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TO early settlers the forest was a nuisance to be got rid of as quickly and completely as possible. It obstructed travel, hid enemies, and halted ploughing.

Today the forests are among the greatest assets of the people of Canada. So valued are they that departments in the Dominion and Provincial Governments are charged with their conservation, and many efforts are being directed toward management so as to ensure a sustained yield over the years.

The figures of Canada's forest resources stagger the imagination. Only two other countries, Russia and Brazil, have greater forested areas. Canada's total is about 1¼ million square miles. The productive area, 770,000 square miles, is about equal to the combined areas of the British Isles, France, Spain, Portugal, the Netherlands, Denmark and Sweden. Compared with the 35 per cent of land area occupied by forest, Canada has only 16 per cent of present or potential value for agriculture.

Not all this vast forest is suitable for commercial operations, either because it is too difficult and expensive to reach, or because the trees are not of suitable size and quality. The accessible portion of the forest covers 430,000 square miles, or 275,000,000 acres. Behind that is a reserve of 340,000 square miles classed as productive but forced to await improvement in transportation systems. It is estimated that less than 200,000 square miles of land now under forest would be suitable for agriculture, but on the other hand some land presently used in farming would be better under forest.

Climate, topography and soil determine the location and nature of the forests. The Maritimes, Quebec and Ontario have 80 per cent of the total accessible timber; the Prairie Provinces 11 per cent, and British Columbia 9 per cent. When only wood suitable for the manufacture of sawn lumber is considered, 44 per cent. is in British Columbia, 50 per cent in the Eastern Provinces, and 6 per cent in the Prairies.

The three primary forest industries are: operations in the woods, the lumber industry, and the manufacture of pulp and paper. Upon these depend many very important secondary industries which use partially manufactured wood or paper as their raw materials. It is virtually impossible, because of the ramifications of these wood-using industries, to arrive at a figure which would accurately describe the money value of the country's forest resources, but here is one tabulation covering the last pre-war year:

Industry	Establishments	Capital Invested	Number of Employees	Value of Products
Wood operations.	—	$198 million	98,000*	$158 million
Lumber.....	3,941	86 million	32,399	100 million
Pulp and paper..	100	598 million	31,016	208 million

* (Man-year basis, distributed over nearly 300,000 persons).

Perhaps the most striking evidence of the importance of forest industries is seen in the part they play in external trade. In 1942 "Wood, Wood Products, and Paper" provided a larger favourable balance in our commodity trade account than any other group of products. Of Canada's total favourable balance of trade in that year, the wood group of products accounted for $352 million.

Pulp and Paper

Canada manufactures about 35 per cent of the world's supply of newsprint, and exports more than all other countries combined. The pulp and paper industry has headed the lists in net value of production since 1920, and in wage and salary distribution since 1922, replacing the sawmills in both cases. It was first in gross value of production from 1925 until 1935. In 1939 the industry occupied first place among all manufacturing industries in Canada in amount of capital employed and amount of salaries and wages paid. In numbers of employees and gross value of products it stood second to the sawmilling industry and the base metal smelting and refining industry. Final comparisons for 1941 are not yet available, but it is known that in that year the industry exceeded all previous levels in both volume and value of production, responding to war demands, and in 1941 the exports were twice as much as in 1939, while employment reached a new peak at 160,000. Preliminary reports for 1942 told of still higher records in gross value of products, amount spent on materials and supplies, persons employed, wages paid, and fuel consumed. In 1942 Canada's newsprint production was more than three times that of the United States, which was a few years ago the world's chief producer.

Through the processes of foreign trade many thousands of tons of pulp and paper shipped across the southern border reappeared in Canada in the form

of training aircraft, guns, tanks and other war supplies which could not at that time be manufactured here.

Lumber

Manufacture of sawn lumber is the second most important industry depending on the forest for its raw materials. Immediately after the outbreak of war the number of mills for processing of wood jumped 700 to 4,675, and employment amounted to 40,000 man-years on a capital investment of $92 million, with salaries and wages of $34 million, and net production amounting to $62 million. Then, in 1941, the production of sawn lumber reached a new high peak. The value was $129 million, using 45,000 man-years with a payroll of $41½ million. The season during which the payroll is distributed is even more important than the amount. In British Columbia the operations are fairly constant throughout the year, but east of the Rockies work in the woods is offered at a time of year when employment in other industries is at the lowest ebb. The steadying effect of this industry on the employment situation, and the fact that it provides a source of income to farmers during the winter months are significant factors in our economy.

