RANGER DISTRICT

FOREST SURVEY MANUAL

MINNESOTA

DIVISION OF FORESTRY

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TABLE OF CONTENTS

	Page
INTRODUCTION	1
PLANNING FOR DISTRICT INVENTORY	2
STEPS IN ACCOMPLISHING INVENTORY	2
Preliminary Office Work	2
Aerial Photo Type Mapping	2
Cover Types	3
Size Classes	6
Density or Volume Classes	6
Course Lines for Travel	8
Field Work	9
Correction of Photo Type Classification	9
Sample Tree Data	10
Management Recommendations	11
Forest Development Recommendations	11
Recreational Use	12
Stagnant Christmas Tree Types	12
Final Office Work	12
Completion of Land Use Cards	12
Compilation of Field Data	16
Annual Cut Computations	17
PREPARATION OF MANAGEMENT PLAN	19
USE OF MANAGEMENT DATA	21
APPENDIX	
Volume Tables	II
Rotation Ages by Site	VI
Site Index Curves	VII
Top Utilization Standards	IX

INTRODUCTION

This manual is for use by fieldmen of the Minnesota Division of Forestry in accomplishing ranger district forest inventory work essential to good management of state-owned lands, and supersedes previous manuals on this subject.

The procedures outlined are designed to provide information necessary for type acreage control.

This type of inventory provides the district ranger with all field information necessary for sound daily timber administration. In addition to summary information for overall planning, the ranger will know specifically where timber stands are located that require attention, when they will require attention and, barring unforeseen damage, how they should be treated. In addition, forest development and multiple land use data is provided. Land use cards make field data immediately available for reference.

Since ranger districts vary in the amount of state land and value of timber types, some modification of procedures between districts is desirable. Such changes may be made following staff consultation and approval.

Loose-leaf assembly of this manual will permit any modification of general procedures that becomes necessary.

Explanation of procedures does not include elementary standard forestry practices that can best be explained during area training sessions.

Staff assistance will be provided whenever needed prior to, or during, the period of survey.

All fieldmen should become familiar with the techniques and procedures outlined.

PLANNING FOR DISTRICT FOREST INVENTORY

District forest inventory, together with district forest management planning, is the responsibility of the regional forester, area forester, and their assistants. These responsibilities include the following:

1. Establish order and priority for inventory or reinventory in the ranger districts.

2. Provide for necessary training of personnel (staff assistance should be requested when necessary).

3. Establish necessary modification of procedures to fit the district in question (with staff approval).

4. Consult with game and fish personnel and other cooperating agencies concerning multiple use requirements.

5. Assign necessary personnel. (Assignment of personnel to specific survey work at regular intervals has been effective).

6. Provide necessary equipment and transportation.

7. Consult with staff personnel as frequently as necessary concerning specific problems.

Compartmentation of some districts is desirable. Lands outside state forests should be separated from lands within state forests (see Circular Letter, SI - State Forests, Sec. 3), since lands outside state forests will not require 100% field examination of merchantable types. Where any district includes more than one county, a separation by counties must be made. Other compartments may be established to delineate type of timber sale areas based on accessibility. As field work progresses, such compartment boundaries may be adjusted in accordance with additional field information obtained. Do not make more compartments than necessary because this complicates data compilation.

In most cases, districts containing less than 10,000 acres of productive state land can be completed by the district ranger with whatever area assistance is necessary. Larger districts requiring additional personnel must be planned as a special project through the regional and staff foresters.

A survey progress wall map should be posted prominently in the district office to aid daily work planning. A red "S" is to be entered on all state-owned descriptions, one diagonal red line entered when the land has been type-mapped, crossed with another diagonal red line when the land has been field checked, and colored solid red when the land use card has been completed.

STEPS IN ACCOMPLISHING DISTRICT FOREST INVENTORY

Preliminary Office Work

Aerial Photograph Type-Mapping

Section lines and corners are placed on the photos before type-mapping. (See Pages 13, 14 and 15 of Aerial Photo Manual.)

