THE FORESTS OF NEWFOUNDLAND

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This report covers a brief reconnaissance of the forest conditions in Newfoundland.

Timbered lands cover some 10,000 square miles. Six site-types occur, only four of which bear timber of commercial importance. The two highest types contain agricultural soil. Sixty per cent of the stands have not yet been disturbed and consequently are producing no net increment.

The climate is moderate, cool summers, mild winters; precipitation is over 40 inches per year, uniformly distributed. Humidity is high, conditions favourable to tree growth. The growth rate on the disturbed stands may be 38 cubic feet per year, or over all timbered lands 15 cubic feet per year, which, on a rotation of 80 years, amounts to 12 cords per acre. On the disturbed stands, however, it varies from 8 to 48 cords, depending on site-type.

Fir regeneration follows cutting, spruce follows fire. The explanation is to be found in seeding characteristics of the two species.

Silvicultural research, already commenced, should include studies of harvest and intermediate cutting methods and regeneration problems.

The labour situation is temporarily unsettled as a result of the war. The interior should be opened by roads. Agriculture should be encouraged. Possibilities of practising fishing and forestry, or farming and forestry, on a communal basis, should be investigated.

INTRODUCTION

THE ANGLO-NEWFOUNDLAND Development Company has been drawing supplies for its mills at Grand Falls from the central, north and eastern sections of Newfoundland since 1907. Certain restricted areas were logged for white pine between 1890 and 1914. The limits of the Bowater's Newfoundland Pulp and Paper Mills, successors to the International Pulp and Paper Company, are on the Humber river basin, and along the north coast, with a small section on the Gander River drainage. Their mills were established at Corner Brook in 1924. Thus it may be seen the pulpwood industry in the island is less than 40 years old.

At the request of the Commissioner of Natural Resources for Newfoundland, on behalf of the Anglo-Newfoundland Development Company, the writer was invited to examine the forest conditions on the limits of the two companies and to consult with the woods managers on the conditions observed and on methods of management for sustained yield. To this end three weeks were spent in reconnaissance. Representative virgin stands, and young stands following fire and cutting on various site-types, were examined.

GENERAL DESCRIPTION

Newfoundland is an island of 43,000 square miles, 15,000 square miles larger than the Province of New Brunswick. The rocky coast, for the most part barren, is indented by many bays and inlets. The sparse population, settled chiefly around the coast, finds its chief employment in fishing. The

1935 census gives the population as 285,000 or seven persons per square mile, as against the New Brunswick population of 458,000 or seventeen persons per square mile.

Over one-half of the land area is waste or poorly stocked with timber. However, about 20,000 square miles on the west and north coasts and in the north interior are rolling lands of fair to good soil, well drained by numerous lakes and rivers. These constitute the timber limits. Most of these lands are now under management and have been surveyed. The records indicate that 50 per cent, or 10,000 square miles of the limits are interspersed with waste lands, barrens, bogs and water surface. Hence, the productive forest lands cover about 10,000 square miles, or less than 25 per cent of the island.

The timbered lands are divided by the Topsail Mountain range which extends the length of the island from north to south. These divisions represent two forest regions, with certain differences in site-types and in forest composition.

COVER- AND SITE-TYPES

It is important, in any management plan, to recognize differences in growth quality of the soil as indicated by the site-types. Obviously growth varies with site. The site may indicate whether a given stand can be logged at a profit, or whether a return cut may be expected in one rotation. Altogether six site-types were recognized during the reconnaissance. Only four of these, however, were seen in the eastern region.

The best of these site-types, Site I, is confined to the St. George district, south of the Humber River. The soil is rich, well-drained, clay loam, the highest quality forest soil, equivalent to the Trillium site-type of Eastern Canada. Much of it is good agricultural land, capable of producing fruit crops. It occupies well-drained flats and lower slopes, sometimes reaching into the upper slopes where these are not exposed.

Among the ground vegetation, the indicator species are Trillium (lily), Cornus (pigeon-berry), Mitchella (partridge berry), Aralia (sarsaparilla) of scattered occurrence, and Aspidium (wood ferns) and Acer pennsylvanicum (striped maple) of prolific occurrence.

For the present the type is designated as Site I, Trillium (Tr T), or '65', the average height of its dominant trees at 80 years of age. The cover-type, yellow birch, maple-balsam, spruce (By M.B.S.) comprises yellow birch, red maple, white spruce, and balsam fir. Occasionally white pine is to be found.

