

DEPARTMENT OF THE INTERIOR, CANADA

HON. CHARLES STEWART, Minister

W. W. CORY, C.M.G., Deputy Minister

E. H. FINLAYSON, Director of Forestry

REPORT

OF THE

DIRECTOR OF FORESTRY

1928-9

(FISCAL YEAR ENDED MARCH 31, 1929)

OTTAWA
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1930

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FORESTRY

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

EMPIRE FORESTRY CONFERENCE

The outstanding event in forestry affairs during the year was the Third British Empire Forestry Conference held in Australia and New Zealand from August to October.

The Canadian delegation was headed by Mr. E. H. Finlayson, Director of Forestry, of the Department of the Interior. Other delegates were Mr. D. Roy Cameron, Associate Director of Forestry; Dr. J. M. Swaine, Associate Dominion Entomologist, of the Department of Agriculture; Mr. E. J. Zavitz, Deputy Minister of Forests for the province of Ontario; and Mr. P. Z. Caverhill, Chief Forester of the province of British Columbia.

The conference reviewed the progress made in forestry in the various parts of the Empire during the five years which had elapsed since the second conference held in Canada in 1923, and discussed in detail forestry problems relating to the Empire in general and to Australia and New Zealand in particular. Meetings were held in the capital cities of the Australian states, with the concluding session at Canberra. In New Zealand, important sessions were held at Wellington and at Auckland, where the conference was wound up on October 22.

The most important feature of the conference, however, was the opportunity afforded for special inspection of forest conditions throughout Australia and New Zealand, for discussion of these conditions with local forest officers, and for comparison of them with conditions existing in all other parts of the British Empire. The importance of Canadian forest resources to the well-being of the British Empire was stressed, and attention was drawn to the necessity for the adoption in Canada, as in other parts of the Empire, of the main elements of proper forest policy.

The following excerpt from the report of the conference is of particular interest: "Emphasis was laid on the need for considering forestry in its national and imperial aspects, rather than as a simple matter of provincial or local concern. The view was advanced that central governments should take the lead in matters of policy—except where they are constitutionally precluded from so doing—laying down policy and taking control of legislation, general management, the alienation of reserved forest, the recruitment and training of superior staff, and research. Interference in petty detail was not contemplated."

GENERAL

The fire season of 1928 was in many respects unusual. Except in British Columbia, the snowfall during the preceding winter was extremely light and with the advent of spring came warm, dry weather, which resulted in an outbreak of fires throughout the Prairie Provinces. A second period of fire danger occurred, as might be expected, during the summer season, but this was followed by a third period during the fall, prolonged, indeed, well into the winter months. As a matter of fact, forest fires were fought in the northern parts of the provinces of Manitoba and Saskatchewan well into the New Year. That the loss to timber and property was kept within reasonable bounds was due largely to improved organization, better equipment, and increased facilities for detection, communication, and transportation. In particular, the use of aircraft was extended and improved to a marked degree.

Activities in forest research continued along normal lines both in the conduct of experiment stations and in co-operative undertakings with the provincial forest authorities and with several of the larger pulp and paper corporations. The Forest Products Laboratories at Ottawa became established in their new location, and a start was made on an extended program of work rendered possible by increased facilities and augmented staff. The year also saw the installation of the Pulp and Paper Division in the new quarters at Montreal provided by the Pulp and Paper Association.

FIRES AND FIRE PROTECTION

Manitoba.—In Manitoba the fire season of 1928 was one of the worst ever experienced. The snowfall during the preceding winter had been light, and warm, dry weather came on in the spring, with the result that the ground dried out rapidly and risk of fire ensued. In the south of the province a high fire-hazard existed from early spring until approximately the end of May. In northern Manitoba these conditions started somewhat later, but continued until the end of August. Another season of fire danger occurred in September and October, although in this case it was not so serious. The danger of fires ceased about the middle of November. Of the fires that occurred in May, 34.4 per cent were due to settlers and 17.5 per cent to incendiaries. In 1,660 hours of flying the aerial patrol detected 179 fires; of this time 34 hours were flown during winter and early spring with aeroplanes equipped with skis. No smouldering ground fires were discovered during the late winter of 1928.

Saskatchewan.—In Saskatchewan the fire season was the longest for ten years; the fire-hazard covered practically the entire season. The area of timberland destroyed, however, was comparatively small and the loss of merchantable timber was extremely slight. The weather in September and October was very mild and prolonged the hazard conditions, which were, however, relieved by a light snowfall in December. The aircraft operations for fire protection proved very successful. A new feature of the situation was the numerous ground fires in the woods during the hunting season (commencing November 15), fifteen or twenty fires having been reported in late November and early December. The total area burned within the national forests was 20,725 acres—less than half of one per cent of the total area of these forests. Losses from fires within the national forests in 1928 are about half the average for the preceding five years; the fire loss on the national forests did not exceed \$16,000.

In the last quarter of the fiscal year (January to March inclusive, 1929) thirty-one fires were reported. These resulted principally from winter logging operations and work on winter freight roads, having been set by loggers, hunters, trappers, and fishermen. They were spreading in the ground under the snow, and all required trenching. Nearly all the fire-ranging staff went on duty early in March, 1929.

Air operations for the 1929 season commenced on March 15. The rangers were transported to their districts, and supplies and equipment sent to the northern posts. Wireless stations at Ladder Lake and Ile à la Crosse reopened during March, and that at Pelican Lake was expected to open early in April. Five wireless stations are now in operation.

Alberta.—In Alberta there were three periods of fire-hazard. The first of these comprised the latter half of May in the Lesser Slave district and Edmonton fire-ranging district, and on to June 5 in the forests of the eastern slope of the Rockies; much of the danger arose from the dried vegetation of the previous year. The second period lasted from the middle of July to the middle of August, and the third began in the first week of September and lasted until the end of November.

During the third period a great quantity of dry vegetable material had accumulated, owing to the prolonged dry weather and the early frosts; many new settlers were using fire for clearing land, and an early harvest and excellent roads gave unusual opportunities for farmers and others to go hunting. All these circumstances combined gave rise to an unusually severe fire-hazard. In the air patrol 241 hours flying was done from the High River base, and 181 hours from the sub-base at Grande Prairie, the total time spent in flying thus amounting to 422 hours.

British Columbia.—The fire season in British Columbia was exceptionally favourable, and the damage done by fire and the cost of fire-fighting were among the lowest on record. During the winter of 1927-8 there was an unusually heavy snowfall. In April there was a small hazard and the month of May was very dry; again in the latter part of July and throughout the month of August there was a severe hazard. The damage from railway fires was very small, though over twenty per cent of the fires originated from the operation of railways. Lightning was another of the chief causes.

The following tables give the figures for the forest fires of the season of 1928-9:—

STATEMENT OF FOREST FIRES ON DOMINION LANDS UNDER THE PROTECTION OF THE FOREST SERVICE, DEPARTMENT OF THE INTERIOR, DURING THE YEAR ENDED MARCH 31, 1929

Table 1

FIRES WITHIN NATIONAL FORESTS: NUMBER, AREA BURNED AND FIRE LOSS BY CAUSES

Causes	Manitoba			Saskatchewan			Alberta			British Columbia			Totals		
	No.	Area	Dam-	No.	Area	Dam-	No.	Area	Dam-	No.	Area	Dam-	No.	Area	Dam-
		acres	\$		acres	\$		acres	\$		acres	\$		acres	\$
Camp-fires.....	5	1,082	222	28	3,383	2,441	6	4	17	9	1,776	1,809	48	6,245	4,489
Smokers.....	5	58	10	7	483	966	6	759	713	17	4,776	9,132	35	6,076	10,821
Settlers.....	3	720		12	11,160	8,696	1	100	67				16	11,980	8,763
Railways.....				12	2,142	2,995	7	50	28	10	95	2,470	29	2,287	5,493
Lightning.....				1	500	377				7	72	360	8	572	737
Industrial operations.....				10	3	50	2	9	8				12	12	53
Incendiary.....	18	19,578	17,546	8	1,933	389	1			15	5,791	5,041	42	27,302	22,976
Public works.....	1														
Unclassified.....			40	2	6					3	20	15	1	26	55
Unknown.....	8	2,106	548	4	1,115	35	2	2,587	4,700				15	5,808	5,283
Totals.....	40	23,544	18,366	84	20,725	15,949	28	3,509	5,533	61	12,530	18,827	213	60,308	58,675
Total costs of suppression.....						3,898			872			13,859			23,320
Total fire losses.....			23,057			19,847			6,405			32,686			81,995

Table 1a

FIRES WITHIN NATIONAL FORESTS: FOREST CONDITION OF BURNED-OVER AREAS, AND MONTHS OF OCCURRENCE OF FIRES

Province	Forest condition					Months of occurrence											
	Non-forested	Young growth	Cut-over land	Merchantable timber		April '28	May '28	June '28	July '28	Aug. '28	Sept. '28	Oct. '28	Nov. '28	Dec. '28	Jan. '29	Feb. '29	Mar. '29
				Area	Value												
	acres	acres	acres	acres	\$												Total
Manitoba.....	14,258	6,762	690	1,834	1,948	2	30		1	2	3	1					40
Saskatchewan.....	14,304	3,893	697	1,831	5,739	8	33	2	1	5	3	5	1				84
Alberta.....	1,877	917	207	508	2,012	1	15		2		16	5	6	1	2	1	28
British Columbia (Ry. Belt).....	2,500	1,484	345	8,201	13,815		9	1	12	17	22						61
Total.....	32,939	13,056	1,939	12,374	23,514	11	87	3	16	24	44	6	13	2	2	1	213

Table 2

FIRES OUTSIDE NATIONAL FORESTS: NUMBER, AREA BURNED AND FIRE LOSS BY CAUSE

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.....	157	182,748	63,695	84	41,641	59,602	51	48,588	26,104	23	14	4	315	272,991	149,406
Smokers.....	16	1,723	1,026	14	19,687	8,875	16	6,596	8,915	41	425	136	87	28,431	18,952
Settlers.....	65	31,088	5,989	73	174,870	90,214	66	106,690	66,020	20	376	1,885	224	313,024	164,106
Railways.....	39	95,559	32,050	8	2,086	4,635	201	13,588	5,569	223	1,262	9,939	471	112,495	52,193
Lightning.....	34	71,045	50,999	12	138,508	132,388	.....	.....	.....	56	322	1,308	102	209,875	184,722
Industrial operations.....	.....	.....	.....	9	31	15,520	4	3,760	3,439	5	1,277	3,859	18	5,068	22,818
Incendary.....	12	3,737	2,855	25	43,518	26,482	5	19,061	17,187	18	300	4,385	60	66,616	50,969
Public works.....	.....	.....	.....	.....	390	57	.....	.....	.....	2	.....	.....	4	390	57
Unclassified.....	4	4,637	10,931	2	26	31	12	2,854	413	17	406	2,190	35	7,923	13,565
Unknown.....	13	6,302	2,932	7	25,662	15,210	13	16,068	30,486	9	563	4,725	42	48,595	53,353
Totals.....	340	396,839	170,477	236	446,419	353,014	368	217,205	158,133	414	4,945	28,459	1358	1,065,408	710,083
Total costs of suppression.....	.....	.....	19,905	.....	.....	27,842	.....	.....	15,377	.....	.....	12,749	.....	.....	75,873
Total fire losses.....	.....	.....	190,338	.....	.....	380,856	.....	.....	173,510	.....	.....	41,208	.....	.....	785,912

Table 3

FIRES WITHIN AND OUTSIDE NATIONAL FORESTS: TOTAL NUMBER, 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.....	162	183,830	63,917	112	45,024	62,043	57	48,592	26,121	32	1,790	1,813	363	279,236	153,894
Smokers.....	21	1,781	1,036	21	20,170	9,841	22	7,355	9,628	58	5,201	9,268	122	34,507	29,773
Settlers.....	68	31,808	5,989	85	186,030	98,910	67	106,790	66,087	20	376	1,885	240	325,004	172,871
Railways.....	39	95,559	32,050	20	4,228	7,630	208	13,638	5,597	233	1,357	12,409	500	114,782	57,886
Lightning.....	34	71,045	50,999	13	139,008	132,765	.....	.....	.....	63	394	1,696	110	210,447	185,460
Industrial operations.....	.....	.....	.....	19	34	15,570	6	3,760	3,447	5	1,277	3,859	30	5,080	22,876
Incendary.....	30	23,315	20,401	33	45,451	26,871	6	19,061	17,187	33	6,091	9,426	102	93,918	73,885
Public works.....	1	.....	.....	.....	390	57	.....	.....	.....	2	.....	.....	5	390	57
Unclassified.....	4	4,637	10,971	4	32	31	14	2,854	413	20	426	2,205	42	7,949	13,620
Unknown.....	21	8,408	3,480	11	26,777	15,245	16	18,655	35,186	9	563	4,725	57	54,403	58,636
Totals.....	380	420,383	188,843	320	467,144	368,963	396	220,714	163,666	475	17,475	47,286	1,571	1,125,716	768,758
Total costs of suppression.....	.....	.....	54,596	.....	.....	31,740	.....	.....	16,249	.....	.....	26,603	.....	.....	99,193
Total fire losses.....	.....	.....	213,395	.....	.....	400,703	.....	.....	179,915	.....	.....	73,894	.....	.....	867,951

Table 3a

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

Province	Forest condition					Cash expenditure for fire-fighting	Fires under jurisdiction Railway Board	
	Non-forested	Young growth	Cut-over land	Merchantable timber			No.	Loss
				Area	Value			
	acres	acres	acres	acres	\$	\$		\$
Manitoba.....	271,920	112,250	2,447	33,766	94,467	24,596	28	1,345
Saskatchewan.....	195,335	148,594	10,785	112,253	117,674	31,740	12	2,725
Alberta.....	139,669	48,641	10,517	22,064	67,009	16,249	208	4,902
British Columbia (Ry. Belt)....	4,933	1,773	2,087	8,682	19,434	26,608	139	8,169
Total.....	611,857	311,258	25,836	176,765	298,584	99,193	387	17,041

NOTE.—In the figures given for fires in the territory under the jurisdiction of the Board of Railway Commissioners in British Columbia, the number of fires (139) refers to fires in the Railway Belt only. Of the total loss (\$8,169), only \$8 represents timber, young or old, the balance being included under the heading "Other Property", such as buildings, logging equipment, etc.

Table 4

CLASSIFICATION BY SIZE OF FIRE

Province	Class A (Under 1 acre)		Class B (1 acre and over, but under 10 acres)		Class C (10 acres and over)		Totals, 1928-29		Totals, 1927-28		Totals, 1925-27	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent by province	Total No. of fires	Per cent Class "A"	Total No. of fires	Per cent Class "A"
Manitoba.....	66	17	93	24	221	59	380	24.1	110	36	463	33
Saskatchewan.....	50	16	75	23	195	61	320	26.4	109	11	221	10
Alberta.....	56	14	148	38	192	48	396	25.2	211	56	268	40
British Columbia (Ry. Belt).....	305	65	105	22	65	13	475	30.3	231	51	446	25
Totals.....	477	30	421	27	673	43	1,571	100.0	661	43	1,398	28

Table 5

DISTRIBUTION BY MONTHS

Month	Manitoba		Saskatchewan		Alberta		British Columbia		Totals	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
April, 1928.....	15	4.0	22	6.9	14	3.6	10	2.3	61	3.9
May.....	154	40.5	148	46.2	187	47.2	101	21.3	590	37.6
June.....	34	9.0	5	1.5	10	2.5	41	8.7	90	5.7
July.....	66	17.4	9	2.9	12	3.0	109	22.8	196	12.5
August.....	29	7.6	17	5.3	9	2.3	105	22.1	160	10.2
September.....	28	7.4	44	13.8	58	14.6	84	17.6	214	13.6
October.....	18	4.7	20	6.3	35	8.8	22	4.6	95	6.0
November.....	2	0.5	24	7.5	68	17.2	3	0.6	97	6.2
December.....	6	1.6	18	5.6	3	0.8	.....	.....	27	1.7
January, 1929.....	10	2.6	4	1.2	.....	.....	.....	.....	14	0.9
February.....	10	2.6	1	0.3	.....	.....	.....	.....	11	0.7
March.....	8	2.1	8	2.5	.....	.....	.....	.....	16	1.0
Totals.....	380	100.0	320	100.0	396	100.0	475	100.0	1,571	100.0

Table 6

STATEMENT OF THE 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	De-precia-tion	Saw-timber	Other timber	Damage				
	Ft. b.m.	Cords	\$	Ft. b.m.	Cords	\$	\$ %	\$ %	\$ %	\$
Manitoba.....	534,000	9,696	40	2,986,530	144,426	94,456	94,496 50.77	89,855 46.88	4,492 2.35	188,843
Saskatchewan.....	81,320	45,024	5,711	9,075,400	316,453	111,881	117,592 32.26	231,596 62.45	19,775 5.29	368,963
Alberta.....	3,919,845	12,125	7,019	14,663,500	56,186	59,990	67,009 40.94	91,096 55.67	5,561 3.39	163,666
Br. Columbia (Dom. Lands).....	4,928	114	4,179	11,051	9,509	15,235	19,414 41.05	1,759 3.72	26,113 55.23	47,286
Totals.....	4,540,093	66,959	16,949	26,736,481	526,574	281,562	298,511 38.91	414,306 53.81	55,941 7.28	768,758

Table 7

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

Province	Total area burned over	Ownership				Forest conditions							
		Public		Private		Merch. timber		Partially cut-over		Young growth		Not forested	
		acres	%	acres	%	acres	%	acres	%	acres	%	acres	%
Manitoba.....	420,383	410,898	97.75	9,485	2.25	33,782	8.03	2,413	0.58	112,250	26.70	271,938	64.69
Saskatchewan.....	467,144	356,281	76.27	110,863	23.73	112,152	24.01	10,820	2.32	148,619	31.81	195,553	41.86
Alberta.....	220,714	219,501	99.45	1,213	0.55	22,064	10.00	10,517	4.76	48,641	22.04	139,492	63.20
Br. Columbia.....	17,475	16,515	95.75	960	4.25	8,620	51.26	2,158	12.33	1,825	10.47	4,872	25.94
Totals.....	1,125,716	1,003,195	89.13	122,521	10.87	176,618	15.70	25,908	2.29	311,335	27.67	611,855	54.34

*Railway Belt.

IMPROVEMENTS

The following is a list of the principal improvements made during the year:—

	Manitoba	Saskatchew- an	Alberta	British Columbia	Total
Ranger houses.....		3	4		7
Ranger cabins.....	3	8	6	1	18
Stables.....	4	5	1		10
Warehouse.....			1		1
Garages.....		1	3	1	5
Barns.....		1	3	1	5
Machine sheds.....	3	4	3		10
Lookout cabins.....	3		12		15
Lookout towers.....		5	3		8
Bridges.....	5	2		1	8
Other buildings.....	2	6	3		11
					Miles
Telephone lines.....	116	34	115	4	269
Roads.....	148	11	14		173
Trails.....		43	434	188	665
Fireguards (ploughed).....	149	93	1		243
Fireguards (cleared).....	41½	66			107½

GRAZING

The objective underlying the regulations for grazing on the national forests is to obtain the maximum use of forage existing on forest ranges. This is not only for the economic benefit to the country of such use, but also because the fire hazard is reduced thereby.

