, leased, or unalienated); kind of land (farm land, waste land, and productive and non-productive forest); the types of forest (softwood, hardwood, or mixed wood; merchantable timber or young growth); the condition of the forest (whether virgin, cut-over, or burned-over); an estimate, by species, of the amount of timber of merchantable size suitable for lumber, pulpwood, ties, poles, posts, etc.; the annual cut for all purposes, and the annual loss from fire, insects, and disease.

In pursuance of the undertaking of the Department of the Interior, three forest-survey parties were engaged in Manitoba in the summer of 1929 and one in Saskatchewan, and in the summer of 1930 there was one party in each province.

Aerial photography has played a great part in the work of the survey, and has been of the greatest assistance, especially when used in conjunction with ground surveys. Up to date, 211,870 square miles of forest have been photographed from the air, and forest-type maps have been made of 59,450 square miles. The maps not only give accurate topographical details, but also show the waste land, merchantable timber, and young growth in the various forest types. The possibilities of these photographs increase to a surprising degree as they are studied. Methods have been devised by the Forest Service for the determination of the heights of trees from the photographs—from the length of the shadows, in the case of the vertical photographs, and, in the case of the oblique photographs, by direct measurement. Considerable progress has also been made in the identification of tree species in the photographs, and work is being done leading to the possibility of securing estimates of the volume of the stands, within a reasonable degree of accuracy.

As part of its co-operation with the provincial services, the Dominion Forest Service is conducting a series of surveys in each province to determine the kind and amount of natural reproduction which is being secured after cutting and fire, and the rate at which this young timber is growing.

The Province of British Columbia has completed an inventory of the forests in the southern coastal region, including Vancouver island and the adjacent mainland. This is the most important part of the province from the standpoint of both the quantity of timber and the forest industries. The total remaining stand in this region is estimated to be over 130 thousand million feet board measure.

Ontario has compiled an estimate of the more important species in the northern part of the province which shows a total stand of 285 million cords of spruce, balsam fir, and jack pine; 7 thousand million board feet (Doyle rule) of white and red pine; 86 million feet of maple; and 335 million feet of yellow birch. In Quebec over 17 per cent of the Crown land has been cruised and reported on, and it is expected that at the present rate of progress sufficient data will soon be available to compile a reliable estimate for the whole province. The Maritime Provinces have not been able to add materially to their knowledge of their forest resources during the past year, but the measurements and records of the rate-of-growth surveys conducted by this Service, combined with the aerial photography carried on by the Topographical Survey of this Department and the Royal Canadian Air Force, will be of considerable assistance in connection with the inventory.

Silvicultural Research

The major activity of the Research Division for the year just closed, both in field and office, has been the Canada-wide rate-of-growth survey started in 1929. The objective of the survey is a statement of the growth rate of the forests by timber types and age-classes, and reliable information of the conditions of reproduction on the areas that have been cut over or burned. Coupled with the information being obtained by stock-taking surveys, this will give a comprehensive statement of Canada's timber resources present and potential. Eight field parties, in the provinces of Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia, respectively, were busily engaged in gathering growth data from May until October. Progress in the compilation of the data has been satisfactory.

The field-work of the working-plan survey of the Petawawa experimental area was completed in 1930. The use of aerial photographic maps made it possible to complete this project in a single season; by the use of former methods of survey, at least two seasons would have been required to obtain as much detailed information. Aerial maps reduce the element of uncertainty and the amount of ground work very materially. The data are nearly all compiled as far as the present stand and the maps are concerned; hence it is possible to proceed with the preliminary stage of the working plan. The plans cannot be completed, however, until the growth rate has been computed.

A similar survey was made of the forest property of the University of New Brunswick. The maps and present stand tables are completed.

First steps were taken at Petawawa to investigate the factors controlling the reproduction of jack pine and of white spruce. Areas recently cut over

provide suitable fields for these studies. The jack pine stands were severely culled and partially burned; the removal of hardwoods from a mixed wood stand leaves ample spruce in a favourable seed-year to ensure a good seed supply.

Fire-protection improvements at Petawawa consisted of the opening of Race Horse road to the Petawawa river, improvements to the Centre Lake road, and construction of a boat-house at Paquette's landing and a fire-engine shed at Long Lake headquarters; new office accommodation is also being provided at Corry Lake.

The annual visit of students from the Faculty of Forestry, University of Toronto, accompanied by Dr. C. D. Howe, dean of the faculty, was made in October. Dr. Howe noted the advancement made in research projects since his previous visit, and contributed some valuable suggestions for continuation work.

Two new timber sales were made at Petawawa in October, one in jack pine, the other in black spruce; however, owing to adverse market conditions, operations were not started on the black spruce area.

The amount of field-work done in connection with the study of site classification was limited because of shortage of suitable personnel. The interim report covering the work of 1929 was received, and indicates that very satisfactory progress is being made with the investigation, and that a method of site classification based on ground vegetation can be evolved for Canada, as has been done for Finland and Sweden.

Some assistance was given the National Research Council in measuring the growth of trees in the Trail Smelter fume zone, the information being used in connection with a damage claim preferred by the federal Government of the United States. A series of germination tests of seed taken from the same zone was also made.

This division co-operated with a paper manufacturing company in conducting an extensive girdling experiment on its limits in Quebec, where the worthless and suppressing hardwoods were destroyed by girdling, the valuable conifers and young hardwoods being thus released. A series of permanent sample plots was established in accordance with Forest Service standards. The data secured have been compiled, and when remeasurements are taken should provide valuable deductions.

Permanent sample plot data for most of the plots established at Petawawa for yield and thinning studies have been compiled, and a brief report showing the deductions has been issued. Similarly some twenty plots at Lake Edward Station have been remeasured, data compiled, and deductions made.

Data relative to the status of planting throughout Canada have been assembled and this information is available to persons or corporations interested.

A number of reports and articles have been issued during the year, including the following:—

"Growth of Coniferous Species on the Miramichi Drainage Area." Research Note No. 21.

"Girdling Hardwoods to Benefit Conifers." Research Note No. 23.