The birch does not seem to be capable of withstanding the severe exposure which follows removal of the conifers nor does it reproduce readily. The more or less scattered white pine is not reproducing adequately. Therefore, the cover-type tends to change to maple-balsam, spruce.

Site II—Cornus (Co T), '60', is the most widely represented of all the site-types. It occurs throughout both regions. The soil ranges from loam to sand, on well-drained flats and lower slopes.

The principal indicator species are *Cornus* and *Hypnum* (moss) in profusion; *Maianthemum* (false lily of the valley), *Clintonia*, (snake berry), *Vaccinium* (blue-berry), *Chiogenes* (trailing snow-berry), *Linnaea* (twin-flower), and *Kalmia* (sheep laurel) of scattered distribution.

The cover-type in the mature stands is composed of white birch, white and black spruce, and balsam fir. In some places scattered white pine occurs; this may run up to 24" D.B.H. but is stunted in height to 70' by reason of exposure.

After disturbance of the stand the birch dies. In some instances it fails to regenerate within two or three decades so that many of the young stands may be pure balsam, spruce, or balsam-spruce. For this reason the local designation "Mixedwood" is not applicable to all the forest-cover on the Co T. Use of the two symbols (Bw-B.S) and B.S would be more satisfactory.

The third site-type in the series, also well distributed in both regions, is designated as Site III, *Sphagnum* (Sp T), '55'. It is acid peat loam or sand, found in wet, poorly drained flats at various altitudes.

The principal ground vegetation is prolific sphagnum and associated mosses; *Ledum* (Labrador tea), and *Kalmia*, of less frequent occurrence, and scattered *Carex* (sedge), *Cornus*, *Coptis* (goldthread), *Chiogenes*, and *Vaccinium*.

Black spruce, usually reproduced by layering, is the principal tree species. Some fir and larch occur. The stands, both virgin and second growth, are usually well stocked. The cover-type designation is black spruce (Sb).

A somewhat inferior black spruce type found in the western region only has been classified as Site IV, *Kalmia-Vaccinium* (K-VT) '50'. The soil is sand to sandy-loam on partially drained flats and lower slopes. The principal indicator species found in profusion are *Kalmia* and *Vaccinium*.

The type is moderately to lightly stocked with black spruce, fir and larch, of medium to slow growth. Its cover-type designation is black spruce (Sb). The type does not appear to cover extensive areas.

The lowest site-type on which any merchantable timber is to be found is designated as Site V, *Kalmia-Ledum* (K-LT) '45'.

Two site-types, equally poor in growth quality, are represented in this class; differences in soil class and situation are probably responsible. The soil is either poorly drained acid peat bordering on bogs, or light, shallow, sandy soils on dry situations. The vegetation is profuse—*Kalmia* and *Ledum* on both situations, and *Rubus chamaemorus* (baked apple berry) in the bogs.

The forest cover consists of very scattered and stunted black spruce on the wet sites; some fir may be found on the dry soils. The types may be designated as Black Spruce (Sb), or Balsam-Spruce (B.S.) respectively.

The stands are so scattered that it may not be economically practical to cut them and, if cut, the growth rate is so slow that a second crop will not be available within 150 years.

Site Type VI, *Cladonia* (Cl T), '25', is restricted to the margins of barrens on the upper slopes and hilltops. The soil is poor, dry sand. Cla-

donia (reindeer moss), lichens, and associated zerophytic plants are the indicator species. The only forest cover is occasional scrubby black spruce of no value. Areas of this site-type are included in the estimate of waste lands.

A study of maps and inventories suggests that the distribution on the 10,000 square miles of timbered lands may be:

SUB-TYPE	COVER-TYPE	PER CENT
I—Tr T	By M.B.S	5
II—Co T	BwA.B.S or B.S	50
III—Sp T	Sb.	30
IV—K-VT	Sb.	5
V—K-LT	Sb. or B.S	10

AGE-CLASSES

It is important to recognize age-class distribution in any management plan, both for calculation of increment and for allocating cutting chances.

It is well recognized that there is no net increment in fully stocked virgin stands. It is equally clear that cutting immature stands results in serious loss of increment, and in abnormally high operating costs.

The survey data indicate that about 15 per cent of the forest lands have been cut or burned in the past twenty years, during which period fires have been well controlled. Prior to that period, fires and a small amount of cutting converted some 30 per cent of the virgin stands to even-aged young stands. Almost invariably full regeneration has followed these disturbances.

