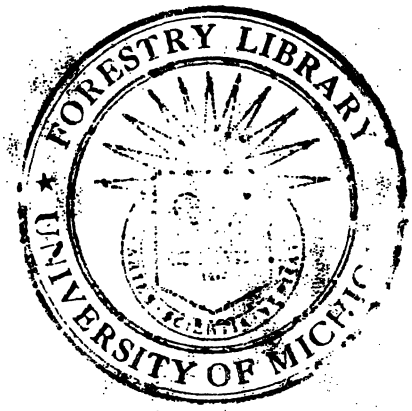
A MODEL FOREST MANAGEMENT PLAN FOR PRIVATE FOREST PROPERTIES

Harold R. Bruning



A MODEL FOREST MANAGEMENT PLAN FOR PRIVATE FOREST PROPERTIES

by

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INTRODUCTION

Too often management plans prepared for private forest properties contain little but technical terminology, tables, graphs, statistics, and professional methods of procedure. All these are frequently completely foreign to the layman. Seldom is there a determined effort to include in the plan a simple, general explanation of the management objectives and the methods of obtaining these objectives. One cannot question the necessity of including in the plan all necessary substantiative data, but why stop there? Is it necessary that the entire plan be so technically prepared and presented that even the professional forester must labor diligently to follow the lines of reasoning?

It seems to me that foresters in the past have placed entirely too much emphasis upon technically correct management plans. In doing so they have, in a sense, defeated their purpose of selling the private forest owner the idea of proper forest management. After trying unsuccessfully to fathom the depths of a completely technical plan, the property owner is apt to throw up his hands in dismay, conclude that all foresters are "crack-pots", and proceed to butcher the forest in his own inimitable style.

A plan which presents in a simple, concise manner, the general plan of management and the reasons for adopting such

a plan and avoids specialized terminology which arouses the suspicions of the nontechnical mind, will go far in promoting better forest practices among private forest owners.

The management plan incorporated in this thesis will be an attempt to present a sample plan which I hope will serve as a guide for the preparation of management plans for private forests.

A presentation ~~plan~~ which contains a general overall picture of the plan and its objectives and is supplemented with the necessary supporting data.

COMPILATION OF DATA

Since this thesis is aimed primarily at presenting a model management plan, the accuracy of certain data such as various production and administrative costs have not been stressed. In some instances where cost data for the locality under consideration were not immediately available, reasonable costs have been assumed. This in no way affects the ultimate purpose of the thesis.

The basic data for the management plan were obtained from a cruise made by Thomas V. Hellings under the supervision of the New York State Ranger School at Wanakena, N.Y. The cruise data included forest type descriptions, stand and stock tables for each type, a type map, and a proposed road system.

Growth studies and yield tables for this and similar areas reveal that under management the following growth rates can be expected:

Hardwood Type:
- Diameter growth[1] - 0.13 inches per year
- Basal area increase[2] - 225 sq. ft. per acre per year

Hardwood - Conifer Type:
- Hardwoods:
  - Diameter growth[1] - 0.13 inches per year
  - Basal area increase[2] - 200 sq. ft. per acre per year
- Conifers:
  - Volume growth[3] - 0.1 cord per acre per year

Spruce Swamp Type:
- Height growth - 6" per year

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[1]References 4, 6, 7, 15, 16, 26.

[2]References 25, 27, 28.

[3]References 1, 17, 18, 19.

TECHNICAL DEVELOPMENT OF THE MANAGEMENT PLAN

A method of basal area control (8)[1] was used to determine the cutting practices necessary to convert this virgin forest to a regulated all-age stand. Briefly, this involves the adaptation of normal yield-table data to all-age forest conditions. The mechanical development of this method is included in the management plan.

This method was applied to the hardwood type and the hardwood species of the hardwood-conifer type. Specialized yield tables were used to determine the allowable cut in the coniferous species in the hardwood-conifer type. The division by species was necessary because the basic cruise data indicated hardwood volume in board feet measure and spruce and fir volume in cords.

Footnotes and references included in the model plan are for academic purposes only and would not be included in any plan presented to a forest owner.

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[1] Numbers in parentheses indicated references cited in the bibliography.

MANAGEMENT PLAN
FOR
SOUTH TIMBER TRACT

INTRODUCTION

A forest, properly organized and wisely managed, constitutes a most responsive type of productive investment. By establishing and maintaining a well regulated reserve growing stock the owner is, in effect, developing a forest capital which will earn for him a substantial rate of interest in the form of volume growth. This volume increase can be removed at regular intervals leaving the reserve stand in-tact to produce another "crop".

The virgin forest is one in which trees of all age classes are present although the majority are in the large mature age classes. This condition enables the owner to "carve" from his virgin forest a regulated stand in which all age or size classes are well represented. Such a regulated forest then provides periodic harvests of the oldest age classes. One of the primary advantages in beginning with a virgin forest is that regular yields can be realized during the conversion period.

It is the purpose of this management plan to present a guide which will enable the owner to better understand the potentialities of his forest property and to intelligently deal with contract logging operators in the harvest of the timber crop.

Section I

DESCRIPTION OF THE FOREST PROPERTY

This property of 708 acres is located about two miles east of the village of Wanakena, N.Y. and is just across the Oswegatchie River from the New York State Ranger School. The north boundary is formed by the Oswegatchie River and the east boundary is formed by the Dead Creek Flow of Cranberry Lake. The west boundary of Clifton Township forms the west boundary of the property.

The topography is rolling to hilly with many prominent ridges throughout the area. Drainage is to the north and east. Several streams and creeks flow through the tract; the largest, Livingstone Creek, flows across the northwest corner of the property. A spruce swamp of approximately 106 acres is located in the west central portion of the tract.

The virgin forest has been untouched except for the removal of a few white pine a number of years ago. It is composed of three distinct forest types: hardwood type, hardwood-conifer type, and spruce swamp type.

The hardwood type covers approximately 193 acres. This type is characteristically found on the well drained upper slopes and ridges. The predominant species are sugar maple,

beech, and yellow birch. The stand ranges from mature to overmature and is classified as an open stand. Reproduction of all hardwood species is satisfactory.

The hardwood-conifer type of about 320 acres is found on the fairly well drained slopes and flats. It occupies the area between the swamp and the upper slopes. The characteristic species are red spruce, yellow birch, and sugar maple. It is an open, mature stand in which some areas are approaching overmaturity. Reproduction is satisfactory.

The spruce swamp type covers approximately 106 acres. It is composed almost entirely of black spruce and balsam fir. The stand has reached maturity and growth is extremely slow. Reproduction is abundant and there is a fine understory of young trees.

The remaining 91 acres of the property are along the shorelines of the two bounding rivers. This is frequently under water for extended periods and consequently unproductive.

Section II

MANAGEMENT PLAN

Before it is possible to decide upon a plan of management for a given forest, it is first necessary to determine the objectives at which such a plan must be aimed. Then one must assure himself that the forest with which he is working is capable of meeting the objectives.

As the owner desires to realize frequent returns from the property, it has been necessary to devise a plan which will allow frequent cuttings of a sufficient size to enable a logging contractor to realize a profit and yet leave a residual stand which will produce another harvest cut within the allotted time of the cutting cycle.

The objective of this plan of management is to develop a stand which will produce 22-inch saw timber in the hardwood and hardwood-conifer types. Thinnings from these types will yield both sawlogs and pulpwood. While the hardwood and hardwood-conifer types react favorably to a partial or selective cutting type of management (14), the spruce swamp type does not. It is therefore recommended that the spruce swamp be clear cut during the first cutting cycle and managed for the production of Christmas trees thereafter.

The forest should be operated on a ten-year cutting cycle, i.e., one-tenth of the area should be cut each year.

The property can be divided into ten clearly defined cutting compartments which will each be cut over once every ten years. The volume removed from each cutting compartment should be no greater than the volume growth which can be expected over a ten-year period. If the growth expected is actually realized, the forest is capable of being managed for a sustained yield under the present plan.

Growth studies should be made at the end of the first cutting cycle to determine the actual growth rate realized. If the growth is not as estimated, the management plan should be revised accordingly. At best, the proposed plan can serve only as a guide to cutting practices necessary to convert this stand to the regulated condition which will provide continuous production. It must be supplemented periodically with new field data.