Considerable progress is to be reported in regard to grazing in British Columbia; Saskatchewan shows a marked decline; in the other provinces the situation remains much the same. In British Columbia the grazing regulations were adopted generally in the season of 1928 for the first time, and were willingly accepted by stockmen; several trails were made and a number of sorting corrals were built to facilitate the use of alpine ranges for sheep, and a round-up of "wild" horses was made.

FOREST MANAGEMENT

The management of national forests along scientific lines for maximum reproduction and improved growing conditions is receiving the closest attention.

Small but more or less stable local industries, based on the demand for railway ties, poles, fuel, and other products manufactured by hand are becoming regular activities of many communities, affording opportunity for the investment of small capital, and offering employment at seasons when work in other pursuits is frequently at a minimum.

In Manitoba the cut of sawlogs was only about half that of the preceding year, but the cut of ties was slightly increased. Six new timber sales were awarded, and a larger number of timber permits than in 1927 was granted. The total cut under permit was, however, somewhat smaller.

Thirty new timber sales were made in Saskatchewan, making 47 sales in active operation.

In Alberta 19 new sales were awarded making a total of 31 active during the year. The lumber cut was 50 per cent greater, and the cut of mining timber doubled that of the previous year. Timber cut under permit also showed a considerable increase.

In the British Columbia Inspectorate there was a year of unusual activity in timber sales. The products taken out were largely standard telephone poles and fence-posts and railway ties of various species of wood.

In all districts the regulations respecting timber disposal were, in general, satisfactorily complied with.

SEEDING AND PLANTING

In Manitoba experiments in seeding were continued in the Sandilands national forest, where a total of 100 sample plots is now under observation. In the Riding Mountain national forest five acres of clear-cut poplar were broadcast-burned and sown to white spruce. In each national forest a nursery is now maintained with, in most cases, a watering system. The totals of the different kinds of stock on hand at national-forest nurseries at the close of the fiscal year was as follows: one-year seedlings, 958,000; two-year seedlings, 340,000; three-year seedlings, 73,000; two-year seedlings one-year transplants, 349,000; two-year seedling two-year transplants, 39,000.



PLATE NO. 1.—A TYPICAL STAND OF SPRUCE AND POPLAR IN A NATIONAL FOREST.
(F. S. Photograph 10838)

In Alberta about fifty-eight acres in the Cooking Lake national forest were planted to white spruce on a fifty-year-old burn; this makes a total area planted in this forest during the past ten years of 225 acres. The growth was satisfactory, but considerable rabbit damage was experienced. Three hundred and forty acres were "seed-spotted" in 1924-5, but the results were not uniformly successful, and this experiment has been discontinued until the results are apparent. In the Crowsnest forest six acres were successfully sown broadcast on a recent burn, and this experiment is to be enlarged.

RECREATIONAL USES OF NATIONAL FORESTS

Manitoba reports increased patronage of the summer resorts in the national forests, in which numerous improvements have been made. The number of visitors to the resorts during the summer of 1928 was about 11,300.

In Saskatchewan there are three established summer resorts. The largest of these (Fish Lake, in the Moose Mountain national forest) is frequented not only by Canadians, but by many United States residents as well; many of the latter, indeed, have built expensive permanent summer cottages in the resort.

The number of persons spending the week-end at this resort reaches as high as eight hundred. A tendency exists to form community recreational clubs to concentrate effort on making a recreational centre for the community; in one case a municipality located near one of the national forests has made an exchange with this service of a parcel of non-agricultural land in return for equivalent lands within the national forests, with the object of establishing a community resort.

In Alberta the only summer resort on a national forest (Elkwater Lake, in the Cypress Hills) was well patronized, the number of visitors being 4,000. Other localities in the national forests were visited by large numbers of tourists. In British Columbia the national forests are being used more than ever for recreational purposes. Camping and picnicking facilities have been provided at a number of points. There is a tendency to get away from the formal resorts and visit the less frequented districts.

SURVEYS

A stock-taking survey was made in the Pasquia national forest by two five-man crews. The forest flora was also studied, in order to test the applicability of Cajander's theory of forest types to the forests of this region. The strip system was used, and 44½ square miles were covered. The final report of the survey of the Lost River block of the Fort à la Corne forest was completed. An extensive stocktaking survey was made in the Fort à la Corne forest, 21 square miles being covered in 28½ days.

In Manitoba four seven-man parties were in the field, three in the Nelson River area, and one in the Saskatchewan basin. A large area was covered, of which timber-type maps were prepared from aerial photographs by the Topographical Survey of the Department of the Interior; these maps were checked by forest officers in flights over the area. Two parties were engaged on winter surveys; one seven-man party continued the survey work in the Lake Winnipegosis area, and a ten-man party examined a number of townships in south-eastern Manitoba. The total area examined by these parties was 4,647 square miles.

SEED COLLECTION AND EXTRACTION

In Manitoba the collection of Manitoba maple and red (Norway) pine seed was carried on. The maple seed was collected in the Dauphin district; of the red pine seed 75 pounds were collected at Woodridge and Vassar, in south-eastern Manitoba, and a small amount at Black island in lake Winnipeg, this latter place being at the extreme northern limit of the range of this species.

In Alberta 500 bushels of lodgepole pine cones were collected—200 bushels from the Cypress hills, the rest from the Clearwater forest.

A poor seed-year was experienced in British Columbia. The quantities of seed collected in that province were as follows: Western yellow pine, 803 pounds; Douglas fir, 63½ pounds; Sitka spruce, 890 pounds; Western cedar, 211 pounds; Western white pine, 2 pounds; Western hemlock, 40½ pounds; cascara, 10 pounds; grand fir, 7 pounds; Western larch, 24 pounds; lodgepole pine, 73 pounds; amabilis fir, 15 pounds.

In Saskatchewan the 1928 crop of white spruce seed was a complete failure. At Prince Albert 248 pounds of jack-pine seed were extracted. The average cost of collection and extraction was \$3.05 per pound, a saving of \$1.35 per pound as compared with the cost of seed in 1927.

The motive underlying the enlargement of this work in recent years is the desire of the Canadian Government to assist the Imperial Forestry Commission to reforest certain areas in the British Isles denuded during the war years. Experience has shown that many Canadian trees, particularly the Douglas fir and Sitka spruce of the British Columbia coast, do well in Great Britain.

From a small beginning in 1917, the work of seed collecting has grown to large proportions and to-day is assisting in building up forests in many parts of the British Empire. New Zealand, in particular, is supplied each year with large quantities of Canadian tree seed, and smaller quantities are shipped to various parts of Australia and elsewhere.

TREE PLANTING ON PRAIRIE FARMS

The season of 1928-9 had several unusual features—an exceptionally wet autumn in 1928, unusually light snowfall in the winter, unexpectedly mild weather in February and March, very cold weather in the latter part of April, and a hot, dry period subsequent to the first week in May. All over the Prairie Provinces there was much winter-killing of ornamental shrubs (even lilacs) and fruit trees, but practically no injury was done to the shelter-belt species of trees.

Excessive rainfall in June and early July caused considerable damage to shelter-belts in southeastern Manitoba, and many plantations were very weedy as a result of the wet weather. In most parts of the Prairie Provinces, however, plantations were successful with the exception of poplar and willow cuttings. The weather in the autumn was particularly favourable for nursery work.

The inspection lists included 13,365 names, an increase of 777 over 1927; of these 3,254 were entirely new applicants. Nine inspectors of tree plantations were employed. Little damage was noticed among the plantations; there was no winter-killing, no insect damage of any importance, only slight damage by rabbits, and some damage through hail-storms. Tent caterpillars were troublesome on native poplars. The poplar and willow aphids, the spruce sawfly, and the red spider did a certain amount of damage. There was a noticeable improvement among the school plantations in Saskatchewan. The older farm plantations are keeping up well, but the force of inspectors is not large enough to investigate these with any degree of thoroughness. The planting of field shelters is increasing, and some significant results have been noted.

The distribution comprised 7,000,300 broad-leaved seedlings and cuttings and 101,500 conifers. The broad-leaved cuttings were sent to 5,939 applicants, the conifers to 1,026. The quality of the 7,745,625 broad-leaved seedlings and cuttings available for distribution from the nursery in 1929 is better than usual. There are also 101,800 evergreen transplants available, and those now coming on in the nursery are of unusually good quality. The benefit of the watering system installed on the nursery in the case of conifers has been very marked. Experimental work with exotic species is also being carried on.

Pending the measurement and plotting of the permanent plantations, little thinning has been done. Caragana used as a filler has been found to affect adversely the growth of spruce. Growth measurements have been started in the permanent plantations of the Sutherland nursery.

The popularity of both nursery stations among visitors continues. On some days from 700 to 1,000 people inspect the stations. Exhibits at fairs, public addresses, and articles for the press are also used as means of publicity.

A technical officer was transferred to the station during the past season for the study of plant diseases, but, as he did not report for duty until late in the season, little but preliminary work was accomplished. A study of the poplar canker has been begun; this disease has been very troublesome among poplars in plantations all over the Prairie Provinces. The conduct of this work marks the inauguration of a new general policy which aims at converting the nursery stations at Indian Head and Sutherland, Saskatchewan, into general forest experiment stations for the study of forestry conditions in the Prairie Provinces.

At the end of the year arrangements were also under way for the transfer to Indian Head of a highly trained technical silviculturist to further strengthen the staff at this station.

Tests in the preservation of fence-posts were continued, 170 aspen posts being added to those already under observation.

There is much opportunity for technical research in various lines on the nurseries, which it is hoped to undertake at an early date.



PLATE NO. 2.—A SASKATCHEWAN FARMSTEAD BEFORE TREES WERE PLANTED.
(F. S. Photograph 19672)



PLATE NO. 3.—THE SAME FARMSTEAD FIFTEEN YEARS AFTERWARDS.
Planting commenced in 1913. (F. S. Photograph 19673)

The development of shelter-belts under the tree distribution system has made a wonderful change in the way of general farm horticulture. In the shelter of these tree-belts the farmer finds he can now grow exceptionally fine vegetables, small fruits, and even fruit trees, and also flowers, herbaceous perennials, and ornamental shrubs to perfection. In the earlier days of settlement—and, in fact, until quite recently—few farmers grew their own vegetables, except, perhaps, potatoes. The shelter-belt is changing this. Last year's reports show that among 7,600 farms inspected where trees had been planted 6,800 had good vegetable gardens, 2,700 were growing small fruits, and 400 various fruit trees. This is one line of endeavour which tends more to the building up of permanent farm homes than almost any other factor and is only possible after a reasonable amount of tree-planting has been done.

FOREST PRODUCTS LABORATORIES

Following a period of unsettlement during the removal of the Montreal Laboratory to Ottawa, and the transfer of the Pulp and Paper Division to the new building in Montreal, the past year has seen reorganization completed, and constructive work on various projects furthered.

OTTAWA LABORATORY

The laboratories at Ottawa are now organized under four divisions, namely, (1) Timber Mechanics, (2) Wood Preservation, (3) Timber Physics, and (4) Timber Pathology. In addition to the equipment intended for the immediate use of these divisions the laboratory buildings also include the library, an exhibit room, draughting room, photographic dark-room, lecture hall, wood-working shop, sawmill, air-drying shed, experimental dry-kiln, and other accessory features.

A noteworthy feature of the work of the laboratories is the steady increase in the number of inquiries received in technical matters. Some of these have been of great industrial importance, and have resulted in the establishment of new projects for research.

Division of Wood Preservation.—The chief objects now occupying the attention of this division are the following: Protection of timber from marine borers (in co-operation with the federal Department of Public Works); resistance to change in moisture content of yellow birch ties treated with 70-30 creosote-coaltar mixture (a) with initial air-pressure, (b) without initial air-pressure; the distribution and penetration of creosote in jack pine ties treated with 70-30 creosote-coaltar mixture (a) with initial air-pressure, (b) without initial air-pressure; the investigation of shale oil as a wood preservative; the separation of the foam encountered in the process of "boiling under vacuum" into its liquid and vapour constituents; the determination of the toxicity of wood preservatives; the observation of test tracks in which creosoted jack pine and hemlock ties and jack pine ties infected with red stain and red rot have been laid; the testing of creosoted Douglas fir timber. An apparatus has been devised and patented for the separation of the foam above mentioned into its liquid and vapour constituents, and a method has been developed for carrying out toxicity experiments on wood itself that has been previously impregnated with varying percentages of the preservative under test.

Division of Timber Mechanics.—A large 200,000-pound timber-testing machine, with a weighing platform of 25 feet in length and a clear head of 16 feet, was installed early in the year. Projects now under way in this division include the testing of small clear specimens of Canadian woods, tests of the nail-holding power of Canadian woods, investigation of the design of wooden containers, research into the relation between the mechanical and physical properties of white spruce, tests of the mechanical properties of various Eastern species of timber (both treated and untreated) which may replace cedar for telephone poles, and the testing of the strength of treated and untreated Douglas fir beams. A certain amount of miscellaneous work is done for other Government services and for manufacturers in the testing of various timber products.

Division of Timber Pathology.—Tests of jack pine infected with red stain and subsequently creosoted show that the organism causing the stain persists after the treatment, and that some modification of present methods of creosoting must be made in order to effect sterilization of the tie. Other studies being carried on include the investigation of moisture content as a factor in timber decay, and a study of blue stain in white pine, with special reference to methods of prevention or control. The reference collection of pathological material numbered 690 specimens at the close of the fiscal year, an increase of 139 during the year. Inquiries from timber users in regard to wood decay largely increased.

Division of Timber Physics.—A study of the relation between the rate of growth and density of white spruce has been made, and the results are being incorporated in a bulletin to be issued shortly. Another problem of great importance has been the investigation of the absorption of water by floating logs, undertaken with a view to preventing the loss of logs through sinking while being 'driven' to the mill; in connection with this project a special tank has been installed at the Ottawa laboratory to accommodate four-foot logs for purposes of observation. A number of investigations of lumber seasoning were carried out in response to requests from the wood-working industries, and plans have been drawn up for a special kiln to be used in this type of investigation. Many requests have been received for wood identification, and a bulletin on the subject is in preparation.

PULP AND PAPER DIVISION—MONTREAL LABORATORY

During the first part of the year (April to September) the work of the Pulp and Paper Division was subject to constant interruption during the process of dismantling the old quarters and removal to the new building. The staff was reduced to a minimum, only five men being employed in active research work. Three projects were carried on throughout the year, namely, (1) chemistry of wood, (2) pulp testing (physical and chemical), and (3) sulphite studies. A fourth project, "formation studies," was begun towards the latter part of the year, together with two distinct development studies.

Chemistry of Wood.—A revision of the literature on lignin is now nearly completed. The work on the determination of lignin by the use of hypochlorous acid has proved of much importance. Other studies have been the isolation of lignin by means of formaldehyde and sulphuric acid, the possibilities of formaldehyde as a catalyst in sulphite cooking, the nature of cellulose and alpha-cellulose, the action of caustic soda on cellulose, the application of concentrated alkali solutions to commercial pulping operations, and the possibility of lignin by-product recovery.

Pulp Testing.—The adoption in other countries of the use of the standard freeness apparatus developed at this laboratory continues, and is now being considered by the British and Scandinavian industries. The work on testing for strength is being greatly furthered by the facilities afforded by the new laboratory. The work in chemical testing covered the development of new procedure for the cellulose, alpha-cellulose, and lignin tests, with study of the existing tests for copper number and baryta resistance.

Sulphite Studies.—This work was confined to the completion of the investigation into the physico-chemical characteristics of sulphur-dioxide solutions.

Formation Studies.—These studies have for their object the determination and study of the principles underlying the formation of a sheet of paper. They comprise (1) the character of the fibres, (2) the character of the stock suspension, (3) conditions during felting, (4) compacting of the sheet, (5) drying of the sheet, and (6) finishing and surfacing. Work up to the present has been confined to the first of these.

VANCOUVER LABORATORY

The scope of work of the Vancouver laboratory has been considerably broadened during the past year through the addition of new equipment, the initiation of several new projects, and closer contact with the timber industry.

Timber Testing Division.—The Vancouver laboratory is co-operating with the Ottawa laboratory in the testing of treated Douglas fir by testing the treated ties, while the Ottawa laboratory tests the larger timbers. Tests on

green Western white pine were completed, tests of air-dried material well advanced, and all records brought up to date. Other projects under way are the study of the effect of variable moisture content on the strength of wood, an investigation of the deterioration of black cottonwood logs in fresh-water storage, and the retention of nails and screws by wood. Many miscellaneous studies were of interest; a number of these were based on the utilization of waste; a study of the shear strength of glues has proved of considerable value to the Dominion Fisheries Branch, and tests made on a lot of timber cut to special order, acceptance of which had been refused, resulted in the order being passed with a saving of several thousands of dollars to interested parties and of several hundred thousand feet of valuable timber to the province.

Timber Products Division.—By means of the experimental dry-kiln, work has been carried on in drawing up drying schedules and temperature and humidity control in the seasoning of various species, the piling of random-width lumber, various methods of piling lumber and shingles, and in the study of equilibrium moisture content for the range of temperature and humidity used in kiln-drying lumber; many of these studies related specially to problems that had arisen in the work of various mills. The third six-day course in kiln-drying was held, with seventeen kiln operators and students in attendance. Degrade tests of lumber were made at three mills during the year, from which it appeared that marked improvement had been made in kiln-drying practice as the result of the studies of the same subject made in 1925. Assistance was given to many mills looking to the improvement of their drying practice. Studies were also made of the cause of loosened grain and of the relative efficiency of air-drying and kiln-drying 2-inch Douglas fir stock. Studies in the absorption of moisture by kiln-dried stock showed that the kiln-dried stock absorbs considerable quantities of moisture when piled in open sheds, particularly if the method of piling be faulty, and so gives unsatisfactory results when put into use. Studies in the absorption of moisture by kiln-dried timber in transit, both by water and by rail, are also being carried on. A survey of mill waste is being carried on with the object of devising methods of utilizing much high-grade material now sent to the burners. Studies are also being made, in co-operation with the British Forest Products Laboratory at Princes Risborough, England, of the development of stain and decay in a cargo of Sitka spruce shipped in the hold of a steamship.

Many requests for technical information were answered during the year. Exhibits were prepared in co-operation with various organizations for the provincial exhibition at New Westminster, the Vancouver Publicity Bureau, the Convention of Western Retail Lumber Dealers at Vancouver, and the National Museum at Ottawa, and collections of material sent to the Australian forest school at Canberra and the forest experiment station at Tokyo, Japan.

SILVICULTURAL RESEARCH

The Silvicultural Research Division in the summer season of 1928 had five parties in the field, four of them full strength and one of partial strength.