The undisturbed or virgin stands, representing 60 per cent of the productive area, are also fully stocked. But, in the older portions, which are overmature, normal mortality offsets growth so that no net increment is accruing. Hence the cutting budget should be calculated on the growth accruing on the 4,000 square miles of young, even-aged stands.

GROWTH RATE

Although central Newfoundland is situated some 300 miles north of the Ottawa district, meteorological records indicate that the climate there is more equitable and favourable for tree growth.

SUMMARY OF METEOROLOGICAL RECORDS

From Dominion of Canada Meteorological Observations—1938

Temperature	Ottawa	Botwood	St. George
Mean annual	41°	39°	40°
Range of daily high	38°/93°	36°/89°	40°/81°
Range of daily low	—34°/45°	—24°/40°	—24°/40°
Precipitation			
Mean annual	33.9"	44.3"	43.9"
Days per month	11	14	15
Humidity	74%	85%	85%
Prevailing Wind			
May-September	East	South	West
October-April	West	West	West
Year	East	West	West

It will be noted that there is no significant difference in the mean annual temperature, but it is more evenly distributed in Newfoundland, with somewhat cooler summers and less severe winters, probably owing to the proximity of the Gulf Stream.

The more equable temperature range, combined with 25 per cent greater precipitation, more evenly distributed, results in 11 per cent higher humidity. Because of occasional late spring frosts the length of the average growing season is from two to four weeks shorter than that of the Ottawa district. In the final analysis, therefore, it is not surprising to find that tree growth is equal to that of Eastern Canada.

Examination of mean annual increment of dominant trees in even-aged stands and of borings taken in spruce and fir in various site-types indicates that:

- (1) There is no significant difference between the growth of spruce and fir;
- (2) Growth is fully as rapid as that in Eastern Canada;
- (3) High growth rate continues for 70 or 80 years, and then declines;
- (4) Growth varies greatly with site type.

The dominant trees of both species on the Cornus site-type average 6" D.B.H. in 40-year stands, and 12" in 80-year. The mean increment is, therefore, one inch in 7 to 8 years. Borings show a growth rate of 4 to 8 years per inch on the Co T, 10 to 15 years per inch on the Sp T, 20 to 30 years per inch on the K-LT.

Reliable growth data are not available, but if the rates as found on similar site-types in Eastern Canada be applied to the immature stands, it might be estimated as follows:

ESTIMATED NET ANNUAL INCREMENT ON
EVEN-AGED STANDS (4,000 Sq. Miles)

Site-Type	Area Acres	Net Annual Increment	
		Per Acre Cu. Ft.	Total Cords (90 Cu. Ft.)
Trillium	128,000	60	85,333
Cornus	1,280,000	50	711,111
Sphagnum	768,000	30	256,000
Kalmia-Vaccinium	128,000	10	14,222
Kalmia-Ledum	256,000	..	
Total	2,560,000	38	1,066,666
Total forested area	6,400,000	15	

Assuming that these values are correct, the even-aged stands may be expected to produce from 8 to 48 cords per acre, varying with site-type, at the end of an 80-year rotation. The stock of the timbered stands as a whole, under present distribution of age-classes, should be 12 cords per acre.

The fact that the average volume removed in past clear-cutting operations is in the neighborhood of 12 cords per acre suggests that these values might be accepted until proper increment data can be collected.

SPECIES CHARACTERISTICS

Unlike the fir in Canada, which does not remain merchantably sound beyond 60 years of age, the fir in Newfoundland shows little or no signs of decay under 100 years of age. Then, since the growth rate of both spruce and fir tends to culminate at 80 years of age, the logical rotation age for the two species would seem to be 80 years, at which time the entire stand would be of merchantable size.

The difference between the seeding characteristics of the two species has an important bearing on regeneration problems. Fir regenerates prolifically almost every year, the seed dropping when ripe. Because of its deep-rooting habit, the seed, when falling on a comparatively deep, mossy ground cover which provides the cool seed-bed which it favours, readily penetrates to mineral soil. The result is a prolific annual crop of fir seedlings, few of which, in the absence of openings in the crown cover, survive for more than a year or so. Spruce seed years, on the other hand, are less frequent, and the seed will not germinate unless in contact with the warmer mineral soil. In these circumstances the regeneration following cutting is mostly fir.

The effects of fire are:

1. To destroy all the fir seedlings and the seed supply;
2. To expose the mineral soil, thus providing ideal seedbed conditions for spruce;
3. To release the spruce seed stored in the soil.

The net result is that a dense spruce reproduction follows a moderate fire at the proper season of the year.