At the outbreak of war the lumber industry was experiencing a period of reasonable activity. Overnight, following the "blitz" on Norway, Canada became the principal, almost the sole, source of supply for Great Britain. Concurrently with the overseas peak requirements, the demand in Canada for construction of establishments for the armed services taxed the construction industry and the suppliers of material. More than 5,000 buildings were erected in 1940 alone, using 430 million board feet of lumber besides shingles, flooring and millwork.

Woodlots

If comment hitherto has been confined to the more spectacular contributions of the three big industries — logging, sawing and pulp and paper — this is not at all to disparage the woodlot. One-third of all the wood cut in Canada in a year comes from farm woodlots, most of it for fuel, but some for pulp. The lumber industry has usually moved out ahead of agriculture, except on the Prairies, but now the farmer is finding it advisable to restore a portion of his holding to the raising of timber. In fact, the woodlot is an inseparable part of the progressive farm. One Ontario farm has a five-acre woodlot, which has supplied 4½ cords of 128 cubic feet a year for thirty years, at a value of more than $5.50 per cord under average circumstances.

Classes of Forest

There are three divisions of vegetation: the grassland, the forest and the tundra. At its discovery, Canada was one dense continuous forest from the Atlantic to Lake Winnipeg, and north of the Prairies to the Rocky Mountains, while the west coast forests stretched south and west to the sea. Today's sub-Arctic forest stretches across the continent from Labrador to the Rockies, with a width ranging from 200 to 300 miles. Scrub pine, black and white spruce, tamarack and poplar are its characteristic trees, and are the last to disappear on the barren grounds at the north. South of the sub-Arctic belt appear the forests characteristic of the different provinces. British Columbia has a forest growth peculiarly its own. In the coastal region the Douglas fir attains a height of 300 feet and a diameter of from 10 to 12 feet, and the western cedar grows even larger. Ninety-four per cent of the Rocky Mountain forest is made up of five species, Engelmann's and white spruce, black pine, Douglas and balsam fir. East of the mountains is the belt of poplar forest running from Edmonton to Winnipeg, a distance of 900 miles with a breadth of 50 miles. In northern Ontario and Quebec the characteristic trees are maple, birch, beech, elm, ash, oak, hickory, pine, cedar, spruce and hemlock. In southern Ontario the predominant trees are the oak, hickory, chestnut, butterwood and tulip. In the Maritimes the same trees as in Quebec are found, but on the sea level of the Atlantic and the Bay of Fundy the cooler climate brings back the spruce and firs. All in all, Canada has more than 130 distinct species of trees. Only thirty-three of these are conifers or softwoods, which are in greatest demand for construction and the manufacture of pulp and paper, but they comprise three-quarters of the standing timber and supply nearly 80 per cent of the wood used for all purposes. Of the deciduous or hardwood species, only about a dozen are of commercial importance.

Depletion

As early as 1726 some persons were protesting the wastage of the forest resources through burning and clearing, and it was estimated at the time of the census in 1891 that 40,000 square miles of agricultural land had been wrested from the forest. The average annual rate of depletion of merchantable timber during the ten years 1930-39, was estimated at 3,623 million cubic feet, of which 70 per cent was used, and 30 per cent was lost through forest fires and other destructive agencies. Insects and diseases destroyed nearly as much forest as was used by the pulp and paper industry (700 million cubic feet and 706 million cubic feet respectively) and in addition there was a loss of 404 million cubic feet by fire, much of it preventable. In 1941, the latest year for which statistics are available, only 66 per cent was used, while 34 per cent was destroyed.

In detection and suppression of forest fire, the great enemy of forests, Canada is second to no country in the world, but the record in fire prevention leaves much to be desired. It is estimated that 90 per cent of the fires causing damage to forests are the result of human carelessness and neglect. In the few years preceding 1940 a combination of favourable weather conditions and an improvement in the methods of detecting and fighting fires tended to reduce the loss, although the number of outbreaks remained about the same. In 1941, however, periods of dry weather, enlistment of key personnel, and shortage of workers combined to bring about severe losses in several provinces.

The loss due to the other main causes of forest damage, insects and fungi cannot be estimated with any degree of accuracy. The destruction of over-mature trees by pests is beneficial, resulting in the replacement of decaying veterans by young and vigorous trees. This, the endemic activity, is continually going on, but periodically there breaks out an epidemic which is dangerous. Just this spring, a member of parliament brought before the House of Commons the menace of insects to the forests. Admitting that as things now are the provinces have

prime responsibility, the member urged that some department of the Dominion Government be made responsible for preventing terrific losses. A budworm infestation north of Sudbury in 1935 laid open the forest to fire hazards, and two days' fire in 1941 caused more damage than had been done in the previous ten years. The budworm, which worked its way westward from the Atlantic, is the most destructive enemy of the pulpwood forests. An estimate given the House of Commons in March said its infestation now threatens 45,000 square miles, with more than 15,000 square miles of forests already destroyed. If only 40,000 square miles are seriously affected, this means destruction of 50 million cords of wood, sufficient to keep the pulp and paper mills going for 35 years.

