FOREST FIRE PROTECTION IN CANADA

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IN view of the prominent place held by Canada in the world's timber export trade and her world leadership in the export of newsprint paper, as well as the leading part taken by the forest industry in her internal trade (where it ranks second only to agriculture), it is but natural that in the deliberations of each British Empire Forestry Conference the protection of Canada's forests from fire has been a subject of considerable discussion. No doubt there are many present who attended the British Empire Forestry Conference of 1923 who will recall their extensive journeys in Canada that year which enabled them to observe for themselves, at first hand, the havoc wrought by forest fires, and at the same time to recognize the need for controlling them. They also realized, as all foresters in Canada do, that the forest fire problem is the chief obstacle to the practice of forestry in Canada.

SUMMARY OF 1923 CONFERENCE REPORT ON FOREST PROTECTION

Since the recommendations contained in the report of that committee were in a large measure responsible for the trend and development of fire protection in this country since that date, it is essential at this stage to review briefly the salient points of that report.

After stressing the general importance of forest protection the report emphasized the following points:—

- (1) That permanent dedication of absolute forest lands is necessary in order that protection plans may be built upon stabilized conditions;
- (2) That a definite forest policy of direction of settlement in forest regions on a community basis should be followed, in preference to permitting indiscriminate locations;
- (3) That Fire Prevention offers the only means of enlisting the whole-hearted support and co-operation of the general public, without which the solution of the fire problem is not possible; and that educational work on fire prevention in the schools and general publicity extensive enough to teach all classes of the population should be undertaken;

(4) That the proper disposal of slash in one form or another is quite feasible in all parts of Canada, excepting, possibly, the Pacific Coast, where its utility had not been finally determined; and that a conference of the provincial ministers of the Crown responsible for forest administration with their chief foresters and federal representatives, meeting together with representatives from the forest industries, should be held with the idea that such a meeting might lay down a fixed course of action regarding slash disposal.

Dealing with "Fire Control" the report enlarged on the need for unification of authority in the organization responsible for fire protection, recommended the adoption of burning-permit requirements, and suggested that fire-report forms be standardized in order that statistical data may be intelligently compiled.

The use of aircraft in forest protection (in its infancy in 1923) was commented on, and governments were urged to grant special assistance in order that further use might be made of them.

The report concluded with the statement that conditions in Canada and in certain other parts of the Empire with regard to forest fire protection were unsatisfactory, but hopeful signs existed, and that, given public and governmental support, the forest authorities could handle the situation which confronted them.

SUMMARY OF PROGRESS, 1923-1928

In the five years which followed the 1923 Conference, substantial improvements took place in the various phases of forest protection in this country. The fire season of 1923 was one of the most disastrous on record, from the standpoint of fire losses. This fact, combined with the prestige given our forestry problems by the Conference itself, accounted in a large measure for the progress which resulted. The most notable advance observed was in the field of fire prevention.

Beginning in the late winter of 1922-3, by Royal Proclamation, the first "Save-the-Forest Week" was established in April of that year. These short-term high-pressure campaigns with definite objectives appealed to the press of the country, which gave them enthusiastic support, and provided the element of news value.

In 1926, the "Save-the-Forest Week" campaign (which had its inception in the United States in 1920) was expanded and attained an international character by the combining of the United States and Canadian forest weeks, the dates of the campaigns being synchronized.

The most interesting feature of the 1928 campaign was the exchange of speakers by the two countries. The addresses delivered by outstanding public

men naturally possessed high news value and came in for wide publicity in both countries. These campaigns, while they employed radio, posters, the co-operation of schools, and other features, stressed the importance of newspaper publicity. The goodwill of the press was the more easily secured by the fact that substantial funds were provided for advertising. The expenditure for this item alone in 1928 exceeded \$27,000.

In addition to the periodic "Save-the-Forest Week" campaigns, steady and consistent propaganda was carried on throughout the entire year. This took the form of exhibits, with distribution of forestry literature, at industrial and agricultural fairs, public lectures, motion pictures, and pamphlets designed to enlist the support of the younger generation.