The importance of spruce reproduction from layering is not generally realized. As a matter of fact, practically all spruce reproduction in the Sp T is obtained by this asexual method. As this method of regeneration requires a deep moss ground-cover, there is always an ample supply of spruce advance growth in this important site-type. Nor is the growth rate or quality of layering spruce in any way inferior to that of seedling stock. Under favourable conditions of light it will attain a diameter of 6" to 8" in 80 years.

CUTTING METHODS

The simple types and the rapid growth rate, culminating as it does at 80 years, and the simplicity of regeneration, all indicate clear-cutting at maturity as the logical system for cutting even-aged stands.

The uneven-aged stands should be converted to even-age as rapidly as possible. This might be accomplished by clear-cutting too. But by this method growth in the immature portions would be sacrificed. Furthermore, operation costs in cutting undersized timber would be unnecessarily high.

The proper procedure would seem to be to remove only mature and over-mature portions of the stand, and leave the young portion to grow to maturity. These young portions would constitute the growing stock for the 40- to 70-year age-classes which are at present deficient in the age-class distribution.

MARKETS

Markets should be found for white birch, the major hardwood species. At present it is a total loss since it invariably succumbs to the effect of disturbance. If it cannot be utilized for pulpwood, the market for veneer and other purposes should be developed.

RESEARCH

There is an extensive field for silvicultural research in Newfoundland. Much of the fundamental study should be undertaken by the Government. However, there are many problems of local interest to the industry which should be undertaken by the operators themselves.

Some experimental cutting areas, to investigate the value of various harvest and intermediate cutting methods, have already been established. These should be extended to include selection cuttings in the virgin stands, improvement cuttings in polewood stands, and thinnings in stands of sapling classes.

There is some indication that slash is beneficial rather than harmful, to survival of seedlings. Factual data should be obtained.

The problem of fir regeneration following cutting, and spruce following burn is of vital importance to the industry. It should be given a place in any research program.

LABOUR PROBLEMS

Until the recent development of the pulp and paper industry the principal occupation of the inhabitants of Newfoundland was fishing. The settlers, scattered in little hamlets in the coves around the coast line, have depended almost solely on the catch of fish for their livelihood. Lacking any transportation system other than the single railroad from St. Johns to Port aux Basques, they had no means of communication with the interior of the island. Nor, until the new industry was established, was there any occasion to leave the coast. Heretofore no attempt has been made to practise agriculture.

Photo 1.—Uneven-aged mature mixedwood stand on Cornus site-type. A good cut of mature timber might be taken, the young portion should be left. Growth rate is about 50 cubic feet per year-acre.

Photo 2.—Overmature uneven-aged spruce stand on Sphagnum site-type. This stand should be cut selectively. Growth is offset by mortality, but if opened up, growth would be 30 cubic feet per year-acre.

Photo 3.—Poorly drained Kalmia-Ledum site-type. Growth rate is estimated to be 10 cubic feet per year-acre. Note the layer of fallen trees three feet below the surface along the canal bank indicating a pre-historic forest.

As a consequence of lack of transportation routes, and of the inborn fishing instinct (despite its poor remuneration), it has at times been found difficult to obtain an adequate supply of labourers for the woods from among the inhabitants.

The Government is now taking action to improve this situation. Good roads are being constructed both by the Government and the pulpwood companies. Soil surveyors are segregating agricultural lands. A similar survey of forest soils should be undertaken. It still remains to convince the fishermen that it is to their advantage to combine woods operations with fishing, or to combine agriculture with woods operations, either of which will greatly raise their present standard of living. After the present period of progress resulting from wartime activities, they may not be satisfied to return to the prewar standards and may be prepared to take advantage of the opportunities offered by the new industries.

Development of community forests offers one means of interesting the fishermen in the woods industry. Where there are sufficient forests surrounding a fishing hamlet to provide the settlers with continuous employment when not engaged in fishing, a community forest might be profitable both to settlers and companies.

Other community forests might be feasible in the interior closer to the mill, where there is sufficient agricultural land to sustain the workers, and sufficient forests to provide spare-time employment.

There is little question that highest increment and yield can only be obtained by well-organized selection cutting methods. But selection cutting can only be practised successfully in districts where the wood cutters are permanently located, where they can return to the same area year after year. This problem is worthy of serious consideration. It might be started on an experimental basis.

Photo 4.—Cornus site-type burned in 1935. Pine, spruce reproduction following fire is prolific.

Photo 5.—A 22-inch black spruce reproduced from layering. Note characteristic crook at stump, and lower branches on side remote from the mother tree.