"Preliminary Report on Rate of Growth of the Forests in the Western Part of Nova Scotia." Research Note No. 29.

"Preliminary Report on Rate of Growth of the Forests in Southern New Brunswick." Research Note No. 31.

"Research in Forestry." Research Note No. 34.

"Growth on Cut-over Forests in Ontario." Research Note No. 36.

Fires and Fire Protection

Alberta alone of all the provinces reported a favourable fire season. In Manitoba the season was fairly favourable, but Saskatchewan and British Columbia were visited by a season of extreme hazard.

In Manitoba a severe hazard was experienced at the opening of the season, owing to the dry weather in 1929, but heavy spring rains in 1930 put an end to this risk. From the middle of May precipitation decreased, and the hazard steadily increased, reaching its peak late in August. Conditions continued unfavourable until the middle of September, when general rains came, and heavy snowfalls about the middle of October practically put an end to the fire danger. One point particularly noted this season was the number of fires caused by lightning; 38 per cent of all fires in the province were due to this cause, and the proportion in the Manitoba North fire district amounted to 95 per cent.

In Saskatchewan a bad fire situation existed during the latter part of May and up to the middle of June, reaching its peak from June 7 to June 10. Heavy rains stopped the fires in the second week of June. Later, the risk again became acute, until in August the situation became critical, thirty to forty fires being in progress simultaneously. A large proportion of the fires was caused by lightning; on several occasions the actual start of lightning fires was witnessed from aeroplanes. A system of settlers' permits was introduced into the province during the season without friction.

In Alberta the hazard was not severe at any time during the season, the weather throughout the entire period being of such a nature as to keep the risk within bounds. The spring was characterized by frequent showers; general rains occurred throughout the province in the latter part of June; the summer was showery, with precipitation well distributed, and snow fell comparatively early—in the mountains on September 6, on the northern plains on October 17. A general snowfall on November 11 ended all fire danger for the year.

In British Columbia the 1930 season was one of the worst yet experienced—as to number of fires starting, the worst on record. Up to July the number of fires reported was below the average; from early July till late September, however, the entire Railway Belt—not excepting the coast district—was extremely dry, and new fires started daily. A large proportion of the fires (twenty per cent) was due to incendiarism, but more fires were due to lightning than to any other one cause.

In northern Saskatchewan and Manitoba aeroplanes did valuable service, both in the detection of the fires and in their suppression. Operations were started in March of 1930, with aeroplanes mounted on skis, and continued throughout the season.

The following tables give the figures for the forest fires of the season of 1930:—

Table No. 1

FIRES WITHIN AND OUTSIDE OF NATIONAL FORESTS: AREA BURNED OVER AND FIRE LOSS BY CAUSES

Causes	Manitoba			Saskatchewan			Alberta			British Columbia			Totals		
	No.	Area	Damage	No.	Area	Damage	No.	Area	Damage	No.	Area	Damage	No.	Area	Damage
		acres	$		acres	$		acres	$		acres	$		acres	$
Camp-fires	86	16,411	25,621	78	105,181	172,240	67	48,310	29,163	32	5,391	183,379	263	175,293	410,403
Smokers	32	4,691	4,173	12	3,937	2,672	16	4,459	6,910	59	6,095	8,095	119	19,182	21,850
Settlers	43	8,614	5,875	117	60,054	22,002	56	18,096	8,972	20	1,110	616	236	87,874	37,465
Railways	56	785	1,022	23	18,008	47,412	102	1,132	226	81	1,625	6,419	262	21,550	55,079
Lightning	159	662,540	212,521	37	82,235	138,030	14	2,440	6,243	132	15,931	73,432	342	763,146	430,226
Industrial operations	1	3,300	6,150	3	3,876	6,491	4	215	nil	10	8,364	116,240	18	15,755	128,881
Incendiary	13	3,655	3,033	54	110,741	91,561	3	370	1,588	90	21,550	150,602	160	136,316	246,784
Public works	11	2,394	3,980	1	.....	.....	2	9	12	1	.....	nil	15	2,403	3,992
Unclassified	6	82	142	2	1,000	150	1	130	.....	6	21	3,024	15	1,233	3,316
Unknown	10	180	8,969	8	5,391	4,510	5	2,125	16,072	13	3,003	20,470	36	10,699	50,021
Total	417	702,652	271,486	335	390,423	485,068	270	77,286	69,186	444	63,090	562,277	1,466	1,233,451	1,388,017
Total cost of suppression	.....	.....	49,066	.....	.....	62,464	.....	.....	12,302	.....	.....	73,819	.....	.....	197,651
Total fire loss	.....	.....	320,552	.....	.....	547,532	.....	.....	81,488	.....	.....	636,096	.....	.....	1,585,668

Table No. 2

FIRES WITHIN AND OUTSIDE OF NATIONAL FORESTS: FOREST CONDITION OF BURNED-OVER AREAS, EXPENDITURE FOR FIRE-FIGHTING, ETC.

Province	Non-forested	Young growth	Cut-over lands	Merchantable timber		Expenditure for fire fighting		
				Area	Value	Ranger service	Other expenditure	Total
	acres	acres	acres	acres	$	$	$	$
Manitoba	505,344	101,216	4,209	91,883	123,521	4,369	49,066	53,435
Saskatchewan	118,165	172,469	7,052	92,737	249,010	4,776	62,464	67,240
Alberta	42,519	12,222	10,330	12,573	22,789	2,285	12,302	14,587
British Columbia (Railway Belt)	8,959	15,923	5,493	32,715	394,483	6,561	73,819	80,380
Total	674,987	301,830	27,084	229,908	789,803	17,991	197,651	215,642

