56

CANADA
Department of Northern Affairs and National Resources
FORESTRY BRANCH

FORTY-FIVE YEARS GROWTH ON THE GOULAIS RIVER WATERSHED

by
J. M. Jarvis

Forest Research Division
Technical Note No. 84
1960

Published under the authority of
The Honourable Alvin Hamilton, P.C., M.P.,
Minister of Northern Affairs and National Resources
Ottawa, 1960

THE QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1960

Cat. No. R47-84

CONTENTS

Technical Note No. 84 has been revised owing to an error in the calculation of volume for balsam fir. The necessary changes have been made in the tables, figures, and text. This reprint replaces the original issue.

D. R. Redmond,
Chief,
Forest Research Division.

83877-1—1½

Forty-five Years Growth on the Goulais River Watershed

by

J. M. Jarvis[1]

ABSTRACT

The Goulais River Observation Area is one of the oldest of its kind in Eastern Canada. It was established in 1920 to obtain information on forest development after logging and fire in the spruce-fir and the maple-birch-spruce-fir cover types characteristic of the Algoma District of Ontario. This report presents an analysis of development to 1956, showing in diagrammatic and tabular form: volumes by species before and after cutting in 1910, changes in stand composition brought about by logging and during subsequent development, changes in volumes by species, periodic net mean annual increment and mortality, and the amount of visible defect (1956) for the various cover types and conditions.

INTRODUCTION

With the expansion of the Canadian pulp and paper industry after World War I, much concern arose over future supplies of wood suitable for pulping. Realizing that sooner or later the industry would be dependent upon cut-over lands for its wood, the Commission of Conservation of the Government of Canada embarked upon a program to study forest development on such lands.

One of the projects set up was the Goulais River Observation Area in the Algoma District of Ontario. This area was selected to study growth and development of spruce and balsam fir after cutting.[2] The first survey was carried out in 1920 with the co-operation of the Spanish River Pulp and Paper Mills, and the results were reported by McCarthy and Mills (1).

In 1921 the Commission of Conservation was abolished and the Goulais River project was taken over by the Dominion Forest Service. At that time it was decided the area could provide information on forest development following fire as well as after cutting, since parts of the area had been burned about 1907 and again in 1920. Another survey was carried out in 1927, and the results were summarized by Mulloy (2). The area was examined for a third time in 1945–46, and the results of forest development to that date were reported by MacLean (3). The present report summarizes the results of those surveys and extends the analysis of forest development to the end of 1956 when considerable ecological data were obtained. Another report is planned to discuss some of the ecological relationships of various communities, means of regenerating desired species, and means of increasing yields on the different sites.

THE AREA

Location

The 58-square-mile Goulais River Observation Area is located in Townships 23 and 24, Range 11, in the Algoma District of Ontario about 30 miles northeast of Sault Ste. Marie. The area occupies that portion of the Goulais Watershed

[1] Forestry Officer, Forestry Branch, Manitoba-Saskatchewan District Office, Winnipeg, Manitoba.

[2] Scientific names for the species mentioned in this report are given in Appendix I.

just north of the junction of the east and main branches of the river and lies near the centre of the Algoma Section L. 10 of the Great Lakes—St. Lawrence Forest Region described by Rowe (4).

Physiography

The area straddles a large valley of preglacial origin and is for the most part upland. Distinctive features are broad-topped hills and ridges aligned in a more or less east-west direction. Many of the ridges are precipitous on the south and southeast exposures, but in other directions the slopes are generally more gradual. The topography is rough and elevations reach about 1,700 feet above sea-level; some of the hills rise as much as 500 feet above the general valley level.

The Goulais River, the East Branch, and four large creeks (Coldwater, Storey, Payette, and Martin) constitute the main drainage system. Glacial deposits and depressions in the underlying bedrock give rise to small lakes and swamps at elevations well above that of the main drainage system. Glacial drift covers the upland areas but the lowland terraces along the Goulais River and the lower reaches of the major creeks are predominantly glacio-fluvial sands and gravels.

Forest Cover Types

In 1920 cover types were classified as softwood, mixedwood or hardwood and mapped accordingly; cut-over areas were classified on the basis of the stand before logging in 1910; burned areas were considered as one entity regardless of the previous cover type. The type boundaries drawn in 1920 were not altered during later surveys.

The softwood cover type included all stands containing less than 20 per cent hardwood by volume prior to logging. Generally these stands were uneven-aged and were found on the sand and gravel terraces along the main drainage channels and on some of the lower slopes, exposed ridges and precipitous bluffs. The predominant species on the sand and gravel terraces were white spruce, balsam fir, and cedar. Jack pine and white pine also occurred on these flats, but not abundantly. On the wetter areas, black spruce, cedar and some larch replaced the white spruce and balsam fir. The associate hardwood species were primarily white birch, trembling aspen and red maple, with some black ash, white elm, and balsam poplar on the moist and wet areas. The predominant softwood species on the lower slopes were white spruce, balsam fir, and cedar; these species also occurred on the exposed ridges and precipitous bluffs in association with white pine. The associate hardwood species were mainly sugar maple and yellow birch.

All stands containing less than 80 per cent either hardwood or softwood by volume, prior to cutting, were classed as mixedwood. This type was found mostly on the middle and lower slopes and on some exposed ridges and precipitous slopes. The characteristic species were sugar maple, yellow birch, elm, red maple, cedar, balsam fir, and white spruce. White pine was present occasionally and white birch was abundant in some areas, having originated after fire. Generally the stands were uneven-aged and the tolerant hardwood species comprised most of the volume. Sugar maple was the predominant species on the well-drained areas, but yellow birch and occasionally white elm replaced it on the moister habitats. Cedar and balsam fir occurred in dry, fresh and moist areas, but spruce was more or less confined to the dry and moist locations. White pine was restricted almost entirely to the drier areas.

The hardwood type was defined as containing less than 20 per cent softwoods by volume. With few exceptions the stands comprising the type were uneven-aged and were found on upper, middle, and some lower slopes. The

characteristic species were sugar maple and yellow birch with some white elm, ironwood, red oak, balsam fir, cedar, white spruce, and white pine as associates. Trembling aspen and white birch growing in pure stands or in mixture with one another were found on some burned areas. Sugar maple was most abundant on the warm, dry and well-drained habitats. Yellow birch also occurred on such locations but was more abundant where drainage was somewhat restricted. Ironwood, red maple, and occasionally red oak appeared on the warm, dry habitats and elm was a frequent associate on moist areas. Balsam fir and cedar occurred sporadically throughout the stands on various habitats, but spruce and pine were more or less restricted—pine to the dry areas and spruce to the dry and moist areas.

History

The history of the area has been described by MacLean (3) and extracts from his report are quoted as follows:

"Pulpwood logging began in 1905 and continued to the winter of 1914. The heaviest cutting took place from 1908 to 1910. Spruce and balsam fir were the species cut. Scattered white pine were cut for sawlogs in Township 24 in the same general operation. On Township 23, white pine was being cut in 1920 at the time of the first survey. Logging was confined to the flats and lower slopes in the softwood type and the intermediate slopes in the mixedwood type."

"Spruce and balsam fir were cut to six inches d.b.h. and only the soundest trees were removed. There was heavy loss due to excessive waste in the stumps and tops."

"Several fires occurred on the area about 1907. In June, 1920, another fire extended up the main river and into a former burn on the East Branch."

The latest fire was in 1948. It occurred along the East Branch on a sand flat that had been burned in 1920. About 900 acres were burned and 14 permanent line plots were destroyed. Acreages of the various conditions as of 1920 are given in Table 1.

Table 1

LAND CLASSIFICATION (1920)

Condition	Number of acres	Per cent of area	Number of plots
Cut-over areas—			
Softwood	4,269	11.4	96
Mixedwood	7,030	18.9	168
TOTAL	11,299	30.3	264
Virgin areas—			
Softwood	522	1.4	14
Mixedwood	4,578	12.3	55
Hardwood	9,914	26.6	
TOTAL	15,014	40.3	69
Old burn	1,635	4.4	
1920 burn	1,507	4.0	75*
Unclassified (mostly hardwood)	6,979	18.7	
Water	853	2.3	
TOTAL	10,974	29.4	75
All	37,287	100.0	408

* Of the 75 plots established in the 1920 burn, 14 were destroyed in 1948. The area of this condition (1920 burn) was reduced in size from 1,507 acres to about 607 acres.

THE SURVEYS

The first survey in 1920 was a 5 per cent strip cruise. The forest cover was mapped and the cover types were further classified as cut and uncut. All merchantable species one inch and up in diameter at breast height and all trees estimated to have died since 1910 were tallied.

In 1927 the method of survey was changed. Instead of the strip system, square permanent plots (each 1/10-acre in size) were established at 20-chain intervals along the strips of the 1920 survey. Additional plots were established in the 1920 burn. The tally was conducted as in 1920. It was later feared that the change in method of survey might make comparison with the first survey difficult, but Sisam (5) showed that average stand tables derived by the two methods were not significantly different.

Field procedures for the 1945-46 survey were the same as in 1927, except that no information was obtained on mortality between 1927 and 1946. The 1956 survey procedures were unchanged from those in 1927, but additional ecological information was obtained on the various forest communities and mortality from 1946–56 was recorded.

RESULTS

Growth and development that has occurred on the Goulais area is summarized separately for the uncut, cut-over and burned areas. Diagrammatic and tabular summaries prepared from appended stand and stock tables show by stages the changes that have taken place. Since the prime purpose of the project was to study spruce and balsam fir, emphasis is placed on these species.

Development of Cut-over Areas

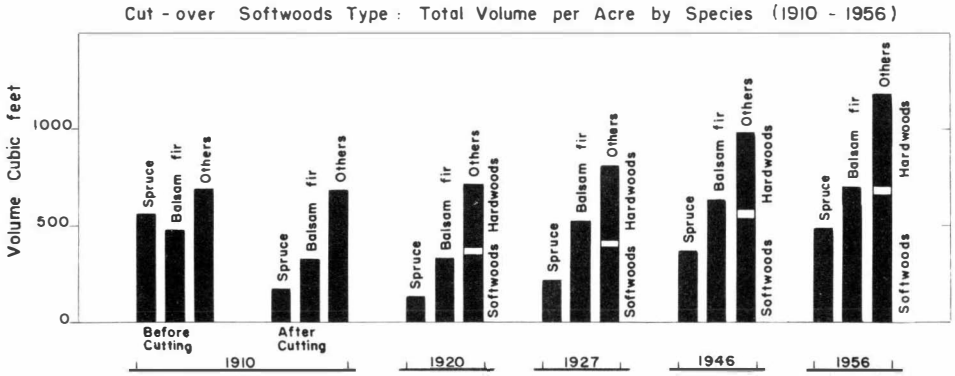
Softwood Type

Previous reports have emphasized the condition of the original type and the "high-grading" that took place in 1910. Most of the stands in the softwood type were all-aged, rather open grown, and contained many defective trees. The loggers removed only the best spruce and balsam fir, leaving residual stands of diseased and suppressed trees.

Before cutting, the softwood type averaged a little more than 1,700 cubic feet per acre of which 551 cubic feet were spruce and 477 cubic feet were balsam fir (Figure 1). Other species, mostly cedar, white pine and white birch in that order, made up the remainder. The logging for spruce and balsam fir removed

Figure 1

Cut - over Softwoods Type : Total Volume per Acre by Species (1910 - 1956)



about one-third of the original volume leaving approximately 1,200 cubic feet per acre still standing. Of this amount 164 cubic feet and 332 cubic feet, respectively, were spruce and balsam fir. The logging converted the softwood type to a mixedwood condition which was still evident in 1956.

In 1920, ten years later, because of the high post-cut mortality (5), the total volume was about the same as it was just after logging. Since 1920, all species increased in volume, with the softwoods slowly but steadily enlarging their proportion of the total. If future development proceeds accordingly, the type will revert to softwood in the very near future.

In 1956 the volume of all species was 2,382 cubic feet per acre. This was an increase of about 39 per cent over the volume in 1910 of 1,713 cubic feet per acre. Spruce and balsam fir formed a smaller proportion of the total volume in 1956 than they did before logging, although their actual volume was greater by some 16 per cent, or 163 cubic feet.

Before logging spruce comprised 32 per cent of the total volume (Table 2), but in 1910 following logging it was 14 per cent. During the next 10 years a further decline took place and by 1920 spruce comprised only 12 per cent of the volume. Since then the proportion of spruce has increased slowly and in 1956 it accounted for 21 per cent of the total.

Balsam fir comprised 28 per cent of the original volume and maintained that proportion despite cutting and other influences until after 1920. By 1927 balsam fir had risen to 33 per cent, but by 1956 the proportion of this species had dropped slightly to 29 per cent of the total. This decline may have some significance as field observations indicated that many of the larger balsam fir were in a decadent condition and dying from various causes. In the near future spruce may again form a greater proportion of the total volume than balsam fir.