State land will be type-mapped on matex by the person most qualified through familiarity with the district and available photographic prints. This will usually be the district ranger. Inexperienced personnel must be trained in the use of the stereoscope and should frequently field check photo mapping until skill is developed. The aerial photograph manual should be reviewed prior to the start of type-mapping.

Where photography is old or of very poor quality, type-mapping must either be done on the ground or deferred until new photographs are available. In some cases, poor photographs have limited use in locating areas of merchantable timber or in locating landmark features for field reference starting points.

Classification of timber types as to main species, size class and density can be determined from stereoscopic examination of photographs. Standard cover type, size class and density symbols, which together make up the timber type "condition class", are as follows:

I. Cover Types

A. Timber Producing Types

Type	Type Symbol	Type Description
Aspen	A	More than 50% trembling or large tooth aspen and paper birch - aspen predominating.
Paper Birch	Bi	More than 50% paper birch and aspen - paper birch predominating.
White Pine	W	More than 50% pine with white pine outweighing Norway and jack pine.
Norway Pine	N	More than 50% pine with Norway pine outweighing white and jack pine.
Jack Pine	J	More than 50% pine with jack pine outweighing white and Norway pine.
Black Spruce*	S	More than 50% swamp conifers with black spruce outweighing other species.
Tamarack	T	More than 50% swamp conifers with tamarack outweighing other species.
Spruce-Balsam	SB	A mixed hardwood-coniferous type characterized by substantial quantities of white spruce and balsam fir - balsam fir predominating.

Type	Type Symbol	Type Description
White Spruce	SBs	Same as SB but with white spruce predominating.
Northern White Cedar	C	More than 50% swamp conifers with white cedar outweighing other species.
Northern Hardwoods	M	More than 50% northern or upland hardwood species. (Maple, yellow birch, basswood, etc.)
Oak	O	More than 50% oak.
Bottomland Hardwoods	E	More than 50% bottomland hardwoods. (Ash, elm, balm of gilead, etc.)
Ash	Ea	A bottomland type composed almost entirely of ash.
Balm of Gilead	Eg	A type composed almost entirely of balm of gilead or of balm of gilead and aspen with balm of gilead predominating.

*May be an upland type as on the North Shore.

B. Potential Timber Producing Types (Deforested)

Type	Type Symbol	Type Description
Grass	G	Upland grass or weed area in the forest less than 10% stocked with commercial tree species. (Also applies to abandoned farms where no farming or grazing is done.)
Upland Brush	UB	Upland brush in forest areas less than 10% stocked with commercial tree species.
Lowland Brush	LB	Lowland brush on potential commercial forest land, less than 10% stocked with commercial tree species.
Offsite Aspen	Ax	An aspen type in which aspen will not produce sound merchantable pulpwood.
Scrub Oak	Ox	A scrubby oak type which will produce only fuelwood material.
Duff	D	Low herbaceous cover only, or litter and herbaceous cover. (Ferns or annuals.) (Generally only used as an understory designation.)
Lowland Grass	LG	Lowland grass area capable of supporting a commercial forest.

C. Nontimber Producing Types

Type	Type Symbol	Type Description
Nonproductive Swamp	Sx Tx Cx	Spruce, tamarack, or cedar bog, in which trees will not produce standard pulpwood or cedar products in 100 years.
Christmas Tree Bog	Sxs	Spruce bog which is nonproductive for timber products but will make Christmas trees.

D. Nonforest Types

Type	Type Symbol	Type Description
Farm	F	Crop, orchard, or pasture but not farm woodland. Fenced farm woods less than 10% stocked to forest trees will be considered open pasture. (To be used only where the area is actively farmed, grazed, or used for hay production.)
Industrial and Residential	I	Platted areas used for industry or residence. Also roads, railroads, cut out rights-of-way, etc.
Recreational	R	Recreational areas including forest lands where timber is reserved from cutting.
Water	L	Lakes, ponds, and ditches.
Rock Outcrop	RO	Rock ridges or knobs either bare or only sparsely covered with vegetation which will not be of commercial importance.
Sand Dunes	SD	Sand dunes including sandy beaches.
Marsh	Mh	Marsh land incapable of supporting a commercial forest. Includes wild grass, cattails, cane grass, some willow or other scattered lowland brush.
Muskeg	Ms	Nonproductive peat land with a vegetation consisting of mosses, and low shrubs such as leatherleaf, laurel, laborador tea, cranberries, bog birch, etc., but not tall willows, alder, dogwood, etc., not capable of supporting a 10% stocking of commercial species, but often characterized by scattered severely stunted black spruce and tamarack of less than site index 23 at 50 years. (There should not be stumps or large snags showing evidence of former commercial stand. If so, the land probably belongs to lowland brush.)