In order to determine the volume to be removed during the initial cut of the hardwood and hardwood-conifer types it was first necessary to estimate the expected volume growth for the ten years following the first cut. A cut equal to this growth was then distributed through the various size classes. This should result, in time, in a good distribution of size classes throughout the stand.

The total cut per acre during the first cutting cycle for the various types is estimated as follows:

Hardwood Type:
Hardwoods - 2570 board feet[1]

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[1]Scribner Log Rule

Spruce and fir - 1 cord

Hardwood - Conifer Type:
Hardwoods - 1800 board feet
Spruce and fir - 1 cord

Spruce Swamp Type:
Spruce and fir - 31.2 cords

Estimated yields per acre for the second cutting cycle:

Hardwood Type:
Hardwoods - 2500 board feet
Spruce and fir - 1 cord

Hardwood - Conifer Type:
Hardwoods - 2000 board feet
Spruce and fir - 1 cord

Spruce Swamp Type:
Christmas trees - 150 trees

The management of the hardwood type is based upon an expected growth increment of approximately 225 board feet per acre per year. This growth volume plus the volume of the thinnings, which are made to create a normal distribution of age classes, should result in a total cut of 2500 bd. ft. per acre every ten years. The volume of spruce and fir is expected to hold up through the first few cutting cycles and then to pass out of the picture. This type is primarily a hardwood type and it is not advisable to favor the spruce as its relative value either as a sawlog or pulpwood product will not warrant the added cost of such treatment (10)(23)(25). After the spruce is no longer present, the space it occupied in the stand will be utilized by the hardwoods with a resulting increase in hardwood volume.

This cut will remove approximately 20 percent of the total volume of the stand. The growth percent anticipated is approximately 2.6 percent compound interest or 2.8 percent simple interest[1] for the ten-year period of the cutting cycle.

The management of the hardwood-conifer type is based upon an expected growth rate of 200 bd. ft. per acre per year and 0.1 cord per acre per year for the spruce and balsam fir. This results in a growth percent of 2 percent compound interest or 2.2 percent simple interest for the hardwoods. A growth rate of about 1 percent compound and simple interest is realized from the spruce and fir. This interest rate is low but the stand is relatively open. It should respond to proper management and gradually increase its growth percent (1)(30).

The initial cut of spruce is greater than the expected growth. There are two justifications for this cut. The removal of the large spruce trees will result in an increase in the growth rate of the younger trees which are now being held back. Secondly, relatively low volume of hardwoods which can be removed in the first cut must be supplemented with an additional volume of spruce so that it will be economically possible for an operator to log the area.

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[1]Calculated from a formula suggested by H. F. Morey (30).

$$P = \left(\sqrt[n]{\frac{V}{v}} - 1 \right) 100$$

Growth studies in this type at the end of the first cutting cycle are extremely important before continuing under the proposed management plan. To follow any management plan without periodic checks is pure folly and might easily prove disasterous.

The spruce swamp type presents a problem of management which is unique and entirely different from the other two types. Repeated experiments in spruce swamps have shown that a selective type of cut results in severe losses from windthrow. Therefore, some method of clear cutting is in order. The ten-year cutting cycle which has been adopted is too short to permit us to expect the forest to replace the volume removed by clear cutting methods. It becomes necessary then to change our management objective after the first cutting cycle. Since a good market for Christmas trees exists in the region and spruce swamps respond well to this type of management, it seems advisable to direct the management plan toward this objective.

Removing all the merchantable volume now results in a cut of 31.2 cords per acre. Although the yield in the future is difficult to ascertain, it is conservatively estimated that 150 trees per acre from 5-12 feet in height can be removed each cutting cycle.

The owner is not expected to follow and to interpret all of the tables, graphs and technical methods which appear at the end of this management plan. These are included for

primary purpose of providing, for any professional forester to whom this plan may be presented in the future, the necessary data, techniques, and methods of procedure used in the preparation of this management plan. It is hoped however that several of the tables and graphs will enable the owner to obtain a clearer picture of the present stand and the general method used to convert this stand into a regulated forest which will provide a continuous series of incomes.

Section III

LOGGING PLAN

Logging operations by small operators in this locality are carried on almost entirely during the winter months. This greatly reduces road construction costs and enables the small operator to log areas in which a relatively light cut is made.

The property has been divided into eighteen cutting compartments.[1] These will be logged in numerical order, i.e., Compartment I will be logged the first year, Compartments IIa and b the second year, etc. All compartments with the subletter "a" lie entirely within the hardwood and hardwood-conifer types. Compartments with the subletter "b" lie in the spruce swamp. The location of the spruce swamp has necessitated this subdivision of compartments in order that one-tenth of the swamp may be logged over each year.

The compartments in the spruce swamp are approximately 10 acres each while compartments in the rest of the forest are about 50 acres. This gives a total cutting area of approximately 60 acres each year.

After the sixth year, cutting will be shifted from Compartment VIa in the southeast corner of the property to Compartment VII in the southwest corner. This shift is made to reduce hauling costs.

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[1] See Appendix for map.

Several reliable logging contractors are located in the near vicinity. These men are familiar with the selection type of cutting and can be depended upon to follow cutting instructions. Two contractors have expressed the desire to discuss in detail the possibilities of obtaining the logging contract for this property. The names and addresses of these men will be furnished upon request.

Section IV

LOCATION AND CONSTRUCTION OF ROAD SYSTEM

There are no roads on the property at present. The nearest road is County Road A which comes within three-eighths of a mile of the northeast boundary. An access road must be built to connect the property with this county road. The access road will have to cross the property of Mr. P. R. Wood of Wanakena, N.Y. and a permanent right of easement must be obtained from him.

The internal road system has been laid out by a qualified forest engineer, Mr. T. V. Hellings. The location of the road system is greatly limited by the topography of the property. Every effort has been made to so locate the roads that there will be a minimum of adverse grades and a maximum of favorable grades. In no case will a load have to be taken up in adverse grade.

Two standards of winter roads will be necessary for this operation, a main haul road and secondary skid roads. The difference is mainly one of location and maintenance. Roads will be built as needed. Construction and maintenance will be handled entirely by the operator.

The construction of roads represents an investment in the property by the operator and it seems reasonable that

he should be compensated in some manner by the property owner. A well located road system is essential to sustained yield management. Such a system involves more care in location and grade maintenance than does a road system which is expected to last only through the life of a liquidation or clear cutting operation. Therefore, since the owner intends to operate this property on a sustained yield basis, a road system which will favor this type of management should be constructed.

The difference between the standards of road systems required for sustained yield and liquidation operations forms a basis for an equitable return to the operator. This return can be easily made through adjustment of stumpage prices.

Road construction and maintenance costs are estimated at $200 per mile for the main haul road and $50 per mile for the skid roads on a liquidation operation. For a road system which will hold up under a sustained yield operation the costs increase to $300 per mile for the main haul road and $75 per mile for skid roads. The necessary road construction consists of 3.33 miles of main haul road and 2.88 miles of skid roads. This represents a total cost of $910 under a liquidation operation or $1215 under a sustained yield program. The difference, $305, is to be returned to the operator in terms of reduced stumpage. This represents a reduction of $0.12 per M bd. ft. for the hardwoods and $0.04 per

cord for the spruce and fir.[1]

No reduction in stumpage prices is necessary after the first cutting cycle. Maintenance costs will be the only costs applicable to the roads and these can be properly borne by the operator.

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[1] See Appendix for detailed breakdown of this deduction.

Section V

CUTTING INSTRUCTIONS

Good selective cutting operations require good timber marking practices. The trees selected to be cut must be plainly marked before cutting begins so that no misunderstanding will develop between the owner and the operator.

Detailed cutting instructions will be found in the Compartment Plans. These instructions will serve as a guide in drafting logging contracts and in actually marking the timber to be cut. They represent the "ideal" and strict compliance in the field is neither expected nor always desirable.

An effort should be made to harvest those trees which have reached maturity and whose removal will benefit the stand. Considerable judgment is necessary in the selection of the trees to be cut and it is advisable to secure the services of a qualified person rather than to entrust the selection to the operator's discretion. Qualified timber markers can be obtained through the New York State Ranger School.