Table 2

COMPOSITION OF THE CUT-OVER SOFTWOOD TYPE (PER CENT VOLUME) 1910 TO 1956

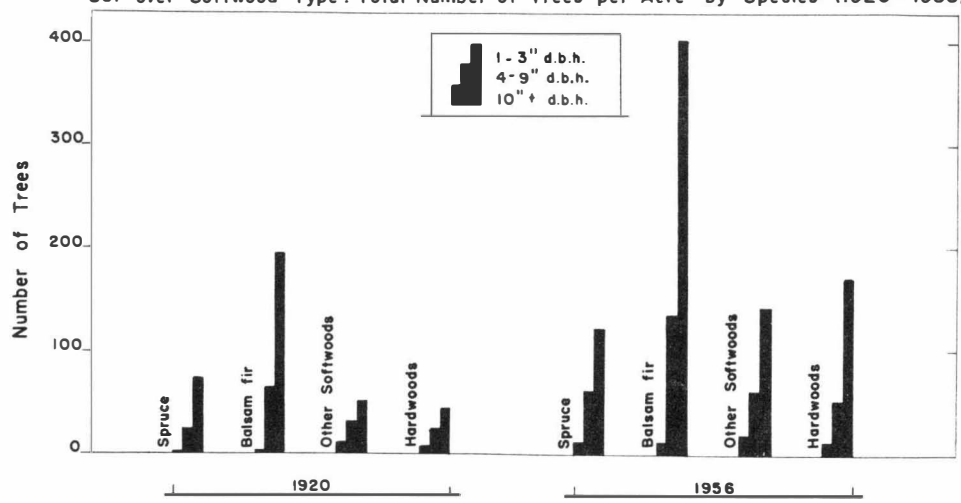
Species	Year					
	1910		1920	1927	1946	1956
	Before cut	After cut				
Spruce	32	14	12	14	19	21
Fir	28	28	28	33	33	29
Others	40	58	60	53	48	50
TOTAL	100	100	100	100	100	100

Both the softwoods and hardwoods increased in numbers between 1920 and 1956, but the greater increase was in the softwoods (Figure 2). Most of the softwood gain has been balsam fir. This species more than doubled its numbers to 403 per acre since 1920. Spruce has increased from 74 to 120, and other softwoods from 53 to 146. All species have increased in the smaller diameter classes as well as in the larger classes, indicating that the stands were regenerating and the areas were being utilized more fully. Although spruce may again form a larger proportion of the total volume than balsam fir, Figure 2 certainly indicates that the latter species will also be well represented.

One of the most important factors in forest development is rate of growth, since it influences regulation and governs the rate at which cutting may be carried out safely. The growth data (net annual periodic increment) for 1921–27, 1928–46 and 1947–56 are given in Table 3. The net annual periodic increment in the softwood type between 1921 and 1956, all species, has been 34 cubic feet

83877-1—2

Figure 2



per acre—more than 1/3 of a cord per acre per year. Spruce and fir have averaged 20 cubic feet per acre per year, other softwoods 9 cubic feet, and hardwoods 5 cubic feet.

Although the average rate of growth has been more than 1/3 of a cord per acre per year since 1921, variations from this average during the three re-measurement intervals have been considerable. From 1921–27 the net annual periodic increment of all species was 49.8 cubic feet per acre and the 1920 growing stock increased by 31 per cent over the 7-year period; this was at a rate of 3.4 per cent per year.[3] The net annual periodic increment from 1928 to 1946 was 23.4 cubic feet per acre and the 1927 growing stock increased by 29 per cent over the 19-year period—a rate of only 0.4 per cent per year. This slow growth rate resulted from a spruce budworm infestation during the late 1930's and early 1940's (3). Mortality from this attack was quite severe until 1947. The net annual periodic increment for 1947–56 increased to 39.5 cubic feet per acre and the 1946 growing stock increased by 20 per cent in 10 years—a rate of 1.8 per cent per year.

Similarly the periodic per cent growth for spruce was 5.9, 2.8, and 2.9, and for balsam fir 6.3, 1.1, and 1.1.

Table 3

CUT-OVER SOFTWOOD TYPE: NET ANNUAL PERIODIC INCREMENT PER ACRE

Species	Increment (cubic feet)		
	1921-27	1928-46	1947-56
	(7 years)*	(19 years)*	(10 years)*
Spruce	10.4	8.1	12.3
Balsam fir	26.4	6.1	7.2
Other softwoods	4.3	6.1	14.5
Hardwoods	8.7	3.1	5.5
TOTAL	49.8	23.4	39.5

* Number of growing seasons.

[3] Periodic per cent growth determined by Pressler's formula.

Annual mortality plus net annual increment show total wood production and give a truer indication of the wood-producing potential of an area. Accordingly, annual mortality for 1921–27 and for 1947–56 is shown in Table 4.

Gross annual periodic increment from 1921 to 1927 was 101.5 cubic feet per acre (more than a cord per acre per year), and from 1947 to 1956 it was 65.3 cubic feet per acre (less than a cord per acre per year).

Table 4

CUT-OVER SOFTWOOD TYPE: MEAN ANNUAL MORTALITY PER ACRE

Species	Mortality (cubic feet)		
	1921-27	1928-46*	1947-56
Spruce	4.6	.....	4.5
Balsam fir	14.6	.....	13.3
Other softwoods	14.1	.....	1.4
Hardwoods	18.4	.....	6.6
TOTAL	51.7	.....	25.8

* No data available.

The unhealthy condition of the type which existed after logging persisted and many of the trees in the 1956 stands were quite defective. The amount of visible defect as recorded by the survey party is summarized in Table 5. If hidden defect were included, it is believed that the estimate in Table 5 would be considerably higher. Borings taken from trees exhibiting no external defects revealed that in many of them heart-rot was present in advanced stages.

Table 5

CUT-OVER SOFTWOOD TYPE: VISIBLE DEFECT 1956

Species	Total stand		Visibly defective stand		
	No. of trees	Volume (cu. ft.)	No. of trees	Volume (cu. ft.)	Per cent of total volume
Spruce	121	489	6	18	4
Balsam fir	403	793	40	72	9
Other softwoods	146	678	19	120	18
Hardwoods	171	514	41	140	27

Mixedwood Type

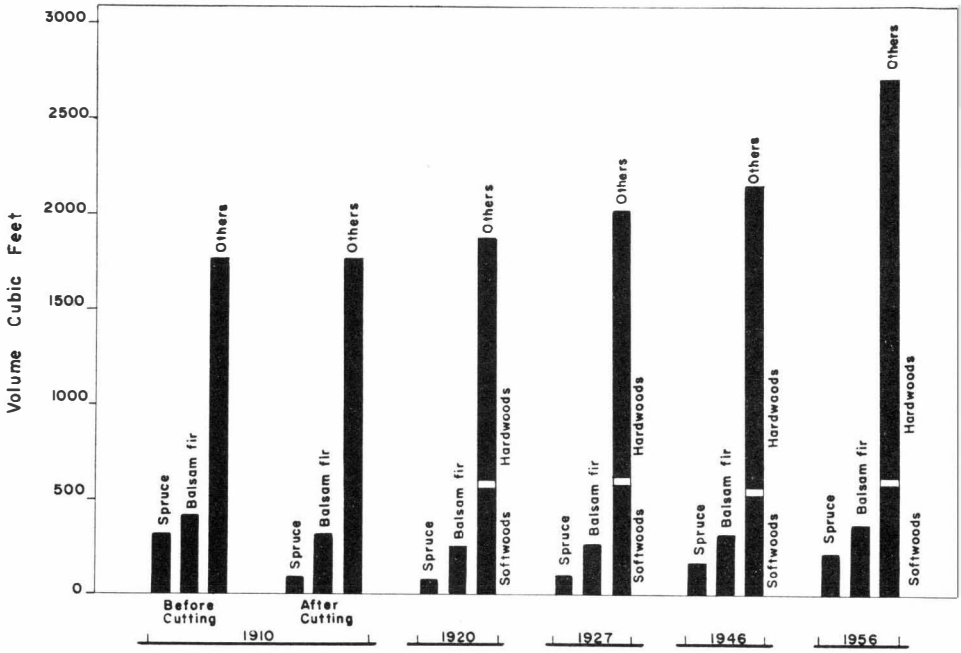
The mixedwoods logged in 1910 were those on the middle and lower slopes. They were all-aged and uneven-aged stands of sugar maple, yellow birch, cedar, white spruce, and balsam fir.

Before cutting the total volume was 2,530 cubic feet per acre, of which 338 cubic feet was spruce and 421 cubic feet was balsam fir. Other species, mainly yellow birch, cedar, maple, and white birch, made up the remainder. The logging removed about one-eighth of the total volume, mostly spruce and balsam fir which were 6 inches in diameter and over. After logging the residual type contained about 2,200 cubic feet per acre, of which 101 and 337 cubic feet respectively were spruce and balsam fir (Figure 3).

83877-1—2½

Figure 3

Cut-over Mixedwood Type : Total Volume per Acre by Species (1910-1956)



In 1920 the total volume of the type, all species, was approximately the same as just after logging because of high post-cut mortality (5). During the interval between 1910 and 1920, the volumes of spruce and balsam fir declined from 101 and 337 cubic feet per acre, respectively, to 95 and 258 cubic feet per acre.

All species except white pine increased in volume after 1920 and by 1956 the type averaged 3,147 cubic feet per acre, an increase of about 25 per cent over the original 1910 volume. Spruce and balsam fir totalled 627 cubic feet per acre in 1956, but this was some 132 cubic feet per acre less than their total volume before logging in 1910.

Originally spruce and balsam fir comprised 13 and 17 per cent of the total volume, but logging reduced their proportions to 5 and 15 per cent respectively (Table 6). From 1910 to 1920 a further decline took place and in 1920 spruce and balsam fir included only 4 and 11 per cent of the total volume. By 1956 spruce had gradually increased to 8 per cent and balsam fir to 13 per cent. The hardwoods increased from 59 per cent in 1920 to 61 per cent in 1956. The general trend since 1920 has been a decrease in the proportion of softwoods and an increase in the proportion of hardwoods. If this continues the type will eventually change to hardwood.

Softwoods and hardwoods alike increased in numbers, but the greatest gain has been in the hardwoods (Figure 4). Spruce increased from 31 per acre in 1920 to 51 per acre in 1956, and balsam fir from 113 per acre to 194. Perhaps the most significant point revealed by Figure 4 is that in the 1 to 3 inch diameter class hardwoods had increased about twice as fast as softwoods, indicating a development towards a hardwood type.

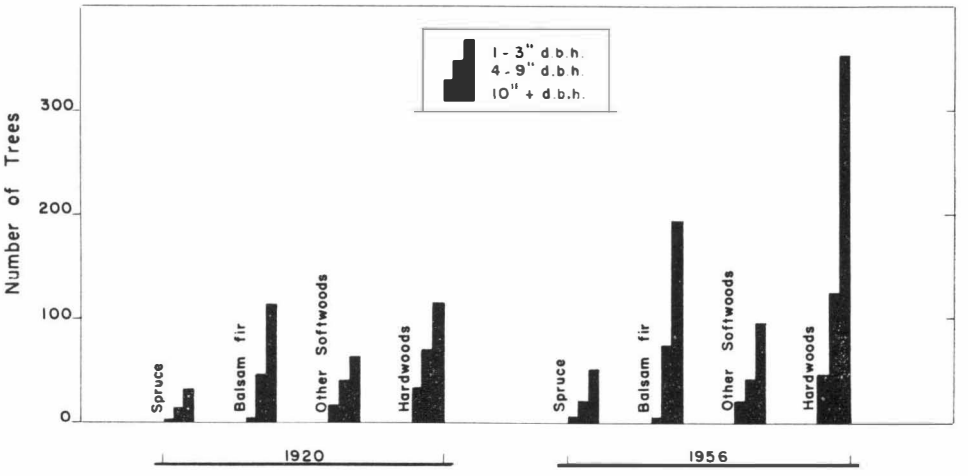
Table 6

COMPOSITION OF THE CUT-OVER MIXEDWOOD TYPE (PER CENT VOLUME) 1910 TO 1956

Species	1910		1920	1927	1946	1956
	Before cut	After cut				
Spruce	13	5	4	5	7	8
Fir	17	15	11	11	12	13
Other softwoods	70	80	26	25	20	18
Hardwoods			59	59	61	61
TOTAL	100	100	100	100	100	100

Figure 4

Cut-over Mixedwood Type: Total Number of Trees per Acre by Species (1920 - 1956)



The average net annual increment, all species, since 1920 has been 25 cubic feet per acre, somewhat less than in the softwood type. Spruce and balsam fir increased by only about eight cubic feet per year, whereas the hardwoods increased by 17 cubic feet per year. This is opposite to the development of these species in the softwood type. Field observations indicated nevertheless that some of the spruce and balsam fir in the mixedwood type (those released by the logging) were growing at a very fast rate. These individuals, particularly the spruce, should develop into trees of good sawlog quality.

As in the softwood type, the rate of growth for the various periods varied considerably from the over-all average (Table 7). From 1921 to 1927 the net annual periodic increment was 21.1 cubic feet per acre; this increased the 1920 growing stock at the rate of just over one per cent per year.[4] From 1928 to 1946 the net annual periodic increment was 13.5 cubic feet per acre, increasing the 1927 growing stock by 0.5 per cent per year. During the last period the net annual periodic increment jumped to 45.4 cubic feet per acre, increasing the 1946 growing stock by 1.6 per cent per year.

[4] Periodic per cent growth rate determined by Pressler's formula.

Table 7

CUT-OVER MIXEDWOOD TYPE: NET ANNUAL PERIODIC INCREMENT PER ACRE

Species	Increment (cubic feet)		
	1921-27	1928-46	1947-56
Spruce	3.6	3.7	4.9
Balsam fir	1.1	3.3	5.9
Other softwoods	2.4	−3.9	6.4
Hardwoods	14.0	10.4	28.2
TOTAL	21.1	13.5	45.4

Mortality was considerably higher between 1921 and 1927 than it was between 1947 and 1956 (Table 8). The gross annual periodic increment rose slightly from 74.6 cubic feet per acre to 78.5 cubic feet per acre. These data and those for the softwoods certainly indicate that the Goulais area has a high wood-producing potential.