Type	Type Symbol	Type Description
Nonpermanent Flowage	LF	Nonpermanent water sources such as beaver flowages.

II. SIZE CLASSES

Each type will be classified into one of the following size classes: (Saw timber stands are measured in bd. ft.; pole timber stands are measured in cords; and restocking stands are measured in number of trees.)

A. Merchantable Size Classes

1. Large saw timber (15+). Most of board foot volume is in trees 15.0 inches DBH or larger.

2. Small saw timber (9-15). Most of board foot volume is in trees less than 15.0 inches DBH.

3. Pole timber (5-9). Most of the merchantable cordwood volume is in trees between 5.0 to 8.9 inches DBH.

B. Restocking Size Classes

1. Saplings (1-5). Stands of trees ranging between 1.0 and 4.9 inches DBH.

2. Seedlings (0-1). Young stands of commercial tree species from 1 foot high to 0.9 inches DBH.

The following table shows size classes by diameter classes and map designation:

Size Class	DBH Class in Inches	Map Designation of Size Class
Large Saw Timber	15+	V
Small Saw Timber	9-15	IV
Pole Timber	5-9	III
Saplings	1-5	II
Seedlings	0-1	I

III. DENSITY OR VOLUME CLASSES

Merchantable types will be classified according to volume per acre. Restocking types will be classified according to the number of stems per acre. The density and volume range of each size class is listed below.

Size Class	Density or Volume Class: Very Poor (°)	Poor (')	Medium ('')	Good (''')	Very Good ('''')
Seedlings 0-1 (I)	*	200-800 Trees/A	800-1400 Trees/A	1400+ Trees/A	*
Saplings 1-5 (II)	*	100-400 Trees/A	400-700 Trees/A	700+ Trees/A	*
Pole Timber 5-9 (III)	1-3 Cds/A	3-7 Cds/A	7-13 Cds/A	13-20 Cds/A	20+ Cds/A
Sml.Saw Timber 9-15 (IV)	500-1300 Bd.Ft./A	1300-2500 Bd.Ft./A	2500-5000 Bd.Ft./A	5000-8000 Bd.Ft./A	8000+ Bd.Ft./A
Lge.Saw Timber 15+ (V)	500-1300 Bd.Ft./A	1300-4500 Bd.Ft./A	4500-8500 Bd.Ft./A	8500-13000 Bd.Ft./A	13000+ Bd.Ft./A

*Classification not used for seedlings and saplings.

The very poor volume class is used only to indicate high value trees such as pine or valuable hardwoods. When using this classification, always show the understory. The understory will be used for acreage summarization.

Classification of Timber Stands

Stands are often composed of more than one crown layer and this survey recognizes a two-story classification. In merchantable stands, the understory is defined as -- The type classification that would exist if the main stand were clearcut. An understory will always be shown.

Where there is no layering of timber stands, the ground cover will be indicated as the lower layer.

$$\frac{\text{S III}'}{\text{LB}} \quad \text{or} \quad \frac{\text{J III}''}{\text{UB}} \quad \text{or} \quad \frac{\text{N IV}'}{\text{G}} \quad \text{or} \quad \frac{\text{J' III}''''}{\text{D}}$$