Table No. 3

CLASSIFICATION BY SIZE OF FIRE

Province	Class A (under ¼ acre)		Class B (¼ acre and over, but under 10 acres)		Class C (10 acres to 500 acres)		Class D (over 500 acres)		Totals 1930-31		Totals 1929-30	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent by provinces	Number	Per cent Class A
Manitoba	93	22	108	25	152	37	64	16	417	28	660	5
Saskatchewan	46	14	44	13	151	45	94	28	335	23	517	19
Alberta	93	35	80	30	74	27	23	8	270	18	396	34
British Columbia (Railway Belt)	166	37	180	41	71	16	27	6	444	31	460	32
Totals	398	27	412	28	448	31	208	14	1,466	100	2,033	20

Table No. 4

DISTRIBUTION OF FIRES BY MONTHS

Month	Manitoba		Saskatchewan		Alberta		British Columbia		Totals	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
January, 1930					1	0·4			1	0
February					2	0·7			2	0
March					41	15·2	3	1	96	7
April	17	4	35	11	55	20·4	27	6	274	19
May	67	16	125	37	27	10·0	17	4	176	12
June	61	15	71	21	26	9·6	177	40	271	18
July	58	14	10	3	57	21·1	172	38	470	32
August	176	42	65	19	15	5·6	46	10	124	8
September	34	8	29	9	8	3·0	2	1	13	1
October	3	1			35	12·9			36	3
November	1				3	1·1			3	
December										
Totals	417	100	335	100	270	100·0	444	100	1,466	100

Table No. 5

STATEMENT OF THE ANNUAL AMOUNT OF TIMBER AND OTHER PROPERTY DESTROYED

Province	Salvable timber			Unsalvable timber			Damage to timber		Damage to young growth		Damage to other property		Total damage
	Saw-timber	Other	Depreciation	Saw-timber	Other	Damage							
	M Ft. B.M.	cords	$	M Ft. B.M.	cords	$	$	p.c.	$	p.c.	$	p.c.	$
Manitoba	114	13,194	3,271	511	193,156	120,249	123,521	45·5	118,449	43·5	29,515	11·0	271,486
Saskatchewan	22,173	53,189	116,717	7,896	457,616	132,280	249,010	51·0	234,712	48·8	1,346	0·2	485,068
Alberta	2,028	688	2,111	13,719	15,053	20,678	22,789	32·0	25,213	36·0	21,182	32·0	69,186
British Columbia (Dominion Lands)	32,695	9,919	12,015	110,364	16,705	382,468	394,483	70·1	62,663	11·1	105,129	18·8	562,277
Totals	57,010	76,990	134,114	132,490	682,530	655,675	789,803	57·0	441,037	31·7	157,172	11·3	1,388,017

Table No. 6

STATEMENT OF DOMINION LANDS BURNED OVER, SHOWING OWNERSHIP AND FOREST CONDITIONS

Province	Total area burned over	Ownership				Forest condition							
		Public		Private		Merchantable timber		Partially cut-over		Young growth		Not forested	
	acres	acres	%	acres	%	acres	%	acres	%	acres	%	acres	%
Manitoba	702,652	696,469	99·1	6,183	0·9	91,883	13·0	4,209	0·6	101,216	14·4	505,344	72·0
Saskatchewan	390,423	353,205	90·5	37,218	9·5	92,737	23·7	7,052	1·8	172,469	44·2	118,165	30·3
Alberta	77,286	74,836	96·9	2,450	3·1	12,573	16·2	10,330	13·2	12,222	15·6	42,519	55·0
British Columbia (Dominion Lands)	63,090	56,510	89·6	6,580	10·4	32,715	51·8	5,493	8·7	15,923	25·2	8,959	14·3
Totals	1,233,451	1,181,020	95·7	52,431	4·3	229,908	18·6	27,084	2·2	301,830	24·4	674,987	54·8

Fire-Hazard Studies

Important progress was made in the fire-hazard research studies being conducted at the Petawawa forest experiment station at Chalk River, Ont. The zones of inflammability for mixed red pine and white pine corresponding to the moisture content of the litter on the forest floor were further investigated and previous findings confirmed. From the added data secured it was possible to begin a statistical analysis of the effect of the different weather factors in altering the moisture content, and therefore the inflammability, of mixed red and white pine forest. Fire-hazard tables are now in course of preparation for this type, by the aid of which it will be possible to compute from the daily weather records the degree of hazard occurring each day.

Similar studies were begun in the pure red pine and in the mixed jack pine, red pine, and white pine types.

In co-operation with the Dominion Meteorological Service, daily weather forecasts were received at the station and experiments are under way to improve the accuracy of weather forecasting as applied to forest-fire hazard.

Improvements

Owing to the special circumstances in which the Service was placed, little improvement work other than necessary maintenance work was undertaken.

Forest Administration

As the actual work of forest administration varied so much in the different provinces, owing to the differing dates of the transfer to the respective provinces of their resources, only a very general report in this regard is possible.

Grazing and Hay.—Manitoba, during the first part of the season, showed some improvement over last year (1929-30). British Columbia showed a decided falling off. In Alberta the conditions were, for the most part, favourable, and stock left the ranges in good shape.

Timber Sales and Permits.—The year was a very quiet one with respect to both sales and permits. Alberta reported a permit business somewhat above normal in the reserves in southern Alberta, and British Columbia reported a fair market for telephone poles, but generally the demand for timber was greatly diminished.

Surveys

Stock-taking surveys were carried on in the Porcupine forest, in Manitoba; in the Pasquia forest, in Saskatchewan; and in an area on the North Saskatchewan river, in and adjacent to the Clearwater forest in Alberta. Rate-of-growth surveys were also conducted in all the provinces in connection with the National Forest Inventory.

Reforestation

Manitoba set out 626,000 seedlings—mostly white spruce and jack pine—in transplant beds, and set out in permanent plantations 366,000 trees comprising 249,000 jack pine, 95,000 spruce, and 11,000 each of red pine and lodgepole pine. Very little loss was met with among the latter. In Saskatchewan 1,800,000 seedlings were set out in transplant beds, and 325,000 trees were set out in permanent plantations.

