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

1927-8

(FISCAL YEAR ENDED MARCH 31, 1928)

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FORESTRY

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

Of considerable significance to Forest Service administration is a greater manifestation of an enlightened public opinion taking cognizance of the importance of science in the development of natural resources. Nowhere is this more evident than in the steady change in the public attitude towards the work of the Forest Service and in the recognition of its place in the scheme of economic development throughout Canada. Indicative of advance is the increasing interest in the practical application of scientific methods in numerous basic industries, resulting in requests for technical information, advice, and assistance received by every division of this service.

Timber losses from fire were relatively low during the season of 1927. This was largely due to generally favourable weather conditions, but also in no small part to increased efficiency in fire-protective organization. This has been brought about largely through the acquisition of larger supplies of up-to-date fire-fighting equipment, the continued study of fire-weather forecasting, and the construction of more improvements, so ensuring better facilities for detection, communication, and transportation. The value of aircraft has been demonstrated more fully for both detection and suppression of fire, particularly in the unsettled northern portions of the Prairie Provinces, while aerial surveying has proved of great value in forest reconnaissance.

Forest research continues to expand in every part of the Dominion, the service co-operating in many instances with provincial governments and private companies. Each year sees a fuller realization of the economic and aesthetic value of the tree-planting work on the prairies. Forest-products research is more and more becoming of the greatest concern to wood-using industries, as shown by the rapidly increasing number of requests for information, by the application of the results of laboratory tests, and by active industrial co-operation in many experimental projects.

A distinct advance has been made in publicity work as a result of better organized campaigns, more extensive exhibits, and carefully prepared courses of lectures. That such work is bearing fruit is evidenced by more requests for active participation in publicity work of all kinds and the quickened general interest in the extent of the timber resources and their protection and proper utilization. Steadily and surely there is developing in the people of Canada a forest-conscious mind.

Fires and Fire Protection

The fire season was an unusually favourable one, the total number of fires reported being much less than that reported annually for many years past.

In Manitoba, the spring fire-hazard was absent. There were many lightning fires in the northeastern part of the province. The season, on the whole, was satisfactory, and the number of fires was the lowest for several years. Both detection and suppression were carried on largely from aeroplanes; by May 29 all sub-bases were in operation, and they continued their work until the middle of October. A marked strengthening of public opinion in favour of forest protection is noted in this province.

In Saskatchewan, the season was a normal one. There were four short seasons of fire-hazard. The largest fires occurred in the north of the province. Air patrol was extended over the northern part of the province, both for detection and suppression. All machines were busy from July 23 to the end of August. Patrols were again started in March, 1928, with the object of locating trappers' fires.

In Alberta, the weather conditions were unusually favourable, the precipitation being very abundant generally. Some danger arose in the country north of the 56th parallel from the latter part of August to the first week of November and elsewhere (especially on the Eastern slope) through no rain having fallen. The frosts, however, were unusually late, and so conditions were ameliorated. A few dry thunderstorms occurred. The aeroplane patrol was carried out as in several years preceding, and a system of lookout towers was started. The fire-permit system inaugurated by the provincial authorities for the burning of settlers' slash now seems to be working pretty well.

PLATE No. 1.—FIRE RANGER EQUIPPED WITH MINER'S CARBIDE LAMP FOR FIRE-FIGHTING AT NIGHT. (F. S. Photo. 19651)

The picture shows the equipment lately brought into use for fighting forest fires at night. These fires burn less violently after nightfall and consequently work done then gets proportionately more and better results. Hence the value of night work and of any means such as the lamp in the illustration which will enable it to be carried on.

In British Columbia, the fire-hazard was the lowest for years, owing to weather conditions. Heavy rains were frequent during all the summer except in the latter part of July and August.

Ready co-operation was secured from the staff of the Directorate of Civil Government Air Operations in the fire-protection work of this service.

The tables on pages 8, 9, and 10 present in summary form information relative to the forest fires on Dominion lands during the calendar year 1927.

PLATE NO. 2.—FIRE RANGER OPERATING PORTABLE FIRE-PUMP. (F. S. Photo. 19906)

With apparatus such as that illustrated, a stream of water can be forced to a distance of half a mile. This is far the most effective way of fighting the forest fire.

PLATE NO. 3.—FIRE-GUARD ON A NATIONAL FOREST ON THE PRAIRIES. (F. S. Photo. 19609)

Older methods of fire prevention are still relied upon in guarding the forests.

FOREST FIRES ON DOMINION LANDS UNDER THE PROTECTION OF THE FOREST SERVICE, DEPARTMENT OF THE INTERIOR. DURING THE CALENDAR YEAR 1927

TABLE I

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

Causes	Manitoba			Saskatchewan			Alberta			British Columbia			Totals		
	No.	Area	Damage	No.	Area	Damage	No.	Area	Damage	No.	Area	Damage	No.	Area	Damage
		acres	$		acres	$		acres	$		acres	$		acres	$
Camp-fires	27	20,593	14,046	35	118,970	592,728	50	27,066	16,814	15	111	1	127	166,740	623,589
Smokers	16	375	457	5	10,067	11,008	8	1,564	6,925	26	726	434	55	12,732	18,824
Settlers	27	92	15	28	10,864	3,412	65	2,515	1,417	12	217	888	132	13,688	5,732
Railways	12	122	154	3	42	95	63	902	2,246	68	19	.....	146	1,085	2,495
Lightning	23	4,883	9,534	8	8,763	24,920	3	85	510	97	2,754	4,872	131	16,495	39,826
Industrial Operations	0	.....	.....	1	75	18	2	1	.....	5	2	.....	8	78	18
Incendiary	2	108	104	16	21,147	72,401	6	2,281	3,848	2	1	5	26	23,527	76,368
Public Works	1	.....	.....	2	8	2	0	.....	.....	0	.....	.....	3	8	2
Unclassified	0	.....	.....	0	.....	.....	4	19	1	3	2	26	7	21	27
Unknown	2	52	10	11	64,342	51,265	10	2,565	5,838	3	180	382	26	67,139	57,495
Totals	110	26,225	24,320	109	234,278	755,849	211	36,998	37,599	231	4,012	6,608	661	301,513	824,376
Total Cost of Suppression	....	.....	3,770	....	.....	12,684	....	.....	3,450	....	.....	10,945	....	.....	30,849
Total fire loss	....	.....	28,090	....	.....	768,533	....	.....	41,049	....	.....	17,553	....	.....	855,225

TABLE II

NUMBER OF FIRES WITHIN NATIONAL FORESTS: AREA BURNED 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	3	4	.....	5	223	61	1	.....	.....	4	2	.....	13	229	61
Smokers	0	.....	.....	0	.....	.....	0	.....	.....	0	.....	.....	0	.....	.....
Settlers	1	30	5	4	3,020	892	0	.....	.....	0	.....	.....	5	3,050	897
Railways	0	.....	.....	1	33	32	0	.....	.....	0	.....	.....	1	33	32
Lightning	0	.....	.....	*	55	200	2	.....	.....	13	1,330	3,640	15	1,385	3,840
Industrial Operations	0	.....	.....	0	.....	.....	2	1	.....	0	.....	.....	2	1	.....
Incendiary	2	98	38	1	5	112	0	.....	.....	0	.....	.....	3	103	150
Public Works	0	.....	.....	0	.....	.....	0	.....	.....	0	.....	.....	0	.....	.....
Unclassified	0	.....	.....	0	.....	.....	0	.....	.....	0	.....	.....	0	.....	.....
Unknown	0	.....	.....	1	.....	.....	0	.....	.....	0	.....	.....	1	.....	.....
Totals	6	132	43	12	3,336	1,297	5	1	.....	17	1,332	3,640	40	4,801	4,980
Total Cost of Suppression	....	.....	28	....	.....	205	....	.....	.....	....	.....	3,226	....	.....	3,459
Total Fire Loss	....	.....	71	....	.....	1,502	....	.....	.....	....	.....	6,866	....	.....	8,439

* Damage due to 1 fire which started outside.

TABLE III

NUMBER OF FIRES OUTSIDE NATIONAL FORESTS: AREA BURNED, 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	24	20,589	14,046	30	118,747	592,667	49	27,066	16,814	11	109	1	114	166,511	623,528
Smokers	16	375	457	5	10,067	11,008	8	1,564	6,925	26	726	434	55	12,732	18,824
Settler	26	62	10	24	7,844	2,520	65	2,515	1,417	12	217	888	127	10,638	4,835
Railways	12	122	154	2	9	63	63	902	2,246	68	19	.....	145	1,052	2,463
Lightning	23	4,883	9,534	8	8,708	24,720	1	85	510	81	1,424	1,232	116	15,100	35,996
Industrial Operations	0	.....	.....	1	75	18	0	.....	.....	5	2	.....	6	77	18
Incendiary	*	10	66	15	21,142	72,289	6	2,281	3,848	2	1	5	23	23,434	76,208
Public Works	1	.....	.....	2	8	2	0	.....	.....	0	.....	.....	3	8	2
Unclassified	0	.....	.....	0	.....	.....	4	19	1	3	2	26	7	21	27
Unknown	2	52	10	10	64,342	51,265	10	2,565	5,838	3	180	382	25	67,139	57,495
Total	104	26,093	24,277	97	230,942	754,552	206	36,997	37,599	214	2,680	2,968	621	296,712	819,396
Total Cost of Suppression	....	.....	3,742	....	.....	12,479	....	.....	3,450	....	.....	7,719	....	.....	27,390
Total Fire Loss	....	.....	28,019	....	.....	767,031	....	.....	41,049	....	.....	10,687	....	.....	846,786

* Damage due to 1 fire which started outside

TABLE IV

CLASSIFICATION BY SIZE OF FIRE

Province	Class A (Under ¼ acre)		Class B (over ¼ acre and up to 10 acres)		Class C (over 10 acres)		Totals, 1927		Totals 1926		Totals 1925	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	Total No. of Fires	Per cent Class "A"	Total No. of Fires	Per cent Class "A"
Manitoba	40	36	34	31	36	33	110	100	463	33	172	27
Saskatchewan	12	11	26	24	71	65	109	100	221	10	135	19
Alberta	118	56	53	25	40	19	211	100	268	40	272	48
British Columbia	118	50	87	38	26	12	231	100	446	25	478	23
Grand totals	288	44	200	30	173	26	661	100	1,398	28	1,057	27

TABLE V

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	4	3·6	2	2·1	6	3·3	5	2·0	17	2·5
May	15	13·7	67	60·1	88	42·1	16	7·1	186	28·1
June	18	16·4	18	17·2	57	26·9	30	14·5	123	18·6
July	26	23·6	4	4·1	12	5·0	65	28·1	107	16·5
August	33	30·0	11	10·3	15	7·3	112	47·2	171	25·8
September	10	9·1	6	5·2	12	5·1	3	1·1	31	4·7
October	4	3·6	1	1·0	21	10·3	.....	.....	26	3·8
Totals	110	100·0	109	100·0	211	100·0	231	100·0	661	100·0

TABLE VI

STATEMENT OF THE AMOUNT OF TIMBER AND OTHER PROPERTY DESTROYED

Province	Salvable Timber			Unsalvable Timber			Total damage to timber		Damage to young growth		Damage to other property		Total damage
	Saw-timber	Other	Depreciation	Saw-timber	Other	Damage							
	Ft. b.m.	Cords	$	Ft. b.m.	Cords	$	$	%	$	%	$	%	$
Manitoba	65,450	1,784	1,303	1,285,000	43,312	16,229	17,532	71	6,633	27	154	2	24,319
Saskatchewan	.....	50	12	11,411,000	1,263,420	631,595	631,607	83	119,832	16	4,400	1	755,849
Alberta	2,600,000	1,208	.....	4,737,000	26,586	28,245	28,245	75	7,767	21	1,586	4	37,598
B.C. (Dom. Lands)	45,000	.....	10	1,037,000	10,213	4,976	4,986	79	1,285	20	338	1	6,609
Totals	2,710,450	3,042	1,325	18,470,000	1,343,531	681,045	682,370	82	135,517	17	6,478	1	824,375

TABLE VII

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	%	acres	%
Manitoba	26,225	26,030	99·3	195	0·7	10,899	41·8	41	0·2	9,282	35·0	6,003	23·0
Saskatchewan	234,278	227,804	97·3	6,474	2·7	79,796	34·0	863	0·4	86,463	36·6	67,156	29·0
Alberta	36,998	36,692	99·1	306	0·9	6,433	17·0	450	1·0	3,902	11·0	26,213	71·0
Br. Columbia	4,012	2,977	75·0	1,035	25·0	1,079	27·0	899	22·0	661	16·0	1,373	35·0
Totals	301,513	293,503	98·0	8,010	2·0	98,207	32·0	2,253	0·1	100,308	33·0	100,745	33·0

IMPROVEMENTS

The work accomplished is synopsized in the following table:—

	Number		Miles
Ranger station houses	5	Telephone lines	97
Cabins	31	Roads	101
Stables (12) and barns (6)	18	Trails	322
Exhibition cabin	1	Fireguards (cleared)	79
Other buildings	28	Fireguards (ploughed)	332
Bridges	8	Fences	18
Ferry	1		
Lookout towers	11		
Lookout stations	8		
Plantation nurseries	18		

GRAZING

The grazing of live stock under permit continues to be one of the most important secondary uses of national forest lands. For the past seven or eight years, however, there has been a marked period of depression in the stock industry. Naturally, therefore, herds were cut down with a consequent curtailment of production. Within the last year there has been an upward trend in market prices of both cattle and sheep. At the present time there is a general optimistic outlook throughout the country in connection with the industry.

In the three Prairie Provinces there were decreases during the year in the number of stock grazed on forest ranges. This was no doubt due in part to the very favourable growing season which provided abundant forage on lands outside of national forests. In British Columbia there was an increase in the use of forest range, and there are indications that the demand for high-altitude sheep range for the summer months will rapidly increase in the near future.

Regulated grazing is a protection to forests. Unutilized forage may constitute a serious autumn fire-hazard. It is most desirable, therefore, that the forest ranges should be fairly well stocked, both from the standpoint of forest protection and from that of efficient utilization of forest resources. With more encouraging market conditions in sight for the stock-raising industry, it is expected that the national forests will be called upon to care for a greatly increased number of stock.

TIMBER OPERATIONS

The report of the Manitoba inspectorate shows eleven active timber sales and a keen demand for timber permits. Cutting on the pulpwood berths was supervised by the Forest Service, as were also the operations of a large lumber company on lake Winnipeg.

The report of the Saskatchewan inspectorate shows fifty-two active sales. Twenty-eight new sales were awarded during the year. There has been a large increase in the sales of pulpwood. Brush disposal has been satisfactory. In one instance the operator has found that his logging costs showed a decrease, owing to the fact that the logs are more easily handled after brush disposal, with the result that he can get the work done with a smaller number of 'swampers'.

In the Alberta inspectorate there were twenty-two timber sales, of which eight were new. Several applications for large sales were being dealt with.

In British Columbia there was a great increase in timber-sale business and a correspondingly increased revenue from this source. The increase in the cut in the Tranquille forest district was especially noteworthy. Twenty-two new sales were inaugurated, fourteen of which were in the Shuswap forest district and eight in the Tranquille district. The revenue for the whole inspectorate from timber sales and timber permits is greater than that of any previous year.

During the year a new feature of forest management was introduced into the field operations of the service by the establishment of supervisors' timber sales dealing with bodies of timber of moderate size.

SEEDING AND PLANTING ON NATIONAL FORESTS

Approximately 200,000 seedlings were planted on various national forests, covering in all about 100 acres. In Alberta 33 acres were seeded, and experimental seeding was carried on in the Sandilands national forest in Manitoba. In British Columbia 200 acres were seeded to Western cedar. The seeding and planting so far carried on in the national forests is of an experimental nature only. In Saskatchewan a number of nurseries are being developed in connection with the national forests, with the idea of ultimately undertaking a definite yearly planting program. These nurseries contain a stock of over 3,000,000 seedlings.

RECREATIONAL USES OF THE NATIONAL FORESTS

The use of the national forests for purposes of recreation and sport affords a most valuable means of educating the public as to the value of the forests, and efforts are continued to meet the general desire for this forest use.

Manitoba now has five summer resorts, and plans are under way for the creation of another resort at Clear Lake, in the Riding Mountain national forest. It is estimated that the number of visitors to the resorts of this province during the season was about 8,400. Some work was done in restocking Madge and Clear lakes with pickerel.

Saskatchewan has three resorts, and it is estimated that the number of visitors for the season was 10,500. Of these, 8,000 visited the Fish Lake summer resort, in the Moose Mountain national forest.

Alberta has one resort at Elkwater lake in the Cypress Hills national forest; this had about 3,750 visitors. There are also many localities throughout the national forests of this district that are particularly well adapted for camping and fishing; some of these are visited by large numbers of persons.

British Columbia has two resorts, and two automobile camps have been built in the national forests. New trails are also being cut to Hyas Long lake, the haunt of large-sized Kamloops trout. Six thousand feet of ditch were dug from Walloper lake to Trout lake in order to facilitate the spawning of fish. The excellent fishing within national forests continues to attract tourists from distant points.

Surveys

The most extensive survey work of the year was that carried on throughout the summer in the Manitoba pulpwood selection area. Ten parties of ten men each were at work, and covered a total area of between 12,000,000 and 13,000,000 acres. The work of this survey was greatly aided by the Directorate of Civil Government Air Operations and the Topographical Survey, who co-operated in the preparation of aerial maps. These maps, which were prepared from oblique photographs taken from lines flown at six-mile intervals at an altitude of from 4,500 to 5,000 feet, showed all the topographical features, such as lakes, streams, and open muskegs, with such accuracy that it was unnecessary to run baselines. The forested area was classified into five grades based on the density of crown cover. With these maps and the photographs, the ground parties were able to concentrate their attention on the areas carrying merchantable timber and young growth of future value, and a very great deal of time was saved by not having to traverse the unproductive land. Further, no timbered areas escaped observation.

Similar surveys were made in an area of 150,000 acres along the Nelson river near Norway House, and 200,000 acres along the west coast of lake Winnipeg, north of the Saskatchewan. In January, February, and March, 1928, 180,000 acres on the Overflowing river, in Manitoba, were surveyed.

More intensive surveys were also made of areas in national forests, aggregating 50,000 acres. In Saskatchewan, a working-plan survey of 10,700 acres was made in the Fort à la Corne national forest, and sample plots were laid out to cover an area of 49,000 acres in the Lost River Block, in that forest. In the Pasquia national forest a stock-taking survey was made of 87,680 acres, and a number of land-classification surveys were made in the Keppel and Big River forests.

Seed Collection and Extraction

The New Westminster seed-extraction plant furnished the largest proportion of forest tree seed obtained during the year; here a total of 2,706¾ pounds of seed was extracted. Of this quantity, 1,547 pounds were Sitka spruce, and 567 pounds lodgepole pine, with smaller quantities of Douglas fir, Western hemlock, Western (red) cedar, Western white pine, Western yellow pine, Engelmann spruce, and Western larch. The Sitka spruce was nearly all sent to the British Forestry Commission, and the Douglas fir to New Zealand. New Zealand also received cedar, Western white pine, and yellow pine. Small quantities were also sent to investigators and experimenters in many other places. At the other seed-extraction plants, seed was produced for local use, red pine being obtained from Manitoba, white spruce and jack pine from Saskatchewan, and lodgepole pine from the Cypress Hills forest, Alberta.