Where two layers of different cover types are present, each layer is identified with the main stand shown in parenthesis. Other things being equal, the larger size class will be favored. Saw timber always takes precedence except where pole timber is at least two stocking classes greater as in the following examples where the tupe class or main stand is shown in parenthesis:

$$\frac{(\text{A IV}')}{\text{SB III}'} \qquad \frac{(\text{A IV}')}{\text{SB III}''} \qquad \frac{\text{A IV}'}{(\text{SB III}''')}$$

In the case of two-story pole timber and reproduction stands, it is not necessary to use parenthesis, since a merchantable size class always has precedence:

$$\frac{\text{A III}''}{\text{SB II}'''}$$

In the case of small and large saw timber (IV and V), always use the size class designation with the greater volume. Never use a V/IV classification. For example: 2500 bd. ft. of size class IV and 2600 bd. ft. of size class V would be added together to make 5100 bd. ft. with a stand classification of V''.

There is a definite break between saw timber and cords in computing density. If a stand is mainly pole timber with a small volume of saw timber, the saw timber volume is <u>not</u> converted to cords and added to pole timber volume to determine pole timber density and vice versa. For example: 1300 bd. ft. per acre of Norway pine growing above 19 cords per acre of spruce-balsam would be shown as follows:

$$\frac{\text{N V'}}{\text{(SB III''')}}$$ and not as SB III''''

<u>Course Lines of Travel</u>

Following completion of the type map, course lines are drawn to cross all merchantable types within state forests. The lines should be either in cardinal directions or 45° angles with arrows to show direction of planned travel. (See figure 1.)

<u>METHOD OF LAYING OUT COURSE LINES TO FIELD CHECK THE TYPE MAP</u>

Scale 4" = 1 mile
Area 320 acres

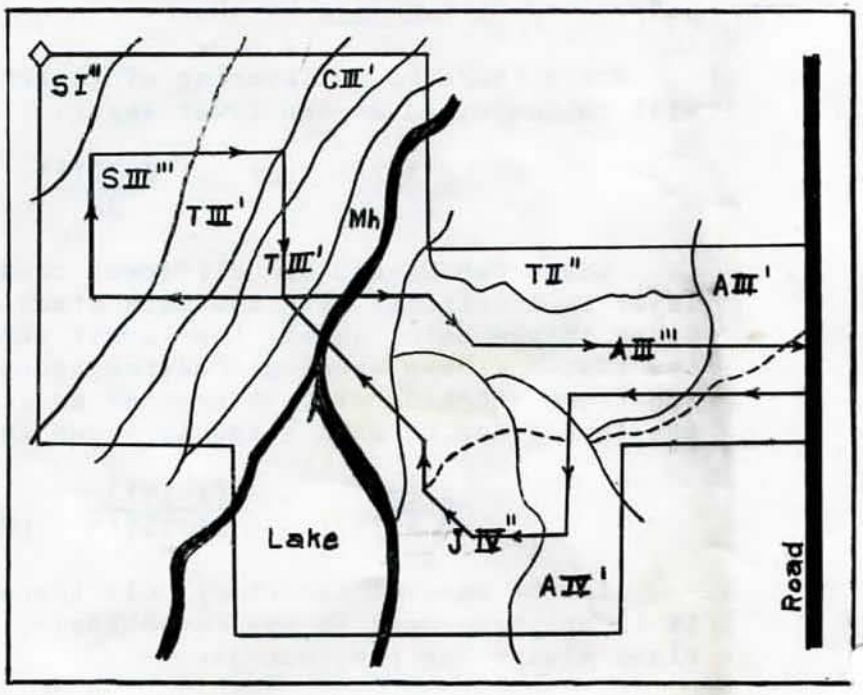
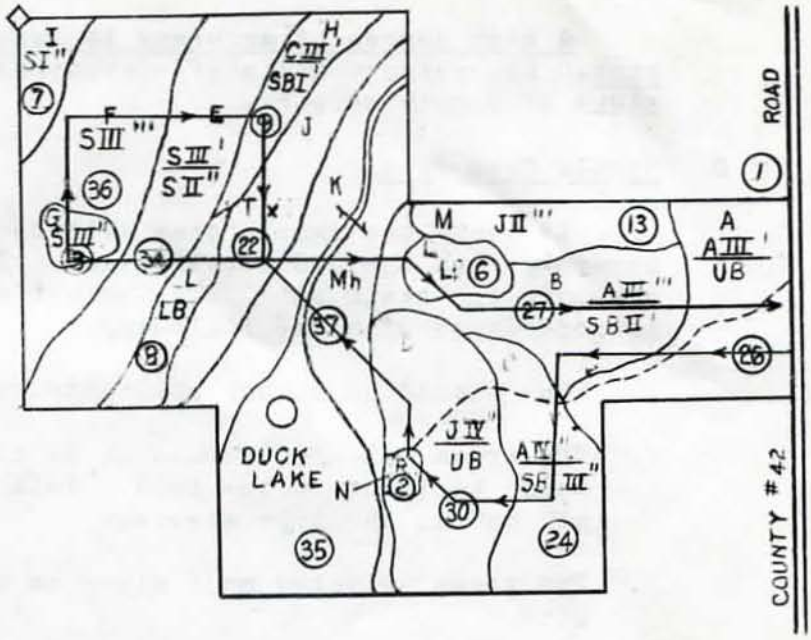