Table 8

CUT-OVER MIXEDWOOD TYPE: MEAN ANNUAL MORTALITY PER ACRE

Species	Mortality (cubic feet)		
	1921-27	1928-46*	1947-56
Spruce	2.2	.....	2.2
Balsam fir	15.1	.....	7.7
Other softwoods	22.7	.....	9.6
Hardwoods	13.5	.....	13.6
TOTAL	53.5	.....	33.1

* No data available.

The amount of visible defect recorded in 1956 (Table 9) is believed to be, as indicated for the softwood type, conservative. However, the data do indicate that the mixedwoods are more defective than the softwoods—a condition that was observed repeatedly during the course of the survey.

Development of Uncut Areas

A considerable portion of the Goulais area supported hardwood cover types. However, as the purpose of the project was to study the development of spruce and fir, the hardwood areas were not sampled.

The uncut softwood type in the Goulais area was made up primarily of those stands which were inaccessible in 1910. Only 14 plots were established in the type so no growth data are given here.

Table 9

CUT-OVER MIXEDWOOD TYPE: VISIBLE DEFECT 1956

Species	Total stand		Visibly defective stand		
	No. of trees	Volume (cu. ft.)	No. of trees	Volume (cu. ft.)	Per cent of total volume
Spruce	52	239	6	21	9
Balsam fir	194	388	26	64	17
Other softwoods	95	596	17	144	24
Hardwoods	355	2,130	120	976	46

Since the 1910 operations were for spruce and balsam fir pulpwood, it follows that mixedwood stands containing only a few trees of these species would be passed by. The uncut mixedwood type discussed in the following paragraphs is composed mostly of stands in which the softwood portion was primarily cedar.

Mixedwood Type

In 1920 the total volume, all species, averaged 3,033 cubic feet per acre (Figure 5). Spruce and balsam fir made up 423 cubic feet, other softwoods 860, and hardwoods 1,750.

In 1956 the total volume, all species, was 3,586 cubic feet per acre, an increase of about 18 per cent over the 1920 volume. Spruce increased from 177 to 226 cubic feet per acre, but balsam fir declined from 246 to 147. Other softwoods and hardwoods grew from 800 and 1,750 cubic feet per acre to 990 and 2,223 cubic feet per acre, respectively.

The composition by volume of the uncut mixedwood type was tending towards a greater proportion of hardwoods (Table 10). If this trend continues (as in the cut-over mixedwoods) the type will eventually become hardwood. In 1920 the hardwoods comprised 58 per cent of the total volume, but in 1956 these species made up 62 per cent.

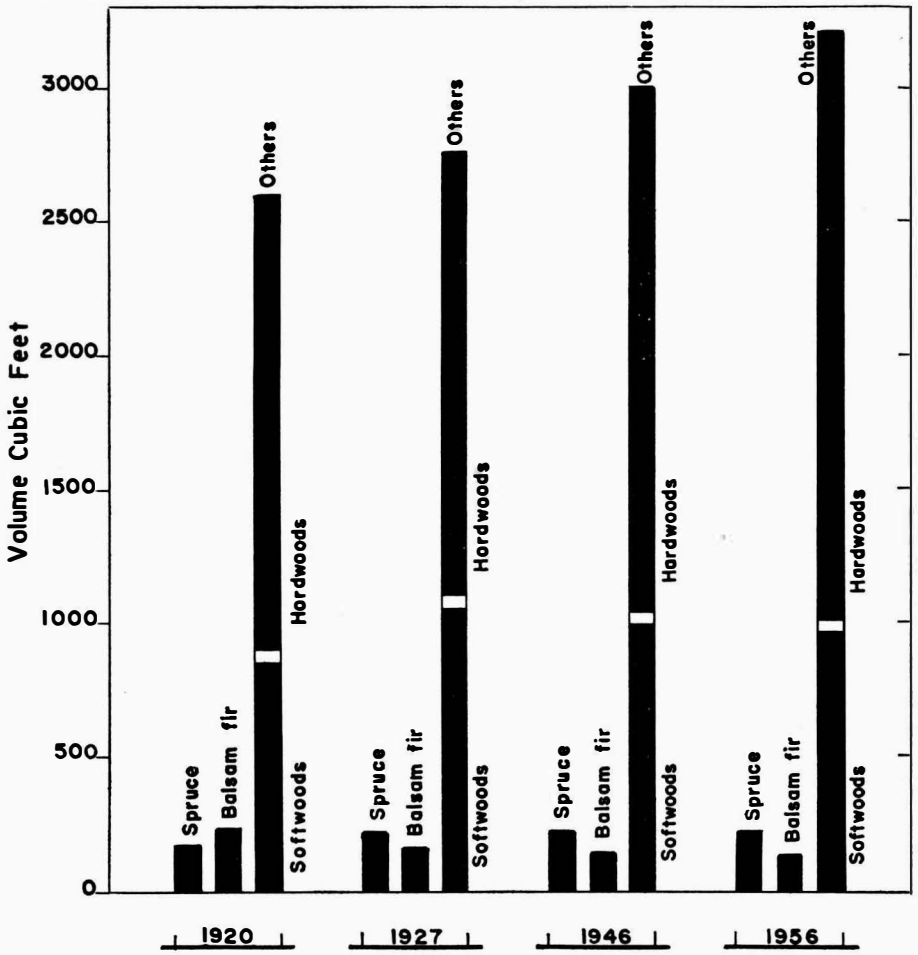
Table 10

COMPOSITION OF THE UNCUT MIXEDWOOD TYPE (PER CENT VOLUME) 1920 TO 1956

Species	Year			
	1920	1927	1946	1956
Spruce	6	7	7	6
Balsam fir	8	5	4	4
Other softwoods	28	34	30	28
Hardwoods	58	54	59	62
TOTAL	100	100	100	100

Figure 5

Uncut Mixedwood Type: Total Volume per Acre by Species (1920-1956)



The total volumes of the cut-over and uncut mixedwoods in 1956 were quite similar (3,147 and 3,586 cubic feet per acre, respectively) and the softwood portion, all species, was just about the same (39 per cent and 38 per cent). Balsam fir comprised 13 per cent of the total volume in the cut-over type but only 4 per cent in the uncut type. Spruce, on the other hand, comprised 8 and 6 per cent of the total volume in each condition, respectively.

Neither the softwood nor the hardwoods (4 inches d.b.h. and over) increased significantly in total numbers (Figure 6). In fact, spruce increased by only one and balsam fir decreased. In total numbers (all diameter classes) the dominant species were hardwoods. It is apparent from these data that there is every likelihood of the type developing into hardwoods and that spruce and fir will not form an appreciable part of the total stand.

From 1921 to 1956 the net annual periodic increment in the uncut mixedwood type, all species, was only 15 cubic feet per acre. This was considerably less than in the cut-over types. Spruce and balsam fir combined decreased in volume; other softwoods averaged only a little more than 3 cubic feet per year;

the hardwoods averaged only about 13 cubic feet per year. In effect the initial growing stock increased by only 18 per cent during the 36-year period from 1920 to 1956.

Figure 6

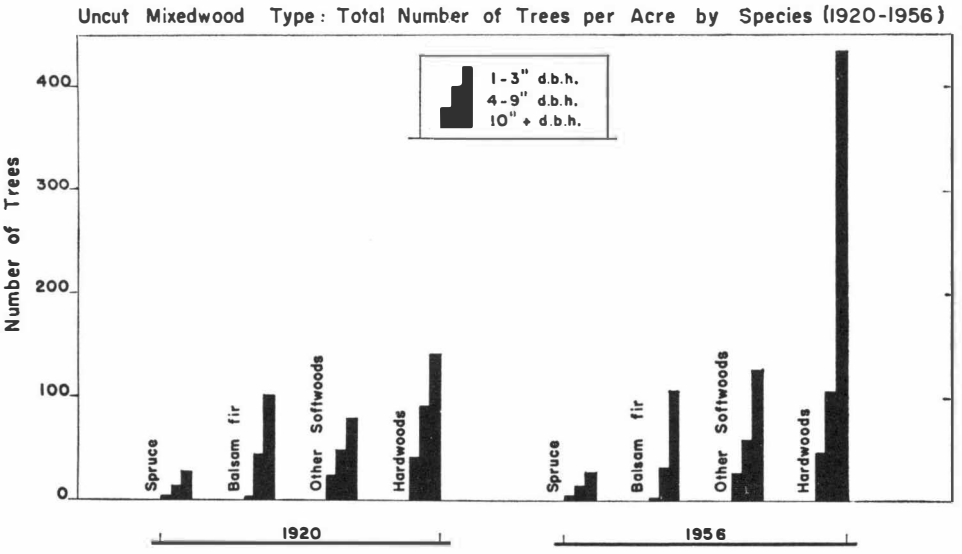


Table 11

UNCUT MIXEDWOOD TYPE: NET ANNUAL PERIODIC INCREMENT AND MORTALITY PER ACRE

Species	Increment (cubic feet)			Mortality (cubic feet)		
	1921-27	1928-46	1947-56	1921-27*	1928-46*	1947-56
Spruce	6.7	0.5	−0.8	.....	.....	6.2
Balsam fir	−10.9	−1.0	−0.3	.....	.....	3.6
Other softwoods	30.6	−3.6	−1.6	.....	.....	16.5
Hardwoods	−8.8	16.3	22.3	.....	.....	13.2
TOTAL	17.6	12.2	19.6	.....	.....	39.5

* No data available.

The net annual periodic increment for the various remeasurement periods and the mortality between 1947 and 1956 are summarized in Table 11. Mortality of various species between re-measurements often exceeded increment. For the last 10 years the gross annual increment, all species, was only 59.1 cubic feet per acre and most of this was lost in mortality. All this suggests that the uncut mixedwoods were at their maximum volume. Barring disturbance, the type may continue at its present volume indefinitely because growth is offset by mortality.

The stands composing the uncut mixedwood type, like the others, contained many unhealthy and defective trees (Table 12). The hardwoods suffered most defect, followed by other softwoods (mostly cedar), then by balsam fir and lastly spruce.

Table 12

UNCUT MIXEDWOOD TYPE: VISIBLE DEFECT 1956

Species	Total stand		Visibly defective stand		
	No. of trees	Volume (cu. ft.)	No. of trees	Volume (cu. ft.)	Per cent of total volume
Spruce	29	226	2	14	6
Balsam fir	107	147	17	15	10
Other softwoods	127	990	24	143	14
Hardwoods	420	2,224	105	795	36

Development of Burned Areas

The data given below are for those areas burned over in 1920, but excluding that portion burned again in 1948.

The 1920 burn was confined mainly to the sand and gravel flats adjacent to the main and east branches of the Goulais River. However, in some places, especially in the southeast portion of the area, the fire did extend into the uplands. It is assumed that the original stands on the flats were softwood types and those on the uplands were mixedwood and hardwood types.

The total volume of all species in the burned areas in 1927 averaged 158 cubic feet per acre (Figure 7). Much of this volume was contained in a few

Figure 7

Burn: Total Volume per Acre by Species (1927-1956)