Forest Products Laboratories of Canada

Forest-products research has been carried on in Canada for several years in two laboratories, the main one in Montreal and a branch laboratory in Vancouver devoting attention to problems relating particularly to British Columbia timbers.

The year under review was marked by the reorganization of the work of the main laboratories in Eastern Canada. The timber-testing, wood-preservation, timber-physics, and timber-pathology laboratories have been transferred from Montreal to Ottawa, where greatly enlarged accommodation has been provided. The pulp and paper laboratory remains in Montreal. Substantial progress has been made in the work of all the laboratories in spite of the interruptions in the work of the main laboratories due to the changes.

The chief problems being investigated in regard to the preservation of wood are the protection of timber from marine borers, which frequently infest wood in salt water; the creosote treatment of hard maple railway ties at high moisture contents; the investigation of the possibilities of shale oil as a wood preservative, by itself or in combination with other toxic constituents, and the behaviour of ties (especially those affected with red rot and red stain) in track under actual service conditions.

Among the problems of fundamental research in timber physics now being undertaken is an investigation into the relation between the rate of growth and the density of the wood of white spruce. This is a matter of considerable importance from a silvicultural standpoint, and is also of particular significance to the pulp and paper industry. The study of the structure of the different Canadian woods is being continued. Investigations of the seasoning of lumber both by kiln-drying and air-seasoning have been actively carried out at the Ottawa and the Vancouver laboratories. Since the establishment of a semi-commercial dry-kiln in Vancouver, courses in kiln-drying have been conducted which have been well attended by representatives from coast mills. A study of the 'sinkage' of logs during 'driving' from the woods to the mills has been inaugurated in co-operation with the Canadian Pulp and Paper Association in an effort to curtail serious losses on this account.

Standard tests of small clear specimens of Canadian timbers, and tests of the nail-holding powers of Canadian woods have been advanced in both the Ottawa and Vancouver laboratories. The testing of wooden boxes and small containers, with the improvement of design and consequent curtailment of heavy transportation losses as its aim, is being carried out by means of a modern "hazard machine". In the Vancouver laboratory a comprehensive investigation was made of the effect of fire-killing on the strength of cedar of pole size. This study was enlarged to include cedar poles infested with borers.

Studies in the pathology of timber include the rots of white cedar telephone poles, tests on the toxicity to fungi of certain water-insoluble substances, and the development of red stain in jack pine ties under service conditions. In addition to these, progress has been made in assembling a reference collection of representative wood-rots. Considerable work was done in the Vancouver laboratory on the study of the deterioration of cottonwood logs in fresh-water storage for different periods.

The work of the pulp and paper division in Montreal was by circumstances already mentioned limited chiefly to problems of a fundamental character. These fell into two main classes, namely, (1) the chemical and physical properties of the 'cooking liquor' used in the sulphite process of pulp manufacture, and (2) the chemical composition and properties of the individual constituents of the wood, particularly of lignin.

Exhibits were prepared in co-operation with the Canadian Forestry Association for the Vancouver exhibition. A more comprehensive exhibit was also arranged by the laboratory for the provincial exhibition at New Westminster.

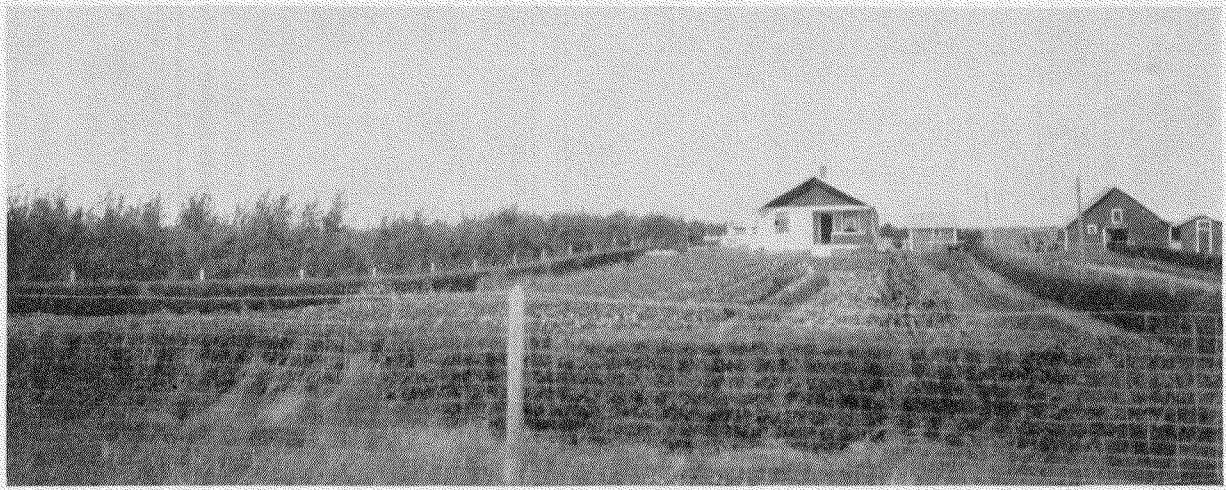

PLATE NO. 4.—A PRAIRIE (SASKATCHEWAN) FARMSTEAD SHOWING SHELTER-BELT ON THE WEST SIDE.
(F. S. Photo. 19562)

This latter work was done in co-operation with the New Westminster Lumbermen's Educational Class and the Dominion Crown Timber office. Arrangements were made for the Ottawa laboratory to put a permanent exhibit in the National Museum in Ottawa.

Appreciation of the services of the laboratories to the timber industries was manifested by the increase in the number of technical inquiries made to the laboratories. In some departments these exceeded requests of the previous year by over 25 per cent.

Tree-Planting on Prairie Farms

After a long cold winter weather conditions through the spring and summer were very favourable for nursery work and general tree-planting operations, and, on the whole, the season was the most favourable for many years for starting new plantations. There was considerable damage from hail-storms in some localities, but with rare exceptions plantations soon recovered from damage of this description. There was practically no winter-killing. Considerable damage was caused by rabbits, but apparently a satisfactory protection has been found in lightly smearing the young trees with axle grease.

Over seven and one half million trees were sent out in the spring of 1927—7,430,350 broad-leaved seedlings and cuttings and 117,240 evergreens. Recipients of broad-leaved trees numbered 5,923 and those of conifers 1,170. National forests in Manitoba received 92,500 trees.

The inspection list included 12,530 names—1,350 more than that of the previous season; of these, 3,600 were new applicants. One additional inspector had to be employed, making nine in all. The inspection showed 98 per cent of the maple, ash, and caragana seedlings planted in the spring thriving, and 95 per cent of willow and poplar cuttings well rooted. Of the evergreens only six per cent of the spruce, four per cent of the jack pine, eight per cent of the Scotch pine, and six per cent of the lodgepole pine were failures. This showing is exceptionally good.

The influence of the farm shelter-belt on horticultural development is very marked. Where, not many years ago, it was the exception to find a farm with a good garden, inspectors last season found that 90 per cent of the farms visited had good vegetable gardens. Still more marked is the increase in fruit growing as a result of the shelter-belts, even in districts considered least favourable for tree growing. Another favourable result of the planting of wind-breaks is shown by the splendid success obtained in growing evergreens under their shelter.

At Indian Head the stock was the best produced for several seasons. At Sutherland growth was not as vigorous, and hence a certain proportion of the stock was carried over for an extra year. Results with coniferous transplants and seed-beds at Indian Head have been much improved owing to the installation of an efficient artificial watering system.

An attack of mites threatened the white spruce transplant beds, but was controlled by spraying. Pine leaf scale and red spiders are proving somewhat troublesome on the white spruce. The bronze birch borer has caused the death of a large number of birch trees in the permanent plantations. The necessity of cutting out the birches so destroyed has increased the amount of thinning done in the permanent plantations. In addition to fuel-wood, fence-posts and pickets were obtained in the larch (tamarack) plantations, where the Siberian species seems to be making a better showing than the native species.

Tests of treated fence-posts are being continued, creosote and zinc chloride being the preservatives used. Creosoted Russian poplar fence-posts, set in the spring of 1917, continue sound, though untreated posts of the same species, set at the same time, rotted out in three years at most.

As in previous years, both nurseries had many thousand visitors.

The permanent plantations have now reached the stage where research work, such as has been already begun on a small scale, will give very valuable results.

Silvicultural Research

The field activities of the Research Division were greatly curtailed during the summer season of 1927 owing to the absence of most of the research men on work in Manitoba in connection with the pulpwood selection area. The work at the Petawawa Forest Experiment Station, however, was carried on, and by securing the temporary services of an outside forester some work was carried out in New Brunswick. The curtailment of field work, however, gave the staff at Head Office time to complete the compilation of various general projects that were already on hand.

In New Brunswick a survey was made on the Miramichi watershed to study the rate of growth of pulpwood species after logging. A regular line-plot survey was made in two areas, from which the current increment was determined. To further study the area, a series of permanent plots was established which will be remeasured at intervals.

At the Petawawa Forest Experiment Station, in northern Ontario, the work was confined largely to remeasurement of sample plots and to making a periodical revision of all the plots on the reserve. The results of five-year remeasurement on these plots were compiled during the winter and formed the basis for a rate of growth for this section in the paper contributed to the proceedings of the British Empire Forestry Conference. Improvement cuttings and thinnings in the red pine-white pine type have already proved their value in increased growth. By continued thinnings on these plots a technique in this important phase of silviculture will be built up.

Type Classification

An event of note during the summer was the visit of Dr. Yrjö Ilvessalo, of Finland, to Canada. He spent some days at the Petawawa Forest Experiment Station and on some of the national forests in Western Canada. Ever since Dr. Cajander, of Finland, published his work on "Theory of Forest Types", interest has been awakened in the possibility of the application of the same method of type classification to Canada. Dr. Ilvessalo has published a complete set of yield tables for Finland based on Dr. Cajander's classification and is eminently competent to judge of the application of this same principle to classification of Canadian forests. After spending some time at Petawawa and on the national forests in the West, Dr. Ilvessalo reported that he saw no difficulty in eventually applying this system to the classification of forest types in each district. A preliminary investigation in Alberta indicated that possibly the system could be used. If this is the case, many problems in survey and timber classification, as well as investigation of increment, will be greatly simplified.

Thinnings

In Manitoba, on the Sandilands reserve, two permanent sample plots of one acre each in dense, immature stands of jack pine were thinned and one acre established for control. Two degrees of thinning were made to determine the correct degree of thinning necessary to obtain optimum benefit.

In Saskatchewan five plots in jack pine of from half an acre to one acre were thinned, the degree of thinning being varied so that the plots form a series. With each plot a control of like area was left in its natural state for comparison and measurement of the benefit derived.

Thinnings in lodgepole pine on the Cypress Hills national forest in Alberta, carried on during the last three or four years, have shown very beneficial results.

Results compiled to date in the British Columbia Railway Belt show that when fifty-year-old lodgepole pine stands are severely thinned a twenty-five per cent increase in growth results, and an increase also in height growth.

Planting and Seeding

At the Petawawa Forest Experiment Station in Ontario about eight acres of red pine and nine acres of white pine were planted on old farm land.

In Manitoba forty acres on national forests were planted with Scotch, jack, red, and lodgepole pine. Very satisfactory progress, with low mortality, was reported. Sowings of jack pine on the Sandilands national forest were made on twenty-seven quarter-acre plots; both seed-spot and broadcasting methods were used. These sowings were made at various seasons of the year to investigate the influence of time of the year on the resulting establishment of seedlings.

A large experiment in British Columbia in seeding up burned cut-over lands with western red cedar promised good results on the moister sites, while seed-spotting proved better than broadcasting on the drier sites.

In Alberta, on the Cooking Lake forest 110 Engelmann spruce, Douglas fir, and lodgepole pine seedlings were set out, and 24 acres of denuded lands on the Bow River forest were seed-spotted and broadcast with lodgepole pine. On the Crowsnest forest, 10 acres not reproducing were broadcast with lodgepole pine.

Mensuration

The form-class volume tables for white spruce developed by the Forest Service, while applicable to Western Canada, did not provide for the larger trees of Manitoba and Saskatchewan—trees from 24 to 36 inches in diameter at breast-height. Data were obtained, therefore, in both these provinces for extension of the existing form-class tables.

A very considerable advance was made in compiling form-class volume tables for eastern species, many tables being developed to meet the various requirements of the operators and wood-using companies. The demand for these tables is growing and it may not be long before they are generally accepted and used in all phases of woods operations.

Many projects such as the Lakefield (Quebec) working-plan survey, Petawawa working-plan survey, and Lake Edward line-plot survey were compiled.

A notable work of the compilation staff was the preparation and distribution in mimeographed form of an index to the Journal of Forestry and Proceedings of the Society of American Foresters. This fills a long-felt want and will be of great benefit in research work.

During the year several editions of the mimeographed publication "Current Forestry Literature" were issued. This entailed a large amount of labour in reviewing.

Publications

In the early part of the year, work on Bulletin No. 78, "Some Commercial Softwoods of British Columbia," was completed, and the distribution commenced. Bulletin No. 79, "Taper as a Factor in the Measurement of Standing Timber," and a revised edition (the 8th) of Bulletin No. 1, "Tree Planting on the Prairies," were brought out. An additional tree pamphlet (No. 13), "Western Yellow Pine," was published in English. French versions of Tree Pamphlets Nos. 7 to 13 (inclusive) were also printed. Two new circulars, both dealing with the work of the Forest Products Laboratories, were published. These were Nos. 21, "Tests of Green-cut Western Cedar Poles," and 22, "Report on Tests of the Relative Strength of Green-cut and Fire-killed Western Cedar Pole Timbers."

86880—2

Probably the most important publication of the year was the report of the 1923 British Empire Forestry Conference, of which the Forest Service assumed the publication. This makes a large volume of over four hundred pages, giving in full the proceedings of the Conference.

Publicity

The annual Forest Week Campaign opened this year (1927) on April 24, and concluded on April 30. The 1927 campaign marked the closest co-operation and co-ordination yet achieved with the United States authorities in their equivalent campaign. The campaign resulted in a greater number of newspaper articles than ever before, with a greatly increased average length. A new feature in forest-protection literature was a children's playlet entitled "Betty in Dreamland," written and donated to the cause by an Ottawa lady.

A corps of lecturers was again maintained for the purpose of visiting boys' and girls' vacation camps; three lecturers visited 29 camps and established contact with 2,267 campers, an increase of five camps and 688 campers.

As in previous years a representative of this service supervised the forestry displays at the Western exhibitions and took personal charge of this work at all "Class A" fairs. Two "Class A" fairs were added to the usual quota—Brandon and New Westminster—making, along with Calgary, Edmonton, Regina, and Saskatoon, six major points at which exhibits were made; and exhibits were also placed at seven minor fairs throughout the four western provinces. A fine log cabin was built on the Edmonton fair grounds for publicity purposes.

It has been found that the log cabins built on the Calgary and Edmonton exhibition grounds to house Forest Service exhibits are a great attraction, and it has been decided, in consequence, to place similar buildings on the Saskatoon and Brandon grounds for the 1928 fair season.

Some of the outside offices of this service have also given considerable attention to publicity work affecting their particular spheres of action. Particular attention has been given to publicity at various exhibitions, and to radio talks, articles in the press, and addresses at gatherings of different natures, including a course of lectures at one of the Manitoba normal schools and another at a short course for farm boys and girls.

Revenue

In comparison with the fiscal year ending March 31, 1927, the revenue from all sources for this fiscal year shows a net increase.

There were 37 more timber sales with an increase of $11,746.81, due to an increase in the sales of pulpwood in Saskatchewan and a general increase in the demand for timber sales throughout the Prairie Provinces and especially in British Columbia. There was an increase of $1,253.60 from tree seed and $6,108.82 in miscellaneous revenue. Timber permits showed a small increase of over $200.

There were, however, 163 fewer grazing permits, with a decrease in revenue of over $600, which was apparently due to a very favourable growing season, giving sufficient fodder on lands outside the national forests. Decreases of over $400 from hay permits, $1,300 from surface rentals, and $2,000 from special use permits were also shown, but the decreases were more than offset by the increases above shown, the net increase amounting to $9,158.37 over the previous fiscal year.

In connection with the statement of Revenue, under the heading "Timber Permits," the kinds and total quantities of timber authorized to be cut from all reserves were as follows:—

Fuel-wood (cords)	30,025
Fence-posts, rails and piling (number)	296,977
Fence-posts, rails and piling (lin. ft.)	1,630
Telephone poles (lin. ft.)	1,075
Railway ties (number)	6,310
Saw-timber (feet board measure)	6,410,231
Mining timber (lin. ft.)	2,432,658
Mining timber (cords)	Nil.
Mining timber (ties)	924
Building logs (number)	28,921
Building logs (lin. ft.)	380,818
Miscellaneous (lin. ft.)	653
Miscellaneous (cords)	399
Miscellaneous (number)	21
Miscellaneous (cords of pulpwood)	4,683

The quantity of saw-timber given above is, of course, quite distinct from that cut under Timber Sales as given in the Statement of Revenue which follows:—

86880—2½

STATEMENT OF REVENUE, FOREST SERVICE, FISCAL YEAR 1927-1928

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	1	72 60	456	3,271 01	29	233 10	275 50	606 15	71 00	.....	64 19	4,593 55
Porcupine No. 1	5	2,408 95	102	3,176 91	1	16 00	19 25	.....	12 00	.....	133 00	5,766 11
Riding Mountain	6	1,422 15	1,389	12,192 02	24	188 15	548 75	1,336 78	109 00	.....	128 85	15,925 70
Sandilands	2	453 75	27	207 00	.....	.....	.....	.....	.....	.....	.....	660 75
Spruce Woods	.....	.....	14	60 75	.....	.....	28 25	.....	.....	.....	.....	89 00
Turtle Mountain	.....	.....	48	222 65	34	276 10	94 25	58 83	7 00	.....	133 00	791 83
Total	**14**	**4,357 45**	**2,036**	**19,130 34**	**88**	**713 35**	**966 00**	**2,001 76**	**199 00**	.....	**459 04**	**27,826 94**
Saskatchewan—												
Beaver Hills	.....	.....	93	353 15	21	175 68	338 75	.....	4 00	.....	.....	871 58
Big River	5	2,121 19	65	1,216 81	3	57 48	304 25	.....	10 00	.....	231 27	3,941 00
Dundurn	.....	.....	35	123 00	6	180 30	36 00	.....	7 00	.....	.....	346 30
Elbow	.....	.....	100	275 75	174	1,098 64	14 25	6 00	136 00	.....	.....	1,530 64
Fort à la Corne	8	1,108 20	347	2,511 26	1	2 44	29 25	53 00	20 00	.....	60 06	3,784 21
Keppel	.....	.....	8	19 00	73	503 91	.....	.....	7 00	.....	3 00	532 91
Manito	.....	.....	32	93 25	108	1,643 51	25 25	83 91	28 00	.....	.....	1,873 92
Moose Mountain	.....	.....	284	1,336 74	50	457 38	144 60	217 27	19 00	.....	857 00	3,031 99
Nisbet-Pines	2	384 05	343	3,026 79	19	279 17	105 50	2 00	20 00	.....	3 30	3,820 81
Pasquia	39	60,928 59	103	6,288 75	1	5 32	198 25	5 00	49 00	.....	326 50	67,801 41
Porcupine No. 2	8	2,192 98	280	2,402 48	6	77 56	343 15	108 00	68 00	.....	.....	5,192 17
Seward	.....	.....	.....	.....	29	724 02	40 00	.....	28 00	.....	.....	792 02
Sturgeon	2	175 17	10	72 60	2	13 85	15 50	40 15	6 00	.....	18 50	341 77
Total	**64**	**66,910 18**	**1,700**	**17,719 58**	**493**	**5,219 26**	**1,594 75**	**515 33**	**402 00**	.....	**1,499 63**	**93,860 73**
Alberta—												
Athabaska	1	50 00	2	12 00	14	111 65	8 00	.....	25 00	.....	163 75	370 40
Bow River	1	201 00	49	218 15	48	2,413 34	29 50	.....	36 25	.....	12 50	2,910 74
Brazeau	10	12,822 96	42	3,544 35	84	324 76	2 00	777 40	25 00	.....	686 06	18,182 53
Clearwater	5	3,845 47	28	505 04	72	414 92	7 25	865 08	22 79	.....	232 50	5,893 05
Cooking Lake	.....	.....	1	2 00	52	387 28	145 00	.....	3 00	.....	120 00	657 28
Crowsnest	6	1,008 44	85	3,838 89	175	5,392 96	3 00	305 03	208 75	.....	174 75	10,931 82
Cypress Hills	.....	.....	296	1,482 57	156	3,106 66	.....	146 05	87 74	.....	194 50	5,017 52
Lesser Slave	6	12,991 08	.....	.....	1	21 10	23 00	.....	7 00	.....	150 25	13,192 43
Total	**29**	**30,918 95**	**503**	**9,603 00**	**602**	**12,172 67**	**217 75**	**2,093 56**	**415 53**	.....	**1,734 31**	**57,155 77**
British Columbia—												
British Columbia Reserves	**50**	**8,025 29**	**20**	**223 67**	**36**	**676 37**	**45 50**	**293 00**	**187 58**	**13,306 00**	**1,551 04**	**24,308 45**
Indian Head Nursery	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,231 86	5,231 86
Forest Products Laboratories	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	475 04	475 04
Sundries	.....	.....	.....	.....	1	40 00	.....	.....	.....	.....	402 29	442 29
Grand total	**157**	**110,211 87**	**4,259**	**46,676 59**	**1,220**	**18,821 65**	**2,824 00**	**4,903 65**	**1,204 11**	**13,306 00**	**11,353 21**	**209,301 08**

*Miscellaneous, $9,754.36, Fishing, $1,598.85.