At the Petawawa forest experiment station a double party was maintained, one devoting its efforts entirely to research and the other to protection and the necessary improvements. Many remeasurements of sample plots were made and new plots established, on the areas cut over in 1921 for poplar match stock, to study the effect upon the reproduction of conifers. Plots were also located in the area cut over for jack pine in 1925 to study the effect of this release cutting on the understory of white and red pine. A number of plots were also established in the poplar-birch type for the study of the release of the understory of conifers. These plots were later thinned during the winter months.

The Quebec party confined its operations to the Lake Edward station. The permanent sample plots established in former years were remeasured and re-organized. With the findings from the line-plot survey conducted in 1925 and 1927 as a guide, six permanent sample plots were located in representative areas. The growth on these plots as obtained from periodic remeasurements will indicate the rate of growth for the types in the district.

In New Brunswick the research party established a series of plots on the experimental cuttings and areas girdled in 1927 at Salmon River. In the same district a line-plot survey was made to investigate the effect of logging operations on reproduction and rate of growth.

The Ontario party was located on the Goulais River watershed near Searchmont, where the line-plot survey begun in 1926 was completed. Four permanent sample plots located in average stands determined from the line-plot survey were established.

This year witnessed the beginning of forest research in the province of Nova Scotia. In co-operation with the provincial forest service a program of thinning farmers' woodlots was initiated, ten permanent sample plots being established in the white pine, red pine, balsam fir, and poplar types.

Research work on the forest reserves in western Canada is carried on under the supervision of the respective district offices, with the Research Division at head office acting in an advisory capacity.

Type Classification.—An investigation of the application of the Finnish system of classifying forest types elaborated by Dr. Cajander, in which plant indicators are used in classifying forest soils, was undertaken in Alberta. While the first summer's work can only be considered as the initial period of this investigation, inasmuch as the work of botanizing and organizing the work had first to be undertaken, it was found that in certain cases good correlation existed between the yields and the flora of the forest. If the underlying principle can be adopted, even for forest zones in Canada, much of the labour of soil classification and type-mapping on surveys and in compilation of yield tables will be greatly simplified. The results already obtained warrant further and fuller investigation by competent men.

Planting and Seeding.—In Manitoba six plots of one-quarter acre each were seeded on the Sandilands national forest by the spot and broadcast methods. These complete a series of experimental sowings commenced in 1925, of 100 plots of one-quarter acre each. A report on the results of direct seeding in this district will be prepared as soon as results can be obtained.

On the Riding Mountain national forest five acres of land which had been clear-cut for poplar fuel-wood were broadcast-burned and sown with white spruce. This is part of a series of experiments on the study of type conversion.

In Alberta, on the Cooking Lake national forest fifty-eight acres of an area denuded by fire fifty years ago were planted with white spruce. The 340 acres seeded by the seed-spot method showed by a preliminary examination that this method was not uniformly successful. Present results seem to indicate that success may be obtained by this method on the moister sites. Broadcast seeding, on the other hand, as tested on an area of six acres of the Crowsnest national forest which had been denuded by fire, showed such success that a large area will be thus treated next year.

In British Columbia the planted and seeded plots already established were examined and data recorded. In addition, all yield and permanent sample plots were examined, remeasured, and thinned where necessary.

In Saskatchewan several detailed investigations of the factors controlling the success of nursery work were undertaken, and several reports made on which future work in forest nurseries in this district will be based.

Mensuration.—The compilation of form-class volume tables for eastern coniferous species and for certain western species has been completed. These tables will form the bulk of the publication of volume tables to be issued shortly in printed form. The final compilation of the study of the solid contents of piled cords of pulpwood has been completed and valuable tables of conversion factors derived. These will be published in the volume-table publication.

PUBLICITY

The year opened with the usual activities incident to the annual Canadian Forest Week. The newspaper-advertising campaign was again entrusted to a commercial advertising agency. As a special feature, an interchange of speakers was arranged with the United States authorities, who were administering United States Forest Week during the same period (April 22 to 28, inclusive). The following prominent Canadians addressed gatherings in the United States: the Hon. Charles Stewart, Minister of the Interior; the Hon. William Finlayson, Minister of Lands and Forests for Ontario; the Hon. J. D. MacLean, Premier of British Columbia; the late Hon. T. A. Burrows, Lieutenant-Governor of Manitoba, and the Right Hon. Arthur Meighen, ex-Prime Minister of Canada. The United States reciprocated by sending Lieutenant-Governor W. I. Nolan, of Minnesota, and Colonel W. B. Greeley, Chief Forester of the United States Department of Agriculture, Washington, D.C., to speak before Canadian assemblies. In addition, Colonel Theodore Roosevelt, jr., was to have spoken at Ottawa, but was unfortunately taken ill at the last moment and could not fill his engagement.

A boys' and girls' vacation-camp lecture service was maintained as usual during the months of July and August. It was, unfortunately, impossible to provide a lecturer for every camp that asked for one, as a greater number of camps made application than ever before and, on the other hand, the department was able to secure only two lecturers instead of the three employed in other years. Nineteen camps were visited and contact made with 1902 children.

In the West, exhibition cabins to house the service exhibits at the annual agricultural fairs were completed at Brandon and Saskatoon. These two cabins have proved strong attractions and have received much favourable publicity in the newspapers; they present a more attractive appearance, with a greater adaptability to their use, than do the Calgary and Edmonton cabins, experience gained in the construction of these earlier cabins having shown the advisability of paying more attention to this aspect of the work. Exhibition activities were again extended to include this year six major (Class A) and twelve minor fairs. An exhibit was also placed in the log cabin at the Central Canada Exhibition at Ottawa.

Publicity work was also carried on by the staffs of the field offices. In Manitoba an effective display was made at the Western Canada Soil Products Exposition in Winnipeg in the month of February, at the Brandon (Class A) fair in July, where the new Forest Service cabin had lately been completed, and at the Dauphin and Swan River fairs. Co-operation was extended to the Canadian Forestry Association, and at the Dauphin Normal School weekly lectures were again given, as well as field excursions. Lectures were also given to public and high school classes and to service clubs and women's organizations. Much effort was also devoted to Canadian Forest Week in April.

In Saskatchewan, besides work for Forest Week and much incidental publicity work, exhibits were made at two class A fairs (Saskatoon and Regina) and seven class B fairs (Estevan, Weyburn, Yorkton, Melfort, North Battleford, Prince Albert, and Tisdale). Co-operation was also extended to the Canadian Forestry Association, especially in assisting in the work carried on by the staff of their fire-prevention car.

PUBLICATIONS

One of the most useful publications issued by this service is the pamphlet "Forestry Lessons" which was published in the autumn of 1928; this consists of a series of studies of the forest in its different aspects, and is intended for the use of teachers in their nature-study classes. A new edition (the eighth) of Bulletin 1, "Tree Planting on the Prairies," with various changes and additions to bring the matter up to date, was brought out. Results of work of the Forest Products Laboratories were published in Circulars 23 and 24—"Absorption of Moisture by Kiln-dried Lumber" and "Strength of Reinforced and Unreinforced Butter and Cheese Boxes," respectively—and the list of publications of the service was issued as Circular 25.

Canada's part in the program of the British Empire Forestry Conference, 1928, at Canberra, Australia, entailed the publication of a number of reports and papers. The chief of these was the quinquennial revision of the report on "The Forests of Canada," and the other papers presented were each published separately as pamphlets; these were "Tree Planting in the Prairie Provinces of Canada," "Timber Testing in Canada," "Timber Pathology in Relation to Wood Utilization in Canada," "Wood Preservation in Canada," "Forest Fire Protection in Canada: Progress Since 1923," "Pulp and Paper Research in Canada," "Timber Physics Research in Canada," "Silvicultural Research in Canada," "Aircraft in Forestry," "State Forests in Canada," and "Softwood Resources of Canada." Dr. J. M. Swaine, Associate Dominion Entomologist, Department of Agriculture, collaborated in the preparation of the series by contributing a valuable paper on forest entomology in Canada.

REVENUE

The revenue from all sources during the fiscal year shows a net increase of \$22,429.10, this increase being substantially larger than any during the last five years. With the exception of the fiscal year 1926-7, when timber sales fell off temporarily, the annual revenue of the service has steadily increased.

The increase of \$21,950.93 in revenue for timber sales, which is greater by \$10,204.12 than the increase for 1927-8, was due chiefly to the introduction of Supervisors' sales.

The decrease of \$8,927.91 in non-competitive timber permits was due to a lower demand in Manitoba and Saskatchewan. There was an increase of \$1,911.64 in grazing revenue, principally from Alberta and British Columbia. There were, also, increases of \$235 in hay, \$1,544.86 in special uses, and \$11,180.34 in miscellaneous revenue.

National forest	Number of timber sales operating	Revenue from timber sales	Number of timber permits	Revenue from timber permits, etc.	Number of grazing permits	Revenue from grazing permits, etc.	Other sources of revenue					Total revenue, all sources
							Hay permits and seizures	Surface rentals	Special uses	Tree seed	Miscellaneous, including fishing*	
Manitoba—		\$ cts.		\$ cts.		\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
Duck Mountain.....	3	1,099 20	357	2,670 25	17	224 40	231 25	688 70	143 00	3 00		5,059 80
Porcupine No. 1.....	2	1,792 00	81	956 09	1	11 00	19 50		19 00		120 00	2,917 59
Riding Mountain.....	1	6,069 90	1,347	12,618 46	18	170 90	529 50	1,420 05	219 00		17 30	21,045 11
Sandilands.....	1	1,168 65	22	173 89			2 25		4 00			1,348 79
Spruce Woods.....			9	21 00			11 75	5 00				37 75
Turtle Mountain.....			34	145 65	25	251 00	58 25	48 31	18 00		153 00	674 21
Manitoba Total	7	19,129 75	1,850	16,585 34	61	657 30	852 50	2,162 06	403 00		293 30	31,083 25
Saskatchewan—												
Beaver Hills.....			46	175 75	18	96 77	272 00					544 52
Big River.....	2	6,659 00	55	1,285 14	2	34 40	212 00		37 50		288 00	8,516 04
Dundurn.....			33	113 50	8	166 45	22 50		6 00			308 45
Elbow.....			153	394 75	134	822 26	11 25	1 00	114 10			1,343 36
Fort à la Corne.....	5	425 38	244	1,614 03	1	2 44	16 00	1 00	16 00		132 00	2,206 85
Keppel.....			4	9 00	77	514 43	7 00		9 00			539 43
Manito.....			28	85 00	79	1,333 87	17 00	108 47	23 00			1,567 34
Moose Mountain.....	1	68 24	205	962 64	26	243 20	92 50	277 61	16 00		785 00	2,445 19
Nisbet-Pines.....	2	934 50	292	1,820 05	17	207 82	117 00		1,389 25			4,468 62
Pasquia.....	21	62,415 52	86	3,182 15			149 25	5 00	43 00		416 00	66,210 92
Porcupine No. 2.....	8	3,710 29	215	1,852 72	6	93 40	334 50	133 00	170 00		3 00	6,301 91
Seward.....					27	668 26	23 25		26 00			717 51
Saskatchewan Total	39	74,212 93	1,361	11,494 73	395	4,183 30	1,274 25	531 08	1,849 85		1,624 00	95,170 14
Alberta—												
Athabaska.....			6	166 51	10	99 55	8 00		28 00		103 75	405 81
Bow River.....	2	2,208 90	56	463 71	78	4,254 12	33 00	1 00	18 00		23 50	7,002 23
Brazeau.....	10	9,744 90	39	870 29	109	375 12		999 77	35 00		967 00	12,992 08
Clearwater.....	2	8,502 48	19	890 08	58	338 92		564 23	20 31	322 50	188 75	10,827 27
Cooking Lake.....			5	18 00	39	336 00	135 75		3 00		156 00	648 75
Crowsnest.....	5	1,537 98	136	5,521 60	138	7,198 04	3 50	33 23	61 90		355 00	14,711 25
Cypress Hills.....	1	66 00	397	1,977 74	107	1,907 61		55 00	62 40	322 50	169 25	4,560 50
Lesser Slave.....	4	14,031 08	1	9 50			29 75		13 00		162 25	14,245 58
Alberta Total	24	36,091 34	659	9,917 43	539	14,509 36	210 00	1,653 23	241 61	645 00	2,125 50	65,393 47
British Columbia Reserves—	36	14,255 61	23	223 69	72	1,499 73	43 25	416 58	258 51	7,732 10	3,806 18	28,235 65
British Columbia Total	36	14,255 61	23	223 69	72	1,499 73	43 25	416 58	258 51	7,732 10	3,806 18	28,235 65
Indian Head Nursery											6,169 70	6,169 70
Forest Products Labs.											37 74	37 74
Sundries									9 31		9,275 89	9,285 23
Gross revenue		134,689 63		35,221 19		20,849 69	2,380 00	4,762 95	2,752 97	8,386 44	23,332 81	235,375 18
Refunds		4,611 57		1,140 87		123 40	81 25		4 00		854 76	6,815 85
Net revenue		130,078 06		37,080 32		20,726 29	2,298 75	4,762 95	2,748 97	8,386 44	22,477 55	228,559 33

*Fishing, \$1,968.30. Nursery stock, \$4,231.75. Tests, \$945.02. Miscellaneous, \$4,724.57. Casual revenue, \$8,066.51. House rental, \$3,098.00. Fines and forfeitures, \$10.00. Sale of equipment, \$288.16.

STATEMENT OF TIMBER SALES—FISCAL YEAR 1928-9

No. of sales	Reserve	Sawlogs	Piling	Mine timber		Ties, hewn	Fence-posts, rails, and droppers	Telephone poles	Building material	Pulpwood	Fuel-wood
				Lagging	Other						
		ft. b.m.	l. ft.	l. ft.	l. ft.				l. ft.	cords	cords
3	Duck Mountain.....	574,322	.....	.....	.....	2,173	.....	.....	580	.....	.....
1	Porcupine No. 1.....	115,867	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	Riding Mountain.....	315,665	.....	.....	.....	26,840	.....	.....	.....	.....	.....
2	Sandilands.....	.....	.....	.....	.....	12,858	.....	.....	.....	.....	431
8	Manitoba.....	1,005,854	.....	.....	.....	41,871	.....	.....	580	.....	431
2	Big River.....	4,069,201	.....	.....	.....	.....	380	.....	.....	.....	.....
4	Ft. à la Corne.....	212,261	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	Moose Mountain.....	39,428	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	Nisbet-Pines.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	729
22	Pasquia.....	9,068,486	.....	.....	.....	7,537	17,269	.....	.....	1,609	.....
7	Porcupine No. 2.....	761,647	.....	.....	.....	.....	.....	.....	.....	.....	.....
43	Saskatchewan.....	14,151,023	.....	.....	.....	7,537	17,649	.....	.....	1,609	729
4	Bow River.....	1,297,990	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	Brazeau.....	4,646,926	.....	210,768	167,352	5,477	.....	.....	.....	.....	.....
6	Clearwater.....	2,382,493	.....	189,188	1,335,526	.....	.....	.....	.....	.....	.....
5	Crownsnest.....	1,173,990	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	Cypress Hills.....	11,962	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	Lesser Slave.....	5,635,978	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	Alberta.....	15,149,339	.....	399,956	1,502,878	5,477	.....	.....	.....	.....	.....
39	B.C. Reserves.....	1,831,706	99,245	.....	.....	31,483	11,192	381,780	.....	.....	93
118	Grand Total.....	32,137,922	99,245	399,956	1,502,878	86,268	28,841	381,780	580	1,609	1,253

STATEMENT OF TIMBER CUT UNDER AUTHORITY OF TIMBER PERMITS—FISCAL YEAR 1928-9

Reserve	Permits		Fuel-wood			Fence-posts		Tele- phone poles	Rail- way ties	Saw- timber	Mining timber		Building Logs		Miscellaneous			Christ- mas trees	Pulp- wood
	Paid	Free	Dry	Green	Fire- killed			l. ft.		ft.b.m.	l. ft.		pcs.	l. ft.	l. ft.	cords	pcs.	pcs.	cords
						pcs.	l. ft.												
Duck Mountain.....	301	56	853	92	144	12,536				1,028,353			77	9,722					16
Porcupine No. 1.....	80	1	622	11	522	1,600				178,287				2,850					
Riding Mountain.....	1,230	84	1,130	7,446	157	29,417				2,907,122			470	39,577			37		
Sandilands.....	20		132		95					20,489									
Spruce Woods.....	9		48																
Turtle Mountain.....	29	1	21	155		4,895				2,000				450					
<i>Manitoba Total.....</i>	<i>1,669</i>	<i>142</i>	<i>2,806</i>	<i>7,704</i>	<i>918</i>	<i>48,448</i>				<i>4,156,251</i>			<i>547</i>	<i>52,599</i>			<i>37</i>		<i>16</i>
Beaver Hills.....	41	5	13	151		1,575							950	8,740					
Big River.....	44	11	100		4,649	4,970				48,346				7,600			100		
Dundurn.....	33			161															
Elbow.....	150		51	432		850													
Fort à la Corne.....	201	43	371	24	720	80,220	1,882			476,474			9,866	16,176					
Keppel.....	2	2	2	22		200													
Manito.....	26		44	61		2,900													
Moose Mountain.....	203	2	316	749		10,211				81,600			788	5,692					
Nisbet-Pines.....	275	17	432	440	2,893	46,740		240		117,148			3,720	7,434	1,050	50	50	48	
Pasquia.....	79	7	5,875	400	233	68,100			1,700	40,120				3,640			57		
Porcupine No. 2.....	151	64	387	462	21	11,768				882,929			154	10,403			14		
Seward.....																			
<i>Saskatchewan Total.....</i>	<i>1,806</i>	<i>163</i>	<i>7,691</i>	<i>2,902½</i>	<i>8,516</i>	<i>227,634</i>	<i>1,882</i>	<i>240</i>	<i>1,700</i>	<i>1,646,617</i>			<i>15,478</i>	<i>59,685</i>	<i>1,050</i>	<i>50</i>	<i>221</i>	<i>48</i>	
Athabaska.....	6					1,070			250					6,214					
Bow River.....	54	1	72		338	6,641				3,268				6,000					
Brasau.....	39		45		6	64			270					277,293	1,528				
Clearwater.....	18		52½		10	650		1,500						120					
Cooking Lake.....	5		16							50,000				156,541					
Crowsnest.....	130	4	340½	36	4	13,783				1,041,595			1,065	23,492				40	
Cypress Hills.....	296	5	238½	787½	51	39,516				1,227,510			2,010	4,120	100		9,504		
Lesser Slave.....	1					72				1,280				634					
<i>Alberta Total.....</i>	<i>549</i>	<i>10</i>	<i>784</i>	<i>823½</i>	<i>409</i>	<i>61,796</i>		<i>1,500</i>	<i>520</i>	<i>1,094,863</i>	<i>1,669,914</i>		<i>4,723</i>	<i>54,441</i>	<i>100</i>		<i>9,504</i>	<i>40</i>	
British Columbia Reserves.....	23		150	149	220	250								848					
Grand Total.....	3,446	305	11,311	11,579	10,063	338,028	1,882	1,740	2,220	6,877,731	1,670,763		20,748	171,843	1,150	50	9,762	83	1

TREE-PLANTING DIVISION

Norman M. Ross, Chief

The season of 1928-9 was very unusual in many respects. There was very little snowfall generally in the winter of 1927-8; the fall of 1927, however, had been an exceptionally wet one and there was, consequently, abundance of moisture in the soil. In February and March there were periods of exceptionally high temperatures, which probably accounted for the considerable amount of winter-killing of many shrubs and fruit trees. Practically all over the Prairie Provinces there was heavy winter-killing of many ornamental shrubs—even lilacs suffering, for the first time in our experience. Fruit trees were badly hit, much wood being winter-killed, and in almost all instances flower buds were killed even on the hardiest varieties. Currants, which have always been considered as especially hardy, were affected considerably in some districts. A strange feature of this general winter-killing, however, was that practically no injury occurred in any of the shelter-belt species, such as maple and ash, though in some seasons winter-killing of these species is not at all uncommon.