Seed Collection and Extraction

At the seed-extraction plant at New Westminster, B.C., a total quantity of 2,933 pounds of seed was extracted from 6,261 bushels of cones; of this seed 1,552 pounds were Douglas fir, 1,114 pounds Western yellow pine (*Pinus ponderosa*), and smaller quantities lodgepole pine, Sitka spruce, lowland fir, red alder, Western cedar, and yellow cypress. Practically all of this seed was sent to the Forestry Commission of Great Britain and the Government Forest Service of New Zealand. From the standpoint of seed collection, however, the year was very unsatisfactory; in nearly all cases the crops were poor in both quantity and quality, and the damage done by insect pests was the worst ever recorded. A small quantity of white spruce seed was extracted at the Prince Albert (Saskatchewan) plant. At Indian Head, caragana and elm seed were secured, and also white spruce and Colorado spruce seed; but the crops of maple and ash seed were total failures.

Tree Planting on Prairie Farms

The growing season of 1930 was even more unfavourable for nursery and tree-planting work than the one immediately preceding. Owing to the cumulative effect of three consecutive years of scanty rainfall, a number of trees died, particularly poplars and willows. In the spring of 1931 little moisture was to be found in the soil, and none at all in the subsoil. Notwithstanding all these discouragements, however, interest in tree planting was greater than at any time in the past.

The dry seasons have emphasized the advantages of thorough preparation of the soil before planting and systematic cultivation after planting, as well as the mistake of planting exclusively fast-growing species. The ash has been found the most reliable for hardiness and resistance, and caragana and elm have stood the test well. Maple has, particularly on the heavier soils, been somewhat of a disappointment in the respects mentioned, but serves a useful purpose in mixture with other species. Poplars do well in all circumstances up to six or seven years of age, produce a quick effect, and may be used in limited numbers. Willows are found to require a comparatively moist situation in order to do well. The coniferous trees (evergreens) are showing good results.

The number of inspections in the season of 1930 was the largest ever made; they numbered 13,780, of which 3,221 were new applications. About 7,500 farmers were listed to get trees in the spring of 1931—400 more than in any previous year. Inspection in the season of 1930 was continued till the middle of October.

Rooted stock showed about the same proportion of survivals as usual, despite dry weather. The number of failures in the cuttings was greater than usual. Plantations up to six years of age showed up well, but it was in the older plantations that the dying out was most apparent. Spacing seemed not to be an important factor in regard to survival. Mulching was proved to cause damage to the plantations so treated, owing to its inducing shallow rooting of the trees. Soil drifting and an abnormally early storm in autumn were also causes of loss.

Field-shelters are being more generally planted, especially in southern Alberta, which now has approximately 175 of these.

The inspection lists for the 1931 season are considerably larger than those of the preceding season (1930), the number of new applications being 2,594.

The distribution work of the 1930 season was completed by the end of April; 6,210,175 broad-leaved trees were sent to 7,107 farmers, and 116,900 coniferous trees were distributed among 1,116 farmers. The loss among these latter, owing to weather conditions, was greater than usual. Fifty thousand two-year seedlings were sent for planting on the Spruce Woods forest.

The research work in thinning among the permanent plots was continued, the maple being cut out in three plots where the main species were tamarack and Scotch pine. A number of tamarack died, probably owing to drought.

The trials of exotic species were continued; the majority of these were derived from seeds collected in western China and Mongolia.

An experiment made in covering nursery beds of white spruce and Scotch pine with burlap during the winter gave the result that the number of seedlings in the burlap-covered beds was from ten to thirteen times that in the beds left bare. In the case of white spruce, the density of seedlings in the autumn-sowed burlapped bed was twice that in the spring-sown bed, germination was two weeks earlier, and the size of the seedlings was somewhat greater.

Pathological research was conducted along four lines, namely, (1) Poplar cankers, (2) coniferous seed-beds, (3) preservative treatment of posts and (4) control of snow mould of lawns. With regard to the septoria disease (canker) of poplar, investigation has established the following facts: (*a*) the disease is equally virulent on Russian, Northwest, and Saskatchewan poplars; (*b*) the disease enters the stem through wounds, but will not penetrate healthy bark; (*c*) the time from infection to maturity is seven weeks. In the case of the perennial canker of poplar (apparently a fungus of the genus *Cytospora*), experiments are being made on the results of tree surgery applied to affected tree stems. Tests were made of chemical treatment of the soil of seed-beds with the object of preventing damping off. Experimental work in treating fence-posts with various preservatives was continued. Some areas of the lawns were treated with chemicals for the purpose of finding a remedy for the snow mould.

Forest Products Laboratories

Ottawa Laboratories

During the year the Forest Products Laboratories carried on seventy-nine distinct investigations. The number of technical inquiries answered was 41 per cent greater than in the preceding year.

Division of Wood Preservation.—Research in this division showed that the taste of creosote sometimes found in water flowing through creosoted wood-stave pipes can be removed by filtration through activated carbon. Investigations were made as to the efficacy of certain chemicals for fire-retardant treatment of wood. Investigative work in the steam seasoning of red pine and jack pine poles which have been given a preliminary steaming and vacuum treatment showed that in all such poles, the checking of the heartwood, and, in addition, the development of "shakes" in the jack pine poles, arises from the preliminary steaming or heating of the pole, and may possibly be reduced by a very slow application of heat. Inspection has shown that, though untreated jack pine piles placed a year ago in docks along the Atlantic coast showed considerable damage from wood-boring insects (*Teredo* and *Limnoria*), piles treated with creosote showed no damage, although *Limnoria* were noticed running over the surface. With the idea of devising an inexpensive treatment for poles and posts, poles were placed in cheap tin containers filled with preservative salts such as zinc chloride and copper sulphate; moisture trickling down the poles dissolves the salt, and during dry weather the evaporation of moisture from the upper part of the pole draws the solution upwards until the pole is eventually impregnated up to a few inches from the top. In time, however, the preservative is drawn away from the part of the pole near the ground line, which is the most exposed to fungus attack, and after a few year's service the parts of the pole just above and below the ground-line need to be subjected to a brush treatment with creosote. Treatment of several bundles of Western red cedar shingles with Grade 1 creosote oil showed a net absorption of 19½ pounds of oil per bundle. Investigations of the toxic qualities of alums, which are being used to a limited extent to protect timbers in mines against decay, showed that the alums were moderately toxic in agar-malt solutions, but not so toxic in wood. Considerable attention was given to a review of the literature on the distillation of Canadian softwoods, preliminary to the preparation of a circular on the distillation of these woods.