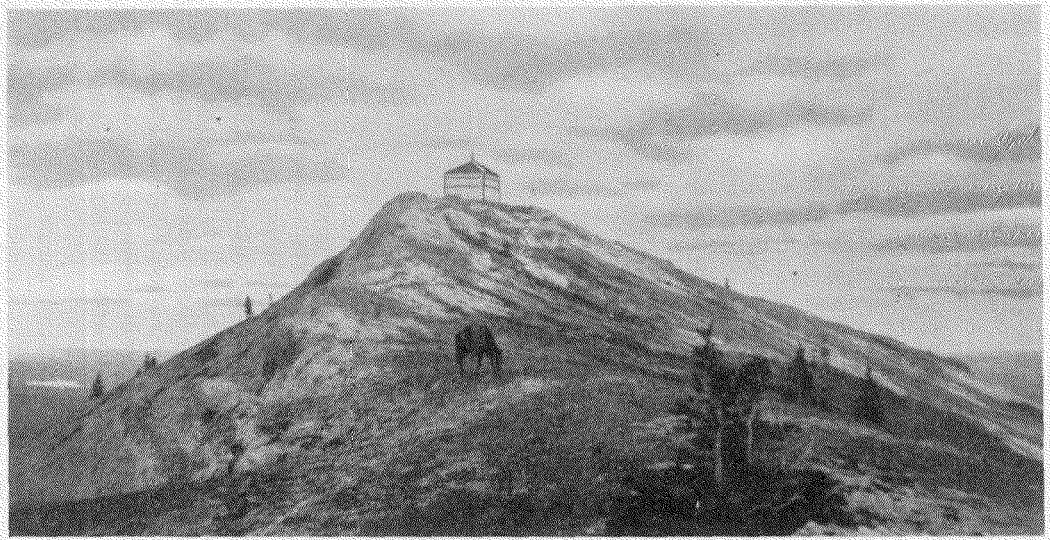

PLATE NO. 5.—DISTANT VIEW OF AN ALBERTA LOOKOUT CABIN. (F. S. Photo. 19998)

DETAILED ADMINISTRATIVE REPORTS

Col. H. I. Stevenson, D.S.O., District Forest Inspector for Manitoba
J. Smart, District Forest Inspector for Saskatchewan
C. A. Morse, District Forest Inspector for Alberta
C. A. MacFayden, District Forest Inspector for British Columbia

Fires and Fire-Fighting

Manitoba

In Manitoba the season of 1927 was notable for the absence of a spring fire-hazard. This was due to the heavy snowfall of the previous winter and the heavy precipitation during the months of April and May, followed by warm weather in June which brought a rank growth of vegetation, thus eliminating the danger of fires running. During the month of May, 1927, the precipitation for Manitoba was 4·70 inches, as compared with an average of 2·15 inches for the previous thirty years. This situation was largely responsible for the reduction in number of settlers' fires during the spring months, since fire would not run and the clearing of land by this means was a difficult matter.

Although the northeastern portion of the province suffered heavily from lightning fires, the season on the whole was very satisfactory and the number of fires was the lowest for any season in the past six years. The fact that 74 of the 110 fires which occurred were less than 10 acres in extent is evidence that the situation was kept well in hand.

The total area burned over in Manitoba during the 1927 season was 26,225 acres—the lowest on record for the past seven years.

Of the total of 110 fires which occurred only 6 were in national forests, and these caused little or no damage in the 132 acres burned over.

The season of 1927 was one of the most favourable ever experienced in Manitoba. While weather conditions contributed favourably to this result, nevertheless organization and equipment enabled the Service to take full advantage of this factor. Again, there is a very marked change of public opinion in regard to the need of forest protection. The operation of a paper-mill at Pine Falls has awakened a new interest amongst settlers, who are now very keen to keep fire out of the forest—young growth particularly. Manitoba has experienced a mining boom in the past two years, and, although the woods have been full of prospectors, comparatively few fires have originated from this cause. Publicity campaigns like Canadian Forest Week and exhibitions featuring the work of the Forest Service have done much to educate public opinion to the need of forest protection.

Saskatchewan

In Saskatchewan the fire season of 1928 was about normal for the national forest districts and southern fire-ranging districts. While the season was generally characterized by good rainfall, it was marked by four distinct periods of hazardous fire-weather. These occurred in May, June, and July, and just prior to the end of the season in October. In the more northern portion of the fire-ranging districts on the Churchill River drainage, the fire-hazard period began about the 15th of June, continuing until the end of August. The largest fires occurred in the north, particularly in the Ile à la Crosse area. This latter area came under air patrol this season, but unfortunately the inauguration of the use of aircraft for detection and suppression of fires was not completely established in time to cope with all these fires in the incipient stage.

Alberta

The weather, which largely governs the fire-hazard, was abnormal for the past year in that precipitation was well above the usual, and this condition, with little exception, prevailed over the spring, summer, and autumn periods. Only in the country north of the fifty-sixth parallel was there a long dry period, and this extended from the latter part of August to the first week in November, during which time practically no rain fell.

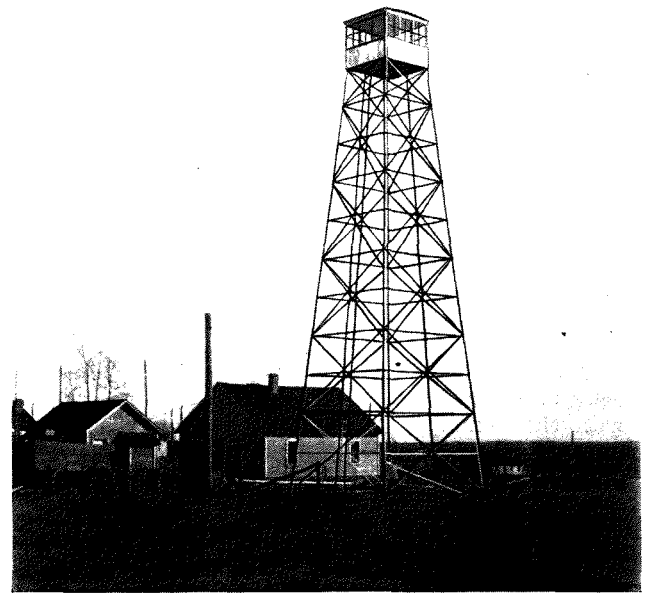

Plate No. 6.—Lookout Tower at Rocky Mountain House.
Part of the scheme of lookouts for the protection of the Alberta national forests.

Unfavourable weather, however, prevailed elsewhere during part of the autumn season, when, beginning with the first week in October, drying winds and decreased precipitation brought on hazardous conditions, particularly in the forests of the East Slope. However, the trouble was greatly mitigated by the lateness of the frosts which, even in the higher elevations, were unusually late last year. Another favourable feature was the very few dry thunderstorms during a season when electrical storms were of quite common occurrence. Sufficient rain usually followed the storms to extinguish effectively any spots that were started by lightning. Finally, a heavy snow with zero weather, which occurred on the night of the 6th of November, effectually put an end to all fire-hazard.

In the entire district, there were two hundred and eleven fires as compared with two hundred and seventy-nine in 1926. May was the most serious month.

A total of 6,433 acres of merchantable timber and 3,901 acres of young growth was burned over in the province. The loss of young growth is even more serious than that of merchantable timber. When mature timber burns, particularly lodgepole pine, one can be reasonably sure of young growth coming in, but when young timber which has not reached the seeding age burns, a veritable desert is the result.

All Supervisors and the Chief Fire Ranger report that the fire-permit system inaugurated a few years ago by the provincial government is working very well indeed. A long period of education was necessary before the permits came into general use, but now they are being obtained by most settlers before burning slash is undertaken. The increased care engendered in the burner by the very fact of securing a permit makes for greater safety in connection with land-clearing operations.

British Columbia

In the Railway Belt of British Columbia the weather conditions were such that the fire-hazard throughout the season was the lowest for many years. Heavy rains during practically the whole summer, with the exception of the latter part of July and August, kept the grass green and gave fires very little chance to gain much headway before they were picked up by either the patrolmen or the lookouts. The rain also kept the air clear of what little smoke there was, and good visibility was obtained throughout the season.

The percentage of fires caused by lightning was exceptionally high this season; these fires were confined practically to July and August.

Air Patrol

Manitoba

Assisting the work of fire protection in Manitoba is the staff of the Directorate of Civil Government Air Operations, which functions chiefly in the fire-ranging districts, with sub-bases at Cormorant Lake, Norway House, and Lac du Bonnet. All sub-bases are equipped with wireless and are in direct contact by this means with the Winnipeg headquarters of both services. In addition to the sub-bases a detachment of one detection machine was established at Winnipegosis. This machine co-operated with Cormorant Lake sub-base for a period of six weeks. Detection patrols were in operation at all sub-bases by May 29 and continued the work of detection and suppression until the middle of October when all danger of fire ceased. During this period 1,014 hours and 53 minutes of flying was carried out by the Directorate of Civil Government Air Operations for this Service on detection, suppression, and related forestry operations. In this time 78 fires were detected by air patrols. The total number of days on which flights were made was as follows:—from Lac du Bonnet, 93; from Norway House, 79; from The Pas, 82; from Red River, 17; from Winnipegosis, 10—281 in all.

The operation on the whole was a successful one and again demonstrated that this is a feasible and desirable means of fire protection in Manitoba. Not only are planes able to spot fires readily and expedite suppression action, but they are an important factor of fire prevention.

Saskatchewan

Steps were taken this year for the establishing of air patrol for the northern part of the province by the Director of Civil Government Air Operations. The country, with its numerous lakes, is particularly well adapted to the operation of seaplanes and flying boats. Two light flying boats for detection and one heavy flying boat for suppression action were detailed to the district. During the latter part of May, flying personnel of various ratings arrived at Ladder Lake, in the vicinity of Big River at the end of steel, and preliminary work was undertaken to establish a temporary base. On June 9, the two detection machines arrived and were put into operation to undertake patrols. Unfortunately, through a landing accident at Ladder Lake, one of the machines was put out of commission permanently. With the single detection plane, all exploratory patrols were undertaken and definite routes laid down, followed by patrol flights. Owing to the fact that the suppression machine was not supplied in time, the single detection machine was used on suppression work also. A second detection plane was provided to replace the machine damaged early in the air operations and on August 17 the heavy machine arrived for suppression work.

The first fires were observed early in July, but the first suppression action necessary by aircraft was on July 23. From that date to the latter part of August all the available aircraft were kept busy on patrol, suppression, or transportation flights. A number of fires were handled in the incipient stage, and extremely efficient use was made of the machines on some of the larger fires in the Ile à la Crosse area.

The total number of flights made was 87; the total number of hours of flying time was 294.

The aircraft in this district were operated last season with only one or two planes equipped with wireless, with a receiving station at Ladder Lake base only. Such a condition in the work and the operation of aircraft in the north was very unsatisfactory, both from the standpoint of safety and efficient operation.

During the month of September and early October, appropriations were available to the Air Force to carry out the construction of a permanent station with suitable buildings to accommodate personnel, stores, and shop-work, and also for the partial completion of a slipway. These facilities will add greatly to the smooth running and efficiency of the air patrols during the summer of 1928.

The last flight of the summer and fall season was on October 5 from Ladder lake to Cormorant lake via lac la Ronge and thence to Winnipeg, where all machines wintered for a general overhaul.

Before the close of the fiscal year 1927-8, a special light machine was shipped by rail from Winnipeg to undertake early spring patrols from the Ladder Lake base. This machine, operated with ski landing-gear, had no difficulty in landing on the ice of the northern lakes. The purpose of these early patrols is to keep in touch with spring trapping operations. Trappers have the custom of setting fire to meadow and marsh land to locate rat houses and runs, and, with the high price at present for rat pelts, many persons are engaged in rat-trapping, scattered over the north. These meadow and marsh fires have been the forerunners of more serious fires later in the season. The first patrols, which covered almost the entire district, reported twenty-three fires which have since received attention. It is expected that the early patrols can be carried on until the end of April, when the ice starts to break up.

Alberta

Due to favourable weather conditions air patrols were not used at all during the spring or early summer, and even in the fall they were used on only twenty-seven days. The actual flying time involved was one hundred and seven hours and forty minutes. In August the flying time was six hours and twenty-five minutes; in September, thirteen hours and twenty minutes; in October, seventy-three hours and ten minutes; and in November, fourteen hours and forty-five minutes. No fires were discovered by aeroplane patrols. An explanation of this is necessary. On one of the forests served, there were no fires to report. On the other, there were three small fires. The first of these occurred in May before the aeroplane patrols were started. The other two were lightning fires which were started at night and were out before morning.

Improvements

Manitoba

The improvement program was carried on throughout the district. One new ranger cabin was built to replace an old one accidentally destroyed by fire, and two other cabins were completed. One stable was built, one partly built, and two others were finished. One wooden lookout tower was erected, one steel tower partly erected, and two steel towers were completed. Bath houses and out-door fireplaces were erected at summer resorts. Maintenance work was done to keep all buildings in good condition.

Six and one-quarter miles of new telephone lines were built, and existing lines were kept in efficient working order. Thirty-six miles of new road were cut. Approximately 4,000 cubic yards of gravel were placed on grades, and many bridges and culverts were built, both on old and new roads. New national-forest boundaries were cut for a distance of 12¾ miles, and 12 miles of boundary were brushed out. One hundred and fifty and one-half miles of fire-guard were reploughed.

Saskatchewan

Owing to the fire conditions throughout the year being favourable, all improvement projects contemplated were undertaken. These included three ranger stations—one on the Fort à la Corne national forest, and two on the Porcupine forest—and two office and warehouse buildings, one of which was for the Saskatchewan air patrol at Ladder Lake and the other for the Battleford fire-ranging district at Spruce Lake. An eighty-foot steel cabin lookout tower was built on the Pasquia national forest, a frame octagonal cabin on the stand-pipe tower at Prince Albert, and a standard frame construction tower on the Big River national forest. Twenty-eight and a half miles of new fireguard were made, thirty-four miles of road, and ten miles of trail. Twenty-eight miles of telephone line were also constructed. Fifteen cabins, mainly for storage purposes, were built. Two lookout towers of pole construction were built by ranger labour.

Alberta

The most important improvement work undertaken during the year was the construction of a series of lookouts. A lookout system has been operating in the Lesser Slave district for several years, and has been so successful that it was decided to extend its scope to the forests of the east slope of the Rockies. The experience of officials in the railway belt of British Columbia, who have had a lookout system in successful use for a considerable number of years, also favoured this step.

It has been demonstrated that a lookout system when connected by telephone is the best of all systems of rapid detection of fires. Consequently, a great effort is being made on all of the forests of the East Slope to complete the lookout program as soon as possible. Lookout cabins are being constructed on strategically located peaks in the mountains and lookout towers on high points in the foothills or lower lands.

A total of eight such structures was built during the past summer. Three lookout cabins were constructed—on the Ironstone ridge and the Livingstone ridge in the Crowsnest forest and on Coliseum mountain near the town of Nordegg in the Clearwater forest, respectively.