Figure 1 - Preliminary type map on matex or map sheet prepared from the aerial photograph with stereoscope. Note course lines intersecting all merchantable types.

Figure 2 - Completed type map as it is to be transferred to the land use card. (See completed card on Page 14.)



Field Work

Field information will be obtained while the crew is following the predetermined course line as indicated in Figure 1. The field notes for each type may be recorded either directly on the land use card, in a pocket note book, or on a sheet of paper kept in a tatum. In any case, the appropriate notes must be later transferred to the card.

The following field information will be obtained and noted for each merchantable type within state forests:

A. Correction of Type Classifications

This is a check on the original aerial photograph type-mapping and any necessary corrections must be noted. Since this survey procedure is aimed primarily at obtaining accurate type acreage figures for type area management control, only enough volume plots will be taken to accurately classify the type. The number of plots required will vary with the density and species variation within the type. For example: A spruce-balsam type consisting of scattered small patches of timber will be more difficult to classify. As skill and experience is developed, it can be expected that fewer plots will be necessary and that accurate classification of some even aged types can be made with few or no sample plots.

In mixed types planned for cutting, the merchantable species should be noted for entrance on the land card. (See Page 15, Completion of Land Use Card.) For example: The SB type might contain balsam, spruce and aspen or just balsam.

When sample plots are necessary, either fixed radius, strip or Bitterlich plots are acceptable, and several kinds of

volume tables are available for reference in the Appendix.

A high degree of accuracy is required in type classification. Supervisory and staff personnel will make field inspections of completed work.

B. Sample Tree Data

At least one sample tree will be measured in each type to determine the age and total height. These two factors together are used to obtain site. The selection of sample trees must be in accordance with the following:

1. They should be either dominants or co-dominants.

2. The trees selected should be of the species management intends to favor in the type. This is usually, but not in all cases, the type species.

3. The trees selected must stand on a spot typical of the site.

4. The trees should be free of disease and chance malformations that affect height growth and free enough of competition to reflect what the site can accomplish in tree growth. It should neither be suppressed, open-grown , or a super tree, but of good form and with a thrifty looking crown.

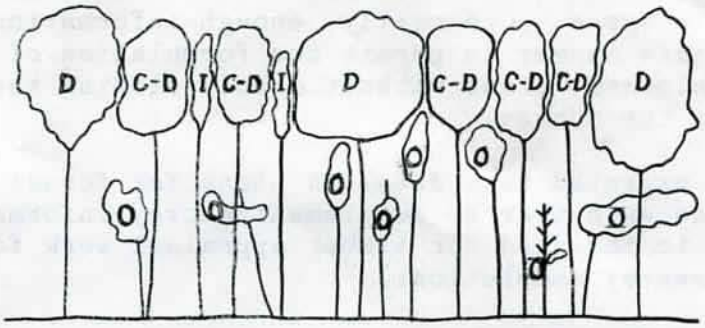
Average type age is determined by boring dominant or co-dominant trees at Diameter Breast Height (DBH) and adding the number of years required to reach DBH. The following table shows the number of years to be added. Sample tree ages are averaged to obtain stand age.