Division of Timber Mechanics.—Tests were made on the mechanical and physical properties of white ash, Eastern cedar, and beech from New Brunswick, white pine from Quebec, and white birch from Nova Scotia. All data on tests of mechanical and physical properties from the commencement of these tests, begun at the time of the establishment of the Laboratories, have been assembled and prepared for publication as a bulletin. A small glue laboratory was installed with apparatus for making glue determinations and the testing machines of the Laboratories were utilized in the determination of the relative holding power of different glues. Investigations were conducted with respect to the relation between the strength of glue and its viscosity and also the relation between the concentration of the glue solution and its jelly strength; results indicated that there is no law applicable to all glues. Another investigation related to the influence of variations in the surfaces glued upon the strength of the joint; results showed that the better the finish on the surfaces jointed, the stronger was the resultant joint. Investigations were made according to standard methods on the nail-holding powers of butternut, large-toothed aspen, Eastern cedar, yellow birch, ash, beech, and white pine. Investigations of the relation between the nail-holding power and the size of the nail, made on the various sizes of cement-coated nails, shows a definite relation between the density of the wood and the load required to pull the nails, the law governing this relation being a straight-line one. Tests were made on boxes of standard style No. 2 and standard style No. 4, varied in each case according to the thickness of the lumber and the nailing schedule. Tests of red-stained jack pine have shown that, of the two fungi (*Trametes Pini* and another still unnamed) which have been found to be the causes of this stain, the former may reduce the strength values by as much as 75 per cent of the normal, while the second has not been found to reduce the strength values by more than 10 per cent. At the suggestion of the Canadian Pulp and Paper Association, tests of bucksaws such as are used in the cutting of pulpwood were carried on, having regard particularly to the question of the effect of the pattern of the saw on its cutting efficiency. A number of tests were carried out for wood-working firms, for the Aviation Inspection Division of the Royal Canadian Air Force (Department of National Defence), the Purchasing Division of the Secretary's Branch of the Department of the Interior, and the National Research Council. Over 300 tests of containers were made, by the use of the hazard machine, for many industries. The total number of tests made by this division during the year was 24,355.

Division of Lumber Seasoning.—A survey was made by this division of over 100 wood-working plants in Quebec and the Maritime Provinces with regard to methods of lumber seasoning, especially kiln-drying practice; wide extremes of efficiency were found. Studies in kiln-drying white pine which had not been water-driven gave definite indications that with proper control of temperature and humidity the occurrence of brown stain could be reduced to an almost negligible degree; the same study showed that a great deal of "kiln brown-stain" almost certainly originates in the seasoning yards, not in the kilns, particularly in the case of stock partially seasoned in the yard and finished in the dry-kiln. Investigations made in connection with the kiln-drying of red pine have shown that with proper drying the gum contained in this wood can be treated so as to make the wood satisfactory for interior finish. A study of air-seasoning of white pine in the Ottawa valley is in progress. Figures have been compiled for shrinkage in commercial sizes of wood dried in the Laboratory's kiln.

Division of Timber Pathology.—Seventy-one specimens were added to the collection of pathological material, bringing the total number up to 821, and a collection of slides of different decays was started. Studies of slime formation in pulp and paper mills were resumed. A study of chemicals useful in combating blue stain in white pine indicated six as likely to be useful, and these were given further tests in mill yards; three mercury compounds proved very effective in controlling the stain; sodium chromate and sodium bichromate prevented the stain, but themselves stained the wood, and sodium fluoride proved less effective than sodium bicarbonate, which is commonly used. All chemically treated wood proved more resistant to infection than untreated wood. Progress has been made in a systematic study of fungi causing stains in softwoods. Study of red-heart in birch showed the fungus *Torula ligniperda* to be the cause of this defect. Considerable work was done in this division for other divisions of the Forest Service, other government departments, and various industrial concerns.

Division of Wood Utilization.—In response to a request from the Canadian Pulp and Paper Association that a study of log sinkage be undertaken, the Laboratories, co-operating with the Pulp and Paper Association and McGill University, have undertaken an extensive investigation of the subject, the part of the study assigned to the Laboratories being the investigation of the effect of seasoning on sinkage. White birch, white spruce, and balsam fir were the species studied, and the results of the investigation indicate that

seasoning improves both the initial and the subsequent buoyancy of logs of the species studied, whether sound or unsound; that birch logs that have been seasoned to 20 per cent reduction of the original green moisture content will float almost as well as those seasoned to a reduction of 60 per cent, but spruce and balsam fir logs must be seasoned up to 40 to 60 per cent of that content in order to float better than green logs; that small top-logs and logs recovered after sinkage can be seasoned so as to improve their floatability considerably, and that severe seasoning checks have no injurious effect on floatability. In connection with a survey of sawmill waste in Eastern Canada fifty representative sawmills in Ontario and Quebec were investigated and reported on. Co-operation was extended to other divisions of the Forest Service in their fire-weather studies, particularly in determining the "flash point" of red and white pine duff and also in defining the zones of inflammability of the same material. Looking to the better utilization of side lumber from hardwood operations in the manufacture of small dimension stock, the Laboratories, in co-operation with the United States Forest Products Laboratory (Madison, Wis., U.S.A.) have been conducting investigations, the work of these laboratories being concentrated on the investigation of the logging of hardwoods and the sawmill operations.

Division of Timber Physics.—Research was undertaken on the dimensions (length and thickness) of the fibre of Engelmann spruce, which are very important to its pulping qualities. Plans were developed for the investigation of variations of the physical properties of wood (weight, hardness, etc.) within the same species. Arrangements were made for obtaining samples of Russian pulpwood on which to carry out tests of cubic footage per cord, density, and pulping qualities. Investigations as to the effect of water of different temperatures on the sinkage of logs tended to show that there was little difference between the floating properties of wood at 35 degrees Fahrenheit and those of the same wood at 60 degrees Fahrenheit; this investigation will be continued.