Balsam fir should not be left in the stand after it attains a size of 10" DBH (12)(30). It is subject to rapid decay upon reaching maturity and in addition its presence in the stand in large numbers constitutes a danger of loss

through damage by the spruce budworm.

Removal of the larger mature and overmature trees, especially during the first cutting cycle, will result in greater than average loss in log volume through defect. This loss will be compensated for to a great extent by the high-grade lumber which can be cut from those large logs which are sound. Even logs which have heart rot or similar defects yield high-grade lumber from the outer part of the log and if the center of the log is sufficiently sound and the log is free from other defects, it may well be sold for veneer stock.

Section VI

FIRE PROTECTION

This forest is located in a forest region which has a relatively low fire danger. The winter roads will provide access to the area during any season in case of emergency. Because of their condition, however, they will not encourage fishermen, campers, or hunters to frequent the area, and thus the fire danger from trespassers is greatly reduced.

Section VII

FOREST APPRAISAL

The average income for the first cutting cycle is $1,817. This is based upon stumpage values of $6.87 per u bd. ft. for the mixed hardwoods and $2.32 per cord for the spruce and balsam (21). The average income for all succeeding cutting cycles is $988.[1] Taxes for the property are $0.50 per acre per year.

The present value of the property, calculated at 3% compound interest is

$$Pw = \$1,817 \frac{1.03^{10} - 1}{03 \times 1.03^{10}} + \frac{\$988}{.03 \times 1.03^{10}} - \frac{\$708 \times \$0.50}{.03}$$

$$= 15,490 + 24,500 - 11,800$$

$$= \$28,190$$

In effect the above formula merely says that a forest property which will yield an income of $1,817 annually for the next ten years and thereafter produce an income of $988 annually less expenses of $0.50 per acre per year is now worth, at 3% compound interest, $28,190. In other words this property represents a sum of money which, if invested at 3% compound interest, would give you an annual return of $1,817

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[1] Stumpage prices for Christmas trees are estimated at current average prices of $0.05 per tree.

omit

for the next 10 years and thereafter produce an annual return [forever] of $988 and on which you must pay an annual tax of $354.

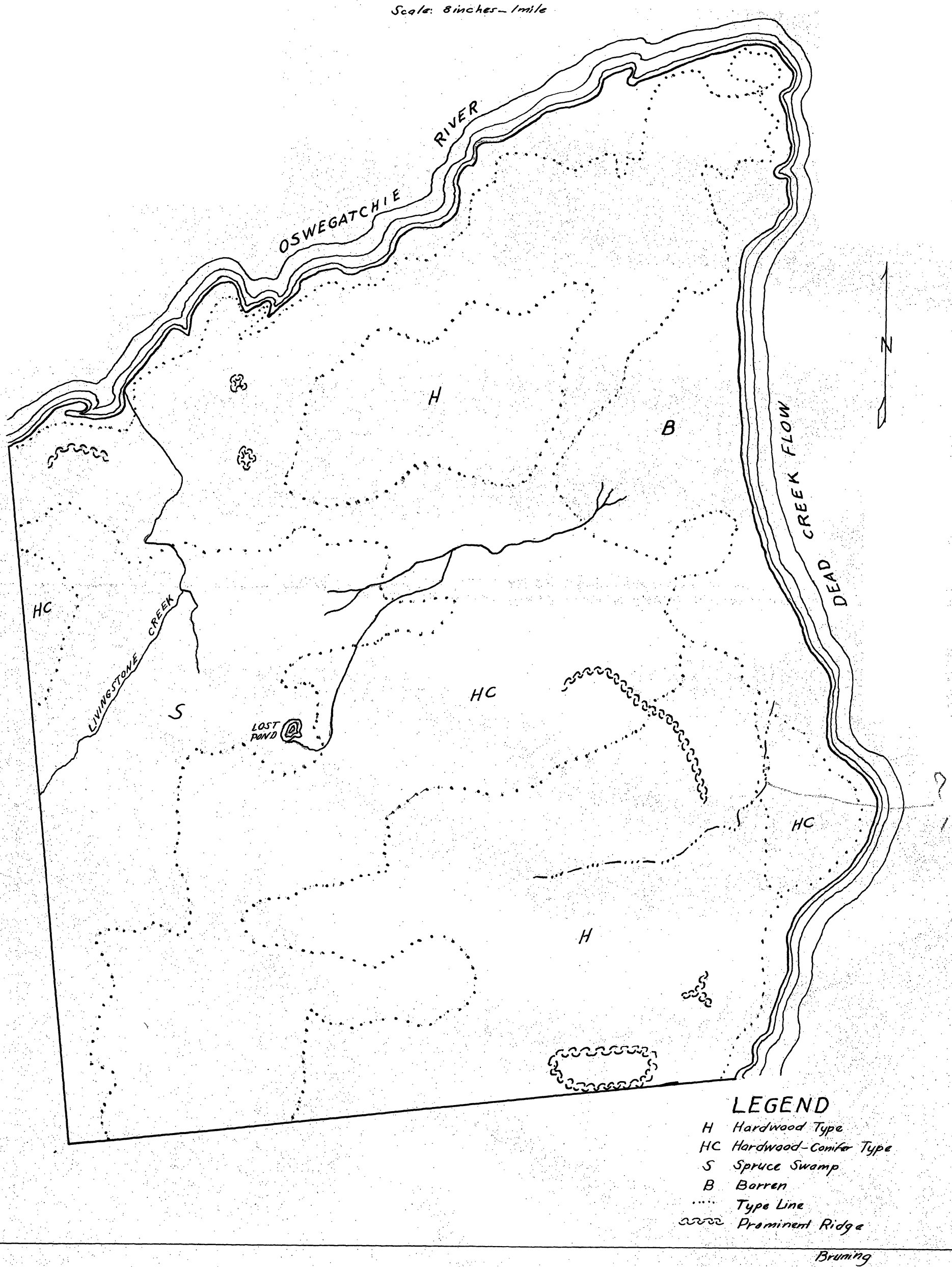
APPENDIX

SOUTH TIMBER TRACT

CLIFTON TOWNSHIP

ST. LAWRENCE CO., N.Y.

Scale: 8 inches – 1 mile



LEGEND

- H Hardwood Type
- HC Hardwood-Conifer Type
- S Spruce Swamp
- B Barren
- ..... Type Line
- Prominent Ridge