In the province of Manitoba, through a co-operative arrangement between educational authorities of that province and the Dominion forest service, lecture courses were included as part of the regular training of students in one of the normal schools, and students were required to pass a regular examination in the subject of forestry. As a result one hundred and seventy-five school teachers in Manitoba were equipped with a teaching knowledge of forestry.

An eventful meeting which gave impetus to the "forest-week" campaigns and paved the way for better forest protection in Canada was the "Forest Fire Conference of 1924." Convoked by the then Minister of the Interior, who acted as chairman, it sat for five successive days, and held nine full sessions in addition to many meetings of committees. Thirty-four authorized delegates attended this gathering which included Ministers of the Crown of all the provinces administering their own natural resources, the chief foresters of those provinces, and many federal government officials. This gathering was the direct outcome of the suggestion contained in the report of the committee on fire protection of the second British Empire Forestry Conference. Representatives of the forest industries were not included, since it was felt that the several forest authorities in Canada should first have an opportunity of correlating their views and agreeing in matters of general policy before approaching the industries. The discussions were informal but frank expositions of the fire problem as it affected the various provinces individually and the Dominion as a whole. The deliberations of the Conference focused attention on the report of the fire-protection committee of the second British Empire Forestry Conference and the suggestions contained therein already enumerated. These formed the basis of the resolutions adopted, and defined a common line of action by the forest authorities of Canada for the improvement of the fire situation.

The ensuing years saw many of these resolutions carried out in full or in part. Some of the more involved, however, including direction of settle-

ment, uniform slash disposal, and land classification, are by their very nature problems requiring many years for satisfactory solution.

The Conference had the effect of bringing together for the first time the various authorities charged with forest protection, and the personal contacts gained were successful in promoting a better understanding, a clearer conception of the problems and difficulties facing the various government authorities, and a thorough appreciation of the need for concerted action by all concerned.

Summing up the progress of fire protection for the period of 1923-28 inclusive, one may say that in 1923 the forest fire situation in Canada was unsatisfactory. By 1928 the situation was greatly improved, owing largely to the fact that six years of fairly intensive propaganda and publicity on forest protection had roused public opinion to the need for action to save the forest from destruction. This appreciation on the part of the general public and governments reacted to the benefit of forest-protection organizations, and was reflected in the increased funds provided for that purpose. Fire-fighting technique progressed correspondingly with additional and improved equipment, and added facilities in the form of general improvements in transport.

Throughout the five years following 1923 weather conditions were favourable to the protection forces, particularly in the years 1927 and 1928, so that at the latter date the outlook for the future was bright.

PROGRESS FROM 1929 to 1935

The period from 1929 to 1934 inclusive will long be remembered as the most difficult ever experienced in the history of organized fire protection, and in reviewing the progress of protection in that time a brief reference is necessary to two factors which influenced the developments of that period, namely unusual climatic conditions and the world-wide depression.

Beginning in 1929, there followed for the next five years a period of unprecedented drought, during which over large areas there was a continuous lack of both winter and summer precipitation. This situation was further aggravated by extreme temperatures and high winds during the fire season from May to October. The Dominion suffered as a whole, but fortunately periods of extreme hazards were not prevalent over all parts of Canada in the same year, but shifted from east to west or vice versa. Needless to say, these dry years resulted in a general lowering of the water table and several wet years will be required to restore and replenish thousands of sloughs, small lakes, and streams which have since disappeared. Coincident with these abnormally dry years was a corresponding increase of the forest-fire hazard, beginning in 1929, a season of unusual severity in western Canada. In 1930, the number of fires increased, and heavy losses were registered in both the eastern and

the western sections. During these years the prevailing weather conditions were conducive to lightning fires, and a record number was attributed to this cause. In 1931, some improvement was noted in Eastern Canada, but heavy losses occurred in the extreme West. This order was reversed in 1932, when conditions remained normal in the west, with heavy losses in Central and Eastern Canada. An interesting feature of this year was the record number of fires attributed to incendiarism, occurring as they did in the low point of depression. The years 1933 and 1934, on the whole, showed a general improvement over previous years, except in the Maritime Provinces. Here weather conditions were extreme, and fires and fire losses attained record proportions for New Brunswick and Nova Scotia.