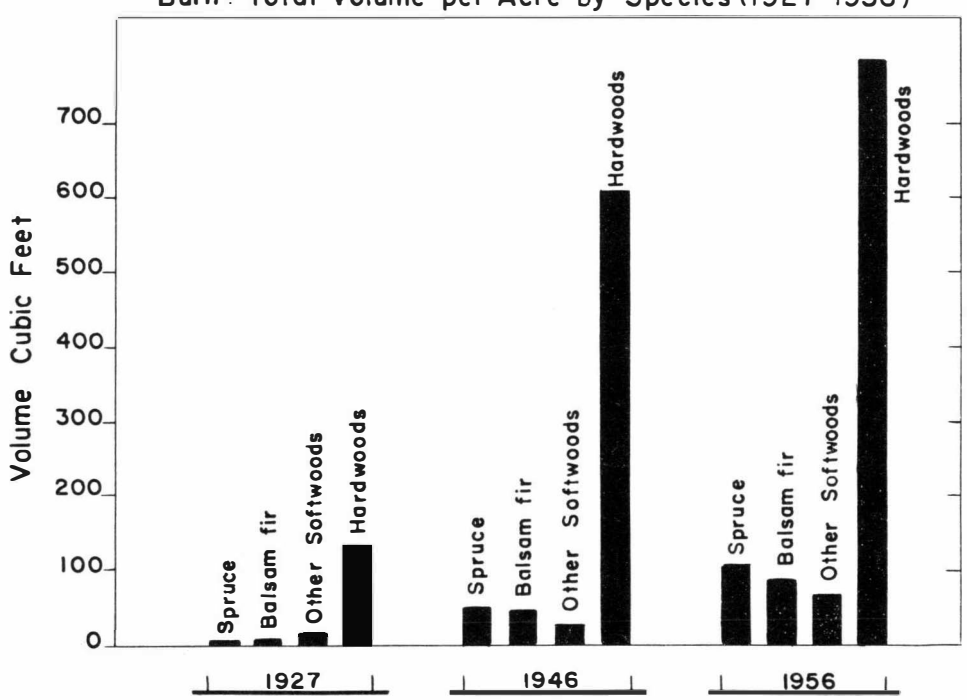
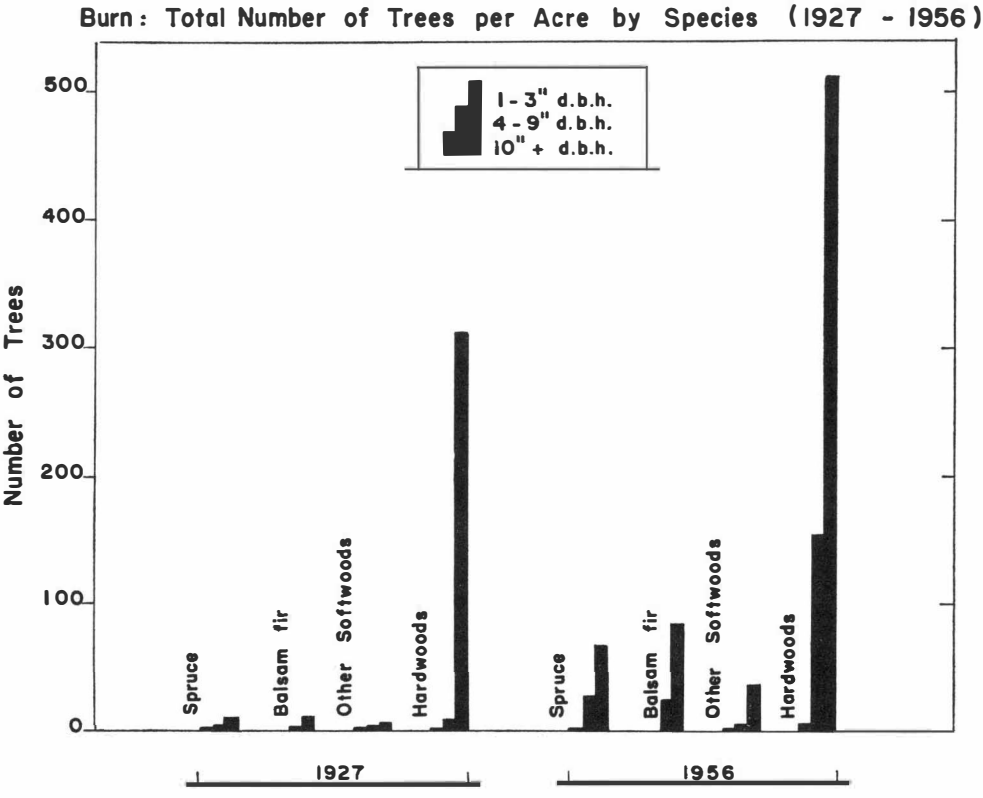


Figure 8



trees which had survived the fire. By 1956 the total volume, all species, had increased to more than 1,000 cubic feet per acre, nearly 7 times the 1927 volume.

The fire eliminated almost all spruce and balsam fir, and in 1927 there were only 9 spruce and 11 balsam fir per acre on the burned areas (Figure 8) with a combined volume of 11 cubic feet per acre. During the 29 growing seasons from 1928 to 1956, the number of spruce and balsam fir increased to 67 and 83 per acre, with a combined volume of 193 cubic feet per acre. Of the other softwoods, cedar appeared to be the only species invading the burns. It increased by 34 per acre and observations indicated that most of the young trees were growing well.

Poplar and white birch averaged 217 trees per acre in 1927 and had a volume of 65 cubic feet. Between 1928 and 1956 these species did not increase appreciably in total numbers, but their volume rose to well over 500 cubic feet per acre. On the other hand, maple and yellow birch increased rapidly in numbers (from 94 to 261 per acre) but slowly in volume (from 51 cubic feet per acre to 265).

Field observations indicated that the tolerant hardwoods (maple and birch) and cedar were the dominant species in the upland sites, whereas aspen, white birch, spruce and balsam fir were the dominants on the flats. Portions of the flats supported pure aspen and birch stands, which may or may not have had an understorey of spruce and fir; other portions had remained treeless and supported only shrubs and bracken fern.

DISCUSSION AND CONCLUSIONS

The basic aim of forest management is to strive for continuous production by obtaining at the earliest possible time an approximate balance between harvest and net growth. To achieve such an aim, information on forest development following fire and cutting is essential. The data being accumulated on the Goulais River watershed will be of considerable value in the planning of silvicultural practices to promote sustained-yield management in the Algoma Section of the Great Lakes-St. Lawrence Forest Region. A brief resumé and discussion of development of stands on this watershed is given below.

Prior to logging, the softwood type was rather open-grown and contained many defective trees. Much of the volume was in species other than spruce and fir and consequently removal of only the best spruce and fir left a residual stand containing many defective and unhealthy trees and changed the composition of the type to mixedwood.

Mortality was very high for some years following logging, then as the type was recovering, a spruce budworm infestation broke out. Considering its original composition, the type of logging and its subsequent history, the softwood type made remarkable growth. During the 36 years from 1920 to 1956, the growing stock of all species was more than doubled, and the spruce and fir component increased at the expense of the other species to almost three times its former volume. Although the type was still mixedwood in 1956, it should soon revert to softwood.

Unfortunately many of the trees in the softwood type were defective, so at the time of the next cut, an attempt should be made to remove and dispose of the defective material. Also, an attempt might be made to modify the stand composition by reducing the number of hardwoods. Although these species may be good nurse trees and help to improve site conditions, they do not develop into merchantable material on those sites occupied by the softwoods.

Most of the mixedwood forest cut in 1910 was composed of sugar maple, yellow birch, cedar, white spruce, and balsam fir. The logging removed only a small portion of the original volume and the species cut were mostly spruce and balsam fir. As in the softwood type many of the residual spruce and balsam fir were defective and high mortality followed logging. The overstorey of hardwoods hindered softwood regeneration and offered severe competition to the residual spruce and fir. As a result the volume of spruce and fir was less in 1956 than it was before logging in 1910. It is doubtful if the volume of these species will be sufficient to warrant another pulpwood (spruce-fir) operation for some time.

The logging released some spruce and fir trees; those individuals (especially the spruce) grew well and should develop into good sawlog material. Integrated operation for hardwood and softwood lumber may yield good returns in the future. However, as in the softwood type, stand improvement measures will have to be undertaken if the type is to produce a volume of merchantable wood anywhere near its potential.

Spruce and fir development was poorest in the uncut mixedwood type. Evidence of this is indicated by the following comparisons.

In the cut-over mixedwood type the proportional volume of spruce and fir rose from 15 per cent in 1920 to 21 per cent in 1956. However, in the uncut mixedwoods the proportional volume of spruce and fir dropped from 14 per cent in 1920 to 10 per cent in 1956.

Also, in the cut-over mixedwoods the net annual periodic increment of spruce and fir (1921 to 1956) was 7.6 cubic feet per acre; in the uncut stands mortality exceeded growth and the combined volume of spruce and fir diminished. Most of the mortality in the cut-over mixedwoods was in the large overmature decadent trees, but in the uncut mixedwoods mortality occurred in both young and old trees.

The upland areas burned in 1920 supported a good stocking of young maple and birch. Observations indicated that many of these trees were defective. Improvement thinnings to release the sound stems would ensure a crop of good-quality maple and birch for lumber and veneer.

The situation on the burned sand and gravel flats varied considerably but generally regeneration was unsatisfactory. Some areas were complete failures and supported only shrubs and bracken fern. Other areas supported pure stands of aspen and white birch or stands of aspen under which spruce and balsam fir were gradually seeding in. Pure stands of spruce and balsam fir were scarce. The quality of the spruce and fir on the sand and gravel flats was very good but the quality of the aspen and birch was poor.

SUMMARY

In 1920 the Government of Canada established an observation area on the Goulais River watershed to follow the development of spruce and balsam fir after a pulpwood logging operation for these species in 1910. Later the project was extended to follow forest development on burned areas.

Surveys were carried out in 1920, 1927, 1945-46 and 1956. This report summarizes the results and presents an analysis of forest development to the end of 1956. Data are given showing original volumes of the types, volumes after logging, changes in stand composition brought about by logging and during subsequent development, periodic net annual increment and mortality, and an estimate of visible defect in 1956.

The results show that the cut-over areas supported a greater volume of wood in 1956 (all species) than they did before logging. Also, considering the original stand, the logging methods used in 1910 and other disturbances since then, the development of the pulpwood species, spruce and balsam fir, especially in the softwood type, was satisfactory. From 1920 to 1956 the spruce and balsam growing stock increased by 152 per cent in the softwood type and by 78 per cent in the mixedwood type.

It is doubtful if the cut-over mixedwood type will contain a sufficient volume of spruce and balsam fir to sustain a pulpwood operation for these species in the near future. However, individual spruce and balsam fir trees released by the logging were growing well. These trees, especially the spruce, should develop into good sawlog trees, and integrated lumber, veneer and pulpwood operations may yield good returns. When the area is logged again, consideration should be given to stand improvement so that the types will develop to their full potential.

In the upland areas burned-over in 1920, regeneration of maple and yellow birch was good. However, these young stands contained many defective stems and were in need of cleaning. Generally, regeneration was unsatisfactory on the sand and gravel flats and many areas were still unstocked. Aspen and birch were the most abundant species but were of low quality. Spruce and balsam fir were present as an understorey in some of the aspen stands but pure stands of spruce and fir were scarce.

REFERENCES

1. McCarthy, E. F. and C. R. Mills 1920. Forest regeneration survey, Goulais Watershed. Canada, Commission of Conservation, Unpub. MS.

2. Mulloy, G. A. 1931. Growth on cut-over pulpwood forest in Ontario. Canada, Dept. of Interior, For. Serv., Silv. Res. Note No. 36.

3. MacLean, D. W. 1949. Forest development in the Goulais River watershed, 1910-1946. Canada, Dept. Mines and Resources. Dom. For. Serv., Silv. Res. Note No. 94.

4. Rowe, J. S. 1959. Forest regions of Canada. Dept. Northern Affairs and National Resources, Forestry Branch, Bull. 123.

5. Sisam, J. W. B. 1939. Forest development on the Goulais River watershed, 1910-33. Canada, Dept. Mines and Resources, Dom. For. Serv., Silv. Res. Note No. 55.

APPENDIX I

List of Species Showing Common and Scientific Names

Common Name	Scientific Name
Balsam fir	*Abies balsamea* (L.) Mill.
Black spruce	*Picea mariana* (Mill.) BSP.
Cedar	*Thuja occidentalis* L.
Jack pine	*Pinus banksiana* Lamb.
Larch	*Larix laricina* (Du Roi) K. Koch
White pine	*Pinus strobus* L.
White spruce	*Picea glauca* (Moench) Voss
Balsam poplar	*Populus balsamifera* L.
Black ash	*Fraxinus nigra* Marsh.
Ironwood or hornbeam	*Ostrya virginiana* (Mill.) K. Koch
Red maple	*Acer rubrum* L.
Red oak	*Quercus rubra* L.
Sugar maple	*Acer saccharum* Marsh.
Trembling aspen	*Populus tremuloides* Michx.
White birch	*Betula papyrifera* Marsh.
White elm	*Ulmus americana* L.
Yellow birch	*Betula lutea* Michx. f.

APPENDIX II

Stand and Stock Tables

Table 13

CUT-OVER SOFTWOOD TYPE: STAND TABLE (NUMBER OF TREES PER ACRE)