Five towers were built. Three of these were constructed with a cupola on top of a short wooden tower, the highest being twenty-six feet; these towers were merely to get the lookout above the timber; they were built on Blue hill near the Red Deer ranger station, on the Bow River forest, and on peaks near the towns of Lovett and Luscar, on the Brazeau forest A steel lookout tower,

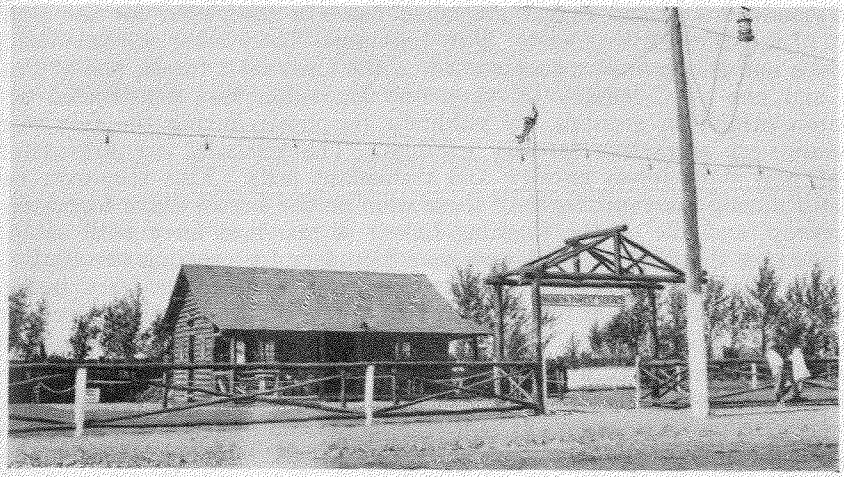

PLATE NO. 7.—CABIN ERECTED BY THE FOREST SERVICE ON SASKATOON FAIR GROUNDS FOR PUBLICITY PURPOSES. (F. S. Photo. 19803)

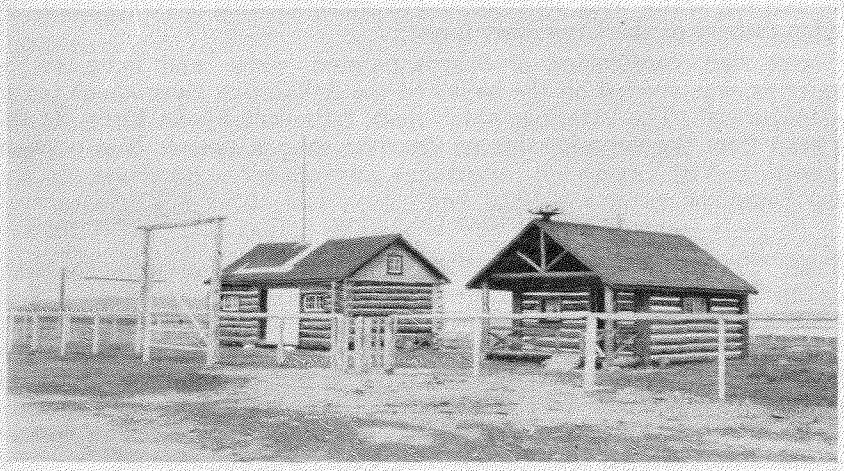

PLATE NO. 8.—RANGER CABIN AND WAREHOUSE AT ILE À LA CROSSE, SASKATCHEWAN. (F. S. Photo. 19848)

The device painted on the top of the building to the left indicates to the aviator that this is a forestry station.

seventy feet high, with a cupola on top, was built beside the Forest Service office on the Clearwater forest at Rocky Mountain House. A wooden tower was built entirely by ranger labour near Sturgeon lake in the Edmonton fire-ranging district; this tower is sixty feet in height and has a platform on top.

A standard six-room ranger station house was completed for the Bighorn district of the Bow River forest. Two buildings—both being a combination of storehouse and garage—were constructed on the Crowsnest forest, one at Pincher Creek and one at Coleman. A very fine log cabin was constructed at the Edmonton exhibition grounds for publicity purposes; during the fair week it held some very attractive forestry exhibits. The grounds, too, are tastefully laid out, and show forest nursery and transplant beds. Five stop-over cabins were built during the year; three of these were on the Lesser Slave forest, one on the Brazeau, and one on the Cooking Lake. A standard ferry with cable was constructed on the Clearwater forest near Saunders for crossing the Saskatchewan river with pack-horses and fire-fighting equipment. The ferry is located at a very dangerous part of the stream; two rangers have lost their lives at this point.

A total of thirty-six and one-quarter miles of telephone line, mostly for rapid communication from lookouts, but some for general administration, was completed during the past season. Of this length, seventeen and one-half miles are on the Brazeau forest, eleven miles on the Bow River forest, and three and one-quarter miles on the Crowsnest forest: four and one-half miles were built to connect the Cypress Hills telephone system with the rural line from Maple Creek.

A total of seventy and one-quarter miles of trail and five and one-quarter miles of wagon road was built. The greater part of the trail mileage was on the Athabaska forest and comprises the Moberly creek, the Sheep creek, and the Kvass Flats trails. The remainder is made up of short trails on the Crowsnest, Bow River, and Clearwater forests which were, for the most part, built to connect existing trails with lookouts. The road-building was confined to the Crowlodge district of the Crowsnest forest.

A large sign, constructed of boards painted white and hung on wires between trees, was erected on the banks of the Athabaska river about ten miles below McMurray. The lettering, which reads "Prevent Forest Fires—It Pays," can be read from the opposite side of the river over a quarter of a mile away.

British Columbia

In the Tranquille forest district 82 miles of new trail were constructed, opening up inaccessible areas for fire-protection and, in some cases, grazing purposes. All former trails were brushed out and put in good shape. All telephone lines were put in a good state of repair and 7¾ miles of new telephone line were constructed. A new stable was built on the Tranquille national forest.

In the Shuswap forest district 83 miles of new trails were constructed and 1½ miles of new telephone line were built. One ranger cache cabin was built, and a small storehouse on the Salmon Arm wharf was constructed.

In the Revelstoke fire-ranging district 26½ miles of new trail were constructed and 6½ miles of new telephone line built. Three ranger cache cabins were built, and a small warehouse was constructed at Golden in which equipment for the Golden district will be stored.

In the Coast fire-ranging district 21 miles of new trail were constructed and one ranger cache cabin was built.

Hay and Grazing

Manitoba

The total number of hay permits issued on the national forests was 238. The utilization of available grazing facilities on the national forests remains at a fraction of its possible development, owing to the fact that very few farmers in the vicinity of the national forests possess many head of stock. The stock pastured comprised 1,120 cattle, 96 horses, and 150 sheep.

Saskatchewan

Forage conditions were excellent during the grazing season on all national forests in the province, owing to the abundant rainfall. The growth of grass and vetches was luxuriant and with the amount of stock grazed it was impossible for them to make any impression on the growth; hence very little benefit will ensue through the reduction of the spring fire-hazard period. Stock went on the range in only fair flesh but came off fat and in good market condition.

There was a slight falling off in the number of permits issued and the number of head of stock grazed. The reduction over last season, despite the improvement in the live stock industry over previous years, is attributed to the abundant forage growth on privately owned pastures outside the national forests.

During the season the number of permits issued was 493, covering the grazing of 7,611 cattle, 2,435 horses, and 262 sheep. The total dues derived from grazing permits were $5,219.26.

No new stock-grazing associations were formed during the past year, but several groups of stock-owners have asked for information with a view to organizing associations for community grazing. There are at present in existence twenty-two grazing associations on forest reserves, the majority of which are operating on the smaller prairie reserves.

Alberta

During the summer of 1927 there were permits issued for stock-grazing on the national forests covering 22,309 cattle, 4,995 horses, and 1,155 sheep. This is not nearly up to the carrying capacity of the range. In fact, it represents a decrease of 2,262 cattle and horses and 1,095 sheep, as compared with the figures for 1926. This falling off is evidently due to the fact that, on account of a particularly favourable growing season, ranchers had sufficient feed at home to take care of much of their requirements.

There were thirty-one permits issued to cut hay on national forests. These permits covered a total of 694 tons. Most of it was cut on the Cooking Lake forest, where grazing demands are not heavy.

British Columbia

Stockmen in the Railway Belt of British Columbia are slowly but steadily realizing the benefits of the forest-reserve grazing regulations, and applications are increasing in number each year. Last season 1,796 cattle, 3,619 sheep, and 99 horses were grazed on the national forests under permit. Sheep are being brought into this district in great numbers, and probably close to 15,000 will be grazing on national forests next season (1928). Forage conditions during the past season on the grazing districts in the national forests were ideal, and all stock was brought in in perfect condition.

Timber Sales and Permits

Manitoba

Moderate quantities of saw-timber and railway ties were cut on timber sales within the national forests. Four supervisors' sales were disposed of, one of which was later forfeited. One timber sale was transferred from one holder to another by assignment. In addition to the operations on national forests, the operations of one private firm on concessions on lake Winnipeg were also under the supervision of this Service. Regulations were followed in a satisfactory manner in all cases. A total of 2,074,627 feet board measure of saw-timber, 39,717 ties, and 232 cords of cordwood was cut.

In addition to the above quantities, 47,543 logs were cut by the firm referred to above. As dues are to be charged on a mill-cut basis the quantity of lumber contained in these logs cannot be stated at present.

The usual brisk demand for permits continued during the year on the national forests, the bulk of this business being confined to the Riding Mountain and the Duck-Porcupine forests. On the whole, there was an increase in the demand for cordwood, with a corresponding decrease in the demand for saw-timber. Settlers continued to take advantage of free permits for building purposes. One mill-site was readvertised and awarded. The total number of permits issued was 1,726. Timber cut on these permits comprised 19,000 feet board measure of poplar and 3,464,781 feet board measure of other species, 56,137 linear feet of all species, 6,560 cords of green poplar, 2,016½ cords of green wood of other species, 5,270 cords of dry wood, 39,288 posts, and 6,571 rails and poles.

All cuttings within the Pulpwood Selection Area, other than those on licensed berths, were supervised by this Service. A start was made towards a more extended application of the policy of slash disposal by burning. This work was done in co-operation with the Timber and Grazing Lands Division, Dominion Lands Administration. Operations by the Manitoba Paper Company were confined to the removal of 5,000 linear feet of cribbing timber on Pulpwood Berth No. 1. Supplies of pulpwood for the operation of the mill were obtained by purchase in this province and in east-central Saskatchewan.

Saskatchewan

The demand for timber on national forests increased this year over previous years, at least in so far as actual applications for timber sales were concerned. Twenty-eight new sales were awarded, aggregating 31,338,000 feet board measure of saw-timber, 12,000 railway ties, 24,994 cords black spruce pulpwood, and 1,000 cords dry fuel-wood. Fifty-two timber sales were active during the year, several of which were closed out at the end of the fiscal year or at the end of the quarterly periods. The total cut on timber sales was as follows: sawlogs, 19,635,508 feet board measure; pulpwood, 2,333 cords; lath-wood, 2,878 cords; railway ties, 21,044 ties; railway shims, 1,153 cords; fence-posts, 3,092; fence-droppers, 390; fuel-wood, 3,327 cords. Timber-sale activities returned a revenue of $66,756.18.

A total of 1,656 permits was issued, including 179 free settlers' permits. Under authority of timber permits, the following material was cut: sawlogs, 2,339,836 feet board measure; pulpwood, 5,472 cords; railway ties, 6,425 ties; round building logs, 105,090 lineal feet; poles, 75,968 lineal feet; fence-rails, 329,687 lineal feet; fence-posts, 78,489 pieces; fence-droppers, 21,048 pieces; fuel-wood, 15,045 cords; miscellaneous purposes, 129 cords (birch). The total revenue from this source was $17,233.93.

The increase in the sale of black spruce for pulpwood, which started in the year 1926 with the inauguration of a pulp and paper industry in Manitoba, is reflected in the heavy sales of pulpwood by timber sale and the very large increase in pulpwood under permit. The cutting of pulpwood has taken such a

place of importance in the winter activities of both logging operators and settlers that there is a danger of over-cutting in the eastern part of the province, both from the standpoint of available supply of accessible pulpwood timber and the amount which can be accepted by the industry in Manitoba during the season the wood is cut. To the settlers clearing up agricultural lands on which there are located small isolated blocks of pulpwood timber, the market for the wood cut in these clearing operations is a great boon from an economic standpoint, if the supply available on such lands is eked out in such a way that it will be a source of income spread over a few years rather than being "a feast and a famine."

On the national forests the cutting of pulpwood and lathstock is almost entirely confined to black spruce, for which only a few years ago there was practically no demand. In a very few instances, white spruce has been used for pulpwood—this in cases where from a silvicultural standpoint it was deemed advisable to take advantage of the chance to dispose of the material from thinning operations, and thus make an improvement in the growing conditions of the remaining white spruce trees. In this practice all trees to be removed in the thinning operation were previously marked.

All logging operations under timber sale and permit cutting were given careful supervision and conform to definite conditions made at the time of the sale or the issuance of the permit. Marking, or otherwise carefully designating the timber to be removed, was carried out. Brush disposal has been very satisfactory. On one timber-sale area in the Pasquia national forest, an operator has this year taken out his logs at a lower cost than formerly owing to the fact that the greater ease of handling logs after brush disposal enabled him to dispense with the services of some of the swampers necessary with the skidding crews.

Alberta

In this district there are twenty-two active timber sales, involving an area of approximately 25,786 acres. Of these, eight are new awards covering about 3,140 acres and 4,025,000 feet board measure. Seven sales satisfactorily completed operations and were closed out. The cut for the year was 9,723,788 feet board measure of saw material and railway ties, 1,055,702 lineal feet of mine-props, and 309,010 lineal feet of mine lagging. Several applications for large sales of timber have been received recently and are being dealt with at present.

There were 290 permits issued during the year, the greater part of the material being dry or fire-killed. Of the dry material there were 641 cords of fuel-wood, 525 fence-posts, 1,455 fence-rails, 10,292 lineal feet of round building logs, 760 poles, 740,040 lineal feet of mine-props, 239,222 lineal feet of mine lagging, and 120,000 feet board measure of sawlogs. In green timber permits were issued for the following material: 390 cords of fuel-wood, 27,840 fence-posts, 100 fence-rails, 19,992 lineal feet of round building logs, and 1,161 poles.

British Columbia

The fiscal year 1927-8 saw a great increase in timber-sale activity, and the revenue for the whole inspectorate from timber sales and timber permits is greater than that of any previous year. This increase is due in part to the sales held on the new Shuswap national forest, which brought the Shuswap forest district timber revenue nearly up to the 1924-5 maximum; and in part to the number of new sales held in the Tranquille forest district, in the Fraser Canyon, Martin Mountain, and Monte Hills national forests.

During the year a total of 22 new sales was held—14 in the Shuswap forest district and 8 in the Tranquille forest district. In these 22 sales the material was all disposed of to the highest bidder by auction. The year saw active bidding on cedar-pole sales. The better prices secured will bring in considerably increased revenue for the next year or so, and the activity has resulted in the

upset prices of poles being raised in accordance with improved market conditions. At the beginning of the year there were 30 sales in the inspectorate, of which 12 had finished cutting and were awaiting final brush disposal.

The year saw the inauguration of the policy of holding Supervisors' timber sales, and this has brought about an increase in the number of sales and has probably also been a factor in the increased total cut and revenue. The revenue has increased more than the cut owing to the fact that a greater proportion of the cut has been cedar poles, with a higher stumpage value, and fewer ties, which sell at a lower price. Another feature of the year has been the great increase in the cut in the Tranquille forest district from only 126,000 feet board measure in 1926-7 to over 640,000 feet board measure during the year just past (1927-8). Only a small proportion of this cut has been in the Fraser Canyon forest, over two-thirds being on the Monte Hills forest, with Martin Mountain and Hat Creek supplying the rest.

The revenue shows an increase somewhat out of proportion to the increase in total cut. This is partly due to the fact that a number of larger sales were held, and the guarantee deposits have added a considerable amount to the revenue, even though not much has yet been cut. It can be seen, however, that the number of poles cut has greatly increased and nearly equals the 1925-6 record. On the other hand, the number of hewn ties cut has steadily decreased, until only about a quarter as many were cut in 1927-8 as in 1923-4. This is partly due to lower prices and also in part to the cutting over of the more accessible tie stands on the Larch Hills forest.

Brush disposal has been carried out quite well, and the policy has been modified in some cases to require only lopping and scattering in places where piling and burning has, from previous experience, resulted in considerable damage to the remaining stand, no matter how carefully it has been carried out. The lopping and scattering is accompanied by very thorough cleaning up along logging roads by piling and burning, and in strips through the logged area.

Forest Surveys

Manitoba

(1) *Pulpwood Selection Area.*—The one outstanding forest-survey project was the cruise made of the Pulpwood Selection Area. This is a large area lying on both the east and west sides of lake Winnipeg, from which areas of pulpwood are to be selected in accordance with an agreement entered into between the Crown and the Manitoba Paper Company, the latter having erected, and placed in operation, a pulp and paper mill at Pine Falls on the Winnipeg river.

It was deemed advisable that the examination of this area should be completed at an early date so that information would be available with reference to the amount of pulpwood thereon. Accordingly, ten parties of ten men each were placed in the field and, with the exception of a few small areas, the examination of the whole of this area was completed during the summer. The magnitude of this enterprise may be judged when it is stated that the Pulpwood Selection Area is of approximately the size of the province of New Brunswick. Although the number of men employed on this project establishes a record, still the area is so large that its examination in one season would have been utterly impossible by ordinary methods. It was made possible only through the co-operation of the Directorate of Civil Government Air Operations and the Topographical Survey (Department of the Interior).

The Civil Government Air Operation staff photographed nearly all the area, and from these photographs the Topographical Survey prepared maps showing not only the lakes and streams but also the location of bogs, burns, and forested areas. These forested areas were further subdivided according to grade. The maps were of the greatest value to the men in the field and,

PLATE 9.—AERIAL PHOTOGRAPH OF PART OF ONE OF THE ISLANDS IN LAKE WINNIPEG.

White lines have been added to the photograph to indicate the limits of different types of country, such as heavily forested country, reproduction, muskeg, etc.

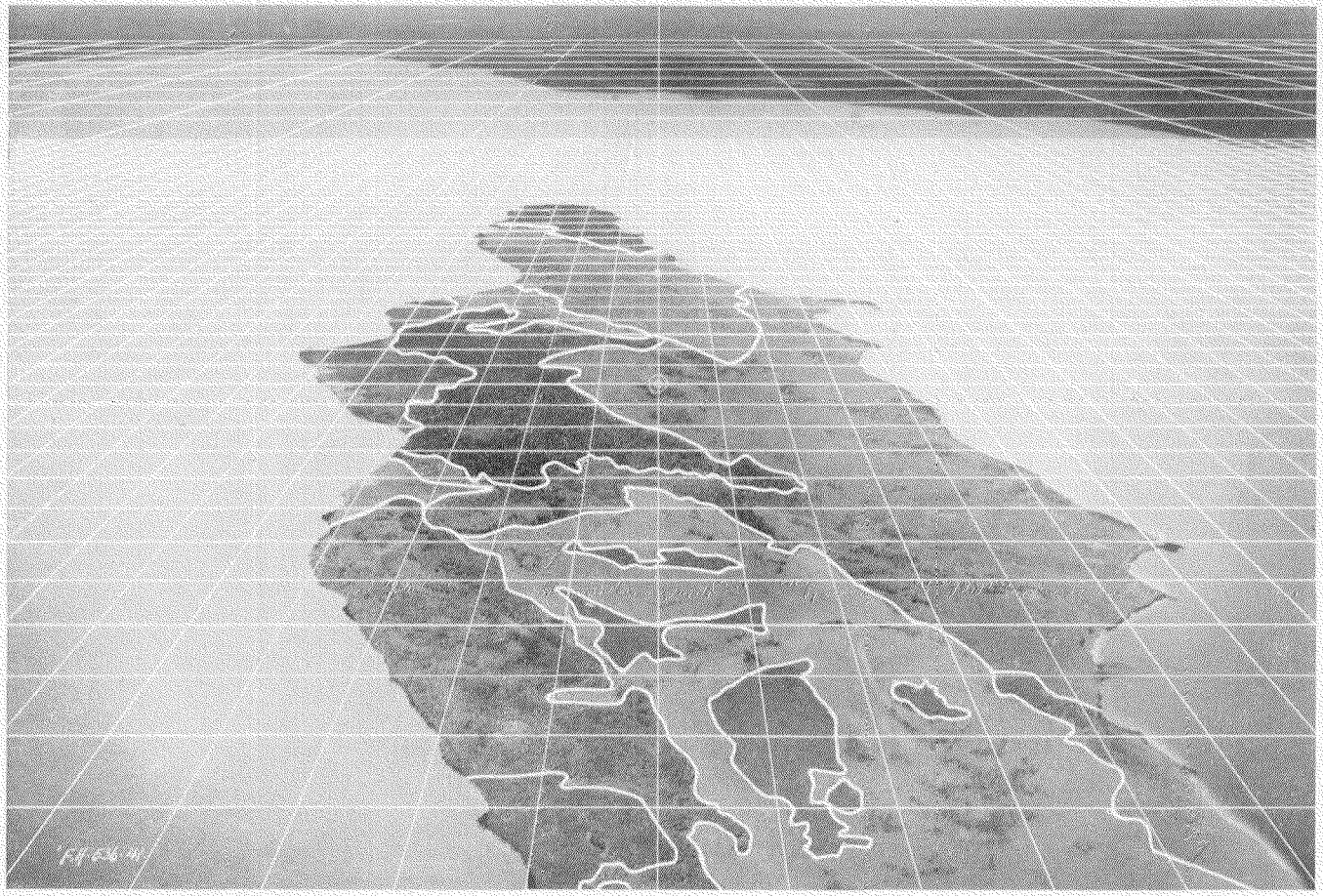

PLATE 10.—A REPRODUCTION OF THE PHOTOGRAPH REPRESENTED IN PLATE 9, WITH "GRID" IMPOSED.