Following closely behind the critical dry years came the world-wide depression, bringing with it economic conditions without parallel in modern times. In spite of the handicap imposed by both physical and financial conditions, due credit must be given to the protection staffs, working with facilities that were barely sufficient for attaining the measure of control obtained. New and hard lessons were learned in the field of fire-fighting, and in this respect, if in no other, it can be said progress was made in protection during the period under consideration.

CHANGE OF FOREST AUTHORITY, 1930

From the time of its inception—about 1900—until 1930, one of the most important activities of the Dominion Forest Service consisted in the protection and administration of the forest lands in the provinces of Manitoba, Saskatchewan and Alberta, and the Railway Belt and Peace River Block of British Columbia. However, late in 1930 the natural resources of these four western provinces were transferred from Dominion to provincial control.

In each of the first three provinces mentioned a new provincial forest service was set up and for the most part these provinces absorbed the existing Dominion Forest Service staff into their new organizations. In British Columbia the case was somewhat different, since that province had organized its own Forest Service in 1912, so that the transfer simply meant an increase of about 18 per cent in their patrol area consequent upon the absorption of the Railway Belt and the Peace River Block.

The situation with regard to forest authority in Canada since 1930 is that each of the nine provinces (excepting only Prince Edward Island, which has no forest lands) has its own provincial forest service. It follows that the administration and protection of forests is now practically entirely a provincial function. Of the Crown lands remaining under Dominion jurisdiction, the Department of Indian Affairs administers the forests on the Indian reserves,

and three branches of the Department of the Interior administer, respectively, the National Parks, the Northwest Territories and Yukon Territory, and the Dominion Forest Experiment Stations.

AIRCRAFT

The first experiments with aircraft for forestry purposes in Canada took place in 1919, when obsolete war machines were employed. These experiments were made possible by the co-operation of the Forest Service, Department of the Interior, and the Royal Canadian Air Force, Department of National Defence. By 1928 this co-operative arrangement was much expanded and a high stage of development had been reached. Some 24 aircraft were employed in the three western provinces of Manitoba, Saskatchewan, and Alberta, where they were found to have a definite and useful place in forest protection.

Many improvements both in performance and method of employment took place, including a specially designed light aircraft for detection and larger, more powerful machines for transporting fire crews. The peak of performance was reached in 1930, when a transportation machine made its appearance which for the first time solved the problem of carrying an effective fire crew to a fire in one trip.

The co-operative efforts of the Dominion Forest Service and the Royal Canadian Air Force came to an end with the transfer of resources late in 1930, when the Royal Canadian Air Force was withdrawn from the forestry field in the three prairie provinces.

FOREST-FIRE RESEARCH

The forest fire-hazard research initiated by the Federal Service in 1926 at its Petawawa Forest Experiment Station has achieved a marked degree of success. This scientific approach to "fire prevention" consists of the study and investigation of the influence of weather factors upon the inflammability of the materials composing the forest floor, in which fires start and spread. The moisture content of these forest fuels depends entirely on the weather. By observing relationships which exists between the moisture content of these materials and the various weather factors, tables have been developed for computing an index or measure of forest inflammability. It is now possible by the aid of these tables, and a daily record of rainfall, rate of evaporation, and relative humidity of the air, to compute each day the index of inflammability which exists in any type of forest for which the necessary data have been collected. This index of inflammability can be shown in graphical form and is then termed a fire-hazard chart. Investigations have been completed in the

pine types—i.e., red, white, and jack pine and their various mixtures—and extended to the mixed hardwood and open grassy subtypes at the Petawawa Forest Experiment Station.

As a result of many tests, zones of inflammability have been established covering the fuel-moisture contents of these types. These zones are designated as Nil, Low, Moderate, High, and Extreme.