AVERAGE NUMBER OF YEARS TO REACH BREAST HEIGHT

Species	Good Site	Poor Site	Species	Good Site	Poor Site
Aspen	1	2	Maple, Hard	8	15
White Pine	8	12	Maple, Soft	2	4
Norway Pine	6	10	Ash	8	15
Jack Pine	5	8	Elm	4	8
Black Spruce	10	20	Basswood	2	4
Tamarack	5	10	Balm of Gilead	1	2
Balsam Fir	10	20	Oak	3	6
White Spruce	10	15			
Cedar,Northern Wh.	10	20			
Birch, Paper	2	4			
Birch, Yellow	8	15			

The relative position of dominant and co-dominant trees in the timber stand is indicated below:

D = Dominant Trees C-D = Co-dominant Trees
I = Intermediate Trees O = Overtopped Trees



Total height of each sample tree is measured to the nearest foot with an accurate stick hypsometer, Abney level or Haga Altimeter.

Site index is the average height of dominant and co-dominant trees at age 50. By measuring age and total height from sample trees and referring to the site curves in the Appendix, Page VII, the capacity of the type to grow timber can be measured. Site classification is necessary to determine rotation age since the same type class growing on different sites will mature at different ages. Rotation age is used in the computation of the annual recommended cut, and in establishing the cutting recommendations.

The five levels of site quality shown on the site curves, Page VII, are:

1. Excellent 2. Good 3. Medium 4. Poor 5. Very Poor

The red oak site curves are used for all of the hardwoods except aspen, balm of gilead and birch. The aspen curves should be used for balm of gilead sample trees. A separate site curve is shown for birch. Site index for seedling and sapling stands under 20 years of age can only be visually estimated.

C. Management Recommendations

This is an all important consideration which must be decided in accordance with age, site, condition, and other multiple use possibilities of the type under examination. Each merchantable type will be recommended either for cutting in 0 to 5 years, 0 to 15 years, or reserved. In addition, the method of cutting will be indicated as clearcut (cc) or partial cut (pc). Other special recommendations should also be noted.

D. Forest Development Recommendations.

There are many acres of deforested state land in need of

planting or other special treatment to make them productive.

Deforested lands or other lands that appear to require development on aerial photographs should be examined and planting or other recommended treatment noted and finally recorded on the land use cards under "Forest Development Plans". This can usually be done as such areas are encountered while enroute to merchantable types. Ordinarily, enough information can be obtained in this manner to permit the formulation of district forest development plans without unduly slowing the overall progress of the survey.

It is expected that detailed plans for forest development must be made each year to supplement survey information. (This is similar to the need for timber appraisal work for timber sales following survey completion.)

E. Recreational Use of State Lands

Due to the great expected increases in population, more and more public land must be utilized for parks, campgrounds, homesites, hunting areas, and multiple uses, in addition to timber production.

When areas are encountered that have a high value for uses other than timber production alone, such information should be noted on the land use cards for future reference and incorporated into the district management plan.

F. Stagnant Swamp Christmas Tree Types

Long and tedious examination of SXS types will be avoided and reliance placed on aerial photograph type-mapping, together with previous Christmas tree sale records. On-the-ground examination should be limited to brief checking of the type classification where aerial photographs or other records are not adequate to identify the type.

Final Office Work

Final office work consists of the completion and entry of all data on the land use cards, compilation of the various type data, computation of the allowable cut, and writing of the district forest management plan.