Division of Markets and Exhibits.—Ninety-seven sets of hand specimens of Canadian woods were distributed—58 in Canada, 26 in the United Kingdom, the rest to widely separated parts of North and South America, countries in continental Europe and Australia and Africa. Sections of birch and maple flooring were sent to Canadian Trade Commissioners in London, Liverpool, Bristol, Glasgow, Dublin, and Auckland (New Zealand). Panels of the most important commercial woods of Canada, in sets of fifteen, were sent to the University of Liverpool; the Liverpool Public Museum; the Chief Engineer, Department of Public Works, Antwerp, Belgium; the Canadian Government Trade Commissioners at Rio de Janeiro, Brazil, and Oslo, Norway; the New Zealand Forest Service; the Department of Public Works, Kingston, Jamaica; the Jamaican Government Railways, Kingston, Jamaica; the Minister of Agriculture, Buenos Aires, Argentine Republic; and the Cawthorn Institute, Nelson, New Zealand. The Laboratories also co-operated in preparing exhibits for the Produced-in-Canada exhibition at Montreal (November, 1930), the Quebec Provincial Exhibition (Quebec city, August, 1930), and the Imperial Institute, London, England.

PULP AND PAPER LABORATORY (MONTREAL)

The former close relations with the Pulp and Paper Association, especially with the Technical Section of that Association, have been maintained. The pulp and paper industry is manifesting great interest in the laboratory's work, and used its services very extensively.

The problems on which the laboratory has been working during the year are comprised under the heads of (1) Methods of Analysis, 2) Definition of Pulp Quality, (3) Definition of Fibre Quality, (4) Sulphite Process Studies, (5) Alkaline Process Studies, (6) Bleaching Studies, (7) Penetration Studies, and (8) Groundwood Studies.

Sixty-seven methods of analysis have been adopted as standard for the laboratories.

In the work on definition of pulp quality, physical tests and chemical tests have been studied. Under the former head, in dry strength testing, a comparative test has been made between the method proposed by the British Wood Pulp Association and that proposed by the Canadian and American Pulp and Paper Associations. In wet testing, trials have been made of a modified tensile tester developed by a large pulp and paper company; application of the bursting principle has given most satisfactory results. In the freeness test, increasing use has been made of the instrument developed at these laboratories, there being now in use one hundred and thirty-six instruments throughout seven countries. The laboratory is now working on a method of analysis by selective screening. Another method of analysis of pulp as to consistency and particle size by means of the action of a beam of light on the effluent from the screens in the test referred to is being investigated. Work as to colour of pulp has been concentrated on increasing the accuracy of an instrument already extensively used. Study of the beating test has been continued, and a new design of test beater has been developed at the laboratory, in which an endeavour has been made to overcome the disadvantages of the present test beaters. Existing methods of chemical testing are being improved by simplification of technique; such methods give results that, in view of their empirical nature, are remarkably accurate, but advancement may be made by improving the technique and closely studying the reactions involved in the various tests. A paper surface tester is being constructed, based on the principle that a uniformly distributed coating of carbon black impressed on the surface of the paper under accurately standardized conditions will leave an impression indicating the printing qualities of the paper. An apparatus is also being devised to measure resilience in paper, working from the thought that resilience increases the absorption of printers' ink into the interstices of newsprint paper.

In the work on definition of fibre quality, the staff of the laboratory have been investigating relative compressibility as a measure of pulp quality, and have also conducted investigations of so-called hydration which have led to a new understanding and a new theory of this characteristic. The work of the laboratory has shown that solutions of sulphur dioxide at temperatures in the neighbourhood of those used in the sulphite process are quite a little less acidic than has commonly been supposed, making it improbable that the primary process of sulphite cooking is acid hydrolysis as usually pictured. Incidental work has proved of considerable value in working out improved operating procedure for sulphite mills. Following discovery of a method of producing soda pulp suitable for the manufacture of artificial silk through the use of low-concentration alkali, further research has been carried out which proves the possibility of varying the characteristics of the pulp produced from those of a typical soda pulp to a pulp closely resembling sulphite. An investigation of the fundamentals of the bleaching process is under way; incidental work in this line has yielded a method of colour measurement, the measurement of hydrogen-ion concentration in bleaching liquors, the application of the viscosity test to define overbleaching, and the development of a satisfactory apparatus for the study of the physico-chemical relationship defined in the main body of the work. Study of the action of the cooking liquor in its penetration of the wood

chips and, subsequently, the wood-fibres promises to lead to great results. In the Groundwood Studies, the work done by the laboratory on freeness, sedimentation, and other points already mentioned is expected to yield an index of quality; plans have been made, and machinery is under construction, to effect the formulation of a definition of stone quality and surface. Surface pattern of stone is now being studied. The laboratory is also making a study of the operation of the rod mill as an economic means of beating and refining.

THE VANCOUVER LABORATORY

In the case of the Vancouver laboratory close contact has been maintained with the industry, which has resulted in many improvements in mill practice. Technical inquiries addressed to this laboratory showed an increase of fifty per cent during the year.

Division of Timber Mechanics.—The Timber Mechanics division made a total of over 17,000 tests—a substantial increase. New projects included a series of tests to determine the relation of colour to the strength of Western red cedar; tests of the strength of Douglas fir and lodgepole pine telephone poles, creosote-treated and untreated; and the preparation of a working-plan for tests of structural timbers. Tests were completed on one shipment of old-growth Douglas fir (green), one shipment of Western white pine (green), and one shipment of Western red cedar (air-dried).