Every indication pointed to a very early spring, but the weather turned very cold in the latter part of April, so that no general spring work was possible till the first week in May. Then followed an exceptionally hot, dry period which brought growth along much more rapidly than usual, so that it was almost impossible to get the stock shipped out before some of it had become too far advanced. This condition rather seriously affected the stock of pine, which had made appreciable new growth before they could be dug. The hot dry weather continued for about two weeks after shipping was completed, and made conditions exceptionally unfavourable for the transplanting of conifers and the rooting of cutting stocks. The spruce, which are always later in starting growth, were not so badly affected, but in many cases the plantations of pine were a complete failure, the average mortality being in the neighbourhood of 60 per cent. This is the first time in twenty years that such unfavourable conditions have been experienced.

On the nursery some of the broad-leaved plots were so badly baked, owing to the heavy precipitation of the previous fall and the lack of snow covering, that it was impossible for the fall-sown stock to push its way to the surface. Several acres of maple had to be resown on this account. The evergreen transplants did not suffer, as the new watering system provided plenty of moisture. Had it not been possible to water, it is quite certain that the 1928 transplanted stock would have been a complete failure. As it is, there is probably the best general stand there has ever been.

Rainfall was fairly general during June and early July. In southeastern Manitoba it was excessive, and much drowning out of crops occurred in the Red River valley. In this area some damage was done to shelter-belts, particularly in the killing out of caragana, which cannot survive with water standing round the roots. In this area, too, plantations became very weedy, as it was an impossibility to do any hoeing or cultivating. Over the greater part of the West, however, all plantations came along very well, with the exception of cuttings of poplar and willow, which did not root as well as usual.

The weather in the autumn was particularly favourable for nursery work, lifting and heeling-in operations being carried on without a break of any kind.

Field Inspection

There were 13,305 names on the inspection lists, an increase of 777 over the previous year. Of these 3,254 were entirely new applications. Nine inspectors were employed from June 1 to the end of October. They visited all but 542 of the listed applicants; those not personally visited were located

mostly in outlying districts, where personal inspections would have entailed too much time and expense. Little damage in plantations was reported, and practically no winter-killing. The usual local hail-storms occurred, from which recovery is generally made in the course of two or three seasons; much less injury was done by rabbits and this pest appears to be dying out. No insect damage of any importance was observed. In some of the northern portions tent caterpillars were prevalent in the native poplars, but did not affect



PLATE NO. 4.—A PRAIRIE FARMSTEAD WITH THE CHARM OF TREES. Six seasons' growth only have imparted to this place its evident attraction. Some of the trees measure twenty-three feet in height. (F. S. Photograph 20186)



PLATE NO. 5.—AN EFFICIENT SHELTER-BELT. Pines planted inside a hardwood belt. Six years' growth on an Alberta farm. (F. S. Photograph 20190)

cultivated plantations. The poplar and willow aphid was considerably in evidence during the latter part of the season, and no doubt did some damage. The spruce sawfly was reported from many points, from Manitoba to Alberta; this sawfly may cause very considerable injury to cultivated spruces if attacks are not noticed in time. It is very easily controlled by spraying with lead arsenate, but, unfortunately, the presence of the larvae is not as a rule

suspected till a considerable portion of the trees has been defoliated. The red spider on spruce is, in some sections, becoming a serious pest and is very difficult to control satisfactorily. Special experiments in connection with the control of this spider are being conducted by the officers of the Entomological Branch of the Department of Agriculture on the nursery station at Indian Head.

There has been a noticeable improvement in the care of school plantations in Saskatchewan, in which province the Department of Education is co-operating closely with this division.

Older farm plantations, as far as can be gathered, are, on the whole, keeping up well. It is obviously impossible, with a limited inspection staff, to keep in close touch with these older plantings. Many of these, now from fifteen to twenty years old and running up to forty feet in height, could undoubtedly be benefited by judicious thinnings, if there were some practical way of inspecting the belts and advising the owners.

The number of belts set out to protect field crops is gradually increasing, and, while it is too soon yet to demonstrate that such field-shelters are an economic success, there are some instances which would indicate very beneficial effects. One example in the Dalesboro district in Saskatchewan appeared very noticeable, where a forty-acre field of summer-fallow protected on four sides by a belt about twelve feet high gave a yield of fifty-four bushels of wheat per acre, the heaviest crop ever raised on the farm, and fourteen to fifteen bushels in excess of the yield of similarly prepared fields on the same farm. In southern Alberta there are now established at least 150 field-shelters ranging from half a mile to three miles in length.

Distribution

The opening of spring was very backward, and shipping was not commenced till May 2 at Indian Head and May 7 at Sutherland. The weather turned suddenly very warm and remained so for three or four weeks. A total of 7,000,300 broad-leaved seedlings and cuttings was sent out from the two nursery stations to 5,939 farms, requiring 12,308 separate bales. Fifteen days were required to complete this shipment.

The digging and shipping of evergreens at Indian Head was commenced May 20; 101,500 spruce and pine transplants were sent out to 1,026 farms, and, in addition, 80,000 jack pine, 25,000 Scotch pine, 36,000 lodgepole pine, and 60,000 white spruce seedlings were sent for planting on the Spruce Woods national forest and the Duck Mountain national forest in Manitoba.

As previously mentioned, the very hot weather brought the pines into growth too rapidly, and many of these were too far advanced for satisfactory results.

Some small lots of tree seeds, amounting in all to about seventy pounds of maple, ash, and caragana, were sent out in time for spring sowing.

Nursery Work

With the exception of the necessity for reseeding some fall-sown plots of maple where the soil became excessively baked, results on the nurseries were very satisfactory. The broad-leaved stock, generally speaking, is better than average in quality.

The total number of broad-leaved seedlings and cuttings heeled in at the two nurseries amounts to 7,745,625, to which is to be added 101,800 evergreen transplants for shipping from Indian Head.

Coniferous seedlings for transplanting were of very good quality. Of spruce and pine 392,000 were set out. The resulting stand has been very satisfactory. The seedbeds sown this spring (1928) show very good stands and a thrifty growth.

Several exotic varieties of both conifers and broad-leaved stock have been grown from seed during the past three seasons. While some varieties have completely winter-killed, others look more promising and many are now sufficiently advanced for lining out into test rows. These stocks are principally of Russian and Northern Chinese origin and their development will be followed with considerable interest.

Seed Collection

It was very difficult to secure any maple or ash seed this season. In the Qu'Appelle valley 970 pounds of ash were collected, and in the Dauphin district 670 pounds of maple. About 600 pounds of caragana seed were secured at the Indian Head nursery and probably 300 pounds at Sutherland. Twenty pounds of Siberian larch seed were extracted from cones collected in the plantations at the Sutherland station. From the Manitoba inspection district 132 bushels of red pine cones were shipped in, and 75 pounds were extracted. This was sent back for use in the Manitoba national-forest nurseries.

Permanent Plantations

Although some of the permanent plantations are in need of thinning, no work was done, as it is first advisable, for the sake of record, to have the plantations carefully measured and plotted.

In Plantations 40a and 40b, where Colorado spruce had been set out in alternate rows with caragana on the west half and with maple on the east half of the plot, the maple and caragana were cut back in December. It is very noticeable that where the caragana was used as a nurse the development of the spruce has been very materially hindered, and the same condition is apparent in other blocks where this shrub was set out as a nurse for either pine or spruce. When it is found possible to make the necessary measurements in these plantations it is hoped to secure some interesting data on this point. From a general impression of the plantations, the ash would appear to have worked out as the best mixture with the conifers. The caragana, while very hardy and not too fast a grower, seems to be too strong a feeder and certainly does not appear desirable as a nurse for either spruce or pine.

This winter a start is being made in securing growth measurements in the permanent plantations at the Sutherland nursery station. Up to date, measurements covering only one plantation have been summarized. These were taken in a Siberian larch plantation covering about one acre. It is very interesting to compare these measurements with those secured at Indian Head covering the same species at the same age.

The Sutherland plantation is now eighteen years old from seed. When planted, the stock had been two years in the seed-bed and two years in transplant rows. Measurements of 100 trees at Sutherland as compared with 100 trees in the Indian Head plantations at the same age are as follows:—

	Height		Diameter	
	Average	Maximum	Average	Maximum
Indian Head.....	25 ft. 2 in.	28 ft. 6 in.	4.16 in.	5.10 in.
Sutherland.....	25 ft. 4 in.	29 ft. 3 in.	3.82 in.	5.05 in.

Height growth is slightly greater at Sutherland, but diameter growth a little better at Indian Head. The spacing was 4 feet by 4 feet in a pure stand. The soil at Sutherland is much heavier than at Indian Head, but the annual average rainfall is nearly three inches less.

Publicity

Exhibits were prepared and shown at the summer fairs at Saskatoon and Regina. As in the past very considerable interest was shown by visitors. Articles have been from time to time prepared for the press and occasional addresses at public meetings have been given by the superintendents of both Indian Head and Sutherland nurseries.

The two nursery stations (Indian Head and Sutherland) are from a publicity viewpoint probably the most important feature. A constant stream of visitors from all over the West passes through these nurseries during the summer months; on some days a conservative estimate would show at least 700 to 1,000 visitors.

Pathological

RESEARCH

This season a technical officer was transferred to the staff of this station for the special purpose of studying diseases affecting either nursery operation or trees generally. Problems of a pathological nature either on the nursery stations or the various national forests will receive attention as opportunity permits.

Undoubtedly the most serious pathological problem at the present time is the so-called poplar canker. The poplars, the fastest-growing species on the prairies, generally become infected with this disease wherever planted, and it is seldom that the average life of these poplars is over eighteen or twenty years. Practically nothing seems to be known at present about this disease, either as to the causal organism or its control. Most of the pathologist's energies this season were directed to a study of this disease. Many cuttings have been specially prepared for experimental work next summer (1929). Cultures prepared in the laboratory have resulted in the isolation of two organisms not yet definitely identified. Specimens, however, have been sent to the laboratory at the Central Experimental Farm, Ottawa, and also to the New York Botanical Garden laboratory for checking. Microscopic studies have been made, specimens have been exchanged with investigators both in Canada and the United States, and an endeavour has been made to secure, as far as possible, all published references. During the winter inoculations have been made on experimental material, for which space was kindly provided in the greenhouse on the experimental farm at Indian Head. Very considerable original research work will evidently be required to determine the actual cause of this disease before any practical control methods can be planned.

Examinations were made throughout the season in the nursery plots and coniferous seed-beds, but no diseases of a serious nature were observed. Studies were made of a disease affecting willows and a leaf-spot causing an early defoliation of caragana.

Considerable mycological material was collected and preparation made for more intensive study during the coming summer.

Wood-preservative Tests

One hundred and seventy aspen posts were added to those already under observation. This lot was used to try out a new preservative called "Creozol," which was furnished from the Forest Products Laboratories at Ottawa. It is claimed that this oil will give satisfactory penetration with a cold treatment. Five posts were untreated, four were given ordinary brush treatment, fourteen were left in the open tank for two hours, forty-three for five hours, and one hundred and four for twelve hours. The amount of oil absorbed is very much less than with heated creosote. In the last test with creosote, aspen posts absorbed an average of 3.97 pounds of oil per cubic foot, while with the Creozol the average absorption was only 1.164 pounds. The absorption was not at all uniform, that is, many posts absorbed practically nothing while only five absorbed 3 pounds or more. These posts were set in the ground in August and will support some of the overhead sprinkling lines in the transplant plots.

NATIONAL FORESTS IN MANITOBA

Col. H. I. Stevenson, D.S.O., District Forest Inspector

The Manitoba inspection district administers the national forests within the province of Manitoba, and also that part of the Duck Mountain National Forest that lies within the province of Saskatchewan. This office also has charge of the fire protection in the forests on the public lands within the province; for these purposes the lands are divided into three fire-ranging districts, known, respectively, as the Manitoba South, the Manitoba North, and The Pas fire-ranging districts.

Fire Protection

The season of 1928 was one of the worst from the standpoint of forest fires ever experienced in Manitoba since the organization of the Forest Service. During the previous winter the snowfall was very light, and what snow there was disappeared early in the season, with the result that the warm dry weather which followed dried out the ground very rapidly, causing a period of severe hazard before the new spring growth of vegetation had made an appearance. In the southern part of the province the hazard continued high until about the end of May, when general rains occurred. In the northern areas the hazard developed later in the spring and continued until about the end of August. During September and October light precipitation and drying winds again raised the hazard above normal, but owing to the lateness of the season conditions did not again become serious, and practically all danger of large fires ceased about the middle of November.

These extreme weather conditions, combined with the large number of mining prospectors who were roaming the woods of the northern part of the province, were chiefly responsible for the extreme fire-hazard of the season.

Of the fires outside the National Forests the greatest number was attributed to "campers", who were responsible for 66 per cent of the fires in The Pas district and 58 per cent of the fires in the Manitoba North district.

Aerial Co-operation

The Directorate of Civil Government Air Operations co-operates with the Forest Service in the work of fire protection over an area of 37,500,000 acres comprising the fire-ranging districts and lying outside of the national forests.

Aerial and fire-ranging bases are located at Lac du Bonnet, Norway House, Cormorant Lake, and Snake Island (Lake Winnipegosis), from which aerial patrols are carried out over the surrounding territory. All bases are equipped with wireless and are daily in touch with Winnipeg, the headquarters for both services. In addition, the detection aircraft at each base are equipped with wireless transmitting sets and by this means can keep the various bases informed of their movements and observations while on patrol. Practically all detection patrols are ordered from Winnipeg and, in most cases, suppression patrols are requested locally by the various district fire rangers.

All bases were in full operation by May 30 and continued operating throughout the season until the end of October, when the aircraft were stored for the winter. During the season a total of 1,659 hours and 45 minutes of flying was carried out, of which 33 hours and 50 minutes flying was done on skis during the winter and early spring. During this time aircraft assisted in the detection and suppression of 179 fires.

Lac du Bonnet, Norway House, and Cormorant Lake were opened on March 15, 1929, for early spring operations, where aircraft, equipped with skis, carried out detection and suppression patrols for the purpose of extinguishing all winter camp-fires before the arrival of the spring fire-hazard and the

opening up of the watercourses when, for a certain period, transportation by any means is impossible.

Co-operation between the Directorate of Civil Government Air Operations and the Forest Service was excellent throughout the season, and on the whole the operation was very successful. Considering the severity of the fire season and the nature of the country involved, little doubt remains as to the soundness of using aircraft for this type of work.

Publicity

In February an effective display was made in the interest of forest conservation at the Western Canada Soil Products Exposition, which was considered by the officials of the company conducting it the most successful winter attraction they have ever attempted. The forestry display attracted a great deal of attention, and was viewed by some 200,000 people. Tree planting on the prairies, fire protection, and forest products were featured, and an opportunity for broadcasting forestry lectures, as well as for the distribution of a large quantity of forest literature, was provided.

Following the Western Canada Soil Products Exhibition, a provincial-wide organization for Canadian Forest Week was completed. This included the co-operation of the Department of Education, many large business firms, and a number of the most influential men in the province; in addition considerable co-operation was secured through the Manitoba Wheat Pool officials and their various locals throughout the province.

The building of the forestry cabin on the provincial exhibition grounds at Brandon marked another achievement in forest publicity in Manitoba. This log building, the most artistic of its kind in Canada, housed our forestry display during the Brandon exhibition (a "Class A" fair) in July, and was the centre of interest during the exhibition as well as during its construction. Being located in the southern part of the province, where log construction has long since passed out of vogue, it is a unique attraction and an effective combination of beauty and utility, and will grow more interesting as time passes. As the Brandon exhibition grounds are used more or less as a permanent park throughout the season, this building is a permanent investment in influence and a constant reminder of the necessity for forest conservation.

Attractive, informative, instructive, and inspirational forest displays were provided for the Dauphin (Class B) summer fair and the Swan River fair. These fairs (while the circulation is not so great as the "Class A" fairs) provide a wonderful opportunity to give the public a first-hand knowledge of the progress in forest conservation. The smaller fairs are well attended, and their attendance is made up of people living in the immediate vicinity of the various reserves. At all fairs, balloons and lead pencils with fire warnings printed upon them were distributed as novelties, and were exceptionally well received.

Active co-operation was resumed with the Department of Education at the opening of the Dauphin Normal School, and the weekly lectures were again given. In addition to this, field excursions were made with the object of identifying trees. Lectures were also given to public and high school classes on various forestry subjects as well as to service clubs and women's organizations.

It is encouraging to note that the press were much more generous in their contribution of space for matters pertaining to forest conservation and that there has been an increased demand for information regarding forestry problems.

Timber Disposal

The quantity of sawlogs cut in the district during the past year was small, amounting to approximately one-half of the previous year's cut. The quantity of ties made was slightly in excess of last year's cut. Three Director's sales

were made, namely, No. 155 on the Porcupine No. 1 Forest, No. 157 on the Riding Mountain, and No. 160 on the Duck Mountain. On Timber Sale No. 155, owing to lack of water for log driving in the Woody River dams, operations were deferred. One district inspector's sale, Manitoba No. 13, took place on the Sandilands forest. Two supervisor's sales were held, designated as Duck Mountain No. 2 and Porcupine No. 3. Cutting operations on the Brown and Rutherford operations on their concessions on lake Winnipeg were not under the supervision of this Service, except for slash disposal.

The total number of permits issued during the past year was somewhat greater than during the previous year, but the total quantity cut was less. Three mill sites were readvertised and awarded on the Riding Mountain National Forest and two on the Duck Mountain.

No pulpwood was cut under permit on vacant Crown lands in the Manitoba pulpwood selection area. Supervision by this Service was, therefore, restricted to slash disposal on a few small operations for steamboat fuel, near lake Winnipeg.