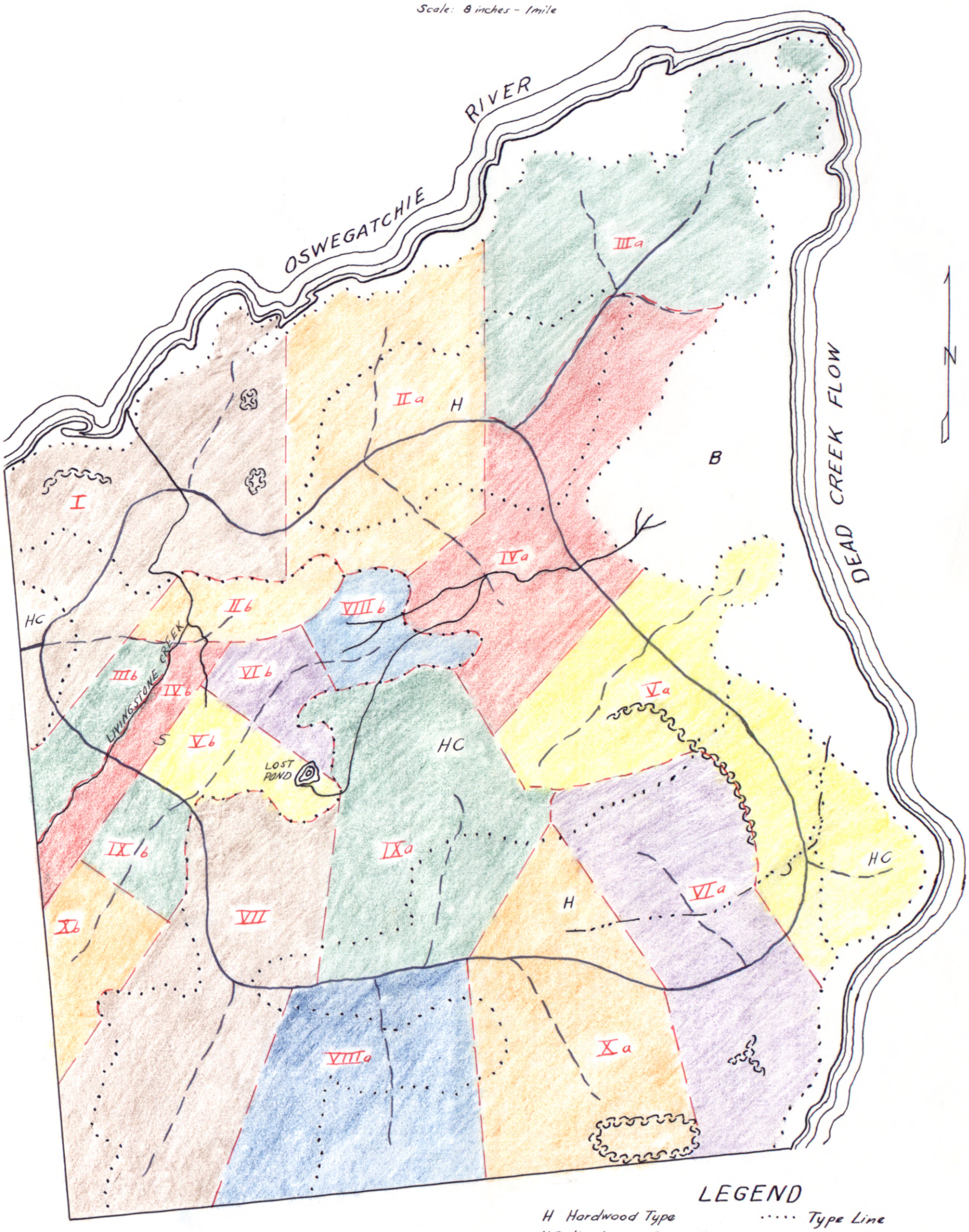
Bruning

SOUTH TIMBER TRACT

CLIFTON TOWNSHIP

ST. LAWRENCE CO., N.Y.

Scale: 8 inches - 1 mile



LEGEND

H Hardwood Type	····· Type Line
HC Hardwood-Conifer Type	~~~ Prominent Ridge
S Spruce Swamp	—— Main Haul Road
B Barren	– – Skid Road
– – Cutting Compartment Boundary	

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COMPARTMENT CUTTING INSTRUCTIONS

COMPARTMENT I

Forest type	Area acres	Volume M.bd.ft.*	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
Hardwood-Conifer	49.1	461.5	319.2	88.4	157.1	98.2	49.1
Spruce Swamp	10.2		318.2		318.2		
Totals	59.3	461.5	637.4	88.4	675.3	98.2	49.1

Road Construction
Primary .53 Mi.
Secondary .27 mi.

Cutting Instructions
Hardwood-Conifer Type
Hardwoods
Remove all trees 30" DBH and above
Remove 39 " 28" "
10 " 22" "
10 " 20" "
20 " 18" "
29 " 16" "
29 " 14" "
59 " 12" "

} Approx. 4

Conifers
Remove all trees 22" DBH and above

Spruce Swamp Type
Remove all trees 6" DBH and above

Income for the first cutting cycle - $2,174

*Scribner

COMPARTMENTS IIa&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. IIa							
Hardwood	23.2	262.2	150.8	59.6	23.2	58.0	23.2
Hardwood-Conifer	27.6	259.4	383.6	49.7	88.3	55.2	27.6
COMP. IIb							
Spruce Swamp	10.1		315.1		315.1		
Totals	60.9	521.6	849.5	109.3	426.6	113.2	50.8

Road Construction

Comp. IIa

Primary .26 mi.

Secondary .28 mi.

Comp. IIb

Primary

Secondary .12 mi.

Cutting Instructions

Hardwood Type

Remove all trees 30" DBH and above

Remove 77 " 28" "

5 " 24" "

7 " 22" "

14 " 20" "

14 " 18" "

30 " 16" "

21 " 14" "

28 " 12" "

53 " 10" " From spruce and fir only

77 " 8" " " " " " "

144 " 6" " " " " " "

Hardwood-Conifer Type

Hardwoods

Remove	all	trees	30" DBH and above
Remove	17	"	28" "
	6	"	22" "
	6	"	20" "
	10	"	18" "
	17	"	16" "
	17	"	14" "
	33	"	12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle-$1,741

COMPARTMENTS III a&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. IIIa							
Hardwood	6.7	75.7	43.6	17.2	6.7	16.8	6.7
Hardwood-Conifer	47.9	450.3	665.8	86.2	153.3	95.8	47.9
COMP. IIIb							
Spruce Swamp	10.1		315.1		315.1		
Totals	64.7	526.0	1024.5	103.4	475.1	112.6	54.6

Road Construction

Comp. IIIa
- Primary .31 mi.
- Secondary .22 mi.

Comp IIIb
- Primary .07 mi.
- Secondary -----

Cutting Instructions

Hardwood Tyep

Remove all trees 30" DBH and above
Remove 22 " 28"
1 " 24"
2 " 22"
4 " 20"
4 " 18"
9 " 16"
6 " 14"
8 " 12"
15 " 10" From Spruce and fir only
22 " 8" " " " " "
42 " 6" " " " " "

Hardwood-Conifer Type

Hardwoods

Remove	all	trees	30" DBH and above
Remove	29	"	28" "
	10	"	22" "
	10	"	20" "
	19	"	18" "
	29	"	16" "
	29	"	14" "
	57	"	12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,813

COMPARTMENTS IV a&b

Forest Type	Area Acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. IVa Hardwood	14.4	162.7	93.6	37.0	14.4	36.0	14.4
Hardwood-Conifer	38.9	365.7	540.7	70.0	124.5	77.8	38.9
COMP IVb Spruce Swamp	10.5		327.6		327.6		
Totals	63.8	528.4	961.9	107.0	466.5	113.8	53.3

Road Construction

Comp.IVa	
Primary	.25 mi.
Secondary	.1 mi.
Comp.IVb	
Primary	.04 mi.
Secondary	-----

Cutting Instructions

Hardwood Type

Remove all trees 30" DBH and above
Remove 48 " 28" "
3 " 24" "
4 " 22" "
9 " 20" "
9 " 18" "
19 " 16" "
13 " 14" "
17 " 12" "
33 " 10" " From spruce and fir only
48 " 8" " " " " " " "
89 " 6" " " " " " " "

Hardwood-Conifer Type

Hardwoods

Remove all	trees	30"	DBH and above
Remove 23	"	28"	"
8	"	22"	"
8	"	20"	"
16	"	18"	"
23	"	16"	"
23	"	14"	"
47	"	12"	"

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income from the first cutting cycle - $1,816

COMPARTMENTS V a&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. Va							
Hardwood	19.8	233.7	128.7	50.9	19.8	49.5	19.8
Hardwood-Conifer	32.5	305.5	451.8	58.5	104.0	65.0	32.5
COMP. V							
Spruce Swamp	11.6		361.9		361.9		
Totals	63.9	539.2	942.4	109.1	485.7	114.5	52.3

Road Construction

Comp. Va
- Primary .5 mi.
- Secondary .44 mi.

Comp. Vb
- Primary .07 mi.
- Secondary .125 mi.