Necessarily the effect of distance, altitude, and other conditions in an "oblique" photograph such as the one reproduced is to bring about a great distortion in the picture, which could not be used directly for making a map. The distortion is overcome by the use of the grid, which divides the photograph into a number of quadrilaterals equal in area; those in the foreground represent an area ten chains square, those in the background areas of one square mile. The photograph was made from an altitude of 4,300 feet.

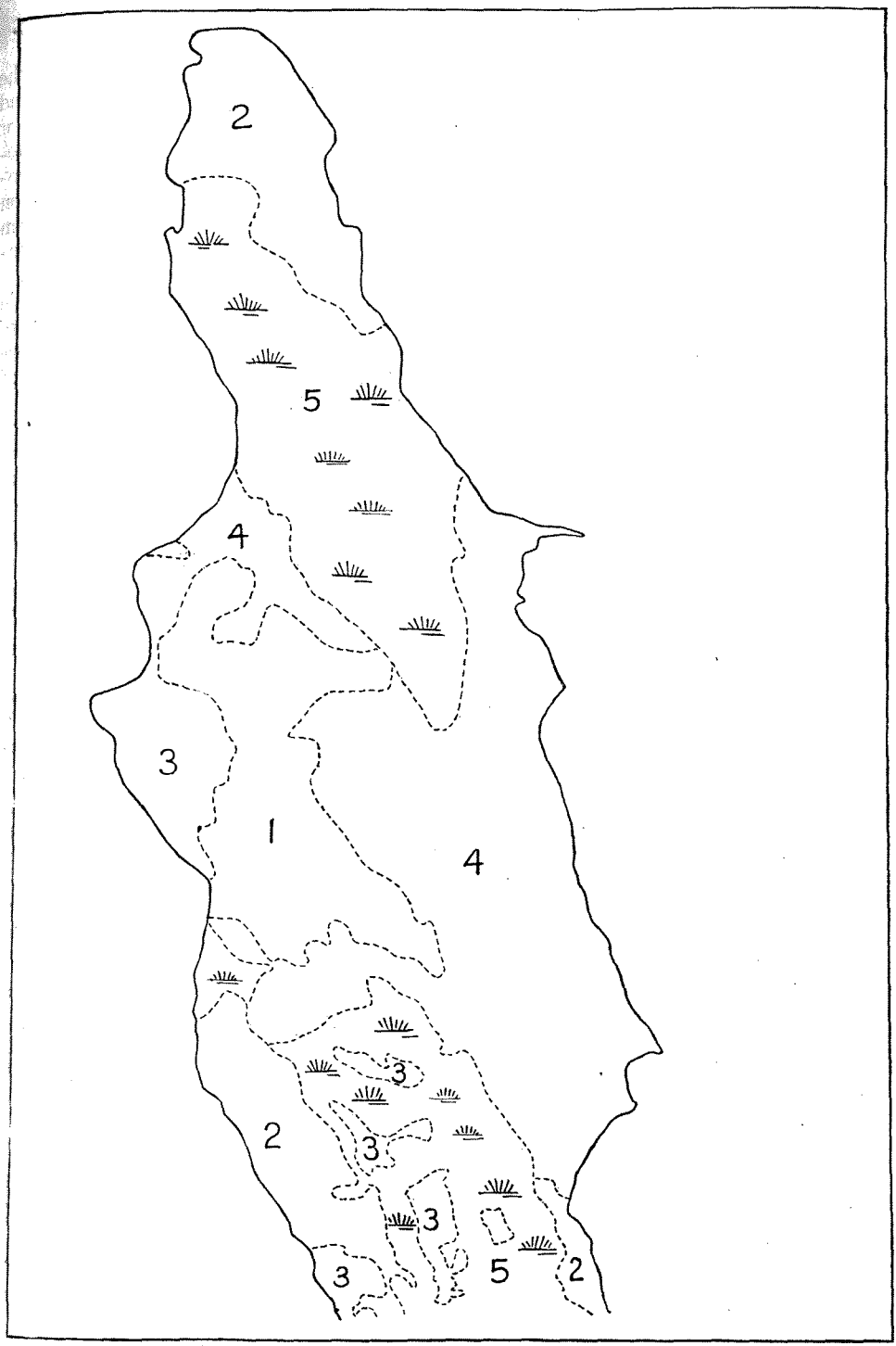

PLATE 11.—MAP OF PART OF ISLAND MADE FROM PHOTOGRAPH REPRODUCED IN PLATES 9 AND 10. A reproduction of a map made from the photograph. Outlines of the different classes of country indicated in plate 9 are inserted. The character of the country is indicated by the numerals. Only areas numbered 1 and 2 were cruised.

86880—3

together with copies of the photographs, which were also provided, enabled the work to be done most efficiently and at a minimum cost. With these maps and photographs at hand no time was wasted in cruising through bogs, burns, or other "waste" areas. Cruising was confined to areas which, from the photographs, appeared to show possibilities for pulpwood. The Air Force also rendered invaluable service through taking members of the personnel engaged on the survey work on flights over different sections of the area. This enabled them to sketch in various features of importance and to acquire a more accurate conception of the country as a whole than would otherwise have been possible.

All merchantable areas of pulpwood were estimated by running sample strips through them, spaced half a mile apart. All trees of merchantable size along these strips for a distance of one-quarter of a chain on each side were tallied and formed the basis of the estimate. This means that the estimates of total quantities are based on sampling of 1¼ per cent intensity.

The total net land area cruised in the Pulpwood Selection Area during the summer is calculated at between 12 and 13 million acres. Information is now available for this area with regard to the amount of pulpwood growing thereon, and maps have been prepared showing its location.

(2) *Nelson River.*—Another area of approximately 150,000 acres was examined along the upper part of the Nelson river near Norway House. This was done in exactly the same manner as that within the Pulpwood Selection Area.

(3) *West side of lake Winnipeg, north of the Saskatchewan River.*—An area of approximately 200,000 acres was cruised for pulpwood along the west coast of lake Winnipeg extending northward from the Saskatchewan river and including a portion of the country tributary to lake William. Here, too, the work was carried out in exactly the same manner as that within the Pulpwood Selection Area.

(4) *Overflowing River.*—During the last three months of the fiscal year (January, February, and March, 1928) a small party of six men examined an area of approximately 180,000 acres along the Overflowing river and its southern tributary, the Santon. The Overflowing river empties into lake Winnipegosis at its northwest extremity. Strips through the merchantable timber of this area were spaced 20 chains apart and of one-half chain width, giving a 2½ per cent estimate.

(5) *National Forests.*—A number of small areas, aggregating 50,000 acres in area, were intensively cruised on the national forests.

TABLE SHOWING ESTIMATED AREAS CRUISED

District—	Area in acres
Pulpwood Selection Area	9,428,000
Nelson river	150,000
West of lake Winnipeg and north of Saskatchewan river	197,000
Overflowing river	175,000
National Forests	50,000
Total	10,000,000

In addition to the above estimated areas cruised there were several other large areas examined by aeroplanes, on which it was found unnecessary to conduct ground surveys. In all approximately fifteen million acres were examined during the season.

In showing the character and location of bodies of timber in the areas examined approximately 70 maps of various sizes and scales were prepared. Where suitable maps such as those supplied by the Topographical Survey from photographic surveys were available, this information was plotted on them, but where such were not available maps showing all essential features were prepared.

Saskatchewan

Working-plan Surveys.—Two three-man crews were employed during the first half of the summer season laying out sample plots that form the sequel to the survey of the Lost River Block working-plan area of 49,000 acres covered originally in a survey of 1926. Four hundred and ninety-three plots were established, and form-class measurements secured from 650 trees. Compilation of all field-notes was completed during the past winter in the district office, and the final report and maps have been submitted.

The same crew completed a stock-taking survey of 10,700 acres of timber land in the west end of the Fort à la Corne national forest, in the Elk House district. This survey furnishes the basic data for the handling of the area under timber sales. With very little additional work the required information for putting the area under a working plan could be obtained, but the data now on hand are sufficient to draw up a management plan for the area for the immediate future needs.

A total of 112 miles of stock-taking strip lines was run on the Pasquia national forest during the summer survey season, and an area of 87,680 acres was covered. This survey fulfils the immediate need of supplying the basic data for the compilation of the estimates and original reports of several blocks of timber applied for under timber-sale regulations. The information gathered was compiled during the winter months at the Pasquia headquarters, and type and stand maps prepared. A continuation of this survey will be carried on during the coming season, and it is hoped that shortly the whole area accessible to the Canadian National railway on the Pasquia national forest will be covered. From this survey, also, the data provide information upon which to base a definite management plan for a period of years, and with little additional work the area could be put on a still more intensive management plan.

In the late winter, towards the end of February, a small base-line survey crew was put in the field to run the base lines required for the stock-taking survey that is to be carried out on the Pasquia national forest during the summer of 1928. Lines running north and south were established in four townships at two-mile intervals on new territory to come under the continuation of the stock-taking survey. A total of seventy-one miles of line was covered.

Land-classification Surveys.—A considerable area in and adjacent to the Keppel and Big River national forests was subjected to a land-classification survey by the Topographical Survey in co-operation with the Forest Service, with a view to definitely determining whether or not it is fit for agricultural purposes or best adapted to tree growth. The Forest Service also examined seventeen quarter-sections on the Fort à la Corne national forest in township 49, range 21, west of the 2nd meridian, south of the Saskatchewan river. On the Pasquia national forest, several quarter-sections were examined along the west boundary in township 44, range 11, west of the 2nd meridian, which were thought to have agricultural possibilities. Other lands were examined in the Nisbet-Pines and Moose Mountain national forests.

The survey of a new subdivision of thirty lots, known as the Sunnybank subdivision, was completed for summer-resort purposes in sections 14 and 23, township 10, range 3, west of the 2nd meridian, Moose Mountain national forest.

Alberta

No forest-cover surveys were carried on during the past year. A base-line survey preparatory to forest-cover inventory was made, however, on the Brazeau forest. There were sixty-eight and one-half miles of line cut, all following the township- and range-line locations. The work done on this project during the past season will serve as a base for future forest-cover surveys, covering approximately 360 square miles.

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Seed Collection and Extraction

Manitoba

The only kind of tree seed collected in 1927 was red pine. As this species bears seeds only intermittently at periods varying from three to five years, the opportunity thus afforded to replenish the supply was not missed. Cone-picking commenced early in September and continued until frosts opened up the cones and released the seed, making further picking futile. This occurred about the end of the same month. Collection of cones was made at two points, Woodridge and Vassar, both in southeastern Manitoba.

One interesting point was noted in connection with the yield of seed per bushel of cones from the two localities where collection was made. The cones collected at Woodridge gave a much higher yield than those from Vassar. The following table shows this quite clearly:—

Place of Collection	Bushels collected	Total pounds of seed	Average pounds of seed per bushel	Average cost per pound
				$ cts.
Woodridge	57	34·5	0·605	4 28
Vassar	67	28·5	0·425	6 19
Both places	124	63·0	0·508	5 14

The yield of seed from the cones collected at Woodridge was 43 per cent higher than the yield of seed from the cones collected at Vassar. The reason for this is not known at present, but is being investigated. The quality of the seed from the two localities is being determined, and if differences are found an attempt will be made to trace them back to ascertain the controlling factor or factors.

Saskatchewan

The season of 1927 was not an abundant seed year. However, 157 bushels of white spruce cones and 398 bushels of jack pine cones were collected from various points in the district—all but 21 bushels of white spruce by ranger labour, the latter being collected by contract labour. The yield per bushel of cones for both species was below normal, and the subsequent germination tests which were carried out both at Prince Albert and Ottawa were on the average low. There appeared to be a great deal of light seed which the machinery at the Prince Albert extraction plant is not capable of eliminating. The seed produced will all be used in the nurseries of the district during the coming season. Experiments in the storage of seed from previous years shows that it is safe to take advantage of good seed-years and produce enough good seed to last over poor years.

Alberta

Approximately 300 bushels of lodgepole pine cones were collected on the Cypress Hills national forest; the seed was extracted at the Rocky Mountain House seed-extraction plant. These cones yielded eight and one-half ounces of clean seed per bushel, a total of 158 pounds. This seed is intended for use in prairie planting, as it is more suitable for such work than the mountain strains of the same species.

British Columbia

Seed-collection was carried out on quite a large scale, although there was no crop of Douglas fir on the coast. From the interior, shipments of cones were made to the New Westminster extraction plant, and extraction of seed resulted as follows:—

Species	Number sacks cones	Number pounds of seed
Douglas fir	174½	146¾
Western hemlock	1	2¼
Western (red) cedar	43	111
Western white pine	205	193
Lodgepole pine	660	567
Western yellow pine	26	41½
Engelmann spruce	6¼	3¼
Western larch	12	17¼

In addition, about sixty pounds of western white pine seed were gathered and extracted at Salmon Arm by ranger labour.

At the coast no Douglas fir seed was collected, but a considerable quantity of Sitka spruce seed from the Queen Charlotte islands and some cedar and hemlock seed from the lower Fraser valley were gathered, as follows:—

Species	Number of sacks	Number of pounds of seed
Sitka spruce	1,245	1,547
Western (red) cedar	30	40½
Western hemlock	33½	36¾

A few pounds of alder (both *Alnus rubra* from the coast and *A. tenuifolia* from the interior) were also gathered. The lodgepole pine yield was very large, reaching, on the average, 0·85 pounds per sack; as high as 1·25 pounds per sack was obtained in the case of some of the shipments from the Shuswap Lake region. The yield of Sitka spruce per sack was better than that of any year since 1923, and came to about 1·25 pounds per sack of cones. The standard two-bushel sack is used but, in general, only about 1¾ bushels of cones are contained in a sack.

The Sitka spruce was nearly all sent to the Imperial Forestry Commission, the Douglas fir to New Zealand, the lodgepole pine to New Zealand, England, Ireland, and Finland, and the cedar and western white pine nearly all to New Zealand, where all the new crop of yellow pine was also sent, together with the large amount, re-cleaned, left over from the 1926 crop. The remainder of the seed was shipped to forest authorities in all parts of the world for experimental purposes, and some samples also to individuals. All continents were represented with the exception of Africa. Seed was sent to Iceland, Chosen (Korea), and Manchuria, and most of the European countries were represented on the mailing list.

Recreational Uses

Manitoba

There are five summer resorts in this district, and a preliminary survey and plan have been made for developing an additional site at Clear Lake. Bath-houses and out-of-door fire-places were erected at resorts during the season and are much appreciated by the public.

A large number of permits were taken out for the five-day open season for big game on the Riding Mountain forest last fall. Considerable numbers of fish have been taken, the majority coming from Whitefish lake. Further stocks of pickerel fry were placed in Madge lake and Clear lake.

The estimated number of visitors to the various summer resorts is as follows:—Clark Beach (Riding Mtn. Forest), 5,000; Kamsack (Duck Mtn. Forest), 1,600; Benito Beach (Duck Mtn. Forest), 800; Lake William (Turtle Mtn. Forest), 500; Max Lake (Turtle Mtn. Forest), 500.

Saskatchewan

During the year 1927 probably greater use was made of the reserves for recreational purposes than during any previous year. With the yearly increase of car-owners, families are more inclined to take holidays, and the public of the prairie districts seek the timbered areas of the province, and hence resort to the national forests. Many of the town residents are attracted to the idea of having summer cottages at the various accessible lakes within a reasonable distance from their permanent location. With this growing interest and healthy frame of mind of the public to enjoy the thrills of short stays in the natural forest country, more is demanded of the Forest Service in the provision of better roads and facilities at summer resorts for the visitors.

The most important summer resort in this inspectorate is on the Moose Mountain forest, which, it is estimated, had last year about 8,000 visitors, including campers and cottagers, a large percentage of whom were United States citizens. The number of cottages completed on the resort is thirty-four, with three new cottages in course of completion, and with better roads quite an increase in building is expected this spring.

Other established resorts are on the Porcupine forest at Greenwater Lake and the Manito forest at Ahrens Lake. So far, on these two resorts only four cottages have been erected, one and three respectively, although on the Ahrens Lake resort five lots are held under yearly permit with the idea of building. The estimated number of visitors on the Manito forest was 2,000 last year. The Greenwater Lake resort serves a comparatively new country. Only two lots have been secured by permit but the improvement of the road into the lake will no doubt result in greater use of the resort. It is estimated that 500 persons visited the lake last season.

Alberta

There is only one summer resort in this inspection district. It is located at Elkwater lake on the Cypress Hills forest. It has been, for the most part, patronized by residents of Medicine Hat, although even country people are now taking advantage of the opportunities for boating, bathing, and camping among the green timber. There are twelve lots occupied in the summer resort on which there are built eight cottages and one general store. It is estimated that 3,750 people visited this resort during the past season.

Although there is only one summer resort in this district, it is not the only place in the national forests that attracts visitors. Quite as many people visit the Gap on the Oldman river, where trout fishing is very good. Other favourite fishing and camping locations are the Castle, Highwood, and Elbow rivers inside the national forests.

British Columbia

Owing to the very wet season, camping lots at Trout lake, in the Long Lake forest, and at Paul Lake, in the Niskonlith forest, were not as much in demand as in former years, but the new auto camp at Paul lake was used by a large number of tourists. Work was started on a new camp at the Alexandria bridge on the Fraser Canyon highway, and on one at Pillar Lake on the Fly Hill forest.

Two new trails were cut to Hyas Long lake on the Niskonlith forest to make it accessible to fishermen who are now going in to this lake in increasing numbers. Kamloops trout weighing up to twenty-two pounds have been taken out of the lake. There is an ever-increasing demand to have different lakes in the district opened up by means of trails and roads to accommodate tourists, who are just starting to discover the splendid fishing to be had in the lakes on the national forests. The most important work ever done in this district with a view to improve the fishing was the building of 6,000 feet of ditch from Walloper lake to Trout lake, in the Long Lake forest, last fall. This was done with two objects in view. As Trout lake is fed only by springs the water during the past dry years has been steadily falling, so that the outlet, Meadow creek, has not run and the fish have not been able to go downstream to spawn. As a result of this the spawn has withered inside the fish and numbers of them have died, but with the building of the ditch the fish are able to go up into Walloper creek and have half a mile of ideal spawning ground in the creek-bottom. Further, there is now a steady stream of water into Trout lake, which will eventually bring the lake back to its former height, thereby causing Meadow creek to run again.