Seed Collection and Extraction

In the autumn of 1928 collections were made of two species of tree seeds. These were Manitoba maple (*Acer Negundo*) and red (or Norway) pine (*Pinus resinosa*). The Manitoba maple was collected in the town of Dauphin. The crop was reported lighter than most years, but the seed was said to be of good quality. Several hundred pounds of this seed were picked, and after being dried, shipped to the Indian Head nursery.

The red pine was picked in two localities, namely, southeastern Manitoba (around Vassar and Woodridge) and Black island in lake Winnipeg. The crop was light, but as this tree does not bear seed every year it was deemed advisable to build up a little reserve supply of seed to tide over the non-seed-producing years. There were 130 bushels of cones collected in southeastern Manitoba and 3 bushels at Black island. The cones were shipped to Indian Head, where the seed was extracted. The yield from the 130 bushels of cones was 75 pounds and from the Black island cones approximately 1 pound.

This Black Island seed is of particular interest as this point is the extreme northwestern limit of the species. It is expected that this seed will prove best for reforestation purposes in localities outside the present range of the species.

Planting and Seeding

Owing to the shortage of planting stock at the nurseries, very little ground was reforested during the summer of 1928, the approximate area so planted being only twelve acres.

On the Sandilands national forest six plots of one-quarter acre each were seeded by the spot and broadcast methods. These complete a series of experimental sowings commenced in 1925. Approximately one hundred plots of one-quarter acre each have been established in connection with this investigation, and it is expected that a preliminary report will be prepared shortly showing what may be expected on this forest from reforestation by the direct seeding method.

On the Riding Mountain national forest five acres of land, which had been clear-cut for poplar fuel-wood, was broadcast-burned and sown to white spruce. This experiment forms part of a series on a study of type conversion.

Nurseries

During the summer of 1928 considerable improvement was made to the forest nurseries which have been established on the national forests. There is now a nursery on each of the six national forests. These are not yet in perfect

shape, by any means, but steady improvement is being made, and the progress is satisfactory. Watering systems have already been installed at most of these, and it is expected that all will be so equipped at an early date.

The following is an approximate estimate of the stock on hand classified according to districts and age:—

District	Age of stock				
	1-0	2-0	3-0	2-1	2-2
Turtle Mountain.....	55,000	6,000	.....	15,000	2,000
Sandilands.....	65,000	60,000	.....	14,000	.....
Spruce Woods.....	244,000	108,000	.....	188,000	4,000
Riding Mountain.....	191,000	80,000	73,000	92,000	33,000
Duck-Porcupine.....	403,000	86,000	.....	40,000	.....
Total.....	958,000	340,000	73,000	349,000	39,000

The expression "1-0" indicates one-year-old seedlings; "2-0", two-year-old seedlings; "3-0", three-year-old seedlings; "2-1", two-year seedlings one-year transplants, that is, plants which, after two years in the seed-bed, were transplanted and have been one year in the transplant beds; "2-2", two-year seedlings two-year transplants.

Forest Surveys

Considerable progress was made again during 1928 in securing accurate and reliable data of the forest resources of this province. During the summer, portions of the Saskatchewan and Nelson River watersheds were examined by four parties of seven men each, one party working in the Saskatchewan basin and the other three in the Nelson River area. The party working in the Saskatchewan River drainage examined the country accessible from the northeast arm of Moose lake and Talbot lake. They also travelled east and examined the country in the upper portion of the William River drainage around Davidson, William, and Little Limestone lakes. On the Nelson River drainage one party was placed on the Minago river, another on the west branch of the Nelson, and the third on the east branch. The Minago river party started at the upper end, portaging into this watershed from Moose lake. They examined the country in this watershed as far as Drunken lake. The two parties working the east and west channels of the Nelson river went in by steamer from Selkirk to Norway House. The party working the west channel examined the country around the Big Playgreen, Kiskittogisu, and Kiskitto lakes. The party working the east channel examined the country in this watershed from Norway House to Cross lake, including the Echimamish river and Pipestone lake. This party then examined the country lying in the triangle enclosed by Pipestone, Cross, and Walker lakes. Owing to unavoidable circumstances, these four parties did not commence work until the latter part of June and the project had to be dropped about the middle of September. Despite the shortness of the season, the area examined was quite large. To each of these parties "timber-type" maps were supplied; these maps were made from oblique aerial photographs by the Topographical Survey, Department of the Interior, and proved of the greatest value, not only for their remarkably accurate and detailed delineation of the topographic features, but also for their information as to timber. Flights were also made by forest officers to check the timber-type maps; these enabled a re-grading to be made. In addition to the summer work above outlined, two parties were out during the winter, both commencing in January, 1929. One of these parties, consisting of seven men, continued the work of the previous winter in the Lake Winnipegosis area. This area had been photographed, and maps and photographs supplied. The other winter party consisted of ten men who were a little less than a month in examining two townships in southeastern Manitoba.



PLATE No. 6.—YOUNG TREES THAT WILL RENEW THE FORESTS

A bed of one-year-old spruce seedlings in the nursery at lake Audy (Riding Mountain, Manitoba).
(F. S. Photograph 20240)



PLATE No. 7.—HOLIDAYS AT A NATIONAL-FOREST SUMMER RESORT

Children enjoying their summer vacation at the Kam-sack Beach summer resort, Saskatchewan.
(F. S. Photograph 20350)

The following is a tabulated statement showing approximately the area examined in each watershed:—

Upper Nelson River watershed.....	3,100 sq. miles
William River watershed.....	350 "
Saskatchewan River watershed.....	675 "
Southeastern Manitoba watershed.....	72 "
Lake Winnipegosis watershed.....	450 "
Total.....	4,647 "

Grazing and Hay

The use of the national forests for grazing purposes in this inspectorate still falls short of its possibilities. Sixty-one grazing permits were issued, and 1,020 head of cattle, 100 horses, and 180 sheep were grazed. Hay permits to the number of 207 were issued, the number of tons cut being 2,492.

Recreational Uses

The public patronage of the various summer resorts in the national forests in this inspectorate showed a considerable increase over that of the previous year. A number of lots at the new resort which is to be opened on the north side of Clear lake were surveyed by a Dominion land surveyor. Numerous improvements were made at the various resorts, including the erection of piers, bath-houses, and kitchens. The number of visitors to the various summer resorts of the inspectorate during the season of 1928 was estimated at 11,300; of these the Clark Beach resort on Clear lake, in the Riding Mountain National Forest, had approximately 7,000.

NATIONAL FORESTS IN SASKATCHEWAN

J. Smart, District Forest Inspector

The Saskatchewan inspection district includes all permanent forest-reserve lands within the province of Saskatchewan, with the exception of areas known as the Cypress Hills forest in the southwestern part of the province and the Duck Mountain forest on the central eastern boundary, which are, for administrative purposes, under the jurisdiction of the Alberta and Manitoba inspection districts, respectively.

Over these forests the Forest Service exercises complete jurisdiction, which includes timber administration and fire protection; and the Service is also responsible for fire protection on the timber-lands outside permanent forest reserves. There are three organized fire-ranging districts to cover fire protection on the areas outside forest reserves, namely, the Saskatchewan Air Patrol fire-ranging district, the Battleford fire-ranging district, and the Prince Albert fire-ranging district.

Fire Protection

The fire-hazard period of 1928 was the longest-drawn-out season in the history of organized fire protection in this province, lasting from early April, with a varied intensity of hazard, until the snowfall in late November and the early part of December. The extreme conditions were due to lack of precipitation. From a study of meteorological data recorded at Prince Albert in the past forty years it appears that on only three occasions (namely, in the seasons of 1894, 1910, and 1917) have conditions as to precipitation been similar to those of 1928. The total rainfall of these seasons was but half the normal fall. Heavy frost, general throughout the province, during the latter part of August resulted in the early drying out of vegetation and the consequent severe hazard condition early in the autumn. Even after snowfall in December, fire-suppres-

sion activities were carried on, with the object of digging out ground-fires burning beneath the snow, due to the extremely dry condition of the forest floor. All brush-burning had to be curtailed in spruce areas during the winter logging operations owing to destructive ground fires resulting from brush disposal.

Forest fires occurring within national forests covered less than one-half of one per cent of the national-forest area. It will be found by a comparison of these figures with the average figures for the past five years, that in spite of the very unusual season the losses from fire, in acreage and value, are about half the five-year averages.

In both the Prince Albert and the Battleford fire-ranging districts hazard conditions were acute for the entire summer in the spruce and pine regions, and in the autumn, with the drying out and frosting of herbaceous growth, fire conditions were extreme until snowfall.

The Saskatchewan Air Patrol district is the largest in area in the province operated as one organization. It covers all the remote, timbered country to the north of settlement and comprises an area of 17,000,000 acres. The main base is at Ladder Lake. During the season forty-two fires were handled by the use of aircraft.

Aircraft Operation

Patrols were commenced by the Civil Government Air Operations staff from Ladder Lake on March 30, one plane being in operation equipped with skis for landing on the ice. These early patrols brought about the detection and suppression of twenty-six of the season's fires; these fires were for the most part "hang-over" winter fires left by freighters and trappers, and some of them, though small, would undoubtedly have caused large fires if not extinguished. The full establishment—four machines, one large, one small, and two of medium size and power—was in operation as soon as flying conditions were possible from open water, and continued to the sixteenth of October.

The details of aircraft operation were as follows:—

	Flights	Time		Miles
		hrs.	min.	
Detection.....	102	320	50	21,086
Suppression.....	37	162	15	10,566
Transportation and supervision.....	80	297	25	19,220
Test and service.....	38	18	00	1,236
	257	798	30	52,108

Grazing

There was a marked falling off in the number of grazing permits issued and in the number of head of stock grazed on national forests in comparison with the previous season. This is primarily due to farmer owners of small herds gradually reducing their stock and putting more of their land under wheat, thereby reducing the area of haylands formerly used for the production of winter feed and retaining only enough to feed dairy stock. The tendency of farmers is to go into mixed farming rather than the straight beef-stock production. On the other hand, there are quite a number of bona fide stockmen increasing their herds and endeavouring to get increased individual grazing enclosures. Twenty-two organized grazing associations functioned on national forests, no new associations being formed during the year and none disbanding. The numbers of both cattle and horses showed a decline, but there was an increase in the number of sheep. The sheep-raising industry is on the ascendancy, many inquiries being received for sheep range.

As in the case of grazing, there was a relative falling off in hay cutting on national forests.

Forest Management

The demand for the sale of timber under national-forest timber-sale regulations increased over previous years, but the aggregate in the quantity applied for under these sales was less during the past season.

It will be noted that there was practically no cutting of pulpwood in the province this past year. This situation is due to the abnormal activity of the previous season, resulting in over-production, and it will take at least one year to absorb the excess material cut on forest areas.

All logging operations under timber sale and permits were given very careful supervision and, as usual, conformed to definite conditions made at the time of the sale or issuance of permits. Marking or otherwise designating the timber to be removed on a recognized silvicultural method, either on a selective basis or a seed-tree method, was applied.

It was found that, owing to the very dry autumn, live burning of brush and other debris from logging had to be prohibited, owing to fire running in the humus and duff and destroying the remaining trees by burning out the roots, and also owing to the danger of fire holding over to the next season. Where brush-burning operations were attempted, extra help had to be obtained in the late winter to cover these areas and dig out and extinguish any fires. This work applied to all timber areas as well as timber sales and timber berths. All brush not burned was piled and will be disposed of in the autumn or early winter when conditions are safe.

Four prosecutions were made during the year, two for setting out fires and two for illegal trapping.

Reforestation

Nurseries.—The nursery season of 1928 represented the first definite attempt to relate the amount of seed sown and the consequent expected seedling survival to the planting program tentatively proposed for the various national forests throughout this province. The results secured were not as good as expected, owing to the unusual lack of rainfall, but, with the installation of artificial sprinkling systems in the most important nurseries, this drawback will not be experienced in dry seasons in the future. The estimated amount of seedling stock of all species on hand in all the nurseries in the fall of 1928 was as follows: Three-year seedlings, 82,000; two-year seedlings, 1,395,000; one-year seedlings, 3,576,000; total, 4,853,000. These numbers represent an increase of 1,700,000 seedlings over the number on hand in the fall of 1927. The total stock at present in the transplant lines of all species and age-classes and for all nurseries combined is 451,857, an increase of 25,695 plants over the total transplant stock reported in the fall of 1927. Transplant stock also suffered from the dry season and will to some extent be taken care of in future by artificial sprinkling. Several species from the western provinces of Canada and from certain European countries have been given a trial in the national-forest nurseries. Of these the red pine from Manitoba, lodgepole pine from Alberta, and Scotch pine from Sweden and Finland are being retained for regular sowings in future nursery work. Special reports were submitted on the relation of fall and spring sowings to the seedling survival catch, the relation of the season of sowing to the size and balance of the resultant seedlings, and the use of zinc sulphate as a weed eradicator. These investigations are being continued in the hope of obtaining more definite results. The Pines nursery at Macdowall, Saskatchewan, is being enlarged to handle an annual production of one million seedlings per year. Seedling production at the Big River nursery is being increased to provide for a more extensive planting program in that locality.

Planting.—There was very little stock available for planting during the past season. The present policy is to leave all stock in the transplant lines for

a period of two years before setting it out in a permanent location. As soon as work with this class of stock proves highly satisfactory in the field-planting operations, the second year in the transplant lines will probably be eliminated.

A total of 4,581 2-2 white spruce was spot-planted on the Big River forest in the spring of 1928. Using a 7½-ft. by 7½-ft. spacing, this number was sufficient for five acres and three-quarters. Approximately 47,000 jack pine plants (2-2 stock, that is, trees that had been two years in the seed-bed and afterwards two years in the transplant bed) from the Pines nursery were set out in that locality by the furrow method of planting in the fall of 1928. With a 4-ft. by 4-ft. spacing, this number of plants made a plantation of sixteen and a half acres. If the survival of plants is found to be satisfactory when the plantation is examined in the spring of 1929, autumn planting will be recognized as a regular procedure to relieve the ordinary pressure of spring nursery work.

Seed Extraction

The white spruce cone crop was an entire failure this past season. There was a heavy crop of jack pine cones in 1928, and a total of 535 bushels was collected on the Nisbet-Pines and Fort à la Corne forests. The Prince Albert extraction plant was in operation during the early part of 1929 and produced 248 pounds of clean jack pine seed. The total collection and extraction cost (\$3.05 per pound of clean seed) represented a reduction of \$1.35 per pound as compared with the cost of the 1927 seed. This reduction is attributed to lower collection and operation costs.

Forest Surveys

The stock-taking survey of the Pasquia national forest, started during the season of 1927, was continued during the past season (1928), an area of 51,200 acres being covered. This survey was carried out as a regular stock-taking survey, but was run intensively enough for timber-sale purposes. The information gathered was compiled during the winter months at the Pasquia headquarters, and type and stand maps were prepared. In addition to the above, in order to supplement the data collected along the strip lines, 515 trees were measured for height growth, 290 of these being also measured for diameter growth. On the Fort à la Corne national forest a stock-taking survey of 49,600 acres was completed in the Fort ranger district, and some 18 square miles (10,500 acres) were also covered in the Elk House ranger district. These surveys were carried out for the purpose of regulating future cuttings under sales and permits and putting the area under some form of management. Considerable work was done on the Pasquia forest in collecting specimens of shrubs, mosses, and other plants in connection with Cajander's theory of site classification.

Land Classification.—A very considerable increase was recorded in the number of applications and requests made to the Department by prospective settlers with a view to having lands opened to settlement that are situated either in national forests or proposed additions thereto. The following parcels were examined in detail by forest officers throughout the district:—

Nisbet-Pines Forest.—Fourteen and one-quarter sections of land were examined, of which only three quarter-sections were found to be agricultural lands and were recommended for withdrawal. Sixteen quarters under reservation as proposed addition were examined, of which two quarter-sections were recommended to be opened for settlement.

Fort à la Corne Forest.—Eight sections were examined, and one and one-half sections recommended for settlement. A further examination of sixteen quarters under reservation as proposed addition resulted in three quarter-sections being recommended for settlement.

Pasquia Forest.—Fifty-two sections were examined in Townships 43 to 45, Range 10, and Township 44, Range 9, west of the Second meridian. Thirty-three and a half sections were classed as agricultural lands suitable for settlement.

The above examinations comprise a total of eighty-two and a half sections, of which a total of thirty-eight sections were found to be of agricultural value, practically all of the latter lands comprising a narrow strip through townships 43 to 45, range 10, west of the Second meridian. In addition to the above examinations, the Topographical Survey, Department of the Interior, carried out a reconnaissance examination over an area equivalent to six townships adjacent to the Hudson Bay railway within the boundaries of the Pasquia forest, which area was subsequently classed as non-agricultural. A similar reconnaissance examination over the greater portion of about thirty townships comprising the proposed Three Rivers forest reserve resulted in some fifty sections being classed as of agricultural value.

Recreational Uses

The use of the national forests for purposes of recreation and sport increased over past years. The handling of tourists and campers on some of the more accessible forests is becoming a very important activity of forest officers, and as far as possible this Service endeavoured to meet the more exacting demands of the public wishing to use national-forest areas for their vacations. The tendency in many communities within reasonable distances of the national forests is to form recreational or outing clubs to concentrate attention on the improvement of the most suitable sites for camping and recreational use and thereby establish a resort for the community. This is exemplified on the Manito forest, where a municipality has taken steps to surrender to the Crown, on exchange, non-agricultural land it has acquired adjacent to the forest for forest lands of equal area, including water, to be used in the establishment of a community resort.

There are three established summer resorts on national forests in the province, situated, respectively, in the Manito, Porcupine, and Moose Mountain National Forests. The largest of these is the Fish Lake resort in the Moose Mountain national forest. This resort is unique in that, though situated in a prairie district, it is well timbered, and, furthermore, its lakes supply good fishing. These characteristics make it extremely popular with local residents; and, as it is close to the international boundary, many visitors are attracted from the United States. Quite a number of United States citizens have built permanent summer cottages in the sub-divisions of the resort and no expense has been spared to make these cottages both attractive and comfortable. Ten new cottages were built during the season and there are many persons intending to build in the near future. Week-end crowds at this resort reach as high as eight hundred persons. A strong demand exists for better road conditions on the summer resorts for all-weather traffic.

Publicity

During Canadian Forest Week co-operation was extended to the provincial committee. In the northern wooded areas of the province all schools were visited, literature on forest protection and conservation distributed, and, in some schools, essay contests carried out. Other means of publicity employed were the daily broadcasts from the radio broadcasting stations at Saskatoon and Prince Albert, newspaper advertising, and motion pictures. Exhibits were made at the following fairs:—Class A: Regina and Saskatoon; Class B: Estevan, Weyburn, Yorkton, Melfort, North Battleford, Prince Albert, and Tisdale. These exhibits took the form of a display of native timber samples and manufactured products

-ranging from rough lumber to rayon (artificial silk). At several points samples of nursery seedlings were exhibited which attracted much attention. At Saskatoon and Regina the District Office co-operated with the Tree-planting Division. Co-operation was also extended to the Canadian Forestry Association in the three weeks' tour of its fire-prevention car in the northern part of the province. The newspapers of the province are giving a considerable amount of publicity to forestry subjects.