Cutting Instructions

Hardwood Type

Remove all trees 30" DBH and above
Remove 66 " 28" "
4 " 24" "
6 " 22" "
12 " 20" "
12 " 18" "
26 " 16" "
18 " 14" "
24 " 12" "
46 " 10" "
65 " 8" "
123 " 6" "

From spruce and fir only
" " " " "
" " " " "

Hardwood-Conifer Type

Hardwoods

Remove all trees 30" DBH and above
Remove 20 " 28" "
7 " 22" "
7 " 20" "
13 " 18" "
20 " 16" "
20 " 14" "
39 " 12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,879

COMPARTMENTS VI a&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated colume to be removed in 2nd cutting cycle M.bd.ft.	Estimated colume to be removed in 2nd cutting cycle Cords
COMP. VI a							
Hardwood	46.1	320.9	299.7	118.5	46.1	115.2	46.1
Hardwood-Conifer	4.4	42.4	61.2	7.9	14.1	8.8	4.4
COMP.VI b							
Spruce Swamp	10.5		327.6		327.6		
Totals	61.0	563.3	688.5	126.4	387.8	124.0	50.5

Road Construction

Comp. VI a	
Primary	.16 mi.
Secondary	.19 mi.
Comp. VI b	
Primary	.12 mi.
Secondary	-----

Cutting Instructions

Hardwood Type

Remove	all	trees	30"	DBH and above
Remove	154	"	28"	"
	9	"	24"	"
	14	"	22"	"
	28	"	20"	"
	28	"	18"	"
	60	"	16"	"
	41	"	14"	"
	55	"	12"	"
	106	"	10"	"
	152	"	8"	"
	286	"	6"	"

From spruce and fir only

"	"	"	"	"
"	"	"	"	"

Hardwood-Conifer Type

Hardwoods

Remove all trees 30" DBH and above
Remove 3 " 28" "
1 " 22" "
1 " 20" "
2 " 18" "
3 " 16" "
3 " 14" "
5 " 12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,767

COMPARTMENTS VII a&b

Forest Type	Area Acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. VII a							
Hardwood	2.0	22.6	13.0	5.1	2.0	5.0	2.0
Hardwood-Conifer	51.6	485.0	717.2	92.9	165.1	103.2	51.6
COMP. VII b							
Spruce Swamp	10.4		324.5		324.5		
Totals	64.0	507.6	1054.7	98.0	491.6	108.2	53.6

Road Construction

Comp. VII a
- Primary .23 mi.
- Secondary .25 mi.

Comp. VII b
- Primary -----
- Secondary -----

Cutting Instructions

Hardwood Type

Remove all trees 30" DBH and above
Remove 7 " 28" "
1 " 22" "
1 " 20" "
1 " 18" "
3 " 16" "
2 " 14" "
2 " 12" "
5 " 10" " From spruce and fir only
7 " 8" " " " " " " "
12 " 6" " " " " " " "

Hardwood-Conifer Type

Hardwoods

Remove	all	trees	30" DBH and above
Remove	31	"	28" "
	10	"	22" "
	10	"	20" "
	21	"	18" "
	31	"	16" "
	31	"	14" "
	62	"	12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,714

COMPARTMENTS VIII a&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. VIII a							
Hardwood	20.8	235.0	135.2	53.4	20.8	52.0	20.8
Hardwood-Conifer	26.8	251.9	372.5	48.2	85.8	53.6	26.8
COMP. VIII b							
Spruce Swamp	10.3		321.4		321.4		
Totals	57.9	486.9	829.1	101.6	428.0	105.6	47.6

Road Construction

Comp. VIII a	
Primary	.17 mi.
Secondary	.19 mi.
Comp. VIII b	
Primary	-----
Secondary	.08 mi.

Cutting Instructions

Hardwood Type

Remove all trees		30"	DBH and above	
Remove 69	"	28"	"	
4	"	24"	"	
6	"	22"	"	
12	"	20"	"	
12	"	18"	"	
27	"	16"	"	
19	"	14"	"	
25	"	12"	"	
48	"	10"	"	From spruce and fir only
69	"	8"	"	" " " " "
129	"	6"	"	" " " " "

Hardwood-Conifer Type

Hardwoods

Remove all trees 30" DBH and above
Remove 16 " 28" "
5 " 22" "
5 " 20" "
11 " 18" "
16 " 16" "
16 " 14" "
32 " 12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,691

COMPARTMENTS IX a&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. IX a							
Hardwood	13.4	151.4	87.1	34.4	13.4	33.5	13.4
Hardwood-Conifer	36.7	345.0	510.1	66.0	117.4	73.4	36.7
COMP. IX b							
Spruce Swamp	10.2		318.2		318.2		
Totals	60.3	496.4	915.4	100.4	449.0	106.9	50.1

Road Construction

Comp. IX a
- Primary ----
- Secondary .2 mi.

Comp. IX b
- Primary ----
- Secondary .125 mi.

Cutting Instructions

Hardwood Type

Remove all trees 30" DBH and above
Remove 45 " 28" "
3 " 24" "
4 " 22" "
8 " 20" "
8 " 18" "
17 " 16" "
12 " 14" "
16 " 12" "
31 " 10" " From spruce and fir only
44 " 8" " " " " " "
83 " 6" " " " " " "

Hardwood-Conifer Type

Hardwoods

Remove	all	trees	30" DBH and above
Remove	22	"	28" "
	7	"	22" "
	7	"	20" "
	15	"	18" "
	22	"	16" "
	22	"	14" "
	44	"	12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,730

COMPARTMENTS X a&b

Forest type	Area acres	Volume M.bd.ft.	Volume Cords	Volume to be removed in 1st cutting cycle M.bd.ft.	Volume to be removed in 1st cutting cycle Cords	Estimated volume to be removed in 2nd cutting cycle M.bd.ft.	Estimated volume to be removed in 2nd cutting cycle Cords
COMP. X a							
Hardwood	46.3	523.2	301.0	119.0	46.3	115.8	46.3
Hardwood-Conifer	3.4	32.0	47.3	6.1	10.9	6.8	3.4
COMP. X b							
Spruce Swamp	11.8		368.2		368.2		
Totals	61.5	555.2	716.5	125.1	425.4	122.6	49.7

Road Construction

Comp. X a
- Primary .24 mi.
- Secondary .19 mi.

Comp. X b
- Primary -----
- Secondary .1 mi.

Cutting Instructions

Hardwood Type

Remove all trees 30" DBH and above
Remove 154 " 28" "
9 " 24" "
14 " 22" "
28 " 20" "
28 " 18" "
60 " 16" "
42 " 14" "
56 " 12" "
106 " 10" " From spruce and fir only
153 " 8" " " " " " "
287 " 6" " " " " " "

Hardwood-Conifer Type

Hardwoods

Remove	all	trees	30" DBH and above
Remove	2	"	28" "
	1	"	22" "
	1	"	20" "
	1	"	18" "
	2	"	16" "
	2	"	14" "
	4	"	12" "

Conifers

Remove all trees 22" DBH and above

Spruce Swamp Type

Remove all trees 6" DBH and above

Income for the first cutting cycle - $1,846

BASAL AREA CONTROL OF CUTTING IN ALL-AGE FORESTS

Hardwood Type

Stand and Stock Table Compiled from Cruise Data

Per Acre

Hardwoods

Dia. in.	No. of trees	B. A. sq.ft.	Vol.ft. b.m.	% vol./ dia.. cl.
6	16.0	3.14		
8	10.4	3.63		
10	11.9	6.49	388.	3.4
12	8.9	6.99	556.	4.9
14	8.0	8.55	983.	7.9
16	8.3	11.59	1345.	11.9
18	7.4	13.07	1630.	14.4
20	4.9	10.70	1699.	15.0
22	3.6	9.50	1349.	11.9
24	2.1	6.61	961.	8.5
26	1.3	4.79	700.	6.2
28	0.9	3.85	578.	5.1
30	0.8	3.92	575.	5.1
32	0.3	1.67	243.	2.1
34	0.3	1.89	221.	2.0
36	0.05	.35	50.	0.4
38	0.05	.39	76.	0.7
40	0.05	.44	62.	0.5
	85.25	97.57	11326.	100.0

Spruce and Balsam

DBH in.	No. of trees	B. A. sq.ft.	Vol. Cords	% vol./ dia. cl.
6	9.9	1.94	0.3	4.6
8	5.0	1.74	.3	4.6
10	2.6	1.42	.4	6.2
12	2.6	2.04	.6	9.2
14	1.4	1.50	.5	7.7
16	1.6	2.23	.8	12.3
18	1.4	2.47	.9	13.85
20	1.1	2.40	.9	13.85
22	0.6	1.57	.7	10.8
24	0.4	1.26	.5	7.7
26	0.2	0.74	.3	4.6
28	0.2	0.86	.3	4.6
	27.0	20.17	6.5	100.00

Determination of Probable Average Diameter of Trees Within Each Cyclic Age Group for Each Cycle Included Within the Range of Diameter of the Cruise Data