Tests of the effect of variable moisture content on the strength of wood were continued, using Douglas fir (both old-growth and second-growth), Western white pine, and Western red cedar. Various British Columbia species suitable for containers were tested as to their power to retain box nails, both coated and uncoated. A study of the relation of purple stains to the properties of Western red cedar boat stock was begun. Researches made in co-operation with the Prince Rupert Fisheries Experiment Station on the strength of glue prepared from fish waste has resulted in the development of at least one satisfactory product. Strength tests were made of one shipment of untreated Douglas fir telephone poles and one shipment of creosoted Douglas fir poles. A series of tests of Douglas fir structural timbers in service for thirty-five years was made. A large number of miscellaneous tests were made for local and outside firms, many of these resulting in better utilization.

Division of Timber Products.—The work of the Timber Products division is carried on under three heads, namely, Lumber Seasoning, Utilization, and Pathology. Work in Lumber Seasoning is further subdivided into studies in (*a*) Absorption of Moisture, (*b*) Air-seasoning, and (*c*) Kiln-seasoning. Under the first heading the study of the change in moisture content of kiln-dried lumber when shipped by water was continued in three shipments of kiln-dried Douglas fir and balsam forwarded to Australia and there checked by the officers of the Forest Products division of the Council for Scientific and Industrial Research of Australia. Results so far indicate such shipments to be economically feasible, provided that the moisture content at time of shipment and the conditions under which shipment is made are closely watched; for instance, where kiln-dried stock is shipped along with wet or only partially seasoned lumber, the moisture content may increase to a point where reconditioning on arrival at destination is necessary. Similarly, shipments have been made to South Africa and to England by way of the Panama canal. A study was commenced to determine the effect of length of storage on the hygroscopicity of seasoned lumber by comparison of the respective absorption of moisture by boards air-seasoned for three years and those seasoned for only six months. Investigation of a case of variation in size of hemlock box shooks prior to assembling indicated the variations were due to faulty practice and were remediable by proper milling conditions.

Investigation of the effect of air-seasoning and kiln-drying on ambrosia beetles in hemlock lumber was initiated. A special degrade study was made in co-operation with officials of the British Columbia Lumber and Shingle Manufacturers, Limited, of relative degrade in air-seasoned and kiln-dried Douglas fir flooring. Assistance was given the Australian representative of the British Columbia Lumber and Shingle Manufacturers, Limited, in methods to be followed in obtaining satisfactory air-seasoning of British Columbia lumber in southeastern Australia.

Investigations in kiln-seasoning have led to the development of further drying schedules for Western red cedar and Western hemlock. Other investigations have related to the effect of rapid circulation on the quality of drying, the shrinkage of commercial sizes of lumber when kiln-dried to different moisture contents under different drying conditions, and the effect of kiln-drying on the durability of cedar shingles. A special study was made of the effect of moisture content on the rusting of cans stored in hemlock boxes.

Reports were issued on the kiln-drying of Western red cedar and on wet spots in kiln-dried cedar.

The fourth annual six-day kiln-drying course had twenty-two students and was much the most satisfactory yet given. The work of the Laboratories in lumber-seasoning has become widely known to the British Columbia woodworking industry and has resulted in improved practice in seasoning. Assistance was given members of the physics department of the University of British Columbia in developing an electric moisture-meter.

Investigations into the amount of mill-waste in British Columbia sawmills showed a smaller amount of waste than had been anticipated. Studies of closer utilization through the use of improved methods of manufacture are being made. Studies relating primarily to the use of sawdust and hogged fuel for heating, both in commercial plants and in private houses, were also made on the heating value of these fuels; these studies were supplemented by a series of combustion tests made by the use of a hot-water boiler and a standard sawdust burner. Studies to determine the amount of waste in logging were continued in the Coast Douglas fir and Western red cedar type of forest.

The investigation of the relation of purple stains to the properties of Western red cedar boat stock was continued, and study was made of the toxicity of a specially developed wood preservative made from red cedar mill-waste, as compared with creosote. The reference collection of pathological material was enlarged and a beginning made in the preparation of a collection of plates showing sections of the woods of North America.

Publications issued in mimeographed or other form for limited distribution included: six issues of a laboratory "News Letter"; articles entitled "Moisture Content of Kiln-dried Lumber at Coast Sawmills"; "Suggestions for Seasoning British Columbia Lumber in Southeastern Australia"; "The Shrinkage of Kiln-dried Lumber"; and a set of tables showing allowable loads for concentrated and uniform loading of beams of various sizes and grades.

The laboratory co-operated with the British Columbia Lumber and Shingle Manufacturers, Limited, in preparing special exhibits of British Columbia manufactured lumber products for: the Canadian National Exhibition, Toronto; the British Columbia lumber representative in Australia; the Canadian Government Exhibition Commissioner for display at small exhibitions; various sales representatives in the West Indies, South Africa, South America, Australia, and New Zealand; the British Industries Fair in South America; the Crystal Palace, London, England; the Aeronautical Inspection Directorate in England; the Imperial Institute, London, England; and the Balfour Technical Institute, Regina, Sask. Minor collections were prepared for: the Ottawa laboratory, the Imperial Institute of Japan, the Imperial University of Japan at

Tokyo, the Consul General of Poland at Montreal, the British Columbia Lumber and Shingle Manufacturers, and the Western Red Cedar Association (Minneapolis, Minnesota). The laboratory also co-operated with the Canadian Forestry Association in preparing the forestry exhibit at the Vancouver exhibition.

Publicity

The first major activity of the division after the commencement of the fiscal year on April 1, 1930, was the annual advertising campaign for forest protection. An extensive campaign placed advertisements in 918 publications during the months of highest fire hazard.

In June, July, and August, a temporary staff of four lecturers visited forty boys' and girls' camps in Ontario and Quebec, addressing a total of 3,820 campers.

During the same period the Forest Service was represented at all Class A fairs in Manitoba, Saskatchewan, and Alberta, by an exhibit housed in cabins erected by the Service at Brandon, Saskatoon, Calgary, and Edmonton, and in the Exhibition Buildings at Regina. Local officers of the Forest Service established exhibits at many of the smaller fairs and exhibitions in the Prairie Provinces and British Columbia. The course of forestry lectures at the Dauphin (Manitoba) Normal school was again given.