REFORESTATION

Manitoba

Planting.—A little planting was done in the spring of 1927 on some of the national forests; Scotch pine, jack pine, and white spruce were the species used. All these plantations made very satisfactory progress during the year and give promise of a low mortality. The following table shows by localities the number and kind of plants used and the number of acres planted:—

District	Number planted					Acres planted
	Scotch pine	Jack pine	Red pine	Lodgepole pine	White spruce	
Spruce Woods	22,400	15,100	.....	11,600	.....	20
Sandilands	6,200	4,800	4,500	.....	.....	13
Riding Mountain	.....	.....	.....	.....	8,875	7

The total number of plants of all species was 73,475.

Seeding.—Reforestation by direct seeding was carried out on only one reserve; this was the Sandlands, where a series of experimental plots was started in 1925 and has, with but few modifications, been continued in 1926 and again in 1927. A total of 27 quarter-acre plots was sown. Sowings were made on May 6, June 11, and October 4, nine plots being sown on each date. The species experimented with were jack pine and lodgepole pine, the latter being collected from two localities (Rocky Mountain House and Cypress Hills). The jack pine was collected on the Porcupine forest in Saskatchewan. Sowings were made by the seed-spot and broadcast methods. In broadcasting two quantities of seed were sown, two and four pounds per acre.

Saskatchewan

Nurseries.—There are at present ten nurseries in operation on the national forests of Saskatchewan. On these nurseries a considerable number of new beds was started with seed-sowing experiments to ascertain the comparative results of spring and fall sowing in the seed-beds and to determine the treatment of seedlings after germination during the growing season, the survival through the winter period, and the method of protection from rodents.

A large number of plants was put out in the transplant lines from the seed-bed stock of previous years. In September approximately 3,400 Scotch pine (all 2-2 stock, that is, trees that had grown two years in the seed-beds, and subsequently two years in the transplant beds) were set out in furrows in the form of a permanent plantation plot on the Nisbet forest. This number of plants occupies an area of one and one-quarter acres and the work represents an experiment in determining the relation between fall planting and subsequent mortality.

It is intended to develop some of these nurseries on a larger scale so as to produce sufficient stock of various species to carry out a definite yearly planting program. Experiments which have now been carried out on the several nurseries for a number of years indicate that there is a wide variance in results, and it can now be determined which nurseries have the prime requirements and can be safely developed for a greater production to meet the needs for artificial reforestation in the district.

The estimated seedling stock for all species in the fall of 1927 was as follows:—

Three-year seedling (3-0) stock	17,000
Two-year seedling (2-0) stock	795,000
One-year seedling (1-0) stock	2,338,000
Total	3,150,000

In addition there is transplant stock, for all species, of approximately 200,000 plants. These figures represent an increase of about 200 per cent over the total stock, all age-classes, in the fall of 1926.

Alberta

Planting.—On the Cooking Lake forest 110,000 seedlings of Engelmann spruce, Douglas fir, and lodgepole pine were set out in their permanent locations. They were so spaced as to cover sixty acres.

Seeding.—A denuded area of twenty-three and one-tenth acres on the Bow River forest was seeded to lodgepole pine—nine and eight-tenths acres by the seed-spot method and the remainder broadcast. The labour cost was less than $2 per acre, and the value of the seed was approximately $4 per acre. On the Crowsnest forest ten acres of land with sparse reproduction was sown broadcast with lodgepole pine at a cost for ranger labour of approximately $1 per acre. It is hoped that these experiments will demonstrate the feasibility of covering large areas by one or the other of these two seeding methods. No direct seeding of denuded areas was undertaken on the Cooking Lake forest during the past season, as the success of seed-spotting is still in doubt in this locality.

Silvicultural Research

Manitoba

Thinnings.—Three permanent sample plots of approximately equal areas were established on the Sandilands national forest to study the effect of thinnings on dense immature stands of jack pine. One of these plots was left unthinned to serve as a control whereby comparisons with the other plots at a later date might be made. The other two plots were thinned—one rather lightly and the other more severely. The following table shows the basal area and number of trees on each plot after thinning:—

—	Plot 1 (Light thinning)	Plot 2 (Medium thinning)	Plot 3 (Unthinned)
Basal area (sq.ft.)	66,899	59,685	74,575
Number of trees	1,681	1,313	2,434

Mensuration.—Approximately 100 cords of spruce pulpwood were cut, measured, and piled in order to determine the relationship between diameter of trees and solid wood volume of stacked cords. These measurements are being combined with data collected elsewhere, and tables are to be prepared giving this information. Measurements were made on 152 large white spruce trees ranging in diameter from 18 inches up to 36 inches in order to secure information on which to prepare volume tables for different units showing quantities by diameters, heights, and form-class.

Saskatchewan

Thinnings.—In the Holbein district of the Nisbet-Pines national forest a series of jack pine thinnings was undertaken. The series includes three one-acre plots and two one-half acre plots of different degrees of thinning, with additional plots of each size laid out and left in their natural state as check plots. All the trees left on the plots were mapped and tagged. The measurements of each were taken and recorded for future reference in checking up.

Mensuration.—Stem-analysis measurements were secured from white spruce trees, ranging from nineteen to thirty-two inches in diameter at breast-height, to facilitate the extension of the white spruce form-class volume tables beyond the present twenty-inch diameter-class limit.

Work was undertaken for the Forest Products Laboratories in Ottawa to secure sample disks from white spruce. Samples were obtained from 200 trees selected from two individual site-classes of the spruce-poplar stands characteristic of Saskatchewan. An analysis of these disks is to be undertaken by the Forest Products Laboratories with a view to establishing a relation between the rate of growth and density of the wood combined with site.

Alberta

Theory of Forest Types.—Considerable work was done in connection with the application of the Cajander theory of forest types to the stands of this country. This work was given a great impetus by the visit to Alberta of Dr. Yrjö Ilvessalo, the noted Finnish authority on silviculture. The work done to date, while of a very general nature, indicates clearly that the Cajander plan of procedure is capable of practical application in this country. It may considerably simplify many silvicultural problems having to do with yield and other related questions.

Thinnings.—Thinnings in the dense lodgepole pine stands of the Cypress Hills forest have been carried on with satisfactory results. At the commencement of this work thinnings were made only by labour hired by the Service, and the cuttings were sold to settlers at a price per piece or per cord ready to load on their wagons. This system is still carried on to a limited extent, but is largely superseded by one in which the person desiring the timber does his own cutting under very close supervision by forest officers. Increased growth of the remaining stand is quite noticeable at the end of three or four years. It is felt that this project constitutes a very definite step ahead in the scientific management of this forest.

British Columbia

Seeding and Planting.—In the spring the first large-scale seeding experiments were carried out with western (red) cedar on a timber berth located to the north of the Alouette river, not far below Alouette lake, which has been cut over and severely burned. A total of 200 acres was seeded, the 1926 crop surplus of cedar seed being used, and the results have so far been fairly good owing to the wet season. In the good locations there is an excellent stand of young cedar, but in the drier parts there are not many seedlings. In the small plots where the seed-spot method was used there was better success in the dry parts.

Yellow pine, big-tree (*Sequoia gigantea*), red oak, and American white elm seedlings and transplants were also set out. Examination in the fall showed that there was very fair success with all species, but that the chief difficulty was rodent damage, particularly with the yellow pine and the hardwoods. The seedlings and transplants used in these experiments were raised in the Salmon River and Salmon Arm nurseries. In the fall further plantations were carried out at the Coast on the same area, and a small experimental nursery was established near Green Timbers. Several new species were planted, e.g., Japanese and Siberian larch, and Monterey pine, and, in addition, quite a number of eastern hardwoods, including sugar maple and white ash.

Planting and seeding experiments were also carried out in the interior, mostly in the Shuswap forest district, on the Larch Hills and Mount Ida forests.

Theory of Forest Types.—During the month of August, Dr. Yrjö Ilvessalo, of the Forest Research Institute, Helsinki (Helsingfors), Finland, made a trip through the district from Sicamous to Lytton. Much material was gathered and specimens collected for data on which to base future reports and research. It is considered that the Cajander system of type classification may be of great utility, not only in intensive surveys, but also in rough reconnaissances, and that it will also give a reliable biological basis for future yield tables.

Mensuration.—In the winter months a great deal of work was done in compiling sample-plot data. All but two of the Barnes Creek and Morris plots, on the Nicola forest, that were remeasured in 1925-6 were compiled and the records put into shape with the exception of the final volume computations and the per-acre data. The field notes have been put into shape and the records all copied on permanent forms. The results to date show that lodgepole pine makes fair growth, even in over-crowded stands, and in stands that are quite old, and that thinning in a 50-year-old crowded stand on a poor site brought about a 25 per cent increase in total growth, even though nearly half the total volume of wood had been removed, and there was also a slight increase in height growth.

THE TREE-PLANTING DIVISION

Norman M. Ross, Chief

The winter of 1926-7 was long and cold, with more than the normal amount of snowfall. These conditions prevailed widely over the three Prairie Provinces. After spring opened up, weather conditions were very favourable for both nursery work and general tree-planting operations, the only drawback being that owing to excessive moisture in some individual cases ground prepared for planting was flooded and plantings postponed for another season. The excessive moisture, while of great benefit to the growth of the plantations, made it very difficult to keep the belts regularly cultivated and the weeds thoroughly controlled. This may give grass and weeds a good start in some plantations, which may later be difficult to eradicate. On the whole, however, reports indicate that this season (1927) has been the most favourable season experienced for many years in giving newly set out plantations a good start.

The summer of 1927 was one of the worst in respect to damage from hailstorms, and many plantations suffered very severely in certain restricted areas. It is wonderful, however, how the young plantations recover from these setbacks, and it is only in very rare instances that a plantation is completely destroyed, though such cases do occasionally occur. No winter-killing of any consequence was reported, the chief injury to plantations being due to rabbits, which were again very numerous in some sections. The ash is the variety which suffers most from these pests, and to a lesser degree the poplars and willows. Mention was made in my last report of the use of axle grease as a protection against rabbit injury. This season many more farmers used this method in their newly planted belts, and all who did so report excellent results. There appears to be no danger of injuring the young trees from the use of axle grease provided it is not put on too heavily. One report of trees having been killed was received, but on investigation it was found that the grease had been smeared on very thickly. The best method is to grease the palm of an old woollen mitt and then pull this lightly up the stem of the young plants, leaving only a trace of the grease on the bark. The merest trace seems to effectively repel the rabbits. Hundreds of small trees can be treated in a remarkably short time, particularly if the weather is not too cold.

No reports were received in respect to any general injury from insects.

Field Inspection

There was a very heavy inspection list this season; it was made up of 12,530 names—nearly 1,350 more than in 1926. Of this number 3,600 were new applications.

It was necessary to employ an additional inspector, so a staff of nine men was in the field from June 1 until freeze-up. Each inspector had an average of about 1,400 applicants to visit.

Detailed reports of 7,643 plantations were made. Of the newly set out material the reports are exceptionally encouraging, showing 98 per cent of maple, ash, and caragana seedlings living and 95 per cent of poplar and willow cuttings well rooted. In the case of evergreens, failures in the various species were as follows:—spruce 6 per cent, jack pine 4 per cent, Scotch pine 8 per cent, and lodgepole pine 6 per cent. This is an extremely good showing, for a large number of the planters were quite inexperienced.

The influence of farm shelter-belts on horticultural development is very marked. Twenty to twenty-five years ago it was only occasionally that even a good potato patch was evident on the average prairie farm. Good farm gardens were the exception, and only rarely did one find any attempt at fruit-growing outside of an odd currant and raspberry bush. Now, inspection reports indicate

PLATE NO. 12.—SHELTER-BELT OF BROAD-LEAVED TREES SUPPLEMENTED BY CONIFERS, PHOTOGRAPHED IN 1923, SOON AFTER PLANTING THE CONIFERS.
(F. S. Photo. 19600)

PLATE NO. 13.—SHELTER-BELT OF BROAD-LEAVED TREES SUPPLEMENTED BY CONIFERS, PHOTOGRAPHED IN 1927, AFTER FOUR YEARS' GROWTH OF THE CONIFERS.
(F. S. Photo. 19601)

The development of an ideal shelter-belt. The upper picture shows a well-established broad-leaved shelter-belt, within which a row of small coniferous trees has just been planted. The lower picture shows the same shelter-belt four years after.

a very marked change. Of the 7,643 farms reported on, where shelter-belts had been established, 6,796 had good vegetable gardens, 2,700 were growing small fruits, 316 crab-apples, 283 standard apples, and 417 plums. These conditions are due almost entirely to the assistance originally given in tree planting and give some idea of the value of the present tree-planting policy as an encouragement in developing more permanent farm homes.

The development in the growing of tree fruits is very remarkable and reports from widely scattered points are most favourable.

One farmer in the Maple Creek district reported that, in spite of much discouragement in the early years, he gathered, in 1926, from ten Wealthy and two crab-apple trees, thirty boxes of Wealthy apples of excellent quality and 1,200 pounds of crabs.

Maple Creek is in a district which is considered one of the least favourable for tree growing, and when such results can be secured under these conditions it is certainly very encouraging for the future of fruit-growing on the prairies generally.

One other striking feature is the splendid success farm planters are having with evergreens such as spruce, Scotch pine, lodgepole pine, and jack pine. Many of the older plantings have made wonderful growth, and as a consequence there is a much greater demand for stock of this class than the nursery can supply at the present time.

Distribution

The first shipments of seedlings and cuttings in 1927 went out from Indian Head on April 27, just a week later than in 1926. Shipping was completed May 21. Shipping at Sutherland started May 2 and was completed May 21.

A total of 7,430,350 broad-leaved seedlings and cuttings was sent out from the two nurseries to 5,923 applicants, the average shipment being 1,254 trees to each. Of this material 905,600 went to Manitoba, 4,245,550 to Saskatchewan, and 2,280,100 to Alberta.

Evergreens to the number of 117,240 were sent to some 1,170 planters. In addition 92,500 seedlings and transplants were shipped to national forests in Manitoba. Of the stock sent to farmers 40,667 were white spruce, 23,570 jack pine, 11,700 lodgepole pine, and 41,303 Scotch pine.

For this spring's distribution 7,745,625 broad-leaved trees are available. Of these 3,445,625 were grown at Indian Head and 4,300,000 at Sutherland. In addition, 101,800 evergreen transplants are ready to go out. This stock will be sent out to about 6,500 applicants as against 5,923 last season. During the past winter 5,962 planting plans were prepared for the assistance of the various planters.

Nursery Work

The season of 1927, both at Indian Head and Sutherland, was very favourable for the growth of nursery stock. With the exception of a very severe hail-storm at Indian Head early in July there were no set-backs. This storm did more damage than was apparent at the time, as to all appearances the stock made a good recovery. At digging time, however, it was found that a considerable percentage of the ash and caragana had been killed.

The general stock, so far as vigour and size is concerned, is the best for many seasons.

At Sutherland the growth ordinarily is not nearly so vigorous as at Indian Head, and for that reason a large proportion of the seedlings has been carried over an extra season to secure greater size. While this entails more labour in digging and packing it has been found that these larger seedlings are preferred by the farmers and get away to a better start than those of smaller sizes; hence

the policy of growing the stock for an extra year will probably be continued at that nursery. Very considerable difficulty was experienced at both nurseries during the digging season owing to the wet cold weather, the men having to work most of the time in mud, snow, or rain. Fortunately, however, all nursery operations were finished before freeze-up, including the sowing of considerable areas to maple, ash, and caragana.

The results with coniferous transplants and seed-beds have been very good this season. Some 297,000 seedlings of spruce and pine were set out in transplant rows, and, as water could be supplied to these at critical periods, the percentage of failures is the smallest experienced for many seasons. Newly sown seed-beds show a very good stand, and growth in the older beds was much better than average.

The new pump and overhead sprinkling system operated very efficiently. The distributing lines are being extended each season to take care of the newly planted plots. The system is designed to serve about twelve acres, the main pipes being all installed. The distributing pipes are now erected for about six acres and another three acres will be connected up this season.

Towards the end of the summer the oldest white spruce transplants showed a distinct discolouration and a somewhat unhealthy appearance. This was put down to soil conditions at first, as an examination did not disclose any apparent diseased condition. However, as the discolouration became rapidly more pronounced, a much closer examination was made, and it was found that the plants were badly infested with an extremely small transparent coloured mite, smaller even than the red spider. The plots were immediately sprayed with nicotine sulphate, which effected practically complete control. The affected plants had the appearance of being gradually dried out, and only a very close examination with lenses disclosed the presence of the mites. If not controlled, these mites would undoubtedly do very serious injury. The insect is very similar to the *Phytopus pyri* which causes the disease commonly known as "pear-leaf blister."

Mention was made in the last report of a collection of tree and shrub seeds furnished by the Arnold Arboretum (Boston, Mass., U.S.A.). These were sown in seed-beds, and the majority germinated quite well. The seeds were collected in northern China, and it will be very interesting to note the behaviour of these exotics under the changed climatic conditions. It is quite possible that among them may be varieties which might eventually prove very valuable for prairie planting. Many of the most promising varieties now giving excellent results are exotics such as the caragana, the Russian willows and poplars, Scotch pine, Siberian larch, European larch, and Siberian fir.

Insect Pests

The most serious insect problem at the present time is an infestation of the bronze birch borer, which seems to have gained considerable headway in all the birch plantations at the nursery during the last two seasons. Up to date the birch has been one of the most promising broad-leaved species, making very healthy vigorous growth. It was only this season that the infection was noticed and was indicated by a few trees showing a sickly appearance and an odd one failing to leaf out. The European cut-leaf birch appears to be most susceptible. All the trees on the nursery were carefully examined by an officer of the Entomological Branch of the Department of Agriculture. Ninety-four per cent of all cut-leaf birch were found infected, some very badly indeed. This is the most ornamental broad-leaved tree on the Nursery grounds, and there were several very fine specimens in the ornamental plantings. A variety of Russian birch very similar in habit of growth to the cut-leaf variety showed 69 per cent infection. Four plantations of native birch showed infection varying from 5 per cent to 44 per cent.

Apparently there is no practical method of controlling these borers in the plantations other than cutting out the infected trees and burning the wood while the insect is still in the larval stage. In the hope of checking a further spread of these borers all trees which were found to be infected were cut out and the wood burned during the winter.

Pine leaf-scale.—This is present on many of the older white spruce. It is a small white elongated scale which settles down on the needles and increases very rapidly if not controlled. A badly infected tree will show a distinct discolouration due to the scale itself and also a lighter colouration of the needles owing to loss of sap. If the scale is not checked, the trees will gradually die. Fortunately this pest can be controlled by spraying with nicotine sulphate or "Black Leaf 40," but this is effective only during a very few days each season when the young are hatching and before they have settled down and formed their protective scale-covering. The young emerge in late June and early July. They are very minute, not much larger than a pin-point, and a very close examination is required to detect them. About three sprayings are necessary, applied at intervals of six or seven days.

Red Spider.—Some of the white spruce have been badly infested with this small insect, which seems to be most difficult to control. Nicotine does not seem to have much effect. Several kinds of miscible oils were tried out, but with these the danger seems to be that when put on strong enough to kill the spider they have a very injurious effect on the tree itself, the cure being worse than the disease.