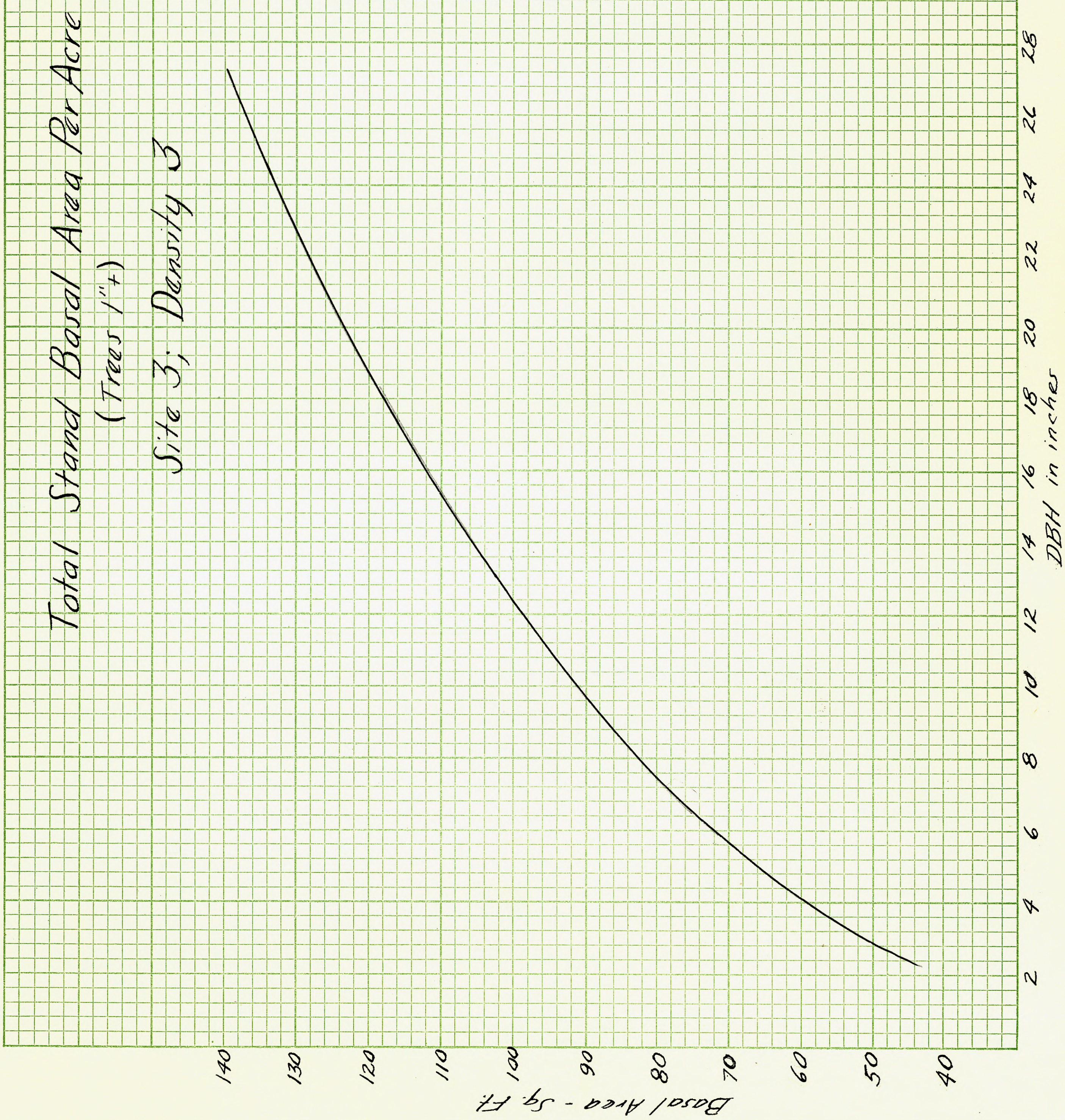
Hardwood Type Control Table

Objective of mgt. - 22" DBH
Estimated rate of growth of timber 6" - - 0.13"/yr.
6" timber is 45 yrs. of age =
Operation on 10 yr. cutting cycle
Minimum size of timber in cruise - 6"

$$\text{No. of Cycles} = \frac{22" - 6"}{10 \times 0.13} = \frac{16}{1.3} = 12$$

Age group		DBH Range	DBH Av.	B. A. sq. ft.*	B. A. percent
I	45-55	5.9-7.2	6.6	75	6.1
II	55-65	7.2-8.5	7.9	82	6.6
III	65-75	8.5-9.8	9.2	88	7.1
IV	75-85	918-11.1	10.5	93	7.5
V	85-95	11.1-12.4	11.8	98	7.9
VI	95-105	12.4-13.7	13.1	103	8.3
VII	105-115	13.7-15.0	14.4	107	8.6
VIII	115-125	15.0-16.3	15.7	111	9.0
IX	125-135	16.3-17.6	17.0	115	9.3
X	135-145	17.6-18.9	18.3	118	9.5
XI	145-155	18.9-20.2	19.6	122	9.9
XII	155-165	20.2-21.5	20.9	126	10.2
				1238	100.0

*From curve of yield table data over DBH.



Determination of the Approximate Diameter Limit of the Harvest cut and Possible Cut per Acre Including Thinnings

Classified Stand and Stock Table

Age Group	B.A. %	Actual B.A. sq. ft.	No. of trees	Dia. range Inches	Av. Dia. Inches
I	6.1	7.2	28.0	6-8	6.8
II	6.6	7.8	18.7	8-10	8.7
III	7.1	8.4	13.3	10-12	10.8
IV	7.5	8.8	9.9	12-14	12.7
V	7.9	9.3	8.0	14-16	14.6
VI	8.3	9.8	7.1	16	15.9
VII	8.6	10.1	5.9	16-18	17.6
VIII	9.0	10.6	5.5	18-20	18.8
IX	9.3	10.9	4.8	20-22	20.8
X	9.5	11.2	4.0	22-24	22.7
XI	9.9	11.6	3.7	24-28	23.9
XII	10.2	12.0	2.3	28 +	31.
		117.7			

The irregular condition of Column 5 indicates an unequal distribution of age classes in the stand. This irregularity will disappear after the first full rotation.

Construction of Classified Stand and Stock Table

	B.A.	No. trees	Volume bd.ft.	Cds.
Class XI				
B.A. required	11.6			
Balance 28" class				
4.71 - 3.33 = 1.38		0.3	78	.3
26" class = 5.53	6.9	1.5	700	.3
B.A. from 24" class	5.7			
% B.A. from 24" class = 5.7/7.87 = 72%				
No. trees from 24" class = .72 x 2.5		1.9		
Vol. from 24" class = .72 x (961 + .5			692	.4
		3.7	1470	1.0
Class X				
B.A. required	11.2			
Balance from 24" class ≅ 2.2	2.2	0.6		
B.A. req. from 22" class	9.0			
% B.A. = 9/11.1 = 81%				
No. trees from 22" class = .81 x 4.2		3.4		
		4.0		
Class IX				
B.A. required	10.9			
B.A. from 22" class - 2.1	2.1	0.8		
B.A. req. from 20" class	8.8			
% B.A. = 8.8/13.1 = 67%				
No. trees from 20" class = .67 x 6		4.0		
		4.8		
Class VIII				
B.A. required	10.6			
B.A. from 20" class - 4.3	4.3			
B.A. req. 18" class	6.3	2.0		
% B.A. req. = 6.3/14.43 = 40%				
No. trees 18" class - .4 x 8.8		3.5		
		5.5		
Class VII				
B.A. required	10.1			
B.A. from 18" class = 9.2	9.2	5.3		
B.A. req. 16" class	.9			
% B.A. req. = .9/13.82 = 6.5%				
No. trees 16" class - .065 x 9.9		.6		
		5.9		

	B. A.	No. trees
Class VI		
B. A. required	9.8	
B. A. fron 16" class	9.8	
%B.A. req. =9.8/12.92 = 76%		
No.trees 16" class = .76 x 9.3 =		7.1
Class V		
B.A. required	9.3	
B.A. 16" class	3.1	2.2
B.A. req. 14" class	6.2	
% B.A. req. = 6.2/10.05 = 62%		
No. trees 14" class = .62 x 9.4		5.8
		8.0
Class IV		
B.A. required	8.8	
B.A. 14" class	3.8	3.6
B.A. req. 12" class	5.0	
% B.A. req. = 5.0/9.03 = 55%		
No. trees 12" class = .55 x 11.5		6.3
		9.9
Class III		
B.A. required	8.4	
B.A. 12" class	4.0	
B.A. req. 10" class	4.4	5.2
% B.A. req. = 4.4/7.91 = 56%		
No. trees 10" class = .56 x 14.5 =		8.1
		13.3
Class II		
B.A. required	7.8	
B.A. 10"class	3.5	
B.A. req. 8" class	4.3	6.4
% B.A. 8" class = 4.3/5.37 = 80%		
No. trees 8" class = .8 x 15.4 =		12.3
		18.7
Class I		
B.A. required	7.2	
B.A. 8" class	1.1	2.1
B.A. req. 6" class	6.1	
% B.A. req. = 6.1/		25.9
		28.0

Harvest Cut and Thinnings

Harvest Cut:

.102 x 117.74 sq.ft. = 12 sq.ft.