Publications

The following publications were issued by the Service:—

Bulletins: No. 72, *Success in Prairie Tree Planting;* No. 1, *Tree Planting on the Prairies* (reprint); No. 83, *Sawmill Waste and Its Utilization in British Columbia.*

Circulars: No. 29, *Strength Tests of Creosoted Douglas Fir Railway Ties;* No. 30, *Rate of Growth and Density of the Wood of White Spruce;* No. 31, *Strength of Telephone Poles: Eastern Cedar, Red Pine, and Jack Pine;* No. 32, *Change in Moisture Content of Kiln-Dried Lumber when Shipped by Rail.*

Tree Pamphlet: No. 14, *Sugar Maple.*

Special Pamphlets: *The Forest Products Laboratories of Canada; Structure of Wood* (reprint).

French Editions: *L'Arbre et la Foret; Le Commerce des Arbres de Noel au Canada.*

Revenue

Owing to the transfer of natural resources to the western provinces, which was effective on July 15 for Manitoba, on August 1 for British Columbia, and on October 1 for Saskatchewan and Alberta, a comparison of the revenue with previous years would not be indicative of conditions within the reserves during the fiscal year, with regard to the uses made of available privileges.

Owing also to this factor the revenue for the fiscal year naturally shows a reduction. The details are given in the following table.

National forests	Timber sales		Timber permits, etc.		Grazing permits		Hay permits and seizures	Surface rental	Special uses	House rent	Tree seed	Fishing	Miscellaneous	Casual	Total revenue all sources
	Number operating	Revenue	Number	Revenue	Number	Revenue									
		$ cts.		$ cts.		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Manitoba District—														3,680 37	3,680 37
Duck Mountain	2	419 95	62	223 40	9	114 20	367 50	176 60	22 00				6 00		1,329 65
Porcupine No. 1	1	95 42	24	381 70	1	2 00	19 00	10 00	15 00					12 60	535 72
Riding Mountain			124	414 03	22	94 85	463 25	198 35	6 00				48 00		1,224 48
Sandilands			6	17 88			3 00								20 88
Spruce Woods							11 00								11 00
Turtle Mountain			7	34 50	30	365 40	147 75	27 60	20 00	77 60		23 00			695 85
Manitoba total	**3**	**515 37**	**223**	**1,071 51**	**62**	**576 45**	**1,011 50**	**412 55**	**63 00**	**77 60**		**23 00**	**54 00**	**3,692 97**	**7,497 95**
Saskatchewan District—														325 19	325 19
Beaver Hills			1	3 00	8	32 88	398 75								434 63
Big River		2,671 35	24	93 75			216 50		19 50	168 00					3,169 10
Dundurn			4	18 00	4	138 80	38 50		6 00						201 30
Elbow			35	79 25	180	1,212 08	31 75	1 00	114 00						1,438 08
Fort a la Corne		771 24	57	408 89	1	3 16	45 50		1 00	96 00			3 00		1,328 79
Keppel					45	351 43	2 50		5 00						358 93
Manito			6	13 00	102	1,526 99	25 25	76 25	46 00						1,687 49
Moose Mountain		19 53	72	284 73	23	195 50	312 25	165 86	36 00	108 00		1,075 00			2,196 87
Nisbet Pines	1	1,371 52	35	138 70	26	332 88	162 50	5 00	427 00						2,437 60
Pasquia	9	2,714 66	24	2,517 47	2	19 00	202 50	1 00	38 00	180 00					5,672 63
Porcupine No. 2	1	2,952 51	37	229 42	7	71 06	471 75	39 00	39 50				3 00		3,806 24
Seward					23	617 22	34 00		23 00						674 22
Saskatchewan total	**11**	**10,500 81**	**295**	**3,786 21**	**421**	**4,501 00**	**1,941 75**	**288 11**	**755 00**	**552 00**		**1,075 00**	**6 00**	**325 19**	**23,731 07**
Alberta District														166 76	166 76
Athabaska					4	23 60	14 50		11 00	108 00		76 00	3 50		236 60
Bow River	1	3,599 45	16	108 87	36	1,570 90	13 50	2 00	32 25			24 00	251 25		5,602 22
Brazeau	2	2,242 18	22	98 25	43	359 20		489 38	23 00	108 00		612 00	10 50		3,942 51
Clearwater	2	3,579 91	7	96 50	37	155 80	7 00	9 55	1 64			418 00	1 25		4,269 65
Cooking Lake			1	3 00	76	547 06	138 50		1 00	108 00					797 56
Crowsnest	2	756 00	89	1,468 20	109	3,569 34	19 00	5 03	169 25			60 00	0 50		6,047 32
Cypress Hills			291	1,529 67	86	2,023 38	73 25	75 00	65 40	108 00			10 50		3,885 20
Lesser Slave	1	5,488 50					28 25			108 00		23 00	0 50		5,648 25
Alberta total	**8**	**15,666 04**	**426**	**3,304 49**	**391**	**8,249 28**	**294 00**	**580 96**	**303 54**	**540 00**		**1,213 00**	**278 00**	**166 76**	**30,596 07**
British Columbia Reserves	17	6,777 67	4	41 37	55	995 02	63 50	181 00	97 89		12,938 13	94 00	18 02		21,206 60
Indian Head Nursery										1,200 00			2,310 48	103 10	3,613 58
For. Products Labs													496 15		496 15
(Petawawa) H.O	3	3,311 09		139 00									6 13	85 13	3,541 35
Gross Revenue	**42**	**36,770 98**	**948**	**8,342 58**	**929**	**14,321 75**	**3,310 75**	**1,462 62**	**1,219 43**	**2,369 60**	**12,938 13**	**2,405 00**	**3,168 78**	**4,373 15**	**90,682 77**
Refunds		2,731 30		1,329 75		76 14	55 50	15 02			59 23		27 00		4,293 94
Net Revenue		**34,039 68**		**7,012 83**		**14,245 61**	**3,255 25**	**1,447 60**	**1,219 43**	**2,369 60**	**12,878 90**	**2,405 00**	**3,141 78**	**4,373 15**	**86,388 83**