The object of the study is to provide, ultimately, a fire-weather forecast which will enable those charged with fire protection to make their plans in advance for the detail of forest employees so that they may be strategically located in accordance with the degree of inflammability which exists in the forest, to regulate the issuance or cancellation of travel permits and burning permits to regulate frequency of forest patrols, and to know when lookout-tower men may be relieved of duty. The use of this knowledge, which is a scientific measure of fire-hazard, is designed to preclude guess-work in forest management. This method has been in practical field use for the past six years in a number of localities in Eastern Canada with considerable success. Tests of this system have indicated an accuracy of from 96 to 99 per cent in determining the probability of occurrence and behaviour of forest fires. A further improvement in technique has taken place in the past two years with the

TABLE I.—FOREST FIRE LOSSES

Year	Total No. fires	Total area burned	Merchant- able timber area	Amount of merchantable timber		Estimated stumpage value	Young growth area
				M ft. B.M.	Cords	\$	Acres
1925.....	5,490	1,913,066	300,015	995,896	742,893	4,826,565	499,988
1926.....	5,690	1,824,015	575,732	649,253	3,396,720	4,208,456	525,796
1927.....	3,605	471,878	114,708	73,160	1,397,241	831,492	137,124
1928.....	4,261	1,345,371	217,451	48,617	631,885	417,883	374,155
1929.....	6,685	6,029,665	663,574	508,715	2,005,386	2,379,582	1,092,442
5-year average							
1925-1929.....	5,146	2,316,799	374,296	455,128	1,634,825	2,532,796	525,901
1930.....	6,805	2,670,249	746,129	663,315	1,988,109	4,452,390	577,982
1931.....	6,954	2,093,869	394,818	230,347	1,104,049	1,715,182	590,227
1932.....	6,295	2,463,608	708,085	549,872	2,619,453	5,056,983	586,141
1933.....	6,298	1,008,557	204,405	255,383	650,317	1,199,305	220,620
1934.....	5,911	1,475,117	321,414	900,002	863,554	1,756,701	242,101
5-year average							
1930-1934.....	6,453	1,942,280	474,970	519,784	1,445,096	2,836,112	443,414
Grand Total							
1925-1934.....	57,094	21,295,395	4,246,331	4,874,560	15,399,607	26,844,539	4,846,576
10-year average							
1925-1934.....	5,709	2,129,539	424,633	487,455	1,539,961	2,684,454	484,658

development of a slide-rule, by means of which the daily hazard may be obtained in a few minutes.

The work is being vigorously prosecuted, and studies have been extended this year (1935) to the pulpwood forests of Quebec. It is ultimately hoped to cover the main climatic and forest types in Canada.

FOREST FIRES

One of the recommendations of the Committee on Fire Protection of the second British Empire Forestry Conference (Canada 1923) suggested that fire-report forms should be standardized in order that statistical data might be intelligently compiled. This suggestion has been carried out to a very large extent. The 1924 forest-fire conference agreed that action in this direction should be taken, and the Dominion Forest Service was delegated to act as a clearing-house through which standardized information should be collected and disseminated.

This information is now submitted to the Federal Service each year by the various provinces and protective organizations in Canada. From the data so secured Table I, showing the forest-fire losses in Canada for the past ten-year period (1925 to 1934 inclusive), has been compiled:—

IN CANADA, 1925-1934, INCLUSIVE

Value of young growth	Cut-over area burned	Value timber and Y.G. lost in cut-over	Value of other property	Non-forested area	Cost of actual fire-fighting	Total loss including fire-fighting
\$	Acres	\$	\$	Acres	\$	\$
1,118,700	201,000	97,000	701,624	912,063	860,415	7,604,304
1,244,266	240,507	181,000	967,335	481,980	866,286	7,467,343
193,481	35,875	36,449	91,670	184,171	242,963	1,396,055
508,419	59,631	49,995	147,288	694,134	205,365	1,328,950
2,004,759	720,910	285,569	310,499	3,552,739	1,239,345	6,219,754
1,013,925	251,585	130,003	443,683	1,165,017	682,875	4,803,281
1,456,134	427,286	275,579	506,777	918,852	1,135,907	7,826,787
1,217,538	535,406	220,366	363,516	573,418	931,518	4,448,120
1,209,063	772,625	615,605	264,769	396,757	683,650	7,830,070
454,648	331,614	187,303	162,075	251,918	509,939	2,513,270
573,469	562,446	246,031	149,923	349,156	827,451	3,553,575
928,170	525,875	308,975	289,412	498,020	817,693	5,234,364
9,980,477	3,887,300	2,194,897	3,665,476	8,315,188	7,502,839	50,188,228
998,048	388,730	219,489	366,548	831,519	750,284	5,018,823

These figures do not include the regular charges for operating the forest protection services, they do not include the losses entailed in the partial or total cessation of forest industry in the districts where losses were suffered, nor do they include the inevitable potential loss in wages and production values occasioned by these fires.