Cut	no. trees	Vol. ft.bm.
28" = .865 x 0.9 =	0.8	1865 x 578 = 500
30" +	1.55	1227
Total	2.35	1727

		ft.bm.	Cds.
Harvest cut = 1727			
Thinnings*			
Group XI	(3.7 - 3.5) 24" trees @ 450 x .2 =	90	
Group X	(4.0 - 3.7) 22" trees .3 x 370 =	111	
Group IX	(4.8 - 4.2) 20" trees .6 x 340 =	204	
Group VIII	(5.5 - 4.9) 18" trees .6 x 220 =	132	
Group VII	(5.9 - 5.4) 16" trees .5 x 150 =	80	
Group VI	(7.1 - 6.3) 16" trees .8 x 160 =	128	
Group V	(8.0 - 7.1) 14" trees .9 x 110 =	99	
Group IV	(9.9 - 8.7) 12" trees 1.2 x .23 cds.		0.3
Group III	(12.2 - 11.0) 10" trees 2.3 x .15 cds. =		0.3
Group II	(18.7 - 15.4) 8" trees 3.3 x .06 cds.		0.2
Group I	(28.0 - 21.8) 6" trees 6.2 x .033 cds.		0.2
		2571	1.0

Estimation of cut during 2nd cutting cycle

Harvest Cut	1727 bd.ft.	
Thinnings	844 bd.ft.	±1.0 cds.
	2571 bd.ft.	±1.0 cds.

After the first rotation and the cyclic age groups are in a regulated condition, the thinning cuts can be easily estimated by subtracting from the number of trees in each group the number of trees in the succeeding age group in the Classified Stand and Stock Table.

e.g. Thinnings from Group I

28.0 - 18.7 = 9.8 trees

Hardwood-Conifer Type

Stand and Stock Table Compiled from Cruise Data

Hardwoods

DBH in.	No. of trees	B. A. sq.ft.	Vol.ft. b.m.	% vol./ dia.cl.
6	7.6	1.49		
8	8.2	2.86		
10	12.7	6.90	424	4.5
12	9.2	7.22	584	6.2
14	8.0	8.55	820	8.7
16	6.5	9.07	1019	10.9
18	5.2	9.19	1130	12.0
20	4.6	10.05	1299	13.8
22	3.0	7.92	1072	11.4
24	2.0	6.29	877	9.3
26	1.4	5.16	697	7.4
28	1.0	4.28	572	6.1
30	0.6	2.94	362	3.9
32	0.2	1.12	156	1.7
34	0.2	1.26	206	2.2
36	0.1	0.71	142	1.5
38	0.04	0.32	39	.4
	70.54	85.33	9399	100.0

Spruce and Balsam

Dia. in.	No. of trees	B. A. sq.ft.	Vol.ft. cords	% vol./ dia.cl.
6	21.3	4.18	0.7	5.0
8	11.8	4.12	1.0	7.2
10	8.0	4.36	1.3	9.35
12	6.1	4.79	1.5	10.8
14	3.8	4.06	1.3	9.35
16	4.0	5.58	1.9	13.7
18	2.5	4.41	1.6	11.5
20	1.7	3.71	1.4	10.1
22	1.6	4.22	1.6	11.5
24	0.6	1.87	0.8	5.75
26	0.3	1.11	0.4	2.9
28	0.2	.86	0.3	2.15
30	0.04	.20	0.1	.7
	61.94	43.47	13.9	100.00

Determination of Probable Average Diameter of Trees Within Each Cyclic Age Group for Each Cycle Included Within the Diameter Range of the Cruise Data

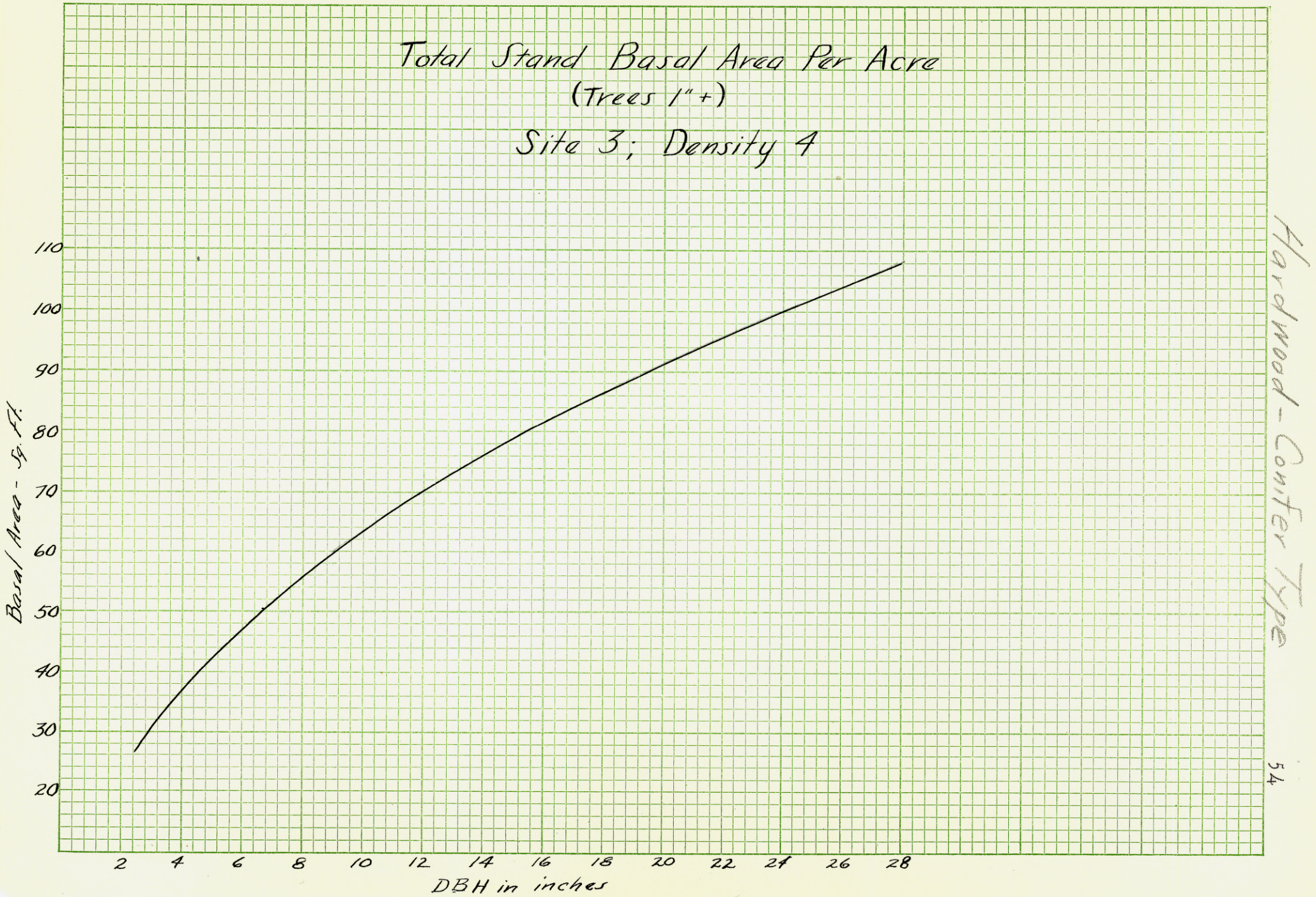
Hardwood Type Control Table

Objective of mgt. - 22" DBH
Estimated rate of growth of timber 6" + - 0.13"/yr.
6" timber is 45 yrs. of age ±
Operation on 10 yr. cutting cycle
Minimum size of timber in cruise - 6"