D.B.H.	Spruce				Balsam Fir				Cedar				White Pine				Yellow Birch				White Birch				Maple				Minor Species*		
	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1927	1946	1956
1.....	26.0	33.4	29.3	26.4	64.0	157.6	152.6	135.4	8.2	23.6	42.4	55.1	0.4	0.6	1.0	0.6	0.6	1.8	1.5	1.0	4.2	22.9	15.6	11.2	6.7	29.4	34.5	32.6	3.0	1.8	21.3
2.....	12.7	21.1	22.7	18.6	35.7	80.3	95.5	79.8	6.4	15.0	14.8	19.1	0.1	0.1	0.4	0.2	0.7	1.6	1.9	0.8	3.3	13.0	13.2	10.8	2.2	6.2	10.7	13.9	3.4	2.4	6.2
3.....	9.4	10.7	18.1	14.5	28.5	39.9	61.3	51.9	4.8	8.8	10.8	10.5	0.1	0.2	0.4	0.2	0.4	1.1	1.5	1.3	1.8	4.5	9.5	8.7	1.0	1.2	6.9	8.1	1.7	2.2	2.7
Total.....	48.1	65.2	70.1	59.5	128.2	277.8	309.4	267.1	19.4	47.4	68.0	84.7	0.6	0.9	1.8	1.0	1.7	4.5	4.9	3.1	9.3	40.4	38.3	30.7	9.9	36.8	52.1	54.6	8.1	6.4	30.2
4.....	6.5	7.7	14.6	12.9	16.5	31.1	44.6	36.0	4.1	12.6	10.3	7.7	0.1	0.1	0.2	.....	0.5	0.8	0.8	1.1	1.5	1.6	5.8	5.6	0.6	1.2	3.8	4.8	0.4	1.7	2.3
5.....	4.4	6.2	11.3	11.1	14.5	21.3	28.6	28.4	3.8	9.2	9.0	8.7	0.1	0.2	0.2	0.3	0.5	0.7	0.9	1.1	1.6	2.2	4.7	3.5	0.5	0.9	1.7	3.1	.....	1.3	1.2
6.....	4.7	4.3	6.5	9.2	11.6	15.1	23.3	22.9	3.5	5.8	7.2	6.0	0.1	.....	0.2	0.3	0.4	0.3	0.4	0.4	1.8	1.1	2.4	4.2	0.5	0.5	1.1	2.0	0.3	0.7	1.3
7.....	3.2	4.7	5.3	5.6	8.9	11.9	12.6	17.7	3.1	5.8	6.1	8.3	0.1	0.4	0.3	0.2	0.4	0.6	0.5	0.7	1.8	1.3	1.8	2.9	0.3	0.7	0.8	1.1	0.1	0.4	0.4
8.....	2.6	3.3	5.1	5.6	6.8	9.6	10.3	11.9	3.1	6.9	5.2	4.3	0.3	0.3	0.2	0.2	0.5	0.1	0.5	0.4	1.4	2.0	1.3	1.6	0.3	.....	0.4	0.5	.....	0.3	0.7
9.....	1.8	3.1	4.0	4.8	4.3	6.0	6.6	8.5	2.2	2.9	4.1	5.5	0.2	0.5	0.3	0.1	0.3	0.2	0.3	0.5	1.3	1.7	1.6	1.1	0.1	0.4	0.4	0.5	0.1	.....	0.3
Total.....	23.2	29.3	46.8	49.2	62.6	95.0	126.0	125.4	19.8	43.2	41.9	40.5	0.9	1.5	1.4	1.1	2.6	2.7	3.4	4.2	9.4	9.9	17.6	18.9	2.3	3.7	8.2	12.0	0.9	4.4	6.2
10.....	1.0	1.9	3.5	2.8	2.6	3.7	3.8	4.1	2.0	3.2	4.0	2.2	0.3	0.4	0.3	0.3	0.4	0.3	0.3	.....	1.4	1.8	1.1	1.1	0.1	0.2	0.2	0.4	0.1	0.1	0.1
11.....	0.7	1.3	1.6	3.5	0.8	1.8	2.7	2.8	1.7	2.1	3.1	4.2	0.3	0.3	0.5	0.5	0.3	0.7	0.5	0.1	1.2	1.8	1.1	1.6	0.1	0.3	0.4	0.5	0.3	.....	.....
12.....	0.4	0.5	1.1	1.7	0.5	1.6	0.9	2.5	1.6	1.2	1.7	3.4	0.4	0.3	0.5	0.2	0.2	0.2	0.3	0.6	1.1	1.5	1.1	1.0	0.1	0.2	0.1	0.1	0.2	.....	.....
13.....	0.2	0.4	0.8	1.5	0.2	0.5	1.0	0.4	1.0	1.5	1.8	2.0	0.2	0.3	0.2	0.3	0.2	0.2	.....	0.5	0.9	0.9	0.9	0.7	.....	.....	0.1	0.1	.....	0.1	.....
14.....	0.1	0.3	0.7	1.1	0.1	0.1	0.5	0.7	0.9	0.7	0.5	1.1	0.2	0.2	0.2	0.1	0.2	0.3	0.1	0.1	0.8	0.8	0.5	0.7	.....	0.1	.....	.....	0.2	.....	.....
15.....	.....	.....	0.4	0.2	0.1	.....	0.1	0.2	0.5	0.5	1.4	0.9	0.2	0.2	0.2	0.3	0.3	.....	0.6	0.3	0.5	0.4	0.5	0.2	.....	.....	0.1	0.1	.....	0.1	.....
16.....	0.1	.....	0.1	0.7	.....	.....	.....	.....	0.4	0.4	0.2	0.4	0.2	.....	0.2	0.1	0.2	0.2	0.1	0.6	0.4	0.1	0.4	.....	.....	.....	.....	.....	.....	.....	0.1
17.....	.....	.....	0.2	0.4	.....	.....	.....	.....	0.4	0.3	0.2	0.5	0.1	0.1	0.2	0.4	0.1	.....	0.1	0.2	0.2	0.4	0.3	0.5	.....	.....	.....	.....	.....	0.1	.....
18.....	.....	0.1	.....	0.2	.....	0.1	.....	.....	0.2	0.2	0.3	0.6	0.1	.....	0.2	0.3	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	.....	.....	.....	0.1	.....	.....	.....
19.....	.....	.....	.....	.....	.....	.....	.....	.....	0.2	0.1	0.2	0.2	0.1	.....	.....	0.1	0.1	0.2	0.1	0.1	0.1	.....	0.2	0.1	.....	.....	.....	.....	.....	.....	.....
Total.....	2.5	4.5	8.4	12.1	4.3	7.8	9.0	10.7	8.9	10.2	13.4	15.5	2.1	1.8	2.5	2.6	2.1	2.2	2.2	2.7	6.7	7.9	6.3	6.0	0.3	0.8	0.9	1.3	0.8	0.4	0.2
20+	.....	.....	0.1	0.1	.....	.....	.....	.....	0.4	0.4	0.5	0.4	0.6	0.1	0.2	0.3	0.4	0.3	0.5	0.5	0.3	0.1	.....	0.3	.....	.....	.....	.....	.....	.....	.....
Grand Total	73.8	99.0	125.4	120.9	195.1	380.6	444.4	403.2	48.5	101.2	123.8	141.1	4.2	4.3	5.9	5.0	6.8	9.7	11.0	10.5	25.7	58.3	62.2	55.9	12.5	41.3	61.2	67.9	9.8	11.2	36.6

* Poplar, larch and jack pine not tallied in 1920.

Table 14

CUT-OVER SOFTWOOD TYPE: STOCK TABLE (CUBIC FEET PER ACRE)

D.B.H.	Spruce				Balsam Fir				Cedar				White Pine				Yellow Birch				White Birch				Maple				Minor Species*		
	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1927	1946	1956
1.....	0.8	1.0	0.9	0.8	2.2	5.5	5.3	4.7	0.3	0.9	1.6	2.0	.....	.....	.....	.....	.....	0.1	0.1	0.1	0.3	1.6	1.1	0.8	0.5	2.2	2.6	2.4	0.1	0.1	1.3
2.....	2.3	3.8	4.1	3.4	7.0	15.8	18.8	15.7	1.2	2.9	2.9	3.7	.....	.....	0.1	.....	0.2	0.5	0.6	0.2	1.1	4.4	4.4	3.6	0.7	2.1	3.7	4.8	1.0	0.6	1.8
3.....	4.9	5.6	9.4	7.5	15.8	22.1	34.0	28.8	2.5	4.6	5.6	5.5	0.1	0.1	0.2	0.1	0.3	0.9	1.2	1.0	1.5	3.7	7.8	7.2	0.8	1.0	5.9	6.9	1.4	1.6	2.0
Total.....	8.0	10.4	14.4	11.7	25.0	43.4	58.1	49.2	4.0	8.4	10.1	11.2	0.1	0.1	0.3	0.1	0.5	1.5	1.9	1.3	2.9	9.7	13.3	11.6	2.0	5.3	12.2	14.1	2.5	2.3	5.1
4.....	7.2	8.5	16.2	14.3	19.5	36.7	52.6	42.5	4.4	13.6	11.1	8.3	0.1	0.1	0.2	.....	0.8	1.3	1.3	1.7	2.4	2.6	9.3	9.0	1.1	2.1	6.5	8.2	0.6	2.6	3.6
5.....	9.0	12.7	23.2	22.7	31.3	46.0	61.8	61.3	7.1	17.2	16.8	16.3	0.1	0.4	0.4	0.6	1.4	1.9	2.4	3.0	4.2	5.8	12.6	9.3	1.5	2.7	5.0	9.1	.....	3.3	3.1
6.....	15.7	14.5	21.9	31.0	41.6	53.9	83.2	81.8	10.3	17.1	21.2	17.6	0.3	.....	0.7	1.0	1.6	1.3	1.7	1.7	7.0	4.4	9.6	16.8	2.4	2.3	5.0	9.0	1.1	2.8	5.2
7.....	16.4	24.3	27.5	29.0	48.2	64.3	68.0	95.6	13.6	25.1	26.4	35.8	0.6	2.2	1.7	1.1	2.4	3.6	3.0	4.2	10.4	7.4	10.2	16.5	2.0	4.5	5.1	7.1	0.5	2.3	2.2
8.....	19.5	24.7	37.9	41.9	51.9	73.7	79.1	91.4	18.7	41.9	31.6	26.1	2.1	2.4	1.6	1.6	3.8	0.8	4.2	3.3	10.4	15.3	9.9	12.2	2.6	.....	3.4	4.3	.....	2.3	5.6
9.....	18.1	31.9	41.2	49.4	44.3	62.4	68.6	88.4	17.8	23.3	33.0	44.2	2.4	5.6	3.4	1.1	3.6	2.2	3.3	5.5	13.0	16.9	15.9	10.9	1.3	4.5	4.5	5.6	1.0	.....	3.1
Total.....	85.9	116.6	167.9	188.3	236.8	337.0	413.3	461.0	71.9	138.2	140.1	148.3	5.6	10.7	8.0	5.4	13.6	11.1	15.9	19.4	47.4	52.4	67.5	74.7	10.9	16.1	29.5	43.3	3.2	13.3	22.8
10.....	13.5	25.8	47.6	38.1	34.2	49.6	50.9	54.9	20.7	33.2	41.6	22.9	4.8	6.0	4.5	4.5	5.2	4.3	4.3	.....	17.3	22.7	13.9	13.9	1.7	2.8	2.8	5.6	1.3	1.3	1.3
11.....	11.7	22.8	28.0	61.2	14.1	30.6	45.9	47.6	22.5	27.5	40.6	55.0	5.6	5.9	9.8	11.8	5.5	12.5	9.0	1.8	19.0	28.4	17.4	25.3	1.0	5.2	6.9	8.6	5.0	.....	.....
12.....	8.1	11.0	24.2	37.4	10.9	33.4	18.8	52.2	24.9	19.3	27.4	54.8	8.6	7.4	12.3	4.9	5.5	4.4	6.6	13.2	21.1	28.8	21.1	19.2	1.0	4.1	2.1	2.1	4.0	.....	.....
13.....	4.3	10.8	21.6	40.5	4.7	12.4	24.8	9.9	19.7	29.0	34.7	38.5	6.7	9.1	6.1	9.1	5.8	5.3	.....	13.2	20.3	20.5	20.5	15.9	0.2	.....	2.4	2.4	.....	2.4	.....
14.....	3.9	9.8	22.9	36.0	1.7	2.9	14.6	20.4	19.9	15.8	11.3	75.1	8.9	7.4	7.4	3.7	7.9	9.5	3.2	3.2	21.5	21.2	13.3	18.6	0.8	2.9	.....	2.8	7.4	.....	.....
15.....	1.2	.....	15.6	7.8	1.7	.....	3.3	6.7	13.8	13.3	37.1	23.9	9.7	8.8	8.8	13.2	10.0	.....	22.2	11.1	15.7	12.3	15.4	6.2	0.6	.....	3.3	.....	.....	3.3	.....
16.....	2.3	.....	4.5	31.8	0.3	.....	.....	.....	13.3	12.1	6.1	12.2	9.3	.....	10.3	5.2	7.3	8.6	4.3	25.9	13.7	3.5	14.1	.....	0.7	.....	.....	.....	.....	.....	3.8
17.....	1.6	.....	10.5	15.8	.....	.....	.....	.....	12.8	10.4	6.9	17.2	7.1	6.0	11.9	23.8	5.5	.....	5.0	10.0	8.0	16.0	12.0	20.0	0.4	.....	.....	4.2	.....	6.0	.....
18.....	1.2	6.0	.....	12.8	.....	4.8	.....	.....	8.9	7.8	11.6	23.3	8.8	.....	13.6	20.4	6.8	5.7	5.7	11.3	6.3	9.0	9.0	4.5	0.2	.....	.....	.....	.....	.....	.....
19.....	1.4	.....	.....	.....	.....	.....	.....	.....	6.5	4.3	8.7	8.7	10.8	.....	.....	7.7	5.1	12.8	6.4	6.4	4.5	.....	10.0	5.0	.....	.....	.....	.....	.....	.....	.....
Total.....	49.2	86.2	174.9	281.4	67.6	133.7	158.3	191.7	163.0	172.7	226.0	331.6	80.3	50.6	84.7	104.3	64.6	63.1	66.7	96.1	147.4	162.4	146.7	128.6	6.6	15.0	17.5	25.7	17.7	13.0	5.1
20+.....	0.6	.....	8.5	7.6	.....	.....	.....	.....	16.6	25.0	31.5	31.4	44.2	10.7	31.9	45.5	14.7	33.9	58.2	47.8	4.3	5.5	.....	17.7	0.5	.....	.....	.....	.....	.....	.....
Grand Total.....	143.7	213.2	365.7	489.0	329.4	514.1	629.7	701.9	255.5	344.3	407.7	522.5	130.2	72.1	124.9	155.3	93.4	109.6	142.7	164.6	202.0	230.0	227.5	232.6	20.0	36.4	59.2	83.1	23.4	28.6	33.0

* Poplar, larch and jack pine, not tallied in 1920.