NATIONAL FORESTS IN ALBERTA

C. H. Morse, District Forest Inspector

The Alberta inspection district comprises the national forests of the province, with an area of 18,700 square miles, and also that part of the Cypress Hills national forest within the province of Saskatchewan, and a considerably larger area called the Edmonton fire-ranging district. The national-forests, most of which are located on the east slope of the Rockies, are permanently dedicated to forest production. The Edmonton fire-ranging district includes those forest areas of the province which have not yet been so reserved. On the national forests there is carried on a general administration, for there the Forest Service controls all the activities of the forest, including timber sales and permits, grazing and hay permits, and the various uses of land under lease or permit. In the fire-ranging district, however, this Service is responsible only for fire protection. Besides these two main divisions of work, the Alberta inspection district staff, under the Board of Railway Commissioners, carries on the supervision of railway fire-protection work.

Forest Fires

Three distinct fire-hazard periods occurred during the season of 1928. The first was from the middle of May until the end of the month for the Lesser Slave forest and the Edmonton fire-ranging district, and until June 5 for the East Slope forests. During this time conditions were particularly dangerous, owing to the dried-out, rank growth of vegetation of the previous year, new growth having not yet started. During the last half of July and the first half of August, a second (but less hazardous) period occurred; really warm weather with low humidity caused some anxiety, but the green growth tended to keep down fire outbreaks to a great extent. The autumn danger period commenced during the first week in September, when early killing frosts dried up the vegetation, and high winds evaporated the surplus moisture from the ground-cover. This condition persisted, with but a short break, until the last of November. The period was exceptional in that there was an almost entire absence of precipitation for a great number of days. Contributing to the danger were the many new settlers in the north country, the early completion of harvest operations, and the excellent condition of the roads, which permitted hundreds of farmers to go moose and deer hunting. This long hazardous period was finally terminated by a light fall of snow with low temperatures on November 30, although on the Clearwater and Brazeau forests this snow soon disappeared and a slight danger continued until the end of the year.

Air Patrol

The prolonged fire-hazard period and the incomplete state of the lookout units on the national forests made it necessary to requisition a great deal of aerial patrol. A total of 24 hours of flying on fire patrol was carried out by the Civil Government Air Operations staff for the Crowsnest, Bow River, and Clearwater forests during the season. Owing to the great influx of settlers to the Peace River district and the extraordinary amount of land clearing being

done in that region, it was deemed advisable to establish an aerial sub-base at Grande Prairie. Although operations did not commence until June 25, very valuable assistance was given in patrolling that large district. A total of 181 hours of flying time was provided there, bringing the total number of flying hours on fire patrol to 422 for the province.



PLATE NO. 8.—HOUSING THE AIR PATROL FORCE

Warehouse and cabin at Sled Lake, in the Saskatchewan Air Patrol District.
(F. S. Photograph 19826)

Grazing

The Forest Service encourages the grazing of live stock on the national forests. Not only is the forage to be found there a valuable resource which should be utilized, but grazing also keeps down the growth of grass which, when dried out, would constitute a dangerous fire-hazard. Permits are issued for horses at ten cents per head per month, for cattle at eight cents, and for sheep at two cents per head per month. Grazing permits were issued last summer (1928) on the national forests covering 21,409 head of cattle, 3,863 horses, and 1,665 sheep. Most of this stock was grazed on the Crowsnest, the Bow River, and the Cypress Hills forests, which are adjacent to the old-established ranching districts of the province. Permits issued to cut hay on national forests covered a total of 108 tons. Most of it was cut on the Cooking Lake national forest, where there are some fine natural meadows and where, as yet, grazing demands are not heavy.

Timber Sales and Permits

There are, in this district, thirty-one active timber sales involving an area of approximately 28,380 acres, of which nineteen, with an area of about 15,088 acres and 30,350,000 feet board measure or its equivalent, are new sales awarded during the year. Ten sales satisfactorily completed their cutting contracts and were cancelled. The healthy condition of the mining and lumbering industries in this province is reflected in the above figures, the lumber cut being 50 per cent, and the mining timber cut more than 100 per cent, greater than for the same period last year. The amount of timber involved in new sales has increased more than seven times.

Seed Collection and Extraction

Approximately 500 bushels of lodgepole pine cones were collected, 200 of which came from the Cypress hills and the remainder from the Clearwater forest. These cones will yield approximately 180 pounds of seed, which will be used in reforestation work, not only in this province but wherever the species can be introduced successfully. The Cypress Hills seed has been found to be particularly adapted for growing stock for prairie planting and is being used in greater quantities for this purpose every year. There was no seed-crop of spruce and, consequently, no seed of that species could be collected.

Recreational Uses

It is estimated that close to 4,000 people visited the Elkwater Lake summer resort during the past season. The Gap, on the Old Man river, where trout fishing is very good, is also a popular resort, and it is not uncommon to find as many as one hundred cars there over a summer week-end. Other favourite fishing and camping locations are the Castle, the Highwood, and the Elbow rivers in the East Slope national forests.

Seeding and Planting

The planting of approximately fifty-eight acres of white spruce was carried out on the Cooking Lake forest on an area denuded by fire of its forest cover about fifty years ago. Altogether, an area of 225 acres has been planted to spruce and pine on this forest during the past ten years. The plantations appear to be making satisfactory growth, although rabbits last year caused considerable damage. In addition to the foregoing, 340 acres were reforested by the seed-spot method of direct seeding in 1924 and 1925. This method has not been found to be uniformly successful on all locations, and the operation has been discontinued until such time as the results attained on the different locations are easily apparent. It is expected, however, that this cheaper method of re-establishing the forest cover will be found to be quite suitable on the moister situations. On the Crowsnest forest a broadcast-seeding experiment was carried out on an area of six acres recently denuded by fire. The result of this experiment has been so successful that a larger area has been chosen for the same treatment next season.

Thinnings

Thinnings in the dense lodgepole pine stands of the Cypress Hills forest have been carried on during the year by two methods. By one of these this Service undertakes the cutting by hired labour under the direct supervision of a technical forester; by the other method the permittee, under the supervision of a ranger, removes thinnings which have previously been marked for removal by a forester. The first method has been largely superseded by the latter, as most of the settlers prefer to do their own cutting. Both methods have been instrumental in removing the crowded trees on a considerable area, which might now be considered to be in first-class silvicultural condition. The older thinned stands are showing a marked improvement in the rate of growth.

Investigative Work

Following a method developed in Finland whereby the vegetation on the ground is used as a means of determining the wood-growing possibilities of a situation, certain investigations were carried out in this district to determine whether or not such methods of classifying forest areas are practicable here. It was found that a definite relation does exist between the ground flora and the rate of growth. The method may be used to very great advantage in forecasting the yield that may be expected from a certain area of forest land. Although

the full value of such a method can be appreciated only by a technical forester, it will nevertheless be clear to all that the determination in advance of what a piece of land may be expected to produce is a tremendously important matter when any scheme of reforestation is to be put into effect, for upon this must depend the sum which may be profitably expended in order to re-establish the forest cover. This study is being proceeded with.

NATIONAL FORESTS IN BRITISH COLUMBIA

Chas. MacFayden, District Forest Inspector

The Forest Service, Department of the Interior, administers all national forests within the Railway Belt of British Columbia and is responsible for forest fire protection on all Dominion lands in the Railway Belt.

Timber Sales and Permits

The year was one of unusual, even unprecedented, activity in timber sales. Altogether there were fifty-five sales in good standing, most of which were actively operated. Well over one-half of these (thirty-five sales) were in the Shuswap district, the Tranquille being next with eighteen. In the Coast district there were only two sales, and in the Revelstone district there was none. All sales are thus practically confined to those national forests located within the interior wet belt and the transition forests between the wet and dry belts. Of the fifty-five sales in good standing during the year, twenty-four (slightly less than one-half) were completed during the period. Of these sales fourteen are located in the Shuswap district, nine in the Tranquille district, and one in the Coast district. It is interesting to note that, of the total, two-thirds were Supervisors' sales; this fact shows that there was a real need for this class of sale, and the recent amendment to the regulations is proving a popular one. The average sale is small, most sales being made to small operators who use this means to supplement an income from other work. Almost all sales extend over a period of two or three years, so that the cut in a given year does not necessarily coincide with the quantity sold during the same time. The total cut for the past year was somewhat less than the quantity disposed of during the year.

On the whole, the different timber-sale conditions were satisfactorily complied with, and only in one or two cases was it necessary to confiscate any part of the guarantee deposit made for each sale. Special attention was given during the year to the special conditions attached to each sale and, while under the present standards of utilization obtaining in the industry as a whole there must be more or less compromise, the cutting on recent sales is believed to be in accord with good silvicultural and forest-protection practice.

Very few timber permits are issued in this district, farmers and others requiring timber in small quantities either having sufficient on their own lands or having access to supplies closer to hand than those of the national forests.

Seed Collection and Extraction

The year was a disappointing one from the standpoint of both the quantity and the quality of seed obtained. The disappointment was the more marked because of the demand that there was for several species. It was, for instance, possible to supply only a small part of a single order for 5,345 pounds of the seed of western yellow pine (*Pinus ponderosa*), and the total collection of Douglas fir seed was very much less than the quantity required by the Forestry Commission of Great Britain alone. In the case of this species not only was the yield below all expectations but the quality, as judged by germination tests, was poor, although a small quantity of very good seed was finally separated. The following is the total yield of cleaned seed from the cones collected during the year:—

Western yellow pine (<i>Pinus ponderosa</i>)	803 lb.
Douglas fir (<i>Pseudotsuga taxifolia</i>)	634 "
Sitka spruce (<i>Picea sitchensis</i>)	890 "
Western red cedar (<i>Thuja plicata</i>)	211 "
Western white pine (<i>Pinus monticola</i>)	2 "
Western hemlock (<i>Tsuga heterophylla</i>)	40½ "
Cascara	10 "
Lowland fir (<i>Abies grandis</i>)	7 "
Western larch (<i>Larix occidentalis</i>)	24 "
Lodgepole pine (<i>Pinus Murrayana</i>)	73 "
Amabilis fir (<i>Abies amabilis</i>)	15 "

Total..... 2,138½ "

As heretofore, by much the greater part of this seed was collected at the request of forest authorities in Great Britain, the various states of the Australian Commonwealth, and the Dominion of New Zealand. Small quantities, mostly for experimental purposes, were supplied to various forest authorities, universities, and experiment stations throughout the world. Inquiries for seed for commercial purposes were referred to commercial seedsmen.

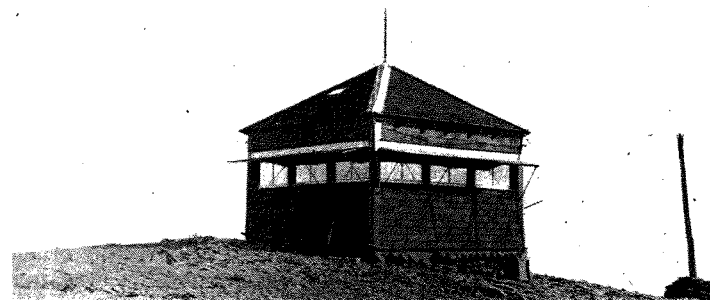


PLATE No. 9.—A ROCKY MOUNTAIN LOOKOUT CABIN

All along the eastern slope of the Rockies similar cabins have been placed at commanding points to shelter the watchers stationed there throughout the fire season to watch for signs of forest fires. (F. S. Photograph 20267)

Fire Protection

Preceded by a winter of unusually heavy snowfall, spring opened with plenty of moisture in the ground and an abundance of snow above the 2,500-foot level, so that the month of April was one of low hazard. May, however—contrary to the usual expectation—proved a very dry month over the greater part of the district, and a total of 101 fires occurred. Conditions were much more favourable during June, but in July, particularly after the middle of the month, and throughout the month of August the hazard rose rapidly. During this time 168 fires were reported. The season did not close until near the end of October, and in some localities fire would run for some time after that date. The autumn months were some of the most open on record. The damages and costs resulting from all fires were among the lowest on record; in fact they are unique when compared with the total number of fires that occurred. They are also unusual in that the damage to timber was but very little more than the damage to other property. The loss in young growth was noticeably low. Although a number of fires were undoubtedly of incendiary origin and many others due

to negligence, good evidence was, as usual, difficult to obtain, and only one person was prosecuted. This case was, however, interesting in that the defendant was charged with the violation of one of the special conditions attached by the forest officer to a permit issued to him. The justice found him guilty and, on the forest officer's recommendation, fined him merely the cost of extinguishing the fire, amounting to \$51. This sum was subsequently paid.

Grazing

Starting at the first of the year the Forest Reserves Grazing Regulations were enforced in this district for the first time. Any misgivings as to the result of this move have been fairly dispelled, and as a whole the stockmen have accepted the change without any opposition. As may have been expected in any change involving old-established practices, progress had to be made slowly and carefully, and where opposition was met the cases were allowed to stand in abeyance, in the belief that the example of the majority would finally be followed by all. At the close of the year the regulations were generally accepted and their fairness admitted; and everyone seemed prepared to abide by them. It was, perhaps, fortunate that the decision to put the grazing regulations in effect was coincident with an improvement in the beef industry.

Grazing is altogether confined to the national-forest ranges within the interior dry belt, practically all of which are suitable for summer grazing only. Special interest is just now shown in the alpine ranges suitable for sheep, and, to make them accessible and facilitate the handling of the herds, a number of trails and sorting corrals were built during the year. So-called "wild horses" are numerous on a number of the ranges, and, through their interference with other stock, the forage they consume or destroy, and the difficulties they add to administration of the grazing regulations, they are a bane to both the stockmen and the Service. With the co-operation of a number of stockmen an experimental roundup of such animals was made on the Savona summer range of the Nicola and Long Lake national forests. Though not attended by complete success, the project demonstrated what could be done in this direction and it is hoped to repeat the work on other ranges. Altogether there were 64 head gathered up, the majority of which were claimed by their owners and released on payment of the expenses and dues against them; the others are yet to be sold or otherwise disposed of. A range reconnaissance was made of the Hat Creek grazing division.

Forest Research

No new research projects were started during the year. A number of the plantations proved on examination to be failures and have been struck from the records. All yield and permanent sample plots were examined and re-measured and thinned where such treatment was called for.

Recreational Uses

The national forests more than ever before were used by tourists and the public generally for purposes of recreation. In recognition of this growing demand, camping and picnicking facilities were provided at a number of the places that have proved most popular. In most instances the improvements have called for very little outlay except for the rangers' time, and if one may judge from the use made of them they were thoroughly appreciated.

There was little or no increase in the demand for cottage or camping lots at the regularly established resorts at Paul lake and Trout lake, although both places continued to be popular retreats during the warmest weather. With the comfortable and convenient camp equipment now available, the tendency seems to be to get away from the formal resort and seek the seclusion and privacy that goes with the exploration of the less frequented districts.

FOREST PRODUCTS LABORATORIES OF CANADA

T. A. McElhanney, Superintendent

The disorganization of the work of the Laboratories during the fiscal year 1927-8, incident to the removal of the greater part of its equipment and staff to Ottawa, had been overcome by the end of that year, and during the fiscal year 1928-9 considerable progress was made in the main laboratories at Ottawa in resuming an active program of research work. The installation of all new equipment was completed early in the fiscal year, so that the staff in all divisions during the greater part of the year was available for constructive work on various projects.

The pulp and paper building in Montreal was completed early in the year, and by the end of the year, with the exception of a few items of equipment, the pulp and paper laboratories were completely installed and in running order.

OTTAWA LABORATORY

As now organized, the main laboratory in Ottawa functions under the following technical divisions:—

Timber Mechanics

In this division attention is devoted to a study of the mechanical and physical properties of Canadian woods, to the design and testing of containers, to the testing and standardizing of glues used in ply-wood and in the application of wood veneers, and to a variety of miscellaneous testing of wood and wood products as required from time to time by the wood-using industries.

Wood Preservation

This division is interested in chemical problems relating to the application to timber of materials which are toxic to wood-destroying fungi and which, therefore, tend to prolong the life of timber. It is also interested in the design and operation of mechanical equipment required in applying such preservatives to wood.

Timber Physics

The problems of this division refer primarily to the study of the structure of the various woods of Canada, to the measurement of fibre lengths of different woods, and to the demonstration of how the structure of wood is a factor in the practical use of wood as lumber or in the pulp and paper industries.

Timber Pathology

Wood under certain conditions is subject to attack by wood-destroying fungi and by various staining organisms. A systematic study is made by the pathological division of the causes of such decays and discolorations and of methods for their prevention or control.

In addition to these four active technical divisions, provision is made in the laboratory for a draughting room, photographic and dark rooms, lecture hall, fully equipped wood-working shop, small sawmill, air-drying shed, small experimental dry-kiln, and other items of accommodation. A large room has been set aside as an exhibit room in order to permit the display of the various woods of Canada and of a large number of articles manufactured from them. Included in this exhibit is a collection of woods from many foreign countries, which forms a valuable addition to the laboratory exhibits and permits comparison of Canadian timbers with foreign competing timbers.

Division of Wood Preservation

Protection of Timber from Marine Borers.—Heavy losses occur each year on the Pacific and on the Atlantic Coasts in timbers exposed to the action of marine borers, as in the case of piling or other timbers used in wharf construction. This matter was drawn to the attention of the Forest Products Laboratories by the federal Department of Public Works, and at their request a number of timbers were treated by three different methods: (1) with creosote containing 40 per cent naphthalene, (2) with creosote conforming to the specifications of the American Railway Engineering Association for Grade 1 creosote oil, and (3) with a mixture of copper carbonate and Paris green in an ammoniacal solution.

Seventy jack pine posts were treated with the above preservatives and shipped to three points in the Maritime Provinces, where arrangements were made with the Public Works Department to have them exposed to the depredations of marine borers. These timbers will be observed periodically in order that the relative merits of the three methods of treatment may be determined.

Resistance to Change in Moisture Content of Yellow Birch Ties Treated with 70-30 Creosote-Coaltar Mixture: (a) With Initial Air Pressure, (b) Without Initial Air Pressure.—One hundred yellow birch ties were supplied by the Canadian Pacific Railway, which is particularly interested in this problem and is co-operating with the laboratory. The work has been carried on as one of a series of studies for the purpose of obtaining data on the most efficient methods for treating hardwood ties. The specific information desired in this case is the relative efficiency of the Rueping and the Lowry processes in retarding variations in moisture content of the ties. The ties supplied by the Canadian Pacific Railway company were treated during the year and are now under observation in the seasoning yard at the laboratories.

Distribution and Penetration in Jack Pine Treated with 70-30 Creosote-Coaltar Mixture: (a) With Initial Air Pressure, (b) Without Initial Air Pressure.—This study was initiated in order to obtain some data on the relative penetration of preservatives in jack pine heartwood and sapwood when treated in various ways. In some cases the sticks tested were incised before treatment, while in other cases they were not incised. The work in connection with this project was completed during the year and a report prepared.