Larch Sawfly.—This insect is gradually being brought under control. Spraying with arsenate of lead has been carried on systematically for several years, and at the same time there has been a considerable increase in natural parasites. The annual spraying has prevented any serious injury to the plantations.

Seed Collection

Last year (1927) was a good seed-year for ash, and 3,269 pounds were collected in the Qu'Appelle Valley. Maple seed was scarce in most districts, but the Forest Supervisor at Dauphin was able to arrange for the collection of 1,900 pounds.

Of caragana seed 450 pounds were collected on the Indian Head Nursery and about 350 at Sutherland. One hundred and twenty-four bushels of red pine cones were collected on the Sandilands forest and forwarded here for extraction; 62 pounds of clean seed were secured which were returned to the Manitoba Inspection office for use in the national-forest nurseries.

Permanent Plantations

Owing to infestation by the bronze birch borer the infested trees in the following plantations were cut out late last fall:—

SCHEDULE OF PLANTATIONS THINNED IN 1927

No.	Date planted	Species	Area	Spacing	Products
			acres	ft.	Cords
8	1906	White spruce Manitoba maple	1	4 × 4	4·81 cords fuel-wood.
26	1908	Manitoba maple Cottonwood Tamarack Birch Ash	3	.....	4 cords birch.
35	1910	Manitoba maple Birch	.....	4 × 3½	1·31 cords birch.
12	1925	Mixed	.....	.....	
19	1908	Tamarack	2	4 × 3½	4·21 cords fuel-wood.
43	1912	Siberian larch Manitoba maple	2¼	4 × 3½	4¼ cords larch; 6 cords maple.
38	1910	Tamarack Manitoba maple	4	4 × 3½	12 cords fuel-wood

NOTES.—The birch in Plantations 8, 26, 35, and 12 show the following percentage of infection:—In No. 8: 1,149 birch showed 44 per cent infection; No. 26: 1,294 birch showed 34 per cent of infection; No. 35: 17 per cent of the birch infected; No. 12: 5 per cent of the birch infected. The infection was, however, far from uniform; in certain groups of trees every one was infected, but in other parts of the plots only one here and there had to be removed. The cutting will, unfortunately, lessen the value of the plantations as experimental plots.

In Plantation No. 19 some blanks had been caused by alkali brought to the surface through leaks in the water main which furnishes water to the town of Indian Head. A complete tally of the plot was made in December, the diameter of each tree being measured. All suppressed and some co-dominant trees were then cut out, and the height of all these cut trees accurately measured. In addition to the fuel-wood noted above, 102 seven-foot posts over two inches in diameter at the top and 140 good pickets were obtained. The average height of the trees in this plantation was 27 feet, the maximum height 31 feet; average diameter 3·9 inches, maximum diameter 5·6 inches.

Plantation No. 43 is the most promising plantation in the nursery. It has made a splendid growth ever since the start, the trees being uniform and of particularly good form. The maple which was planted as a filler might have been cut back three or four years prior to the date of thinning with advantage to the larch. A complete tally of all the trees in this plot was made, and all suppressed and some co-dominant trees removed in the thinning. In addition to the fuel-wood, 184 seven-foot posts and 59 pickets were obtained. Much of the maple was cut out, making six cords of the fuel. The behaviour of the Siberian larch, an introduced species, is of special interest. The average height of the trees in the plantation was 29 feet, maximum height 37 feet; the average diameter was four inches, maximum diameter 6·5 inches.

Plantation No. 38 was not measured. The maple was thinned because in places it was crowding the tamarack.

Wood-preservative Tests

In the last annual report of this station, an experiment in treating posts of various species was outlined. Two hundred and eighty-eight posts were used. During the past summer 132 additional posts were treated, 65 with creosote and 67 with zinc chloride. These latter are all native aspen and have been used to support the distributing pipes for the overhead watering system. All posts are numbered and will be carefully checked from time to time. Several untreated cedar posts were set at the same time and in similar lines for a comparative test. There are now 420 treated posts under observation. The method of treatment with zinc chloride is the same as that used with creosote. The 65 creosoted posts were immersed for 2½ feet in the hot oil, and the temperature maintained at about 200° Fahrenheit for one hour and the posts left in the tanks to cool from 7 to 14 hours. The posts, averaging 3½ inches top measurement, showed an absorption of oil of from ¼ to 1¾ pounds each.

The zinc chloride was made up to a 5 per cent solution, or 20 pounds chloride to 40 gallons of water. The solution was heated in the same manner as the creosote, but the posts were left in the tanks to cool for 36 hours. The posts absorbed from 1½ to 8 pounds of the 5 per cent solution.

In 1916 several posts of Russian poplar were sent to the Forest Products Laboratory at Montreal for creosoting and were set in the ground in the spring of 1917. A number of untreated posts of the same variety were set at the same time for checks. These posts were all of small size, running from 1½ inches to 2½ inches top measure. The untreated posts all rotted out in the second and third years. The treated posts are still, after ten years in the ground, to all appearances as sound as the day they were set out.

Publicity

Exhibits consisting of models, transparencies, and leaf, wood, and seed specimens were again prepared and shown at the summer fairs in Regina and Saskatoon in connection with the general exhibit prepared by the district staff. These exhibits created a considerable amount of general interest and were very favourably commented on. This exhibit was also used in Winnipeg during February, 1928, in connection with a "soil products exhibition." A number of articles have been prepared for the press. Two talks were given over the radio from

Regina and an address at a very well attended banquet of the Kiwanis Club in Regina. Mr. McLean also gave four or five illustrated lectures in northern Saskatchewan and Alberta.

Visitors

An enormous number of visitors go through our nurseries in the course of a season. As Saskatoon is so close to the Sutherland station, the handling of the large crowds of visitors is at times a serious problem, but is a welcome indication of the great interest taken in the work by the general public.

Fruit-Growing

Much success still attends the experiments with apple and plum growing. In spite of an unfavourable season over 1,000 pounds of standard apples of good size were obtained. Twenty-two varieties fruited well, the best being Blushed Calville, Hibernal, Charlamoff, and Patten's Greening. Hundreds of inquiries have been received this winter from farmers interested in fruit-growing, and it is a great advantage to have the actual results of work and observation at this station on which really practical information and advice can be based.

PLATE No. 14.—VIEW OF THE PLANTED GROUNDS OF A SASKATCHEWAN SCHOOL.
The ornamental planting has been made possible by the belt of trees shown in the background. These trees were planted in 1916, and when the photograph was taken in 1928 were 18 feet high. (F. S. Photo. 20020)

Research

In order to properly take advantage of much of the work already accomplished, special study should be made along certain definite lines. At the present time it is particularly necessary to make a close examination of most of the permanent plantations on the Indian Head nursery. These plantations were set out originally to determine the most suitable varieties, mixtures, rate of growth, etc. About 75 acres are under such plantations. Some have made excellent progress, while others are distinctly poor. Very valuable data could be secured from careful studies carried on at the present time.

FOREST PRODUCTS LABORATORIES OF CANADA

T. A. McElhanney, Superintendent

The year 1927-8 has been the most important one in the history of forest products research in Canada, not because of the volume of research work accomplished, but rather on account of the significance of the reorganization of the work and the successful arrangements which have been consummated by the Minister of the Interior for the adequate accommodation of all branches of the Laboratories' activities.

For many years the Montreal laboratory was seriously handicapped through lack of space in which to carry on effectively the work already established or to make provision for the expansion which development in the forest products industries of the country rendered necessary if the laboratories were to continue to function effectively. During 1926-7 the Pulp and Paper Association of Canada offered to provide accommodation for the Pulp and Paper Division of the Montreal laboratory in a new building which the Association proposed to erect. It was suggested by the Association that this building be designed to accommodate the executive offices of the Association, the Pulp and Paper Division of the Forest Products Laboratories of Canada, and the Department of Cellulose and Industrial Chemistry of McGill University. Such an arrangement was finally effected among the three organizations concerned. The site chosen for the building was that on which the Forest Products Laboratories already had accommodation in a number of old buildings which had outlived their usefulness. It was, therefore, decided to demolish most of these buildings in order to provide a suitable site for the new Cellulose Institute. This necessitated finding new quarters for the main laboratory.

A building well suited to accommodate all the activities of the Montreal laboratory, with the exception of the Pulp and Paper Division, was available in Ottawa, and it was, therefore, decided to move the main laboratory to Ottawa. Arrangements for this building were made in May, 1927, and the transfer to Ottawa effected during June and July. Considerable disorganization of the program of the laboratory consequently ensued, as a great deal of work was involved in transferring and installing experimental equipment and in purchasing new equipment, some of which required several months to construct. With the exception of some of the larger equipment, which had to be built in England, installation was practically complete at the end of the year under review.

The Main Laboratories, Ottawa

Accommodation is provided in the Ottawa laboratories for a timber-testing laboratory, in which is installed one hydraulic universal testing machine, with a capacity of 200,000 pounds, one universal testing machine with a capacity of 30,000 pounds, four universal testing machines of capacities of 10,000, 30,000, and 100,000 pounds, and two impact machines. Besides these, a large hazard drum has been installed for testing boxes and containers. The timber-testing laboratory is also supplied with suitable drying ovens, balances, and other small equipment required in timber testing.

In the wood-preservation laboratory, in addition to a small two-foot treating cylinder and auxiliary equipment which were used in the Montreal laboratory, a large five-foot treating cylinder and working tank, completely equipped, has been installed. The wood-preservation division is also equipped with a chemical laboratory for carrying on the analyses of wood preservatives.

The timber-physics laboratory is well supplied with various small equipment required in the study of wood structure and the physical analysis of wood. It has, besides, a small dry-kiln for experimental work in lumber seasoning, and a log pond for the study of sinkage of logs in fresh water.

The pathological section is fully equipped with a sterilizer, microtome, microscopes, and other small equipment required in the study of the decay of wood. Provision is made for a room for storage of a special reference collection of wood decays and decay cultures.

Accommodation has been arranged for an exhibit room where forest products may be suitably set up for display and educational purposes and greatly improved provision has been made for the technical work of the laboratories.

The library, which has been increasing in size for fifteen years, is now the most complete of its kind in Canada in reference to information pertaining to the utilization of wood. Its value has been further enhanced during the year by the addition of a considerable number of volumes pertaining to the work of the laboratory, and also by the fact that it is now more adequately accommodated than has heretofore been possible.

Protection of Timber from Marine Borers

Each year heavy losses are encountered in timber structures on both the Atlantic and Pacific coasts on account of the attack of marine borers, such as teredo and limnoria, unless the timbers are adequately protected by suitable preservatives. The Department of Public Works is particularly interested in this, in view of the fact that they have to maintain a large number of timber structures on both coasts. At the instance of this department, tests are being carried out to determine the relative efficiency of three preservatives in resisting the attacks of these borers. These preservatives are the following:—

(1) Creosote (Grade 1 of the American Railway Engineering Association specifications); (2) creosote containing 40 per cent naphthaline; and (3) a mixture of copper carbonate and paris green in ammonia.

Jackpine posts have been treated in the laboratory treating plant with these preservatives, and these posts will be suitably exposed to marine-borer attack at Lunenburg and Grand Narrows, N.S., and at Charlottetown, P.E.I., by the Public Works Department, and will be inspected periodically by an officer of the laboratory to determine the relative efficiency of the three different preservatives in resisting the attacks of the borers.

The Creosote Treatment of Hard Maple Ties at Moisture Contents of 35 per Cent and Higher

The railways, particularly in Eastern Canada, use a large number of hardwood as well as softwood ties. One of the most serious objections to the use of hardwood for this purpose is the fact that it is inclined to check seriously in seasoning, with resultant loss of strength, and also loss of resistance to decay. Hardwood ties were submitted to the laboratory by the Canadian National and the Canadian Pacific railways for experimental purposes and treated at different moisture contents with very satisfactory results. A paper summarizing the data so far available was presented at the annual meeting of the American Wood Preservers' Association in Montreal in January, 1928.

Investigation of the Possibilities of Shale Oil as a Wood Preservative

A very considerable portion of the wood preservatives at present used in Canada are imported. Shale oil is one of the natural resources of the Dominion which seems to offer possibilities in the wood-preserving industry. At present the low price of crude oil prevents the development of shale deposits. The cost of creosote is, however, very considerably higher, and, if shale oil can be used in part to replace creosote, it is considered that a market for it might be established. Creosote is so expensive that it is now customary for large consumers

PLATE NO. 15.—THE FOREST PRODUCTS LABORATORIES AT OTTAWA, 1928.

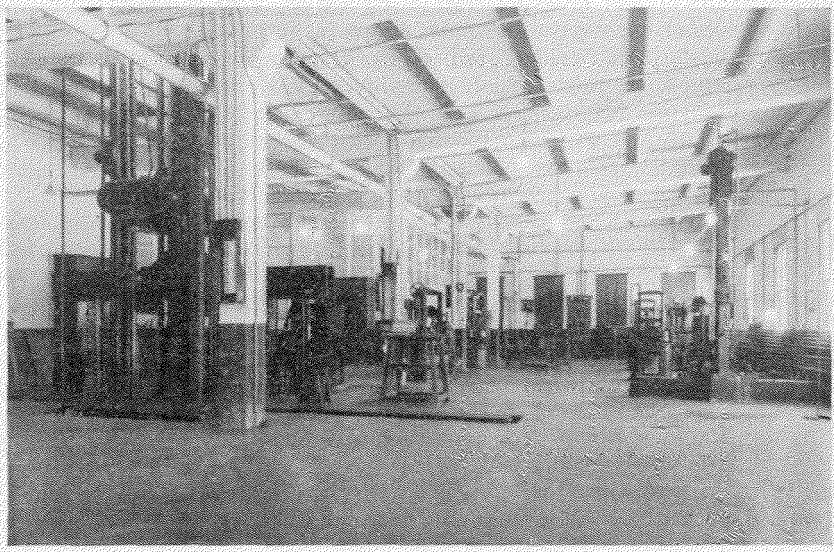

PLATE NO. 16.—WEST END OF TESTING LABORATORY, TIMBER TESTS DIVISION, FOREST PRODUCTS LABORATORIES, OTTAWA.

to dilute it with tar or crude oil. Penetrability of the treating mixture, however, limits the proportion of tar which may be used to about 30 per cent. The percentage of crude oil that can be safely used is more uncertain, common practice ranging from 30 to 70 per cent. There is a certain loss of toxicity when creosote and tar oil are mixed that is greater than the loss calculated from the proportions used.

The possibilities of shale oil as a wood preservative largely depend on the question whether this oil can be mixed with creosote in greater proportion than can either tar or crude oil. Tests are under way to obtain information on this point.

Test Tracks

In 1920, in co-operation with the Canadian Pacific railway, the Laboratories treated some jack pine and hemlock ties and established them in test tracks at St. Clet, P.Q. These were examined during the year. In 1924, in co-operation with the Canadian National railway, a study was instituted on the effect of red stain and red rot on the life of treated and untreated ties. These were placed in the track at Ste. Genevieve, P.Q., in that year, and have been periodically examined since. The examination in the year under review showed that all these ties were still in good condition.

Jack pine is used extensively for railway ties. The effect of red rot and red stain in jack pine is, however, a serious problem in grading ties, and undoubtedly a large number of stained ties which might have given good service have been culled out, because no reliable information existed, establishing the effect of such red stain on the serviceability of the tie. On account of the importance of this problem, a more detailed study has since been initiated so as to embrace more particularly the pathological aspects of the problem.

Determination of the Relation between Rate of Growth and Density of White Spruce

In the field of fundamental research, the investigation of the relation between rate of growth of trees and the inherent quality of the wood is a problem of the greatest importance. As previous investigations at the Laboratories have shown that the density of many woods varies considerably with differences in the widths of the annual rings, the study to determine whether the relation between rate of growth and density is constant or whether geographical location also influences the density of timber will constitute an important step in the progressive study of species variations. White spruce has been selected as the first wood for full investigation, as this species furnishes the greater portion of of the pulpwood cut in Canada, and it is expected that the information obtained regarding it will be immediately applicable to the pulp and paper industry.

Some work has already been done on this project by the Woodlands section of the Pulp and Paper Association of Canada, over a limited range of the species. The work conducted at the laboratory will be on a more extensive and detailed scale. Twenty-eight hundred samples from over four hundred representative trees have been secured.

Sinkage of Logs in Fresh Water

On account of the great distance of logging operations from pulp-mills and sawmills, necessitating sometimes drives of two years or even more, heavy losses are encountered through the sinkage of logs. This is being made the subject of extensive field-study by the Pulp and Paper Association of Canada. There are, however, several aspects of the problem which are not susceptible to field analysis, but require careful laboratory investigation. For this reason, in co-operation with the Pulp and Paper Association, studies on the movement of moisture in wood stored in water are being undertaken. These studies will have in view obtaining data on the following points:

(1) The extent to which the different species absorb water;
(2) The effect of density, bark, knots, inherent characters, decay, insect damage, and mechanical injuries on the absorption of water;
(3) The effect on sinkage of different degrees of seasoning before floating;
(4) The effect of the temperature of the water at the time of the river drive, and several other minor points pertaining to the general problem.

A Study of Wood Structure

For several years, as opportunity offered, an intensive study has been carried on to determine the inherent physical characters of different species of Canadian woods. Much of this fundamental research is based upon microscopic technique. In this connection a set of photomicrographs at a magnification of 15 diameters was prepared from the polished end grain of native Canadian woods. Experience has shown that such photographs representing the appearance of wood magnified with a pocket lens are the type most suitable for inspectors and purchasers of lumber. Suitable work has been done in the preparation from this study of a ready key for distinguishing the various Canadian woods. This work is practically complete, and it is planned to publish the results at an early date.

Studies in the Seasoning of Lumber

In the utilization of wood one of the most difficult technical problems involved is that of seasoning lumber without degrade to such a condition that its use in construction or in the manufacture of articles of wooden equipment does not later occasion trouble through undue shrinkage or expansion. A survey of dry-kiln condition in wood-working factories aroused considerable interest, and has been responsible for many technical inquiries to the Laboratory for information regarding problems involved in the control of temperature, relative humidity, and circulation in dry-kilns. In order to facilitate these studies at the laboratory a small dryer was designed and installed. Some preliminary work has been done with this dryer as a basis for the determination of drying schedules for commercial kilns.

At the same time, studies have been conducted on air-seasoned lumber, with a view to obtaining in particular the variations in moisture content which occur through changes in atmospheric conditions at different periods of the year.

Testing of Small Clear Specimens of Canadian Timbers

A certain amount of work has been done every year since the Forest Products Laboratories were established in working out mechanical and physical properties of all the timbers of Canada along lines which have, to a large extent, been standardized in all forest products laboratories of the world. This work has been carried to such a point that information is now available on nearly all Canadian timbers. A large number of computations, accumulated during the year 1926-27, were analysed for publication purposes. This involved during the year over 95,000 individual computations or determinations.

Nail-Holding Power of Canadian Woods

In all wooden construction work, and especially in the assembly of wooden containers, the question of the nail-holding properties of the different woods is one of considerable importance. During the latter part of the year, after the installation of testing machines had been effected, considerable work was done in determining the nail-holding powers of various hardwoods and softwoods both in the green and the air-dry conditions.