Table 15

CUT-OVER MIXEDWOOD TYPE: STAND TABLE (NUMBER OF TREES PER ACRE)

D.B.H.	Spruce				Balsam Fir				Cedar				White Pine				Yellow Birch				White Birch				Maple				Minor Species*		
	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1927	1946	1956
1.....	9.7	14.5	13.2	14.0	37.1	88.1	73.9	54.6	10.2	18.1	31.8	34.8	0.1	0.8	0.6	0.2	2.5	11.3	7.0	7.2	4.0	14.0	5.3	2.3	16.8	80.4	100.4	120.6	1.3	0.2	10.9
2.....	5.3	10.5	10.8	9.5	17.5	43.8	51.0	36.4	7.0	10.4	11.2	12.6	0.1	0.4	0.2	0.2	2.9	5.3	6.5	6.3	2.3	9.1	5.8	8.9	7.3	12.2	33.0	35.5	0.7	0.7	4.9
3.....	3.5	4.5	8.7	6.9	12.7	20.7	35.3	25.7	5.1	4.8	6.5	6.6	0.1	0.1	0.1	0.2	2.4	3.7	5.3	4.5	1.6	4.1	5.8	10.5	4.1	6.8	16.4	17.9	1.3	0.4	2.6
Total.....	18.5	29.5	32.7	30.4	67.3	152.6	160.2	116.7	22.3	33.3	49.5	54.0	0.3	1.3	0.9	0.6	7.8	20.3	18.8	18.0	7.9	27.2	16.9	21.7	28.2	99.4	149.8	174.0	3.3	1.3	18.4
4.....	2.4	3.5	5.2	4.6	10.0	15.2	25.4	22.2	4.3	5.5	4.0	3.8	0.1	0.2	0.2	0.1	2.2	3.3	4.4	4.7	1.3	3.6	5.4	4.4	3.0	4.6	9.5	11.6	1.5	0.3	1.3
5.....	2.2	2.2	3.6	3.0	9.5	10.8	17.2	17.9	3.7	4.4	4.4	3.9	0.1	.....	0.1	0.2	2.3	2.5	3.3	3.5	1.5	2.7	3.7	3.2	2.9	2.9	6.6	8.0	1.3	0.6	1.0
6.....	1.8	1.7	2.5	3.2	7.7	8.2	12.2	12.7	3.6	5.0	3.5	3.1	0.1	0.2	0.1	.....	2.4	3.0	2.2	2.1	1.6	2.2	3.7	2.7	2.8	2.8	3.0	5.1	0.6	0.9	0.9
7.....	1.6	1.8	1.7	1.3	6.0	7.5	6.5	8.7	3.1	3.5	3.6	3.8	0.1	0.1	0.1	0.1	2.0	3.0	2.0	2.0	1.6	2.7	2.3	9.0	2.1	3.2	3.4	3.2	0.3	0.3	0.5
8.....	1.3	1.5	1.7	1.7	4.9	3.9	5.6	6.2	3.2	2.4	3.1	3.3	0.1	0.4	0.1	0.2	2.1	2.5	2.2	1.2	1.5	2.1	1.8	2.1	2.2	2.8	2.4	2.4	0.4	0.5	0.3
9.....	1.0	1.5	1.3	1.0	3.2	3.1	2.5	4.4	2.8	3.3	2.9	2.2	0.1	0.1	.....	.....	1.7	2.2	2.3	2.6	1.5	1.5	1.8	1.7	1.8	2.1	2.7	2.5	0.1	0.2	0.2
Total.....	10.3	12.2	16.0	14.8	41.3	48.7	69.4	72.1	20.7	24.1	21.5	20.1	0.6	1.0	0.6	0.6	12.7	16.5	16.4	16.1	9.0	14.8	18.7	23.1	14.8	18.4	27.6	32.8	4.2	2.8	4.2
10.....	0.6	1.2	1.3	1.1	2.3	1.8	1.8	1.8	2.7	2.7	3.3	2.9	0.2	0.1	0.4	0.1	2.0	2.1	2.5	1.6	1.5	1.2	1.4	1.2	2.0	1.6	2.3	2.8	.....	0.1	0.2
11.....	0.5	0.6	1.0	1.2	1.3	1.3	1.4	1.5	2.2	3.2	2.0	3.0	0.1	.....	0.1	0.2	1.6	2.7	2.0	2.4	1.3	1.6	1.4	1.3	1.6	1.6	1.2	2.5	0.1	0.1	0.1
12.....	0.4	0.5	1.2	1.2	0.6	0.2	0.4	0.8	2.3	2.8	3.1	2.4	0.1	0.1	.....	0.2	1.6	1.8	2.2	2.0	1.2	1.2	0.9	0.7	1.6	1.7	1.7	1.7	.....	0.1	.....
13.....	0.3	0.2	0.6	0.6	0.3	0.4	0.3	0.3	1.9	2.5	2.2	2.2	0.1	0.1	0.1	0.1	1.4	1.5	2.5	2.2	0.8	1.6	0.9	0.9	1.1	1.6	1.6	1.1	0.1	0.1	0.3
14.....	0.1	0.1	0.4	1.3	0.1	.....	0.1	0.3	1.9	1.8	1.8	2.5	0.1	0.1	0.1	.....	1.5	1.8	2.0	1.6	0.8	0.3	1.1	0.8	1.3	0.7	1.0	1.5	.....	.....	.....
15.....	0.1	0.1	0.4	0.3	.....	.....	0.1	0.1	1.8	1.8	1.4	1.3	0.1	.....	0.1	.....	1.4	1.5	1.6	1.5	0.6	0.2	0.6	0.6	0.8	0.9	1.2	0.7	.....	.....	0.1
16.....	0.1	0.2	0.1	0.4	.....	0.1	.....	0.2	1.3	1.7	1.3	1.2	0.1	0.1	0.1	0.1	1.2	1.3	1.3	1.7	0.4	0.4	0.4	0.6	0.5	0.5	0.6	0.6	.....	0.1	.....
17.....	0.1	0.1	0.1	0.2	.....	.....	0.1	.....	1.1	1.0	0.8	1.1	0.1	0.1	.....	.....	1.0	1.1	0.9	1.6	0.3	0.2	0.2	0.4	0.3	0.2	0.5	0.7	.....	.....	.....
18.....	.....	.....	0.1	0.1	.....	.....	.....	0.2	0.9	1.2	0.9	1.0	0.1	.....	.....	.....	1.0	0.7	1.3	1.1	0.2	0.1	0.3	0.3	0.2	0.4	0.2	0.8	.....	.....	.....
19.....	.....	.....	.....	.....	.....	.....	.....	.....	0.7	0.8	0.5	0.5	.....	0.1	0.1	0.1	1.0	1.0	1.0	1.0	0.1	0.2	.....	.....	0.1	0.4	0.2	0.2	.....	.....	.....
Total.....	2.2	3.0	5.2	6.4	4.6	3.8	4.2	5.2	16.8	19.5	17.3	18.1	1.0	0.7	1.0	0.8	13.7	15.5	17.3	16.7	7.2	7.0	7.2	6.8	9.5	9.6	10.5	12.6	0.2	0.5	0.7
20+.....	.....	.....	0.1	0.1	.....	.....	.....	.....	1.2	1.1	0.8	1.3	0.3	0.1	0.2	0.3	2.5	2.1	2.4	3.6	0.1	0.2	0.4	0.4	1.0	0.2	0.3	0.5	0.1	.....	0.1
Grand Total.....	31.0	44.7	54.0	51.7	113.2	205.1	233.8	194.0	61.0	78.0	89.1	93.5	2.2	3.1	2.7	2.3	36.7	54.4	54.9	54.4	24.2	49.2	43.2	52.0	53.5	127.6	188.2	219.9	7.8	4.6	23.4

* Poplar, white elm and black ash, not tallied in 1920.

Table 16

CUT-OVER MIXEDWOOD TYPE: STOCK TABLE (CUBIC FEET PER ACRE)

D.B.H.	Spruce				Balsam Fir				Cedar				White Pine				Yellow Birch				White Birch					Maple			Minor Species*		
	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1927	1946	1956
1.....	0.3	0.5	0.4	0.5	1.3	3.0	2.5	1.8	0.4	0.7	1.2	1.3	.....	.....	.....	.....	0.1	0.7	0.4	0.4	0.3	1.0	0.4	0.2	1.3	6.0	7.5	9.0	0.1	0.1	0.6
2.....	1.0	2.1	2.1	1.9	3.6	9.0	10.4	7.4	1.4	2.0	2.2	2.5	.....	0.1	.....	.....	0.9	1.6	2.0	1.9	0.8	3.0	1.9	3.0	2.5	4.2	11.4	12.2	0.2	0.2	1.5
3.....	1.9	2.5	4.8	3.8	7.5	12.3	20.9	15.2	2.7	2.5	3.4	3.4	.....	.....	.....	0.1	1.9	2.9	4.1	3.5	1.3	3.4	4.8	8.6	3.5	5.8	14.0	15.3	1.1	0.3	2.0
Total.....	3.2	5.1	7.3	6.2	12.4	24.3	33.8	24.4	4.5	5.2	6.8	7.2	.....	0.1	.....	0.1	2.9	5.2	6.5	5.8	2.4	7.4	7.1	11.8	7.3	16.0	32.9	36.5	1.4	0.6	4.1
4.....	2.7	4.0	5.9	5.2	12.5	19.0	31.7	27.7	4.7	5.9	4.3	4.1	0.1	0.2	0.2	0.1	3.5	5.2	6.9	7.4	2.0	5.8	8.6	7.0	5.2	7.9	16.3	20.0	3.3	0.6	2.0
5.....	4.5	4.6	7.5	6.2	21.6	24.5	39.1	40.6	6.9	8.2	8.2	7.2	0.1	.....	0.2	0.4	6.2	6.8	8.9	9.4	4.0	7.2	9.8	8.4	8.4	8.6	19.5	23.0	3.5	1.7	2.7
6.....	6.0	5.8	8.5	10.9	28.1	29.8	44.4	46.2	10.6	14.7	10.3	9.1	0.3	0.7	0.2	.....	9.9	12.6	9.2	8.8	6.3	8.8	14.8	10.8	12.5	12.7	13.6	23.1	2.8	3.9	3.7
7.....	8.5	9.3	8.6	6.7	32.9	41.0	35.5	47.5	13.5	15.1	15.6	16.4	0.6	0.6	0.6	0.6	12.0	18.2	12.1	12.1	8.8	15.4	13.1	51.2	13.5	20.7	22.0	20.7	1.6	1.6	2.9
8.....	9.6	11.1	12.6	12.6	38.0	30.5	43.7	48.4	19.4	14.6	18.8	20.0	0.8	3.2	0.8	1.6	17.5	20.9	18.9	10.0	11.6	16.0	13.7	16.0	19.5	24.4	20.9	20.9	2.9	4.2	2.4
9.....	9.7	15.3	12.5	10.2	34.1	32.6	26.2	46.2	22.3	26.5	23.3	17.6	1.4	0.7	.....	.....	18.7	24.2	25.3	28.6	14.5	14.9	17.9	16.8	20.3	23.5	30.2	28.0	0.7	2.1	2.2
Total.....	41.0	50.1	55.6	51.8	167.2	177.4	220.6	256.6	77.4	85.0	80.5	74.4	3.3	5.4	2.0	2.7	67.8	87.9	81.3	76.3	47.2	68.1	77.9	110.2	79.4	97.8	122.5	135.7	14.8	14.1	15.9
10.....	8.7	16.3	17.1	15.0	30.9	24.5	24.5	24.5	28.3	28.1	34.3	30.1	2.3	0.9	6.0	1.5	28.7	29.8	35.5	22.7	18.8	15.1	17.6	15.1	28.8	22.6	32.4	39.4	.....	1.7	2.6
11.....	8.4	10.5	17.5	21.1	21.5	22.4	24.1	25.8	28.8	41.9	26.2	39.3	2.3	.....	2.0	3.9	28.8	48.3	35.8	42.9	20.4	25.3	22.1	20.6	27.5	27.7	20.8	43.4	1.0	2.2	1.7
12.....	8.7	11.2	26.8	26.7	13.3	4.3	8.6	17.2	36.4	45.1	49.9	38.6	2.7	2.5	.....	4.9	35.3	39.4	48.2	43.8	22.7	23.0	17.3	13.4	32.8	35.0	35.0	35.0	.....	2.5	.....
13.....	6.9	5.5	16.5	16.6	7.3	10.4	7.8	7.8	36.9	48.3	42.5	42.4	2.7	1.8	1.8	3.0	36.0	39.8	66.3	58.3	18.9	36.5	20.5	20.5	27.8	39.0	39.0	26.8	1.5	1.6	7.6
14.....	4.4	2.0	13.5	43.8	3.4	.....	3.1	9.3	42.5	40.7	40.7	56.5	3.3	3.7	2.2	.....	47.3	56.7	63.0	50.9	20.1	8.0	29.2	21.2	36.2	20.0	28.5	42.8	.....	.....	.....
15.....	4.4	4.0	16.2	12.1	1.4	.....	3.6	3.6	46.4	47.7	37.1	34.5	2.2	.....	2.6	.....	52.5	55.5	59.2	55.5	18.2	6.2	17.2	18.5	25.1	29.3	29.1	22.8	.....	2.6	.....
16.....	3.8	9.6	4.8	19.2	0.2	2.5	.....	8.2	39.4	51.5	39.4	36.3	3.1	3.1	3.1	5.2	53.6	56.2	54.4	73.9	15.1	14.1	14.1	21.1	18.9	18.5	22.2	22.2	.....	.....	3.7
17.....	2.8	5.6	3.4	11.2	0.3	.....	2.8	.....	37.6	34.5	27.6	38.0	3.0	3.6	.....	.....	49.6	54.6	44.6	79.4	10.8	8.0	8.0	16.0	14.2	8.4	20.9	29.3	.....	.....	.....
18.....	0.7	.....	6.5	6.5	0.2	.....	.....	10.6	36.5	46.6	34.9	38.8	3.4	.....	.....	.....	54.9	39.6	71.3	62.2	8.0	2.7	11.7	13.5	7.9	18.7	9.3	37.4	.....	.....	.....
19.....	0.8	.....	.....	.....	.....	.....	.....	.....	29.9	34.7	21.7	21.7	3.1	4.6	4.6	7.7	64.2	64.2	64.0	64.2	4.0	10.0	.....	.....	4.7	20.7	10.4	10.4	.....	.....	.....
Total.....	49.6	64.7	122.3	172.2	78.5	64.1	74.5	107.0	362.7	419.1	354.3	376.2	28.1	20.2	22.3	26.2	450.9	484.1	542.3	553.8	157.0	148.9	157.7	159.9	223.9	239.9	247.6	309.5	2.5	10.6	15.6
20+.....	1.1	.....	5.1	8.5	.....	.....	.....	.....	73.5	65.4	44.2	75.1	39.7	5.2	21.4	34.4	252.2	224.6	281.5	420.5	7.9	11.1	23.5	26.8	6.4	12.3	17.6	34.3	4.3	.....	8.0
Grand Total.....	94.9	119.9	190.3	238.7	258.1	265.8	328.9	388.0	518.0	574.7	485.8	532.9	71.1	30.9	45.7	63.4	773.8	801.8	911.6	1,056.4	214.5	235.5	266.2	308.7	317.0	366.0	420.6	516.0	23.0	25.3	43.6

* Poplar, white elm and black ash, not tallied in 1920.