$$\text{No. of cycles} = \frac{22" - 6}{10 \times 0.13} = \frac{16}{1.3} = 12$$

Age group		DBH Range	DBH Av.	B. A. sq.ft.*	B. A. percent
I	45-55	5.9-7.2	6.6	50	5.7
II	55-65	7.2-8.5	7.9	56	6.3
III	65-75	8.5-9,8	9.2	60	6.8
IV	75-85	9.8-11.1	10.5	65	7.4
V	85-95	11.1-12.4	11.8	69	7.8
VI	95-105	12.4-13.7	13.1	73	8.3
VII	105-115	13.7-15.0	14.4	76	8.6
VIII	115-125	15.0-16.3	15.7	80	9.1
IX	125-135	16.3-17.6	17.0	83	9.4
X	135-145	17.6-18.9	18.3	87	9.9
XI	145-155	18.9-20.2	19.6	90	10.2
XII	155-165	20.2-21.5	20.9	93	10.5
				882	100.0

From curve of yield table data over DBH.



Hardwood - Conifer Type

Determination of the Approximate Diameter Limit of the Harvest Cut and Possible Cut per Acre Including Thinnings

Classified Stand and Stock Table
Hardwood of Hardwood-Conifer Type

Age Group	B.A. %	Actual B.A. Sq. ft.	No. of trees	Dia. Range inches	Av.Dia. inches
I	5.7	4.9	16.9	6-10	7.3
II	6.3	5.4	9.9	10-	10.0
III	6.8	5.8	8.0	10-12	11.5
IV	7.4	6.3	6.6	12-14	13.2
V	7.8	6.6	5.7	14-16	14.7
VI	8.3	7.1	5.1	16	16.0
VII	8.6	7.3	4.1	18	18.2
VIII	9.1	7.8	3.8	18-20	19.4
IX	9.4	8.0	3.4	20-22	20.8
X	9.9	8.4	2.9	22-24	23.0
XI	10.2	8.7	2.4	24-28	25.8
XII	10.5	9.0	1.74	28 +	31.0
		85.3			

The irregular condition of Column 5 indicates an unequal distribution of age classes in the stand. This irregularity will disappear after the first full rotation.

Construction of Classified Stand and Stock Table

	B. A.	No. of trees
Class XI		
B. A. required	8.7	
Balance from 28" class	1.6	.4
B.A. req. 26" class	7.1	1.4
B.A. 26" class	5.2	
B.A. 24" class	1.9	
% B.A. from 24" class = 1.9/6.3 = 30%		
No. trees 24 " class = .30 x 2 =		.6
		2.4
Class X		
B. A. required	8.4	
Balance from 24" class	4.4	1.4
B.A. req. 22" class	4.0	
% B.A. from 22" class - 4.0 ÷ 7.9 = 51%		
No. trees from 22" class = .51 x 3.0		1.5
		2.9
Class IX		
B. A. required	8.0	
Balance from 22" class	3.9	1.5
B.A. req. from 20" class	4.1	
% B.A. from 20" class - 4.1 ÷ 10.0 = 41%		
No. trees from 20" class = .41 x 4.6		1.9
		3.4
Class VIII		
B. A. required	7.8	
Balance from 20" class	5.9	2.7
B.A. req. from 18" class	1.9	
% B.A. from 18" class - 1.9 ÷ 9.2 = 21%		
No. trees from 18" class = .21 x 5.2		1.1
		3.8
Class VII		
B. A. required	7.3	
Balance from 18" class	7.3	4.1
Class VI		
B. A. required	7.1	
B.A. from 16" class	7.1	
% B.A. from 16" class - 7.1 ÷ 9.1 = 78%		
No. trees from 16" class = .78 x 6.5		5.1

	B. A.	No. of trees
Class V		
B. A. required	6.6	
Balance from 16" class	2.0	1.4
B.A. req. from 14" class	4.6	
% B.A. from 14" class = 4.6 ÷ 8.6 = 53.5%		
No. trees 14" class = .535 x 8.0		4.3
		5.7
Class IV		
B. A. required	6.3	
Balance from 14" class	4.0	3.7
B.A. req. 12" class	2.3	
% B.A. from 12" class = 2.3 ÷ 7.2 = 32%		
No. trees 12" class = .32 x 9.2		2.9
		6.6
Class III		
B. A. required	5.8	
Balance from 12" class	4.9	6.3
B.A. req. 10" class	0.9	
% B.A. from 10" class 0.9 ÷ 6.9 = 13%		
No. trees 10" class = .12 x 12.7		1.7
		8.0
Class II		
B. A. required	5.4	
B.A. req. 10" class	5.4	
% B.A. from 10" class = 5.4 ÷ 6.0 = 90%		
No. trees from 10" class = .9 x 11		9.9
Class I		
B. A. required	4.9	
Balance from 10" class	.6	1.1
Bal. from 8" and 6" classes	4.3	
No. trees 8" and 6" classes		15.8
		16.9

Harvest Cut and Thinnings

Hardwoods

Harvest Cut:

.105 x 85.33 = 9 sq. ft. B. A.

Cut	No. trees	Vol.ft.bm.
28"	.6	344
30" +	1.1	905
	1.7	1249

Harvest Cut			1249
Thinnings			
Group XI	(2.4 - 2.3)	24" trees	
Group X	(2.9 - 2.7)	22" trees	
	.2 x 350		70
Group IX	(3.4 - 3.2)	20" trees	
	.2 x 280		55
Group VIII	(3.8 - 3.4)	18" trees	
	.4 x 215		85
Group VII	(4.1 - 3.8)	18" trees	
	.3 x 215		65
Group VI	(5.1 - 4.5)	16" trees	
	.6 x 155		90
Group V	(5.7 - 5.1)	14" trees	
	.6 x 100		60
Group IV	(6.6 - 5.8)	12" trees	
	1.2 x 100		120
			1794 ft.bm.

Residual of 7650 bd.ft.

Conifers

Cut	No. trees	Vol. cords
26" +	.5	.8
24" class	.6	.8
22" class	1.6	1.6
	2.7	3.2 cds.

Residual of 10.7 cords
growth rate 0.1 cd./yr.

After the first rotation and the cyclic age groups are in a regulated condition, the thinning cuts can be easily estimated by subtracting from the number of trees in each group the number of trees in the succeeding age group in the Classified Stand and Stock Table.

e.g. Thinnings from Group I
16.9 - 9.9 = 7.0 trees

DETAILED BREAKDOWN OF STUMPAGE REDUCTIONS FOR INCREASED ROAD COSTS

From the stand and stock tables for the hardwood and hardwood-conifer types

1 sq. ft. BA = .11M bd. ft.
1 sq. ft. BA = .32 cords

Equating:

.32 cords = .11M
1 cord = .34M or 340 bd. ft.
or 1M = 2.9 cords

Total volume removed during the first cutting cycle:

Hardwoods:
Hardwood Type = 2.57M x 192.7A = 495M
Hardwood-Conifer Type = 1.8M x 318.9A = 575M

1070M

Conifers:
Hardwood Type = 1 cord x 192.7A = 193 cd.
Hardwood-Conifer Type = 3.2 cd x 318.9A = 1020 cd.
Spruce Swamp Type = 31.2 x 105.7A = 3295 cd.

4508 cd.

Equivalent bd. ft. volume = 4508 cd. x .34 = $\frac{1530M}{2600M}$

Deduction per M for additional road costs = $\frac{\$305}{2600M}$ = \$.117

Deduction per cord = $\frac{\$0.117}{2.9}$ = \$0.04

Stumpage Values (21):
Hardwoods = \$6.99 per M
Spruce fir = \$6.85 per M or \$2.36 per cord

Adjusted Stumpage Values:
Hardwoods = \$6.87 per M
Spruce fir = \$2.32 per cord

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