Testing of Wooden Containers

A large proportion of the goods which are shipped in Canada are enclosed in wooden containers, involving the use of a great deal of timber, generally of the lower grades. A wooden box seems a very simple article, but its design for economy and efficiency is of the greatest importance in view of the value of the

content and the heavy losses sustained by transportation companies through breakage in handling. So serious have been these losses, that at the instance of the railways, box manufacturers, and other commercial interests, considerable attention has been focused on the testing of wood for containers, and on the design and methods of nailing and otherwise strengthening these containers. Large revolving drums have been designed, with "hazards" arranged in such a manner as to cause drops between different sections of the drum, which simulate, to a considerable extent, the hazards encountered by a package in transit from point of assembly to destination. The first machine of this kind in Canada has been established at the Forest Products Laboratories. A large number of tests have been carried on for shipping companies and for departments of the Dominion Government. During the current year arrangements have been made for the investigation of some of the fundamental problems involved in the design of wooden containers.

Reference Collection of Pathological Material

It is essential in studying the pathological problems of wood that a reference collection be made of decayed wood and also of sporophore material. Additions to the laboratory collection are being made from time to time as opportunity occurs.

Tests of Toxicity to Fungi of Water-insoluble Substances

In connection with the study of the preservation of woods by different chemicals it is essential that the toxicity of the different chemicals studied to different kinds of decay be reliably established. In order to obtain this information, sawdust made from wood blocks impregnated with the chemical under test was placed in flasks, moistened with distilled water (or in one case 2½ per cent dextrose solution), sterilized under pressure in an autoclave, and inoculated with 1 sq. cm. of a fungus mat taken from a petri-dish culture. Cultures thus set up were allowed to develop from one to two months, and the viability of the fungi was then tested by removing the original inocula to malt-agar slants. Sawdust was also removed from each flask to agar slants in order to determine whether the fungus had spread on the treated wood. The following conclusions were drawn:

(1) Barium carbonate, under the experimental conditions obtaining in the test, was ineffective in preventing growth of the fungi tested, viz: *Trametes pini, Lenzites saepiaria,* and *Fomes annosus.*
(2) *Lenzites saepiaria* was killed by 5 per cent paranitraniline, but its growth was not affected by a 1 per cent or 0·1 per cent concentration.
(3) *Lenzites saepiaria* was not affected by diethylaniline in 5 per cent solution in alcohol.
(4) Cupric ferrocyanide, deposited by treatment with 8 per cent cupric chloride and 9·92 per cent potassium ferrocyanide or stronger concentrations, killed *Fomes annosus.*
(5) Cupric arsenate, deposited by treatment with 4 per cent cupric chloride and 6·64 per cent sodium arsenate, or stronger concentrations, killed *Fomes annosus.*
(6) When wood was treated with 5·9 per cent cupric sulphate and 6·64 per cent sodium arsenate and then leached for one month, the cupric arsenate was ineffective in killing *Fomes annosus, Lenzites saepiaria,* or *Fomes applanatus.* It, however, prevented the spread of the fungi through the sawdust, except in the case of *Fomes annosus* on wood moistened with dextrose solution, and of *Fomes applanatus* on wood moistened with water.

Red Stain in Jack Pine: Its Development in Treated and Untreated Railway Ties Under Service Conditions

Considerable work has already been initiated in this connection from a service standpoint in co-operation with the Canadian National railways. Experience, however, showed that the pathological aspects of the problem should be carefully studied, and for that purpose a more detailed investigation was later started on jack pine ties in co-operation with the Canadian Pacific railway at Delson, P.Q. In the fall of 1926, the first examination was made of these ties. The red-stained ties which were tested for the viability of the staining organisms in 1926 were re-tested in the fall of 1927. From the 415 ties used, 4,184 cultures were set up; of these 6·7 per cent contained *Trametes pini*, 20·4 per cent yielded Fungus No. 2, 27·6 per cent were blank, and 45·4 per cent presented moulds, yeasts, or bacteria. The results indicated that *Trametes pini* is much less viable and Fungus No. 2 somewhat more viable in seasoned than in green ties.

Cultural tests were made on fifty jack pine ties showing white-pocket rot in June, 1927, and again in November, 1927. These showed a reduction in the viability of *Trametes pini*, and an increase in the viability of Fungus No. 2 during the season. Cultures made from freshly cut jack pine showing dark red stain established the constant association of *Trametes pini* with this stage of the rot. Of 387 cultures 88·8 per cent produced *Trametes pini;* 3·3 per cent were blank; 5·4 per cent gave Fungus No. 2, and 3·8 per cent Fungus No. 3. The purity of the cultures, as compared with those from similar samples of water-driven wood, supports the theory that water assists in the penetration of secondary organisms.

White Cedar Telephone Poles

In Eastern Canada white cedar has been the most important timber for telephone and telegraph poles. This species is becoming increasingly difficult to obtain, and as a consequence cedar is being used containing a considerable amount of decay or incipient decay. An examination was made near Lacolle, P.Q., of a number of new cedar poles being put in the line, and also of a number of old poles which were being taken out. As a result of this examination, it was learned that the same types of rot were present in the old as in the new poles. Two types of rot were found to be very common in the cedar examined, a honey-combed to laminated type, and a brown cubical rot. Two wood-destroying fungi common in balsam fir were obtained from the cedar samples studied, namely, *Polyporus balsameus*, or the brown cubical rot, and an unidentified fungus which has been associated with pocket rot in balsam fir. In butt sections of old poles, rot appeared to have advanced very little or not at all while the poles were in service. Much of the ground-line disintegration appeared to be due to the attack of insects.

Technical Service

In addition to the carrying out of systematic investigation along certain definite lines, a great deal of the attention of the Laboratories is devoted to conducting minor investigations resulting from inquiries made of the Laboratories for technical information. In addition, a large number of requests are made involving the review of information bearing on these inquiries which is available as the result of previous investigations in Canadian laboratories or in other forest products laboratories. The number of these inquiries and their nature is a good indication to the Laboratory of the appreciation of its services by the wood-using industries. The release of articles for publication in technical and trade journals or the issuing of bulletins on the results of investigations is always followed by an increased number of inquiries. There has been a very large number of technical inquiries and requests for minor investigations.

Separate reports are submitted herewith of the work carried out in the Vancouver laboratory and in the Pulp and Paper Laboratory, Montreal.

Pulp and Paper Division

E. P. Cameron, Superintendent

New Building

The new building comprises a single-storey portion, specifically designed as an experimental mill, and a three-storey structure housing the executive offices and the chemical and physical research laboratories. Accommodation for pulp-testing laboratories is furnished in the basement of the main building.

The most important undertaking was the design and purchase of equipment for the experimental mill. Arrangements have been made to "modernize" the thirty-inch experimental paper machine in line with present-day practice. This, together with a complete 2-4 ton grinder unit and other added pulp-mill equipment, some of which has been donated by the manufacturers of such equipment, will make the experimental pulp and paper mill installation one of the most modern and efficient of its kind in the world.

Program of Work

Owing to lack of facilities for carrying out experimental and technical research, occasioned by disorganization on account of building operations and consequent dismantling of mill equipment, the work of the Division was largely fundamental in character, dealing essentially with problems relating to the theory of sulphite cooking, the constitution of lignin, etc. These researches are summarized under the heading "Sulphite Studies". Previous investigations on the chemistry of wood, concerning the development of methods of analysis to determine the constitution of wood, were brought to a satisfactory close, and were discontinued in favour of researches as outlined below.

Sulphite Studies

This project was divided into two main classes of research:—

(1) The chemical and physical properties of the "cooking liquor" as used in the sulphite process;

(2) The chemical constitution and properties of the individual constituents of the wood, particularly with reference to lignin, which constitutes approximately twenty-eight per cent of the weight.

Under heading (1) the first step was to investigate the physical properties of the cooking liquor by determining the vapour pressure of an aqueous solution of sulphur dioxide at varying temperatures. The results so far obtained have already proved of value to the industry. Concerning chemical properties of the cooking liquor an elaborate investigation is under way dealing with the ionization of sulphurous acid and bisulphites in solution over the temperature range employed in cooking.

Under heading (2), owing to the complicated nature of lignin chemistry, it was necessary to spend considerable time on the acquisition of necessary fundamental data relative to comparatively simple substances, such as saturated aldehydes, etc. From these researches knowledge was gained leading to a much better understanding of the cause of "burnt cooks", which when thoroughly developed should lead to a prevention of this trouble.

Lignin, thought to be in the unchanged state, has been prepared by extracting spruce meal with ethylene glycol containing a trace of iodine or hydrochloric acid, at a low temperature. Instead of glycol, other derivatives such as glycerol and chlorhydrin may be employed, and from the results of this work it is hoped to arrive at (1) the manner in which reaction between lignin and the cooking liquor occurs, and (2) the properties of the lignin itself and its possible application as a new industrial raw material.

Researches on the constitution of lignin with respect to halogen derivatives are under way, and also a study of lignin as isolated by the action of acidified hypochlorite solution on wood meal. No definite conclusions can be advanced at this juncture, but results so far obtained are very encouraging in affording some evidence as to the constitution of lignin.

The use of furfural in relation to pentose determinations was closely studied and a paper on this subject was prepared.

One of the most important, yet least understood, phenomena is the mechanisms by means of which liquids penetrate fibrous materials. A series of fundamental investigations on the penetration of spruce and pine by various liquids has been commenced, and the results so far achieved provide confirmation of certain aspects of a recent theory on penetration.

Owing to concentrated efforts relative to a study of lignin chemistry, only a limited program of research on cellulose was possible. The properties of ring structures related to cellulose and data relating to the important question of polymerization were obtained, and will be further developed, as this investigation bears closely on problems relating to hydration, fibre strength, and the manufacture of rayon, etc.

Some interesting results were obtained on the action of bisulphite cooking liquor on a variety of pulps and cotton fabrics, which tend to disprove the commonly accepted belief that cellulose is not readily attacked by this reagent.

Pulp Testing

Object.—To develop standard methods of evaluating pulps. The most outstanding development in this field was the revision of existing methods of testing the initial strength of pulp. As a result of the Laboratories' co-operation with Canadian and American pulp-testing committeees, a proposed standard method for the preparation of test sheets to determine the initial strength of pulp was developed. In this connection, it is hoped to hold an International Conference, probably in London, on this all-important problem, during the ensuing year.

A number of miscellaneous investigations were undertaken in co-operation with pulp manufacturers, and in one instance many of the beating problems were largely solved. A minor investigation on the strength properties of sugar-cane waste compared with soda pulp gave encouraging results as to the possible use of this raw material in the pulp industry.

Many requests for strength tests, size tests, fibre analyses, etc., were disposed of during the year.

The service of calibrating standard freeness testers developed by these Laboratories for groundwood-mill control is being maintained. Some seventy of these instruments are now in general use in the industry.

Vancouver Laboratory

R. M. Brown, Superintendent

During the year 1927-8, very substantial growth has taken place in all branches of the laboratory's activities. This is particularly evidenced by the satisfactory increase in the number of inquiries for technical information regarding problems in wood utilization from timber manufacturers and wood-working plants within the district served by this laboratory as well as from other parts of Canada and, particularly, from foreign countries where British Columbia timbers are marketed. The staff of the laboratory has also been in increasing demand for papers and addresses on subjects pertaining to wood utilization.

The following is a brief summary of the work which has been accomplished on problems of major importance:—

Standard Tests for Mechanical and Physical Properties

Tests were continued on green material of western (red) cedar and western white pine and on air-dried material of Douglas fir, amabilis fir, lodgepole pine, and western (red) cedar. One shipment of western white pine from Vancouver Island and one shipment of western larch from southeastern British Columbia were secured. The number of tests under this project was considerably curtailed owing to the large amount of work done on new projects, but over 3,000 tests were completed.

The Effect of Variable Moisture Content on the Strength of Wood

Testing under this project was done in conjunction with the previous project, selected material being taken from each log used for standard test purposes. Nearly 2,000 tests were completed under this project.

Cedar Pole Investigation

Full detailed reports were prepared on the tests made to determine the effect of fire-killing on the strength of western (red) cedar poles. The study was broadened, as noted in the report for last year, to include poles infested by cedar borers, and the reports show (1) the comparative strength of green-cut poles from the Coast and from the interior of the province, (2) the influence of fire-killing on the strength of poles left standing on the stump for varying periods of time, and (3) the effect of the red cedar borer on the strength of poles. The results of these tests have been received with keen interest both in Canada and the United States, and it is anticipated that the publication of the report on the influence of fire-killing on the strength of red cedar poles will materially increase the market for material of this class.

Deterioration of Cottonwood Logs in Fresh-water Storage

This study was initiated early in the year in an effort to discover the extent of reduction in strength and other properties of black cottonwood veneer logs when held in fresh water for periods up to one year. Companion bolts were chosen for a parallel study of the influence of air seasoning on the same properties over the same period of time. This study is now nearing completion, and detailed reports are in course of preparation. Nearly 3,000 tests have been made for this investigation. Pathological examination was carried out on the test pieces coincident with the mechanical testing, involving the preparation of 1,800 cultures.

The Retention of Nails and Screws by Wood

Testing under these new projects was begun early in the year after numerous requests for the nail-holding power of western woods had made it evident that such information, at present incomplete or unavailable, was greatly needed. Special apparatus was designed in the laboratory. The first tests were made in response to a special request for the comparative holding power of Douglas fir, western hemlock, and some Eastern hardwoods. The projects were then extended to include all British Columbia species, material being taken from each shipment so that a fair average for each species will be assured. Nearly 3,500 tests have been made under these projects.

Miscellaneous Tests on Wood

Special tests on wood products of many kinds constitute a steadily increasing part of the laboratory service, and more business firms are availing themselves of the opportunity to secure data on the strength and other properties of their products. This service shows an increase of over 40 per cent over the past year, 650 tests being carried out.

Experimental Dry-kiln

The value of the experimental work in kiln-drying has been demonstrated repeatedly during the year through the application of results obtained in the experimental kiln to commercial plants, where large savings have already been noted. The work of this division in seasoning methods has resulted in a greater appreciation of the value of proper kiln-drying and a consequent improvement in drying practice. As experimental work continues and better equipment and drying practice are obtained in the mills, an annual saving (due directly to improved drying methods) of thousands of dollars per year to the lumber industry may confidently be expected. During the year 50,000 board feet of material was kiln-dried in the laboratory dry-kiln, chiefly of Douglas fir in select and common grades, both thin wide and thick wide stock being run. This material was loaned by lumber mills to the laboratory for experimental purposes. The addition of a "ten-minute tester" for the rapid drying of moisture discs has greatly facilitated the service of this division to commercial plants, since a report on moisture condition may now be given in a very short time. Nearly 700 moisture determinations were made in connection with this project.

Visits were paid to many local plants to inspect new installations and to suggest means of improving drying practice. A trip was made to selected mills and wood-working plants throughout Washington and Oregon to study the latest seasoning methods and equipment and also improvements in manufacture.

Air-seasoning Studies

The study of stock in selected piles at local mills which co-operated in this work was completed early in the year. The project was then temporarily discontinued, but the information gathered indicates that a great deal of work may still be advisable in order to compare the economic value of kiln-drying and air-seasoning, the losses occurring through faulty piling of air-seasoned stock, the rate of drying and absorption, etc.

Absorption of Moisture in Kiln-dried Stock

Studies were completed on the rate of absorption of moisture by selected kiln-dried boards of various species placed in open piles, to determine the best seasoning and handling methods, in order to reduce shrinkage and expansion of lumber in use as far as possible. Similar tests on the rate of absorption in kiln-dried lumber when bunk-piled in an open shed were begun in December, 1927. These tests will be completed early in the new year and a detailed report on the project is in course of preparation. The results indicate clearly the necessity of more careful handling, piling and storage methods, particularly during the season of high humidity and low temperatures, in order to ensure satisfactory results when the lumber is placed in service. This project required the taking of 2,750 weights and nearly 200 moisture determinations during the year.

Timber Decay

Preliminary investigations into the pathological conditions in sawmills, lumber yards, and storage sheds indicate the need for a close study of these conditions in an effort to find the best way of bringing about needed improvements. Plans are under way to start this work during the coming year.

Mill Waste

Plans have been laid to make a systematic survey of the problem of mill waste with the object of suggesting improvements in milling practice.

Technical Information

The answering of requests for technical information relating to the properties and uses of British Columbia species, particularly with regard to new uses, new markets, or new industries looking to the closer utilization of raw material, forms a very important part of the work of the laboratory. The rapid increase in the number of such requests is very satisfactory, and indicates the importance of the laboratory in the timber industry of the province. During the year some three hundred and fifty such requests, many coming from foreign countries, were answered.

Publications

A final revision of the proposed bulletin "Natural Defects in British Columbia Softwoods" was completed. A report on the "Rate of Absorption and Change in Shipping Weight of Kiln-dried Shingles" was mimeographed and circulated to interested shingle companies. Several articles dealing with the work of the laboratory were published in the local lumber journals.

Educational

During January, 1928, two six-day courses in kiln-drying were held at the laboratory, when kiln operators, selected through the co-operation of the British Columbia Lumber and Shingle Manufacturers' Association, were given instruction in all details of lumber seasoning. Test charges were dried in the laboratory dry-kiln and used to demonstrate the information given in the lectures. It had been planned to hold only one six-day course, but the demand for the course was so great that the second course was made imperative. Twenty-six lumber-mill and box-factory operators, and six University students, availed themselves of the privilege of attending. A keen interest was shown in the work, and, as a result, the kiln operators have formed a small club, holding regular meetings for the discussion of the problems arising from kiln operation. A marked improvement in kiln operation has been noted at plants in charge of men who took this course. Mimeographed copies of the lectures and of drying schedules obtained from test runs have been made available to interested mills and factories.

Exhibition Service

In co-operation with provincial and national organizations exhibits were prepared for the Vancouver and New Westminster Exhibitions. These displays showed a few of the many uses of timber and some of the stages of manufacture of materials such as paper products, rayon silk, distillants, etc.

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.* For publications available in French, see below.)

Annual Report of the Director of Forestry, 1917-18-19-21-22-23-24-25-26-27-28.

BULLETIN 1 Tree-Planting on the Prairies.
" 49 Treated Wood-block Paving. (Price, 10 cents, post-free. Apply King's Printer)
" 51 Game Preservation in the Rocky Mountains Forest Reserve.
" 53 Timber Conditions in the Smoky River Valley and Grande Prairie Country.
" 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)
" 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)
" 77 Statistical Methods in Forest-investigative Work. (Price, 25 cents, post-free. Apply King's Printer)
" 78 Some Commercial Softwoods of British Columbia. (Price, 25 cents, post-free. Apply King's Printer)
" 79 Taper as a Factor in the Measurement of Standing Timber. (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.
" 18 The Kiln-drying of British Columbia Softwoods.*
" 20 List of Form-class and Miscellaneous Volume Tables.
" 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.

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.*

*This publication may also be obtained in French.

Forest Facts.*

Stories and Plays for Children—

Talking Trees.

Betty in Dreamland.

The Woodland Fairy.*

The Trees of the Lord.

Forestry Lessons. (Price 25 cents. Apply King's Printer.)

Bow River National Forest. Descriptive pamphlet with map.

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, $1.00, post-free. Apply King's Printer)

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

Forest Research Manual. (Price, $1.00, post-free. Apply King's Printer)

The Tree-planting Division: Its History and Work.

The Forests of Canada.

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.

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*This publication may also be obtained in French.

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.