Table 17

UNCUT MIXEDWOOD TYPE: STAND TABLE (NUMBER OF TREES PER ACRE)

D.B.H.	Spruce				Balsam Fir				Cedar				White Pine				Yellow Birch				White Birch				Maple				Minor Species*		
	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1927	1946	1956
1	5.1	7.1	8.0	8.5	22.1	64.5	57.5	37.4	10.9	20.7	38.9	46.8	.....	.....	0.4	0.2	1.1	8.5	9.5	10.0	0.4	12.5	4.9	2.2	16.5	88.2	237.6	221.3	3.3	1.7	7.5
2	7.7	4.2	4.5	4.3	17.6	34.6	28.4	24.1	9.6	14.4	14.4	14.6	.....	.....	.....	.....	3.7	4.9	5.1	5.2	1.1	5.1	3.5	2.8	12.9	18.4	39.8	55.5	3.7	1.1	3.0
3	3.4	1.6	3.6	2.3	15.3	20.9	17.1	14.1	9.7	6.4	6.7	5.2	.....	.....	0.2	0.4	2.0	2.7	5.6	3.9	2.1	1.5	2.7	1.3	9.5	9.8	15.8	17.2	1.4	1.1	0.6
Total	16.2	12.9	16.1	15.1	55.0	119.4	103.0	75.6	30.2	41.5	60.0	66.6	.....	.....	0.6	0.6	6.8	16.1	20.2	19.1	3.6	19.1	11.1	6.3	38.9	116.4	292.6	294.0	8.4	3.9	11.1
4	2.4	3.3	1.6	1.9	11.7	12.4	14.0	10.2	5.1	8.9	6.7	3.0	0.2	0.2	.....	0.4	2.8	1.5	4.0	3.1	1.9	1.1	1.8	1.3	5.5	8.5	12.0	11.1	.....	0.8	0.4
5	1.9	2.5	3.1	1.3	10.4	9.8	8.2	8.2	4.6	6.7	8.2	7.2	0.1	.....	.....	.....	3.0	3.1	2.0	1.5	1.2	0.4	0.5	1.7	5.0	4.5	4.9	8.6	0.2	.....	1.4
6	1.3	2.5	1.6	1.1	8.3	7.1	6.2	5.2	4.0	5.8	5.1	5.2	0.1	0.5	0.2	0.4	2.8	2.4	2.2	1.7	1.7	1.5	1.6	1.3	4.1	3.5	5.8	4.7	0.2	0.4	0.2
7	1.4	1.3	1.8	1.5	5.7	4.7	4.3	2.2	3.2	4.9	5.6	4.3	0.1	0.2	0.4	0.2	2.4	2.7	2.2	2.2	1.3	1.6	1.3	1.7	3.3	4.7	3.6	4.8	.....	0.2	0.8
8	1.0	1.6	1.1	0.9	4.5	3.1	0.9	3.5	3.4	4.5	4.7	5.9	0.1	0.4	0.2	0.7	2.5	1.3	2.0	1.3	1.2	1.5	0.7	0.9	3.4	2.4	2.9	3.0	.....	0.4	0.2
9	1.0	1.5	0.9	1.5	2.6	1.5	1.5	0.7	3.1	4.9	4.3	3.2	0.1	0.7	0.5	0.4	2.0	2.9	2.6	1.7	0.8	1.1	0.2	0.4	3.3	3.6	3.2	3.4	0.2	0.4	0.2
Total	9.0	12.7	10.1	8.2	43.2	38.6	35.1	30.0	23.4	35.7	34.6	28.8	0.7	2.0	1.3	2.1	15.5	13.9	15.0	11.5	8.1	7.2	6.1	7.3	24.6	27.2	32.4	35.6	0.6	2.2	3.2
10	0.8	3.1	1.1	0.6	1.8	0.5	0.9	0.9	3.3	3.8	4.4	4.9	0.2	0.7	0.4	0.2	2.1	2.4	1.7	2.5	0.8	1.3	0.4	0.2	3.5	2.9	2.9	3.0	0.2	0.2	0.2
11	0.8	0.2	1.5	1.1	0.9	0.4	0.4	0.4	3.3	4.0	3.3	3.3	0.1	0.4	0.5	0.4	1.8	2.2	2.5	1.7	0.8	1.6	1.1	0.6	2.8	1.8	2.9	2.7	.....	.....	.....
12	0.6	0.9	0.9	0.9	0.6	.....	0.2	.....	3.4	4.5	3.1	2.4	0.2	1.1	0.2	0.7	2.0	1.5	1.8	2.7	0.8	0.7	1.3	1.7	3.4	2.9	1.5	1.9	0.2	0.2	.....
13	0.5	0.2	1.5	1.3	0.4	.....	0.2	0.4	2.7	3.1	2.9	3.0	0.2	0.4	0.9	0.6	1.4	2.4	2.4	1.1	0.4	0.2	0.5	0.6	2.4	1.8	2.3	2.6	.....	0.2	0.2
14	0.5	0.9	0.2	0.8	0.1	.....	.....	.....	2.6	2.2	2.8	2.0	0.1	0.2	.....	0.6	1.8	0.7	0.9	2.4	0.5	.....	.....	0.2	2.2	2.4	0.9	1.3	.....	.....	.....
15	0.3	0.2	0.2	0.4	0.1	0.2	.....	0.2	2.1	2.0	2.2	2.0	0.2	0.2	0.7	0.2	1.9	1.3	2.3	1.5	0.4	.....	0.2	.....	1.5	1.6	1.8	1.6	.....	.....	0.2
16	0.3	0.5	0.5	0.4	.....	.....	.....	.....	1.8	1.5	2.4	1.1	0.2	0.2	0.4	0.7	1.3	1.5	1.2	1.5	0.2	0.2	.....	.....	1.1	1.1	1.4	0.8	.....	.....	.....
17	0.1	.....	0.4	0.2	.....	.....	.....	.....	1.3	0.9	0.5	1.1	0.1	0.5	0.2	0.6	1.4	1.1	1.8	1.1	0.2	0.2	.....	.....	0.7	0.5	0.2	1.5	.....	.....	.....
18	0.1	.....	0.2	.....	.....	.....	.....	.....	1.0	1.6	1.5	0.9	0.1	0.2	.....	0.2	1.1	2.2	0.9	2.2	0.2	0.2	0.2	.....	0.5	0.5	0.7	1.2	.....	.....	.....
19	.....	.....	.....	0.2	.....	.....	.....	.....	0.8	1.8	0.9	1.1	0.1	.....	0.4	.....	1.4	1.5	0.9	1.0	0.1	.....	0.2	.....	0.2	0.5	0.6	.....	.....	.....	.....
Total	4.0	6.0	6.5	5.9	3.9	1.1	1.7	1.9	22.3	25.4	24.0	21.8	1.5	3.9	3.7	4.2	16.2	16.8	16.4	17.7	4.4	4.4	3.9	3.3	18.3	16.0	15.2	16.6	0.4	0.6	0.6
20+	0.1	0.2	.....	.....	.....	.....	.....	.....	1.4	2.2	1.6	1.6	0.8	0.6	0.6	0.8	3.7	2.8	6.0	6.5	0.1	.....	.....	.....	0.2	.....	1.0	1.8	.....	.....	.....
Grand Total	29.3	31.8	32.7	29.2	102.1	159.1	139.8	107.5	77.3	104.8	120.2	118.8	3.0	6.5	6.2	7.7	42.2	49.6	57.6	54.8	16.2	30.7	21.1	16.9	82.0	159.6	341.2	348.0	9.4	6.7	14.9

* Poplar, white elm, black ash, red oak and hornbeam, not tallied in 1920.

Table 18

UNCUT MIXEDWOOD TYPE: STOCK TABLE (CUBIC FEET PER ACRE)

D.B.H.	Spruce				Balsam Fir				Cedar				White Pine				Yellow Birch				White Birch				Maple				Minor Species*		
	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1920	1927	1946	1956	1927	1946	1956
1.....	0.1	0.2	0.2	0.2	0.7	2.0	1.8	1.1	0.4	0.8	1.4	1.7	.....	.....	.....	.....	0.1	0.5	0.6	0.6	.....	0.9	0.4	0.1	1.2	6.6	17.8	16.5	0.2	0.1	0.4
2.....	1.3	0.7	0.8	0.7	3.3	6.4	5.3	4.5	1.9	2.8	2.8	2.8	.....	.....	.....	.....	1.1	1.5	1.5	1.6	0.4	1.7	1.2	0.9	4.4	6.4	13.8	19.2	1.3	0.3	0.9
3.....	1.7	0.8	1.8	1.1	8.3	11.3	9.2	7.6	5.1	3.3	3.5	2.7	0.1	.....	0.1	0.2	1.6	2.1	4.4	3.0	1.7	1.2	2.2	1.1	8.1	8.4	13.5	14.7	1.2	0.9	0.5
Total....	3.1	1.7	2.8	2.0	12.3	19.7	16.3	13.2	7.4	6.9	7.7	7.2	0.1	.....	0.1	0.2	2.8	4.1	6.5	5.2	2.1	3.8	3.8	2.1	13.7	21.4	45.1	50.4	2.7	1.3	1.8
4.....	2.6	3.5	1.7	2.0	13.8	14.6	16.5	12.0	5.6	9.6	7.2	3.2	0.2	0.2	.....	0.4	4.3	2.4	6.3	4.9	3.0	1.8	2.9	2.1	9.5	14.6	20.6	19.0	.....	1.2	0.6
5.....	3.8	5.0	6.2	2.5	23.0	21.7	18.1	18.1	8.7	12.5	15.3	13.4	0.3	.....	.....	.....	8.2	8.4	5.4	4.0	3.3	1.1	1.3	4.5	14.7	13.3	14.6	25.4	0.5	.....	3.7
6.....	4.3	8.3	5.3	3.7	30.0	25.8	22.6	18.9	11.8	17.1	15.0	15.2	0.5	1.8	0.7	1.4	11.6	10.1	9.2	7.1	6.7	6.0	6.4	5.2	18.6	15.9	26.3	21.3	0.8	1.7	0.8
7.....	7.3	6.7	9.3	7.8	31.9	26.1	23.9	12.2	13.9	21.2	24.2	18.5	0.7	1.1	2.2	1.1	14.4	16.3	13.3	13.3	7.4	9.1	7.4	9.6	21.5	30.4	23.3	31.0	.....	1.2	4.7
8.....	7.5	12.2	8.4	6.8	36.1	25.0	7.3	28.2	20.5	27.3	28.5	35.8	0.9	3.2	1.6	5.6	20.7	10.9	16.7	10.8	8.8	11.4	5.3	6.8	30.0	20.9	25.3	26.1	.....	3.2	1.6
9.....	10.5	15.9	9.5	15.9	28.6	16.5	16.5	7.7	25.1	39.4	34.6	25.7	1.6	7.9	5.7	4.5	22.4	31.9	28.6	18.7	8.2	10.9	2.0	3.9	37.3	40.3	35.8	38.1	2.2	4.3	2.2
Total....	36.0	51.6	40.4	38.7	163.4	129.7	104.9	97.1	85.6	127.1	121.8	111.8	4.2	14.2	10.2	13.0	81.6	80.0	79.5	58.8	37.4	40.3	25.3	32.1	131.6	135.4	145.9	160.9	3.5	11.6	13.6
10.....	11.5	44.0	15.6	8.5	25.7	7.1	12.8	12.8	34.3	39.5	45.8	50.9	3.1	10.5	6.0	3.0	30.4	34.1	24.1	35.5	9.7	16.4	5.0	2.5	48.8	40.9	40.9	42.3	2.7	2.8	2.7
11.....	15.0	3.8	28.2	20.7	16.4	7.0	7.0	7.0	43.4	52.4	43.2	43.2	2.5	7.8	9.8	7.8	32.6	39.4	44.8	30.4	11.8	25.3	17.4	9.5	48.1	31.1	50.2	46.8	.....	.....	.....
12.....	15.6	21.6	21.6	21.6	12.5	.....	4.2	.....	53.9	72.5	49.9	38.6	5.4	27.0	4.9	17.2	43.6	32.9	39.4	59.1	15.4	13.4	25.0	32.6	70.5	59.7	30.9	39.1	4.0	4.0	.....
13.....	13.8	6.0	44.9	38.8	8.8	.....	5.0	10.0	51.5	59.8	56.0	57.9	4.5	12.1	27.3	18.2	37.6	63.6	63.6	29.1	8.9	4.6	11.4	13.7	58.3	43.9	56.1	63.5	.....	4.7	4.8
14.....	19.8	33.0	7.3	29.3	2.9	.....	.....	.....	59.7	49.7	63.3	45.2	2.6	7.4	.....	22.3	57.3	22.1	28.4	75.6	13.0	.....	.....	5.3	61.3	68.4	25.7	37.0	.....	.....	.....
15.....	14.6	8.8	8.8	17.6	2.3	6.7	.....	6.7	56.7	53.0	58.3	53.0	6.6	8.8	30.8	8.8	69.2	48.1	85.1	55.5	13.6	.....	6.2	.....	48.9	52.2	58.7	52.1	.....	.....	6.6
16.....	15.1	26.0	26.0	20.8	0.8	.....	.....	.....	55.4	45.5	72.7	33.4	7.7	10.3	20.6	36.0	55.7	64.8	51.8	64.8	8.1	7.0	.....	.....	41.1	40.7	51.8	29.6	.....	.....	.....
17.....	7.9	.....	24.2	12.1	0.4	.....	.....	.....	44.2	31.1	17.3	37.9	5.4	29.8	11.9	35.7	70.9	54.6	89.3	54.5	8.4	8.0	.....	.....	28.8	20.9	8.4	62.7	.....	.....	.....
18.....	7.7	.....	14.0	.....	0.4	.....	.....	.....	36.9	62.1	58.2	35.0	5.4	13.6	.....	13.6	64.5	124.5	50.9	124.5	9.0	9.0	9.0	.....	21.5	23.4	32.7	56.0	.....	.....	.....
19.....	1.6	.....	.....	16.0	.....	.....	.....	.....	36.5	78.1	39.1	47.8	9.2	.....	30.8	.....	88.6	96.3	57.8	64.2	4.5	.....	10.0	.....	7.8	25.9	31.1	.....	.....	.....	.....
Total....	122.6	143.2	190.6	185.4	70.2	20.8	29.0	36.5	472.5	543.7	503.8	442.9	52.4	127.3	142.1	162.6	550.4	580.4	535.2	593.2	102.4	83.7	84.0	63.6	435.1	407.1	386.5	429.1	6.7	11.5	14.1
20+.....	14.9	27.8	.....	.....	.....	.....	.....	.....	86.7	127.9	93.1	101.9	151.5	126.8	124.7	150.5	374.4	318.6	601.5	688.6	5.4	.....	.....	.....	13.6	.....	62.6	109.0	.....	.....	.....
Grand Total....	176.6	224.3	233.8	226.1	245.9	170.2	150.2	146.8	652.2	805.6	729.4	663.8	208.2	268.3	277.1	326.3	1009.2	983.1	1222.7	1345.8	147.3	127.8	113.1	97.8	594.0	563.9	640.1	749.4	12.9	24.4	29.5