Increment

This battle against fire and pests is only part of the larger picture of an enlightened system of forestry. Forests are renewable resources, and with due care their productiveness can be maintained indefinitely. In fact, by the application of proper principles of silviculture it can usually be increased. "Silviculture" is the forestry man's term for the art of reproducing and maintaining forests so as to secure the best possible return — the largest crops of the best kinds of timber in the least possible time and with the least expense. In an ideally regulated forest the growing stock is in condition to produce a maximum annual yield, there are no decadent stands, everything is growing, and yield is harvested as fast as it matures. Protection alone will not achieve the desired end.

The only feature of very early regulations having any trace of silvicultural requirements was the imposition of a diameter limit, providing that only trees of a certain girth might be cut. This leaving of small trees did, in some measure, provide for regeneration, but it was found that the majority of trees remaining in a cut-over forest were too suppressed or unhealthy to serve any useful purpose as re-seeders. When trees are to be spared as seed trees they should be specially selected for that quality; they should not be suppressed weaklings that are themselves beyond recovery. Experts, with knowledge of the inner life of the forest and of soil and climatic conditions are best qualified to judge the trees to be left. If planting must be resorted to, and some circumstances make it necessary, it will be found to be very costly.

Hand in hand with practical silvicultural work by Provinces and Dominion, there must go education on a wide scale. Education such as will mobilize public opinion behind development and preservation of the forests must go much farther than merely placarding trees with "Do not smoke" signs and grim warnings about the dangers of fire.

The general policy both of the Dominion Government and the provinces has been to dispose of timber by means of licenses to cut, thus keeping for the State ownership of the land and control of the cutting operations. The Maritimes did not adopt this policy to the same extent as did the rest of Canada. In Nova Scotia 87 per cent of the forest land is privately owned, nearly half being in holdings exceeding 1,000 acres; in New Brunswick over 50 per cent has been sold, and 20 per cent is in holdings exceeding 1,000 acres. The percentage of privately owned forest land in the other provinces, exclusive of national parks and Indian reserves, is: Quebec 7.3; Ontario 6.6; Manitoba 9.1; Saskatchewan 13.6; Alberta 7.7; and British Columbia 3.4.

Area of productive timbered land — 725 square miles.

Prince Edward Island

This province has no forest lands, but the government is interested in the preservation of farm woodlots and has started the nucleus of a nursery.

Productive forest land — 11,950 square miles.

Nova Scotia

A certain amount of planting is carried out on burned and otherwise barren land, partly by provincial authorities and partly by private individuals to whom trees are supplied free by the provincial forest nursery. In general, however, it is felt that natural regeneration can take care of future needs if cutting is carried out in a careful manner. No government regulations are yet in force relative to cutting on private lands.

Productive forest land — 21,770 square miles.

New Brunswick

New Brunswick forests form a compact area suited to management, on which conditions for natural growth are excellent. First forestry developed out of the need of Great Britain for white pine masts and spars for the Royal Navy — in fact all the pine areas in the province were at one time reserved for this purpose. New Brunswick, like other provinces, is realizing the damage done by injudicious settlement. Cut-over lands are being reforested naturally, it not having been found necessary or financially practical to go in for planting trees, intensive silviculture and slash disposal, although it is recognized that these would hasten reproduction and improve the new crops of timber.

Productive forest land — 296,870 square miles.

Quebec

Forest industries are the leaders in production in Quebec. Each license holder must furnish a working plan covering a definite sector where all applicable silvicultural measures are taken into account in order to regulate the yield. The conditions vary from one limit to another, and different measures must be applied, but all regulations are aimed at arriving in the shortest time possible at sustained yield management. The department of lands and forests, concerned to lead all license holders toward the goal of maximum productivity, co-operates by assigning forest engineers to work with the license holder's engineers in choosing the treatment to be applied.

Productive forest land — 173,800 square miles.