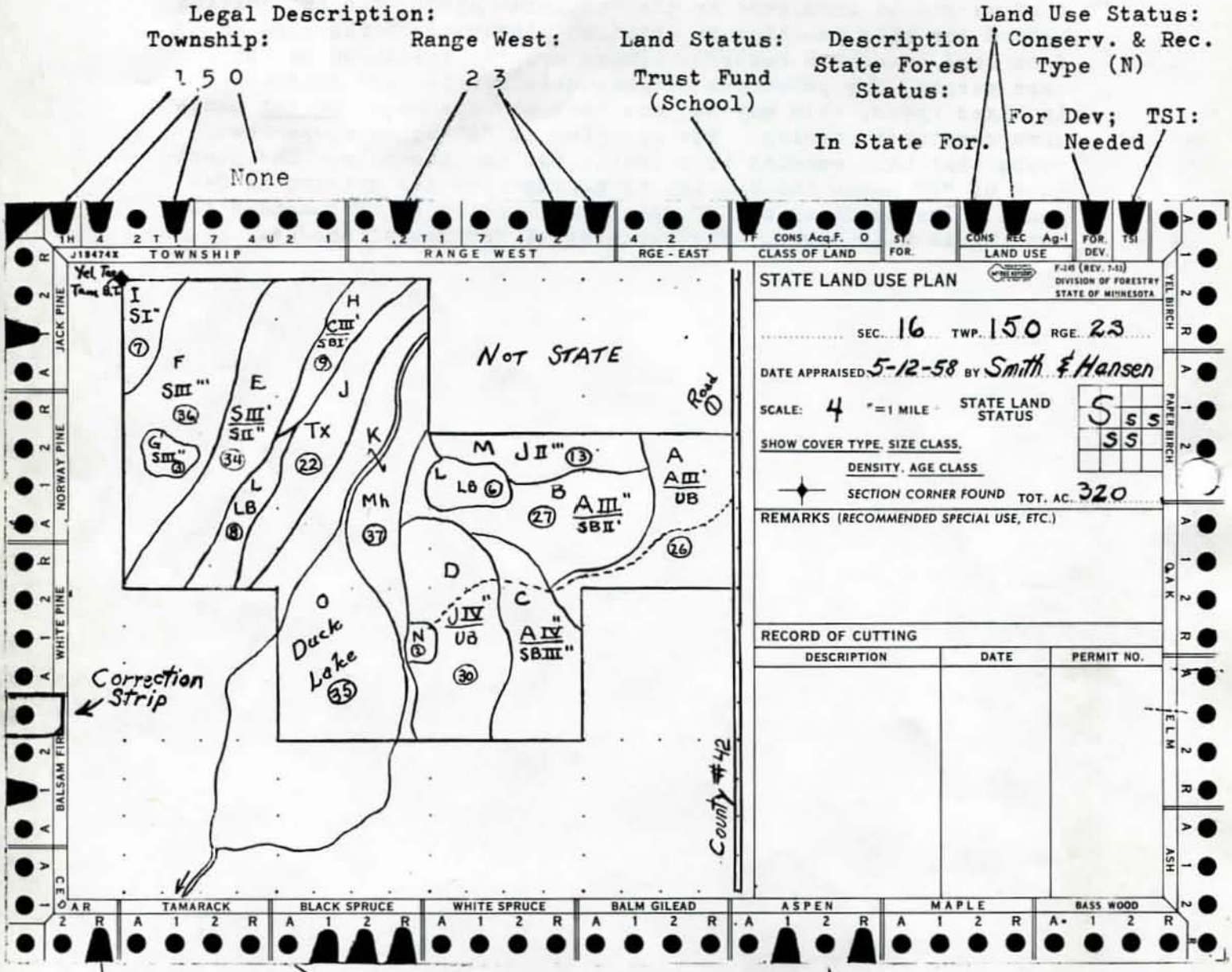
1. Completion of Land Use Cards

All pertinent data obtained in the field must be transferred to the land use card. (See back of land use card, Page 15.) A careful check of the cards should be made to see that all work is completed such as entering type acreages, etc. However, volume entries by types are not required on the back of the card headed "Species and Volume". In this space, the important species in mixed types should be shown together with other pertinent notes.

The corrected forest type map is entered on the front of the land use card together with the description, date of examination, names of estimators, scale of map, and state land status. A map scale of 4" to the mile is preferred, but the 8" to the mile scale may be used where the detail for small acreages must be shown. No other scale should be used.