* Poplar, white elm, black ash, red oak and hornbeam, not tallied in 1920.

Table 19

BURN—STAND TABLE (NUMBER OF TREES PER ACRE)

D.B.H.	Spruce			Balsam Fir			Cedar			Yellow Birch			White Birch			Maple			Poplar			Minor Species*		
	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956
1	3.9	11.1	16.7	5.5	23.5	25.5	3.2	21.5	15.1	30.1	24.3	9.4	66.0	80.3	27.7	44.8	164.1	103.8	99.5	46.4	9.8	0.1	1.4	2.3
2	2.8	6.1	12.8	1.9	13.7	18.4	0.7	7.6	11.3	3.5	16.3	10.8	15.1	86.9	36.8	11.2	57.7	50.0	16.8	44.4	14.6	.....	0.3	1.6
3	0.8	6.1	9.2	1.4	8.9	13.4	0.4	2.9	5.9	0.1	9.9	7.9	4.8	41.3	32.4	1.5	28.1	31.1	7.3	33.2	19.3	.....	0.4	0.9
Total	7.5	23.3	38.7	8.8	46.1	57.3	4.3	32.0	32.3	33.7	50.5	28.1	85.9	209.5	96.9	57.5	249.9	184.9	123.6	124.0	43.7	0.1	2.1	4.8
4	0.7	5.2	9.9	0.8	4.0	8.9	.....	0.8	2.4	0.1	2.5	4.9	3.2	17.1	19.2	0.3	11.7	18.3	1.5	26.4	16.8	.....	0.1	0.1
5	0.1	2.4	5.7	0.5	2.9	6.2	.....	0.9	1.9	.....	2.1	1.2	0.7	9.4	8.9	0.4	4.3	10.5	0.7	12.0	12.4	.....	.....	0.5
6	0.5	2.8	3.5	0.7	2.3	4.0	0.1	.....	0.8	.....	0.6	1.5	0.3	7.2	6.0	.....	1.4	4.9	0.1	10.0	8.0	.....	0.1	.....
7	0.1	1.1	3.8	.....	1.2	2.7	.....	0.1	0.2	.....	.....	0.2	0.1	4.5	7.3	0.3	0.6	3.5	0.1	4.5	6.1	0.1	.....	.....
8	0.1	0.9	2.1	.....	0.8	2.4	.....	.....	0.4	.....	0.3	0.9	0.1	1.9	3.1	0.1	0.2	0.3	.....	2.4	4.6	.....	.....	0.2
9	.....	0.8	1.0	.....	0.5	1.1	.....	.....	0.2	.....	.....	.....	0.1	0.9	3.0	0.1	0.1	3.7	.....	0.5	3.4	.....	.....	0.1
Total	1.5	13.2	26.0	2.0	11.7	25.3	0.1	1.8	5.9	0.1	5.5	8.7	4.5	41.0	47.5	1.2	18.3	41.2	2.4	55.8	51.3	0.1	0.2	0.9
10	0.1	0.4	0.3	.....	0.3	.....	.....	.....	.....	0.3	.....	0.2	0.3	0.3	1.1	0.1	.....	0.2	.....	0.6	1.3	.....	.....	.....
11	.....	0.3	1.2	.....	.....	.....	0.3	.....	.....	.....	.....	.....	.....	0.3	0.6	0.1	0.1	0.3	.....	.....	1.0	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....	0.1	.....	0.1	.....	.....	.....	0.4	0.5	.....	.....	.....	.....	0.1	0.7	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	.....	.....	0.1	.....	.....	0.1	0.3	0.4	.....	.....	.....	.....	.....	.....
14	.....	.....	0.2	.....	.....	.....	.....	0.1	0.2	.....	.....	.....	.....	.....	0.5	.....	0.3	0.2	.....	.....	.....	.....	.....	.....
15	.....	0.1	0.3	.....	.....	.....	.....	0.1	.....	.....	.....	.....	.....	.....	.....	0.1	0.2	.....	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	.....	.....	.....	.....	.....	0.2	.....	.....	.....	0.1	.....	.....	0.1	.....	.....	.....	.....	0.2	.....	.....	.....
17	.....	.....	.....	.....	.....	.....	.....	.....	0.2	0.1	.....	.....	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	.....	.....	.....	.....	.....	0.2	.....	0.1	0.2	.....	.....	.....	.....	0.3	.....	.....	.....	.....	.....	.....	.....
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	.....	.....	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	0.1	0.8	2.0	.....	0.3	.....	0.3	0.3	0.8	0.7	0.1	0.4	0.7	1.0	2.7	0.5	1.2	1.1	.....	0.7	3.2	.....	.....	.....
20+	.....	.....	.....	.....	.....	.....	0.1	0.1	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.1	.....	.....
Grand Total	9.1	37.3	66.7	10.8	58.1	82.6	4.8	34.2	39.2	34.5	56.1	37.2	91.1	251.5	147.1	59.2	269.4	224.2	126.0	180.5	98.2	0.3	2.3	5.7

* White pine, white elm and black ash.

Table 20

BURN—STOCK TABLE (CUBIC FEET PER ACRE)

D.B.H.	Spruce			Balsam Fir			Cedar			Yellow Birch			White Birch			Maple			Poplar			Minor Species*		
	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956	1927	1946	1956
1	0.1	0.3	0.4	0.2	0.7	0.8	0.1	0.8	0.6	1.8	1.5	0.6	4.8	5.9	2.0	3.4	12.3	7.8	6.0	2.8	0.6	.....	.....	0.1
2	0.5	1.0	2.1	0.3	2.5	3.3	0.1	1.5	2.2	1.1	4.9	3.2	5.1	29.1	12.3	3.9	20.0	17.3	5.2	13.7	4.5	.....	0.1	0.4
3	0.4	2.9	4.3	0.7	4.6	6.9	0.2	1.5	3.1	0.1	7.7	6.2	4.0	34.0	26.7	1.3	24.0	26.6	5.9	26.7	13.1	.....	0.2	0.5
Total	1.0	4.2	6.8	1.2	7.8	11.0	0.4	3.8	5.9	3.0	14.1	10.0	13.9	69.0	41.0	8.6	56.3	51.7	17.1	43.2	18.2	.....	0.3	1.0
4	0.7	5.3	10.0	0.9	4.4	9.7	.....	0.9	2.6	0.2	3.9	7.7	5.1	27.4	30.7	0.5	20.1	31.5	2.4	42.0	26.7	.....	0.1	0.1
5	0.2	4.4	10.4	1.0	5.7	12.2	.....	1.7	3.5	.....	5.7	3.2	1.9	24.9	23.5	1.2	12.7	31.0	1.9	32.3	33.3	.....	.....	1.3
6	1.5	8.3	10.3	2.2	7.4	12.8	0.3	.....	2.3	.....	2.5	6.3	1.2	28.8	24.0	.....	6.3	22.2	0.4	41.3	33.0	.....	0.4	.....
7	0.4	4.9	16.8	.....	5.8	13.1	.....	0.4	0.9	.....	.....	1.2	0.6	25.6	41.5	1.9	3.9	22.6	0.6	26.6	36.1	0.6	.....	.....
8	0.6	5.6	13.0	.....	5.5	16.5	.....	.....	2.4	.....	2.5	7.5	0.8	14.5	23.6	0.9	1.7	2.6	.....	19.3	37.1	.....	.....	1.6
9	.....	6.7	8.4	.....	4.7	10.3	.....	.....	1.6	.....	.....	.....	1.0	8.9	29.8	1.1	1.1	7.8	.....	5.2	35.4	.....	.....	1.1
Total	3.4	35.2	68.9	4.1	33.5	74.6	0.3	3.0	13.3	0.2	14.6	25.9	10.6	130.1	173.1	5.6	45.8	117.7	5.3	166.7	201.6	0.6	0.5	4.1
10	1.1	4.2	3.2	.....	3.7	.....	.....	.....	.....	4.3	.....	3.0	3.8	3.8	13.9	1.4	.....	2.8	.....	8.0	17.2	.....	.....	.....
11	.....	3.9	15.7	.....	.....	.....	3.9	.....	.....	.....	.....	.....	.....	4.7	9.5	1.7	1.7	5.2	.....	.....	16.6	.....	.....	.....
12	.....	.....	.....	.....	.....	.....	.....	1.6	.....	2.2	.....	.....	.....	7.7	9.6	.....	.....	.....	.....	2.0	14.1	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.7	.....	.....	2.3	.....	.....	2.4	7.3	9.8	.....	.....	.....	.....	.....	.....
14	.....	.....	4.4	.....	.....	.....	.....	2.3	4.5	.....	.....	.....	.....	.....	13.2	.....	8.5	5.7	.....	.....	.....	.....	.....	.....
15	.....	2.6	7.6	.....	.....	.....	.....	2.7	.....	.....	.....	.....	.....	.....	.....	3.3	6.5	.....	.....	.....	6.6	.....	.....	.....
16	.....	.....	.....	.....	.....	.....	.....	.....	6.1	.....	.....	.....	3.5	.....	.....	3.7	.....	.....	.....	.....	.....	.....	.....	.....
17	.....	.....	.....	.....	.....	.....	.....	.....	6.9	5.0	.....	.....	4.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	.....	.....	.....	.....	.....	7.8	.....	5.7	11.3	.....	.....	.....	.....	14.0	.....	.....	.....	.....	.....	.....	.....
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.4	.....	.....	5.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	1.1	10.7	30.9	.....	3.7	.....	3.9	6.6	25.3	20.6	5.7	14.3	18.6	16.2	46.2	12.5	38.0	23.5	.....	10.0	54.5	.....	.....	.....
20+	.....	.....	.....	.....	.....	.....	8.8	13.2	26.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.5	.....	.....
Grand Total	5.5	50.1	106.6	5.3	45.0	85.6	13.4	26.6	70.9	23.8	34.4	50.2	43.1	215.3	260.3	26.7	140.1	192.9	22.4	219.9	274.3	18.1	0.8	5.1

* White pine, white elm and black ash.