From Table I it will be observed that, beginning in 1929, four successive seasons of unusual severity occurred, notable for the increasing number of fires reported. As previously explained, in these years the prevailing weather conditions were extreme, because of lack of winter and spring precipitation. As a result, fires, once started, spread rapidly, covering large areas and making control measures both difficult and costly. The worst season since 1923 occurred in the year 1932 (the low point of the world depression), at which time protection staffs functioned at minimum strengths, and only expenditures for actual fire-fighting increased.

In considering the causes underlying forest destruction by fire there are two classes of risk to which Canada's forests are subjected, namely, natural risk and artificial risk. The former comprises chiefly lightning, while the latter refers to conditions created by human agencies, which constitute the main source of fires, as the following statement will show:—

TABLE II—STATEMENT OF FIRES BY CAUSES FOR 10-YEAR PERIOD 1925-1934, IN CANADA

Cause	Year										Total	Per cent	Average annual number of fires by causes, 1925-1934
	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934			
Camp-fires.....	944	999	669	814	1,332	1,256	1,540	1,302	1,202	1,111	11,169	19	1,117
Settlers.....	692	763	532	728	769	966	1,095	1,385	1,265	946	9,141	16	914
Lightning.....	978	823	716	485	1,167	1,482	880	651	940	957	9,079	15	908
Smokers.....	531	513	369	500	856	762	937	809	893	971	7,141	12	714
Railways.....	711	1,129	574	752	1,011	731	624	254	312	255	6,453	12	645
Unknown.....	714	729	337	320	637	553	607	641	725	655	5,918	10	592
Incendiary.....	204	167	95	230	387	521	673	746	511	349	3,883	7	388
Miscellaneous known.....	431	260	130	227	240	276	367	243	300	365	2,839	5	284
Industrial operations.....	257	247	129	170	206	160	134	91	139	198	1,731	3	173
Public works.....	28	60	54	35	80	98	97	73	11	104	640	1	64
Total.....	5,490	5,690	3,605	4,261	6,685	6,805	6,954	6,295	6,298	5,911	57,994	100	5,799

From Table II it will be observed that 15 per cent of all forest fires starting in the past ten years were due to lightning or other natural causes; the remainder (85 per cent) are attributed to human carelessness. The control of man-caused fires is possible, but the extent to which success may be

attained will depend firstly upon the funds provided for the organization and equipment of efficient protection services, and secondly, and most important of all, upon the co-operation of the forest users.

Any relaxation of effort, due to decrease in funds or staff, may mean that the result of many years of relatively successful protection operations may be wiped out in a single season of serious fire-hazard. Furthermore, the final cost of suppressing forest fires is much greater if they are permitted to attain large size before organized effort for suppression is exerted. True economy in times of depression, as in times of prosperity, is secured when every person entering the forest on business or pleasure takes the necessary precautions against the starting and spread of fires.

Fire prevention, which means most of all the elimination of carelessness by the forest users, is the most effective means of reduction, both of fire losses and of costs of fire protection.

CONCLUSION

A review of the six-year period 1929 to 1934 shows that some progress has been made in fire protection in Canada. During 1929 and 1930 the various protection services were not handicapped by the financial restrictions which later ensued. In fact, the year 1930 reached a high point in the development of fire-protection organization in this country, witnessing an extension of forest improvements and additions of staff and equipment to areas formerly lacking these facilities of organized protection. From 1931 on, these gains were turned into losses. The economic depression brought in its wake curtailed expenditures and reduction in protection staffs below minimum requirements for normal fire years. All this occurred in years of critical fire danger. Such advances as were noted in the period under consideration were confined entirely to organization for the detection and suppression of fires starting. The most important phase of fire protection, namely, forest fire prevention was largely neglected. In these circumstances the forest authorities view with concern the fire situation in Canada as it exists to-day.