Investigation of Shale Oil as a Wood Preservative.—A preliminary investigation was carried out to obtain some reliable information regarding the possible utilization of shale oil as a wood preservative, either by itself or when mixed with other toxic materials such as creosote. Over 400 toxicity experiments were carried out on shale oil and on mixtures of shale oil with creosote and other materials. The main conclusions arrived at from this study are as follows: (1) that the sample of shale oil tested is not sufficiently toxic to fungous growth to permit its use alone as a wood preservative, (2) that a preservative mixture of shale oil and creosote has characteristics similar to those of a mixture of fuel oil and creosote, though the former mixture does not appear to have any advantages over the latter, (3) that by bubbling chlorine gas through the shale oil the oil was readily increased in weight 5 per cent. This chlorinated oil was found to be more toxic than the unchlorinated oil, but, as part of it was a gummy solid, it would be difficult to use the chlorinated product to impregnate wood, (4) that the possibilities of mixtures of tar acids derived from low-temperature creosotes and fuel oil or shale oil seem to be very promising, especially for the small consumer who may have to pay 50 cents a gallon for creosote. By using 10 per cent tar acids with 90 per cent fuel oil or shale oil instead of a mixture of 50 per cent creosote and 50 per cent fuel oil or shale oil, the small consumer can effect considerable saving if tar acids are procurable for less than \$2 per gallon.

Apparatus for Separating Foam into its Liquid and Vapour Components.—In the treating process known as "boiling under vacuum," creosote foams violently and it has been found difficult to withdraw the vapour and retain the liquid creosote in the treating cylinder. At the Forest Products Laboratory during the year an apparatus was designed and constructed to overcome this difficulty. As the principle was new and original, and as it offered important possibilities in commercial wood-preservation plants and possibly in other processes where foaming occurs, patent protection was applied for.

New Method of Determining Toxicity of Wood Preservatives.—Toxicity experiments are usually carried out by growing fungi in agar-malt media containing varying percentages of the preservative under examination. It is quite possible that the killing point of a preservative determined as above for agar-malt may be quite different from that obtained by using wood as a medium. After experimenting, a method has been developed whereby toxicity experiments can be carried out on wood itself which had previously been impregnated with varying percentages of the preservative under test. The method was tried out on wood treated with standard preservatives and with several new preservatives of doubtful value.

Test Tracks.—In 1920, creosoted jack pine and hemlock ties were treated at the Laboratories and installed in a test track at St. Clet, P.Q. In 1924, jack pine ties infected by red stain and red rot were treated at the laboratory, and in 1925 installed in a test track on the Canadian National railway at Ste. Genevieve, P.Q. These two test tracks have been under periodic observation, and during the past year were again carefully inspected by a representative of the laboratories. It is too early yet to draw any definite conclusions from observations of these test tracks. In both cases, however, valuable track data are being obtained which will undoubtedly have an important bearing on information derived from laboratory investigations along similar lines.

Treatment of Douglas Fir Timber.—Difficulty has frequently been encountered by Canadian manufacturers of Douglas fir timber in marketing such timber for use in exposed situations where it is desirable that treated timbers should be used. This difficulty has arisen generally on account of the lack of knowledge on the part of foreign purchasers of proper methods of treating Douglas fir. An impression obtains in some countries that Douglas fir cannot be satisfactorily treated, and that under methods of treatment obtaining on the Pacific Coast there is serious reduction in strength. To this view treating companies in Canada take strong exception. This matter was, therefore, made a subject of inquiry by the wood-preservation specialist of the laboratory when on the Pacific Coast during the year, with the result that it was decided to have a number of ties and beams treated by a commercial creosoting plant and to have them afterwards tested in the laboratories. A division was made of such materials, part being sent to the Vancouver laboratory, and the remainder to the Ottawa laboratory, in order to expedite tests and publication of the report on such tests. Some of the timbers were tested green, while companion sticks were treated. Considerable progress was made on this project before the end of the fiscal year.

Division of Timber Mechanics

Testing Equipment.—Canada is particularly fortunate in having a number of important woods which are recognized in most lumber-consuming countries of the world for their value as structural timbers. These timbers, however, have to encounter considerable competition from foreign timbers. The Forest Products Laboratories are frequently called on to test timbers in large sizes, and for that reason, when the laboratories were moved from Montreal to Ottawa, in addition to small testing equipment it was considered advisable to

install at least one large testing machine. After study of the design of various types of 200,000-pound machines it was decided to purchase an hydraulic machine with a weighing platform 25 feet in length and with a clear head of 16 feet. This machine was erected early in the year by a representative of the makers and is the only hydraulically operated machine in the Canadian Forest Products Laboratories, all others being operated by electric motor on direct current.

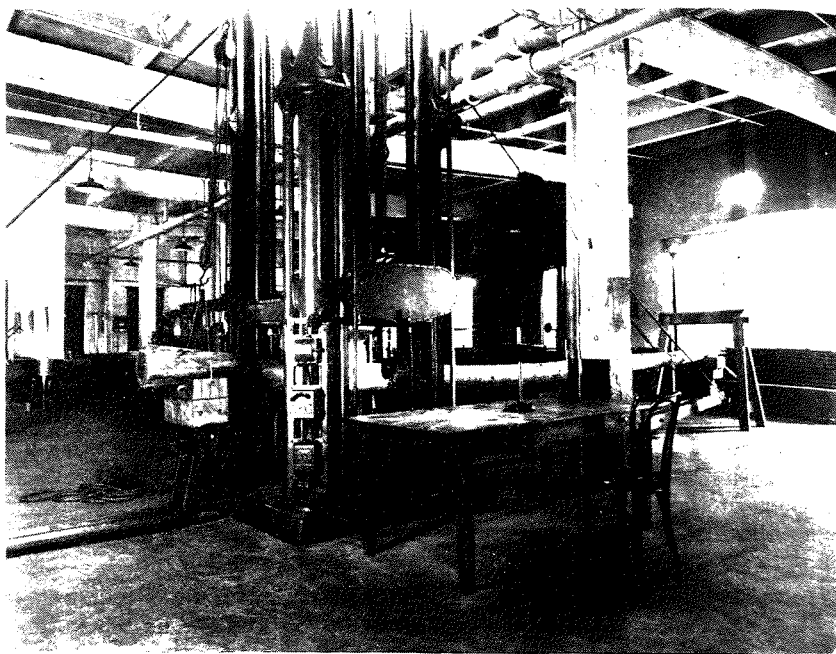


PLATE NO. 10.—TESTING 25-FOOT TELEPHONE POLES AT THE FOREST PRODUCTS LABORATORY, OTTAWA

Testing of 25-ft. telephone poles in 200,000-lb. hydraulic testing machine in Ottawa Laboratory. Pressure is applied vertically at a point corresponding to the ground line of the pole in service. The stress at the top support corresponds to that on the cross-arm carrying wires. Nearly 200 poles of jack pine, red pine, and white cedar were tested, some of which had been treated with creosote.

Tests on Small Clear Specimens of Canadian Timbers.—Since the establishment of the laboratories an investigation has been carried on as opportunity afforded on small clear specimens of Canadian woods. In the more important species shipments were obtained from various localities within the habitat of such species. Up to the present, in some cases only one shipment has been tested. This work is done in accordance with the procedure which has been adopted in all important timber-testing laboratories of the world. Woods are tested in the green or unseasoned condition and in the air-seasoned condition. Tests have been made during the year on nine different shipments of timber after air-seasoning. A great deal of attention was also devoted to the analysis of results of previous tests, having in view the incorporation of all data, up to date, in a bulletin on mechanical and physical properties of Canadian timbers. Charts were prepared showing the value in comparative form for each standard mechanical test for each species. Approximately 800 summaries were made from existing data with a view to ascertaining the interrelation between rate of growth, specific gravity, percentage of summerwood, and the more important strength functions. About 600 curves were plotted from these summaries.

Nail-holding Power of Canadian Woods.—In order to meet a demand from the industry for the relative nail-holding properties of different woods, tests have been conducted from time to time by the laboratory with nails driven into the wood and then withdrawn under standard methods of procedure, making the results between species directly comparable.

Over fifteen hundred tests were completed during the fiscal year, and these, combined with earlier work done on this project, were included in a table in the paper "Timber Testing in Canada," published during the year.

Design of Wooden Containers.—Loss through breakage of boxes and other containers in the shipping of goods by railways and in other ways is very heavy. This has been made the subject of intensive study by other laboratories and by the Freight Container Bureau of the United States railways. Several large testing drums have been established in the United States, and it was considered advisable to have a similar drum, known as a "hazard" machine, erected in the Canadian laboratories. During the year a considerable number of tests on containers submitted by different shippers were made by the Ottawa laboratory.

It was planned to make a systematic study of the design of wooden boxes and other containers, but time did not permit launching this program. Some time, however, was devoted to planning the work, which will be undertaken when staff is available, after completion of other projects on hand.

Relation between Mechanical and Physical Properties of White Spruce.—Mechanical tests of white spruce were carried out in connection with the study of the relation between rate of growth and density of spruce. In this project 6,550 tests in compression parallel to the grain were made on small specimens cut from disks taken from different heights in the tree. An analysis of results will show whether there is a close relationship between density of wood and its mechanical properties.

Tests on Telephone Poles.—Eastern Canadian companies using large numbers of telegraph and telephone poles are encountering increasing difficulty in getting suitable poles at a reasonable price. Eastern cedar has been the popular pole timber of Eastern Canada for general use, but supplies of suitable poles of this material are not so readily available as they used to be. There is, in fact, some competition from foreign timbers which have been treated with wood preservatives. This has aroused considerable interest, on the part of pole consumers, in definite data on the relative mechanical properties of various Eastern species which might replace cedar, and also of foreign competing species. A demand has arisen for tests both in the treated and untreated condition. Before taking any definite steps in this connection, a questionnaire was circulated to all important Canadian telephone and telegraph companies. From the interest taken and the requests for data received, it was apparent that an investigation of this kind should be undertaken at an early date, particularly as it has a direct bearing on the importation of foreign timbers. By co-operation with commercial companies shipments of Eastern cedar, red pine untreated, red pine treated, and jack pine untreated were secured and piled in the lumber-seasoning yard of the laboratory. A large tank was erected for butt-soaking these timbers before testing in order to simulate as nearly as possible actual service conditions.

No actual testing was carried out during the fiscal year, but special auxiliary equipment required for testing long poles on the 200,000-pound hydraulic machine was designed and purchased.

Strength of Treated and Untreated Douglas Fir Beams.—As already explained under the heading of wood preservation, arrangements were made for creosoting a number of Douglas fir beams and ties in a creosoting plant on the Pacific Coast. The Timber Mechanics Division co-operated in the testing

of these beams. Some of these were tested in the green condition without any seasoning, while companion sticks were treated and afterwards allowed to soak up water again so as to bring their moisture content up to fibre saturation before being tested. During the year under review 82 green beams were tested, and in addition to these 4,095 tests were made on small clear specimens cut from these beams. During the coming year the treated beams will be tested.

General Testing.—The facilities of the laboratory are extended to manufacturers and users of timber products in the testing of their products. A large part of this work is done for the Royal Canadian Air Force. In all, tests of this kind to the number of 561 were made during the year.

Division of Timber Pathology

Reference Collection of Pathological Material.—In order to have a pathological collection for reference purposes, of typical decays in Canadian timbers, advantage has been taken of every opportunity to obtain new specimens for the laboratory collection. During the year 139 specimens of sporophores of rotted wood were added to the collection, making a total of 690 specimens in the herbarium of the laboratories. An effort was made during the year to get a widely representative collection of typical wood rots by inviting co-operation of various foresters throughout Canada. Only twenty specimens of sporophores or of rotted wood were obtained in this way, the additions to the collection being made principally from material submitted to the laboratory by wood-working organizations, or by collections made by members of the laboratory staff.

Red Stain in Jack Pine: Its Development in Treated and Untreated Railway Ties under Service Conditions.—Further work was done in connection with the study of red stain in jack pine, observations being made on 415 red-stained ties which permitted their being grouped in four lots: (1) Ties which had yielded *Trametes pini* as the only staining fungus; (2) Ties which had yielded "Fungus No. 2" as the only staining fungus; (3) Ties which had yielded both *Trametes pini* and "Fungus No. 2"; (4) Ties which had yielded neither *Trametes pini* nor "Fungus No. 2." Half of each lot was creosoted and the remainder left untreated. Of the 49 ties showing white-pocket rot when examined in 1927, 3 were analysed, 23 were creosoted, and 23 remained as untreated controls. Representative ties from all groups were selected for analysis, numbering 30 in all. These were sent to the laboratories, and the remaining ties were delivered at a point on the Canadian Pacific railway near Ellwood station, south of Ottawa. They will be placed in track during the spring of 1929. The results of tests on the ties brought to the laboratories revealed that of the fifteen ties in which *Trametes pini* was originally alive, eleven still contained living mycelium two years after their manufacture. Of the fifteen ties containing *Trametes pini*, ten were creosoted, and of these ten, eight yielded living *Trametes pini* after treatment. The results showed that Fungus No. 2 also survived seasoning and creosoting. It is apparent, therefore, that present methods of creosoting will have to be modified if ties affected with red-rot are to be sterilized in the treatment.

Moisture Content as a Factor in Timber Decay.—Some preliminary work has been done in studying the effect of the moisture in wood on the development of decay in wood. Experiments have been conducted to find a toxic material which will effect surface sterilization without having a permanent effect on wood. Benzine and acetic acid have been tried in this connection. Benzine was found ineffective, but acetic acid sterilized the wood successfully. In the first tests, however, with acetic acid, the treated blocks were not readily decayed when inoculated with mycelium of a suitable wood-destroying fungus. Work will be continued on this project as it is considered of very great importance fundamentally.

Blue Stain in White Pine with Special Reference to Methods of Prevention or Control.—In the white pine (*Pinus Strobus*) district of Eastern Canada during the summer of 1928, in which there was heavy rainfall and consequent high humidity, severe losses were encountered in white pine on account of blue stain. This problem was brought to the attention of the laboratory by the White Pine Bureau, and a conference was held with officials of this bureau. Consequent on this conference considerable work was done in reviewing all literature pertaining to the subject as the result of blue-stain investigations in other districts and in other species, and also in formulating plans for further investigations, particularly with relation to the kiln-drying of white pine and to dipping it, while still green, in chemical solutions, in order to prevent stain. It has been estimated that the loss on account of blue stain in Canadian white pine during 1928 was approximately \$1,000,000, whereas in a normal year the loss on this account is between \$200,000 and \$300,000. A questionnaire distributed to the various mills yielded information which has proved very valuable in formulating definite plans for devising methods of prevention or curtailment of loss in white pine on account of blue stain. In addition to actual progress on definite projects a great deal of miscellaneous pathological work was done at the request of other divisions of the laboratory, and of the timber industries. The latter work is of very great importance, and the large increase in the number of inquiries is a convincing indication of growing interest on the part of timber users in the significance of wood decay in connection with the marketing and use of wood, particularly in exposed situations.

Division of Timber Physics

Relation between Rate of Growth and Density of White Spruce.—It has been found that ordinary physical and mechanical properties of wood, which determine uses to which each species may be put, vary reasonably uniformly with density of the wood. Density may, therefore, be considered an important quantitative indicator of the properties of wood, particularly important in measuring wood volumes in pulp manufacture. It was therefore decided to undertake an investigation of the relation which might exist between rate of growth and density in spruce. The rate of growth is readily discernible, and it was realized that, if some relation might be established between rate of growth and density, the actual dry weight of spruce per cord could be much more closely estimated than is now possible. In order to advance knowledge along these lines, 400 trees from the Dominion National forests in Saskatchewan and Manitoba were selected and felled, after which disks were cut from these at eight-foot intervals throughout the whole commercial bole of each tree. These disks were carefully studied for rate of growth and density. This investigation has yielded some very interesting and important information, a preliminary report of which was given at the annual meeting of the Woodlands Section of the Canadian Pulp and Paper Association in Montreal in January, 1929. The complete results of the investigation are being assembled for incorporation in a report.

Study of the Absorption of Water by Floating Logs.—It has been estimated that about two and one-half million dollars per year are lost in Eastern Canada on account of the sinkage of logs while being floated from the woods to the mill. This problem has already received considerable study in European countries. The Pulp and Paper Association of Canada, through their Woodlands Section, has recently taken a keen interest in this problem, as their members have realized that the results of floatability studies of European woods were not directly applicable to Canadian conditions and species. There is a wide difference in the manner in which different species float when first placed

in the water and in their subsequent floatability after different periods. At the request of the Woodlands Section of the Pulp and Paper Association, the Forest Products Laboratories undertook the investigation of certain aspects of the problem which could be dealt with more adequately by laboratory methods than by field studies. These related to the effect on floatability of such factors as (1) Seasoning, (2) End and side penetration, (3) Agitation of the water, (4) Variations of temperatures of the water, (5) End coating, (6) Size of log, etc. A tentative working plan was drawn up covering several different phases of the problem, and a special tank about 16 by 35 feet in size was installed in the laboratory to accommodate 4-foot logs for purposes of observation. A preliminary report was made of the results of the work accomplished, at the annual meeting of the Pulp and Paper Association in January, 1929. The experience gained, however, indicated the desirability of concentrating on a few of the more important problems rather than trying to cover so many problems at one time. Consequently, for the following year it was decided that the laboratories would devote special attention to the effect of seasoning, temperature of water, and agitation.

Lumber Seasoning.—The work carried out in lumber seasoning during the year under review was largely confined to a number of minor investigations resulting from requests made to the laboratories for co-operative assistance by the wood-working industries. These investigations pertained to such problems as (1) the kiln-drying of balsa wood, which is used to a considerable extent as a heat insulator, (2) the study of drying schedules in furniture factories, (3) the conditioning of air in lumber storage rooms, and (4) the development of schedules for kiln-drying oak and ash.

Semi-commercial Experimental Lumber Dry-kiln.—The equipment of the laboratory for kiln-drying consists at present of only one small kiln which will not accommodate a greater length than four feet. It was realized that in order to encourage better practice in kiln-drying in lumber mills and other wood-using plants it was essential that the laboratories should have at least one kiln semi-commercial in size. After investigating many types of kilns, a special kiln was designed which may be operated either as a natural-circulation or as a mechanical-circulation kiln. Provision has been made for the erection of this dry-kiln during the coming year.

Wood Identification.—The services of the Forest Products Laboratories are available to lumber companies and others interested in identifying Canadian or foreign woods concerning which there may be some doubt. A large number of such requests are received at the laboratories each year. It has been considered advisable to prepare, for reference, information regarding the chief characteristics of different woods which permits their identification. Considerable work has, therefore, been accomplished in the preparation of a bulletin on wood identification, involving the making of a large number of photomicrographs of wood sections at different magnifications. Laboratory work in this connection was well advanced at the close of the fiscal year.