Ontario

The government is exercised to bring about a proper balance between the revenue from the sale of timber and the management of the resources with future yield in mind. An eye is kept on the indirect revenue which exceeds direct return to the treasury many times over, including as it does the employment and wages of men in harvesting and pro-

cessing logs and pulpwood, the return on capital investment, and the purchase of equipment and supplies. Ontario is well advanced in legislation, authorities believing that there is sufficient now in force to provide for adequate control and supervision of all authorized activities. The province pioneered in the use of aircraft for forest protection, and owns and operates the largest aerial forest fire-fighting organization in the world. A unique feature in reforestation is the provision of a coniferous seed station. This plant has buildings capable of handling 25,000 to 30,000 bushels of cones, and it has seed storage vaults with thermostatic control.

Productive forest land — 30,440 square miles.

Manitoba The forests have always been important in Manitoba's economic life. They were the home of the fur-bearing animals which attracted the fur trade that opened up the province; and they furnished the early settlers with building material and fuel. In the south and west there is a small area which is naturally grassland, and an area to the north which is naturally tundra, while scattered through the forests are grassy marshes. Combined with comparatively low precipitation, these conditions give rise to the greatest fire hazard in Canadian forest land. Consequently, particular attention is paid in timber-cutting operations to see that all brush and debris are burned, leaving the forest as free as possible from fire hazard. Special conditions vary with cutting circumstances to secure natural regeneration. These may require that the trees to be cut are marked by the forest ranger, and the balance reserved to make further growth. In some limited areas natural reforestation is so difficult or slow that planting stock is supplied from nurseries.

Productive forest land — 46,070 square miles.

Saskatchewan The forestry branch follows a policy of strict regulation and supervision by restricting cutting to mature trees of valuable commercial species by the systematic marking of trees to be harvested. A radio network is maintained by the fire protection organization as a supplement to a ground telephone system, and a commercial firm is employed to carry out airplane patrols. White spruce and jack pine, the principal species in Saskatchewan, reproduce themselves naturally and readily. Licensees are restricted to a minimum diameter limit aimed at leaving an adequate stand of small trees for a subsequent cut and also sufficient seed trees to restock the cut-over areas. Three nurseries are operated where trees are propagated from seed to four or five years old, to be set out on barren or burned-over areas not suitable for natural stocking.

Productive forest land — 93,080 square miles.

Alberta Timber is disposed of under comprehensive regulations, in which the removal of slash and the fire-guarding of the forest are provided for. No stipulation has as yet been made for reforestation other than that of leaving seed trees. Alberta is favoured on the eastern slope of the Rockies and in the foothills with lodgepole pine, which retains its seed-bearing cones for a number of years. These are gradually released by the rays of the sun, but a great many are not opened up until after a fire. As a result there is usually ample coverage of young growth in the pine areas. The same fortune does not follow the spruce stands, and methods have not yet been devised whereby suitable reproduction is obtained except by planting seedlings. The forestry service has gone in quite extensively for the growing of trees in nurseries and is prepared to reforest some denuded lands when sufficient help is available after the war.

Productive forest land — 85,860 square miles.

British Columbia Topography and climate make British Columbia essentially a forest country. This province has the biggest area of saleable timber in the world, with volumes up to 50,000 board feet per acre not unusual, and individual acres producing as high as 200,000 board feet. Nevertheless, the forests are being cut at a rate beyond their sustained yield capacity. The government is reviewing actively the forest resources and remedial measures. A full dress enquiry, which may last a year, is under way. Already 30 million trees have been planted and production of seedlings is at the rate of 10 million a year. It is revealed in a report by the Vancouver Daily Province of a Commission session that the province is planting artificially from 12,000 to 15,000 acres of forest a year, but 36,000 to 45,000 acres a year are being denuded, and there are 1 million acres of denuded land to catch up. It is probable that if other provinces had investigations on the same down-to-bed-rock scale there might be equally staggering figures disclosed.

Little has been said in this brief survey about other than the commercial values of Canada's forests, though other advantages are very important. There is not a business of the human race, not an art, science, comfort or beauty, which does not issue from a tree, and without trees the whole earth would be a hideous Sahara. Canada's forests are the country's water tap, regulating the storage and flow of water; they prevent soil waste, provide cover for wild life, screen the soil from the heat of the sun's rays, open an immense surface to the cooling processes of radiation, and give off an incalculable evaporation of moisture. They maintain and shade the streams in which game fish abound, and they provide attractive sites for summer homes and vast playgrounds for tourists. History is an arm-in-arm march of man and forest. Not only would man never have been able to advance from savagery to his present civilization without trees, but without them he could not even have been a savage; he could not have existed at all. Now the forests are calling upon man to repay some of that debt in care and preservation.

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