DIVISION OF PULP AND PAPER (MONTREAL)

E. P. Cameron, Chief of Division

Lack of accommodation during the dismantling of the old building and the work of re-establishing the laboratory in the new premises, to which must be added the reduction of the staff of the laboratory to the minimum strength, interfered greatly with the progress of research work.

Three projects were carried forward throughout the year, namely, (1) Chemistry of Wood, (2) Pulp Testing (Division I, Physical Testing; Division II, Chemical Testing), and (3) Sulphite Studies.

Towards the latter part of the year a further project was developed, namely, "Formation Studies," which were very closely related to the work of the physical division of pulp testing, but were nevertheless very distinct in their nature.

Two distinct development studies were also undertaken during this period, namely, "The use of formaldehyde as a catalyst in the dissolution of ligneous tissue and its technical applications," and "The use of concentrated alkalies in the pulping of wood."

These various fields of work are covered separately below.

(1) Chemistry of Wood

Object: To develop accurate methods for the determination of the components of wood by the study of their characteristics and reactions.

Lignin.—Considerable work had been carried out in previous years both at this and other laboratories on the reactions of lignin. Our work on the isolation of lignin by hypochlorous acid seemed particularly promising and led to the very definite need of a thorough review of the lignin literature. This was undertaken early in the year and the task is now nearing completion.

The original work of this laboratory on the isolation of cellulose by hypochlorous acid opened a very promising lead in lignin by precipitation of this material from its ammonia solution as obtained from the cellulose determination. This lead was the basis of considerable work on the determination of lignin by hypochlorous acid and the ultimate perfecting of an improved method for the determination of this compound.

While the study of the precipitated lignin was being carried on, its reaction with formaldehyde was discovered. This lead was developed, resulting in the definition of a further method for the isolation of lignin, by means of formaldehyde and sulphuric acid. A study of the commercial possibilities of formaldehyde as a catalyst in sulphite cooking was also carried out. The results of the work with formaldehyde and sulphuric acid on lignin were published in some of the pulp and paper magazines during the year.

Cellulose.—A great volume of work had been carried out during 1926 and 1927 on cellulose, alpha cellulose, and the action of caustic soda on cellulose. This work was reviewed, broadened somewhat, and well substantiated by a further series of test investigations. From this work a manuscript was developed and published.

While work on these investigations was being conducted, the application of concentrated alkali solutions to commercial pulping operations suggested itself. This phase of the work was developed and remarkable pulping results were obtained. The economics of the process, however, mitigate against its commercial development.

From this work in high alkali concentration cooking has arisen the possibility of lignin by-product recovery. At the present time very promising results are being obtained in this field.

(2) Pulp Testing

Object: To develop standard physical and chemical methods for the determination of pulp quality.

Division I—Physical Testing.—The adoption of the standard freeness apparatus developed at these laboratories continued throughout the year, some ten instruments being standardized and shipped to the industry. Work was received as to the serious consideration of this instrument for use as standard by the British and Scandinavian industries.

The laboratory has established very close relations with the United States Forest Products Laboratory (Madison, Wisc.) and the Committee on Pulp Standards of the American Pulp and Paper Industry. These three groups working together will no doubt accomplish something of definite value.

Division II—Chemical Testing.—The work in this field covered the development of new procedure for the cellulose, alpha cellulose, and lignin tests, with a critical study of the existing tests for copper number and baryta resistance. This work was naturally closely allied with that carried out on the chemistry of wood, but was more concerned with the development and substantiation of procedure than with the constitutional aspects of the problems.

(3) Sulphite Studies

Object: To develop accurate data on the fundamentals of the sulphite process.

This work was confined to the completion of the investigation into the physico-chemical characteristics of sulphur dioxide solutions. Working continuously in this field throughout the year very excellent progress was made. The investigation as originally outlined was completed and a full report submitted.

Formation Studies

Object: To determine and study the principles underlying the formation of a sheet of paper.

Many of the factors involved in making a sheet of paper are interdependent and the factors themselves ill-defined. The general factors concerned may be taken as the following:—

- (1) Character of the fibres;
- (2) Character of the stock suspension;
- (3) Conditions during felting;
- (4) Compacting of the sheet;
- (5) Drying of the sheet;
- (6) Finishing and surfacing.

Up to the present time the active work has been confined to the first of these, and tests have been developed to determine rate of drainage, flexibility, hydration, and other related characteristics. Such tests have been developed in a preliminary way and apparatus constructed for the purpose.

VANCOUVER LABORATORY

R. M. Brown, Superintendent

The scope of work of the Vancouver laboratory was considerably broadened during the year through the initiation of several new projects and closer contact with the timber industry. Requests for technical information and for assistance in working out problems of manufacture, utilization, etc., show a continued increase, both in number and importance. Additions to equipment and improvements in the arrangement of existing equipment have facilitated the work of all departments of the laboratory.

Division of Timber Tests

Much of the time of this division has been taken up in the testing of creosoted Douglas fir ties in pursuance of the arrangement already outlined. As a result of work on this project some other projects show a slight falling off in the number of tests made, but the total for all tests in this division shows a substantial increase, almost 13,500 tests having been completed.

Standard Tests for Mechanical and Physical Properties.—Tests on green Western white pine were completed and one shipment each of Western larch and Western red cedar were procured from the interior of the province, and testing furthered. Tests on air-dried material were well advanced, while all records were brought up to date. An analysis of air-dried test results was begun to determine the relative merits of different test methods. A total of 3,000 tests is recorded for this project.

The Effect of Variable Moisture Content on the Strength of Wood.—Testing was carried on in conjunction with the previous project on Western white pine, Western larch, and Western red cedar, over 1,600 tests being completed.

The Deterioration of Black Cottonwood Logs in Fresh-water Storage.—This study, begun during the previous year, was completed during this year, in so far as the original working plan is concerned. An analysis was made of the results obtained. This analysis showed a negative result for material tested and indicated the need of further tests on some material taken from storage at the mill before a full report could be prepared. Some 600 tests and 1,000 cultures were made in completing this project.

The Retention of Nails and Screws by Wood.—Testing under these projects, on selected material from all shipments for standard project tests, was continued and 3,000 tests were made.

Tests to Determine the Effect of Creosoting on the Strength of Douglas Fir Ties.—Nearly 4,000 tests were made on full-sized ties and the smaller test-pieces cut therefrom.

Miscellaneous Tests on Wood.—This part of the work of the laboratory continues to show gratifying increase, indicating that the services of the laboratory are becoming more widely appreciated and utilized, not only by business firms in British Columbia, but also by other provinces and by foreign countries. Many of the tests this year were based on the utilization of waste and consequently are of particular value to the timber industry. A study of the sheer strength value of glues manufactured from fish waste has proved of considerable value to the Department of Fisheries in their experiments. Tests made on timber cut to special order, acceptance of which had been refused, resulted in the order being passed, bringing a saving of several thousands of dollars to the interested parties and of many hundred thousand feet of valuable timber to the province. In all nearly 1,000 special tests were made.

Customs Tests.—The laboratory has the only testing machine in British Columbia capable of making heavy tensile tests. Local contracting firms, engineers, and manufacturers continue to call on the laboratory facilities for the testing of materials of construction—wire, rope, etc. Four hundred and fifty-seven tests were made during the year.

Division of Timber Products

Experimental Dry-kiln.—The investigation of satisfactory drying schedules and correct temperature and humidity control was continued on Douglas fir commons and on Western (red) cedar clears, 40,000 feet being put through the experimental dry-kiln. Different methods of piling random-width lumber were studied during the runs on red cedar, as a result of which changes were made at one mill whereby greatly improved drying has been obtained. Three experimental kiln-runs, made in a specially remodelled kiln to determine the effect of two modifications of the standard internal-fan type of kiln, were supervised by laboratory representatives at a local cedar mill, and very satisfactory results were secured. A study was made of the relative efficiency of four different com-

mercial methods of piling shingles for kiln-drying at two mills, and improvement in methods suggested which have resulted in greatly improved drying. Studies were begun to check the relative efficiency of the "A"-shaped and vertical flues in the drying of lumber, and to measure the relative efficiency of various types of natural-circulation kilns for drying lumber and shingles. A study to determine the equilibrium moisture content for the range of temperature and humidity used in kiln-drying lumber was initiated. The third six-day course in kiln-drying was held, with seventeen kiln operators and students in attendance. Great satisfaction has been expressed at the success of the course, and improvement in drying practice under those attending has been marked. As a direct result of the course, an organization embracing all kiln operators and assistants has been formed for the interchange of ideas and the working out of drying problems. Assistance was requested by many mills in improving their drying practice. Visits were made to 30 mills, and over 1,600 moisture determinations made in connection with these studies.

Lumber Degrade Studies.—Degrade tests in lumber on account of faulty kiln-drying methods were made at three mills during the year, in order to find out whether improvement in drying practice had occurred since 1925, when the first studies were made. Marked improvement was noted at each mill where tests were conducted. Studies were also made at two mills to determine the relative degrade of 2-inch Douglas fir common air-dried and kiln-dried to the same moisture content. These studies will indicate the economy in kiln-drying thick stock of the common grades. A study was also initiated to determine the cause of loosened grain, a defect which has been responsible for a great deal of degrade in seasoned lumber.

Absorption of Moisture in Kiln-dried Stock.—The studies on the rate of absorption of moisture by kiln-dried lumber close-piled in open sheds, initiated in the previous year, were completed. Preliminary studies indicated that far too little attention has been given to reabsorption of moisture by kiln-dried stock and that a great deal of benefit gained by kiln-drying was lost through faulty piling and storing of the finished lumber. The studies showed that kiln-dried lumber will quickly absorb a considerable amount of moisture, particularly during the winter months, and will then gradually increase in moisture content until equilibrium with atmospheric conditions is attained. This absorption of moisture brings unsatisfactory results when the lumber is put into service. The report on this study clearly shows the need of greater care in handling, piling, and storing if satisfactory service results are to be expected.

Studies on the absorption of moisture in kiln-dried lumber in transit by rail to Eastern Canada and by water to the United Kingdom were initiated, two shipments being sent by rail to Ottawa and Montreal and one being made by boat to England and also one to California. These studies are important owing to the lack of information on the subject and the possible influence on drying practice for such material. The Forest Products Laboratories at Ottawa and at Princes Risborough, England, are co-operating in the studies.

Mill Waste.—The survey of mill waste in British Columbia saw-mills was initiated during the year and studies made at thirteen mills. The study shows a high percentage of high-grade clear material being sent to the burners or converted into fuel, and clearly indicates the need of more careful manufacturing methods in order to utilize in the best way this high-grade material. Many favourable comments on the work already done have been received, and it is expected that the study will result in a material reduction in waste of this kind, since the attention of manufacturers is being directed to the relatively small proportion of the log which is recovered as lumber. Coincident with this survey, studies have been made on the proportion of sawdust resulting from different stages of manufacture. Reports of the two studies will be combined.

Timber Decay.—A thorough survey was made of pathological conditions in 42 sawmills, lumber yards, and storage sheds at Coast mills, in order to obtain first-hand information on the nature and extent of decay and the part it plays in the degrade of lumber. The study indicated the need in some cases for improvement in handling and storage methods in order to reduce losses from decay to a minimum. As a result of the investigation many requests for information on decay were received, and improvements in yard and storage conditions noted at several plants. Cultures were obtained from stained wood, and studies were made of red stain in Douglas fir at two mills. The development of stain and decay in lumber shipped to Europe in the holds of steamships has long been a source of annoyance and heavy loss to manufacturers. In order to determine the extent of such stain and decay development under varying conditions and at different seasons of the year, a study was initiated late in the year, when a thorough examination was made at time of loading of a shipment of Sitka spruce consigned to London, England. Arrangements have been made to have this lumber carefully checked on arrival in England by the Forest Products Laboratory at Princes Risborough.

General

Technical Information.—The number and importance of requests for technical information in large measure indicates the value of the laboratory to the timber industry of Western Canada. This year the number of such requests reached 375, a slight increase over last year, and showed considerable increase in relative importance. Many dealt with the development of new uses designed to permit closer utilization of material.

Several representatives of forest products laboratories in other countries visited the laboratory to discuss problems of mutual interest, and through these visits valuable lines of contact for the exchange of technical data were established.

A summary of the lectures for the course in kiln-drying had a considerable circulation.

The staff of the laboratory on request contributed several addresses to technical organizations and papers for local lumber journals and newspapers.

Exhibition Service.—The laboratory co-operated with the Canadian Forestry Association in the assembly and preparation of a small exhibit of manufactured products as a part of the association's forestry exhibit. Under direction of the laboratory and through co-operation with the British Columbia Lumber and Shingle Manufacturers, Limited, the New Westminster Lumbermen's Educational Class, and the Crown Timber Office, a very complete exhibit of forest products, featuring mill products, natural and finished, was made at the provincial exhibition, New Westminster. The exhibit was more extensive and better prepared than that of last year and received a great deal of favourable comment regarding its outstanding value as an attraction and for its educational value. The laboratory co-operated with the Canadian Forestry Association in preparing and setting up a small exhibit of forest products and of forest scenes in the window of the Vancouver Publicity Bureau. Co-operation was also extended to the British Columbia Lumber and Shingle Manufacturers, Limited, in setting up a display of manufactured products at the Hotel Vancouver during the convention of the Western Retail Lumber Dealers. A considerable quantity of exhibit material was assembled and specially prepared in response to requests for samples of British Columbia timbers and forest products. In this connection a collection of small log sections was sent to the forest experiment station, Tokyo, Japan, a special set of samples of British Columbia species was prepared for the Australian forest school at Canberra,

and arrangements made with the University of British Columbia for the collection and mounting of foliage to correspond. A set of foliage, cones, etc., of selected British Columbia species was collected for the National Museum, Ottawa, to accompany special exhibit material in course of preparation. The work on exhibits has provided a great deal of valuable advertising for British Columbia forest products and has resulted in many inquiries for information, directed not only to the laboratory but also to other organizations.

LIST OF FOREST SERVICE PUBLICATIONS

(Correspondence in regard to bulletins listed below should be addressed to the Director of Forestry, Department of the Interior, Ottawa, *except where the price is noted*, in which case requests for the publication should be addressed to the *King's Printer, Ottawa*. Where name and number are omitted, the publication is not available for distribution. Only publications listed herein are available for distribution at date of publication of this list, namely, May, 1929.)

Annual Report of the Director of Forestry, 1914-15-17-18-19-21-22-24-25-26-27-28-29.

- BULLETIN** 1 Tree-Planting on the Prairies.
 " 33 Forest Conditions in the Rocky Mountains Forest Reserve.
 " 59 Canadian Woods for Structural Timbers.
 " 61 Native Trees of Canada. (Price, 50 cents, post-free. Apply King's Printer).
 " 66 Utilization of Waste Sulphite Liquor. (Price, 50 cents, post-free. Apply King's Printer).
 " 67 Creosote Treatment of Jack Pine and Eastern Hemlock for Cross-ties. (Price, 15 cents, post-free. Apply King's Printer).
 " 69 The Care of the Woodlot.*
 " 71 Canadian Sitka Spruce: Its Mechanical and Physical Properties. (Price, 15 cents, post-free. Apply King's Printer).
 " 72 Successful Tree Planters.
 " 74 Distillation of Hardwoods in Canada. (Price, 25 cents, post-free. Apply King's Printer).
 " 75 Wood-using Industries of Ontario—II.
 " 76 Pulping Qualities of Fire-Killed Wood. (Price, 10 cents, post-free. Apply King's Printer).
 " 78 Some Commercial Softwoods of British Columbia. (Price, 25 cents, post-free. Apply King's Printer).
CIRCULAR 13 The Cascara Tree in British Columbia.
 " 16 Preservative Treatment of Fence-posts.
 " 17 Forest-investigative Work of the Dominion Forest Service.
 " 22 Report of Tests of the Relative Strength of Green-cut and Fire-killed Western Cedar Pole Timber.
 " 23 Absorption of Moisture by Kiln-dried Lumber.
 " 24 Strength of Reinforced and Unreinforced Butter and Cheese Boxes.
 " 25 List of Forest Service Publications.
 " 26 Creosote Treatment of Douglas Fir.
 " 27 Stain and Decay in Lumber-seasoning Yards.

* This publication may also be obtained in French.

- TREE PAMPHLET** 1 White Pine.*
 " 2 White Spruce.*
 " 3 Douglas Fir.*
 " 4 Hemlock (Eastern).*
 " 5 Western Hemlock.*
 " 6 Red Pine.*
 " 7 Jack Pine.*
 " 8 Lodgepole Pine.*
 " 9 Balsam Fir.*
 " 10 Cedar (Eastern).*
 " 11 Western Cedar.*
 " 12 Sitka Spruce.*
 " 13 Western Yellow Pine.*

Stories and Plays for Children—

Talking Trees.
 Betty in Dreamland.
 The Woodland Fairy.*

Bow River National Forest. Descriptive pamphlet with map.

Forestry Lessons.

* This publication may be obtained in French.

- FORESTRY TOPIC 2 Forest Fire Protection in Canada.
 " 3 Silviculture in Canada.
 " 4 The Need of a Definite Forestry Policy.
 " 5 Tree Planting for Ornamental Purposes.

Manual of Methods of Communication Adapted to Forest Protection. (Price, \$1, post-free. Apply King's Printer).

Dominion Forest Service Message Code. (Price, 10 cents, post-free. Apply King's Printer).

Forest Research Manual. (Price, \$1, post-free. Apply King's Printer).

The Tree-planting Division: Its History and Work.

The Forests of Canada.

Form-class Volume Tables

Papers presented before the Third British Empire Forestry Conference, held in Australia and New Zealand, 1928:—

Tree Planting in the Prairie Provinces of Canada.

Timber Testing in Canada.

Timber Pathology in Relation to Wood Utilization in Canada.

Wood Preservation in Canada.

Forest Fire Protection in Canada: Progress since 1923.

Pulp and Paper Research in Canada.

Timber Physics Research in Canada.

Silvicultural Research in Canada.

Aircraft in Forestry.

State Forests in Canada.

Softwood Resources of Canada.

LISTE DES PUBLICATIONS QUI PEUVENT ÊTRE OBTENUES EN FRANÇAIS

BULLETIN 69—Entretien d'un Lot Boisé.

CIRCULAIRE 18—Le séchage au Four des Bois Tendres de la Colombie-Britannique.

Informations relatives à quelques essences canadiennes importantes: Fascicules: 1, Le Pin Blanc; 2, L'Epinette Blanche; 3, Le Sapin de Douglas; 4, La Pruche; 5, Le Tsuga de l'Ouest; 6, Le Pin Rouge; 7, Le Pin Gris; 8, Le Pin de Murray; 9, Le Sapin Baumier; 10, Le Thuya (Cèdre de l'Est); 11, Le Thuya Géant; 12, L'Epinette de Sitka; 13, Le Pin à Bois Lourd.

La Situation Forestière.

La Fée des Bois.