The border of the land use card is used for McBee system sorting. All applicable holes are punched or cut out to the card margin as indicated on the completed card. The information needed for this punching is obtained elsewhere on the card or from land ownership records. Where species are shown on the card margin, the principal merchantable species are punched. In mixed types, this may be more than one species. Do not punch unmerchantable species. The punching of "A" under a species means that this species is suitable for auction sale. The punch-inch of "1" means the species is recommended for cutting in 0-5 years. The punching of "2" means the species is recommended for cutting in 0-15 years. The punching of "R" means reserve.

Completed Land Use Card
(Front Side)



Cedar Reserved

Not for Auc.Sale but Sec.1 or other sale. (If punched, it would mean spruce to be sold at auction.)

To be cut in 0-5 years. (If 2 punched, it would mean cut in 0-15 years.)

Descriptive features noted on the map portion of the card include cover types, type acreage, corners found, bearing tree, yellow tag, roads and trails, lake, stream with direction of flow, state ownership.

Completed Land Use Card
(Back Side)

Products and other pertinent notes. Age Site Treatment

TIMBER APPRAISAL, CONDITION

TYPE NO.	COVER TYPE SYMBOL	TYPE AREA	SPECIES AND VOLUME (USE SEPARATE COLUMNS FOR EACH STANDARD OF MEASURE, I.E. CORDS, M.B.F., ETC.) — CORDS / M. BOARD FEET / PIECE PRODUCTS	REMARKS
A	AIII/UB	26		30 P Underplant + J or N Herbicide Release
B	AIII/SBII	27		30 G Reserve
C	AIII/SBIII"	24	Aspen & Birch sawlogs, Spruce & Balsam pulp.	60 G Cut A, Bal. 45++ Res W.S. 0-5
D	JIII"/UB	30	Very scattered W.S. sawlogs	60 G Cut A & J 0-5 Res N scarify
E	SIII/SII"	34		100 P Res.
F	SIII"	36		100 G Cut 0-15
G	SIII"	3	Some scattered tamarack	100 G Mistletoe cc 0-5
H	CIII/SB"	9		80 P Res.
I	SI"	7		10 G
J	TX	22	Very wet	
K	Mh	37	Has been cut for hay	
L	LB	14	Fair site East of creek. Hand plant Spruce & Herbicide Release	
M	JII'''	13		20 G Thin 1970
N	Rec	2	Campsite used by hunters and rice pickers	
O	Lake	35		
P	Road	1		
		320		

FOREST DEVELOPMENT PLANS (PLANTING — TYPE AND SPECIES, DISCING, ETC. — BY TYPE)
A Underplant N or J by hand in furrows
L plant B.S. by hand East of creek

PLANTING RECORD

RECENT DATE	BURNS FIRE REPORT NO.	ACRES

Merchantable types are listed first, followed by non-merchantable, deforested, and non-forest types. The type letter is entered in red for each type requiring cutting within 15 years.

Volume need not be shown under "Species & Volume". In this space, show the species and approximate percentage of each, by volume, in mixed types to be cut and any other pertinent information.

Under the "Remarks" column, show age, site, and treatment prescribed. For example: 100, G, cc, 0-5, means 100 years old, good site, clearcut in 0-5 years.

2. Compilation of Field Data

Assistance should be requested for this phase of the work if previous experience is limited.

Some variation in procedure between districts is acceptable if the end result is comparable to the summary information obtained in the following manner. IBM may be utilized in some districts where large acreages of State land and important management considerations are involved.

Large accounting analysis sheets (14" x 25¼") may be used to list type acreages from the land use cards for each compartment as indicated below.

Merchantable Types

Compartment No. 1

Aspen Type Acreage

III'				III''				III'''				III''''			
Cut 0-5 Yrs.	Cut 0-15 Yrs.	Res.	Write Off	Cut 0-5 Yrs.	Cut 0-15 Yrs.	Res.	Write Off	Cut 0-5 Yrs.	Cut 0-15 Yrs.	Res.	Write Off	Cut 0-5 Yrs.	Cut 0-15 Yrs.	Res.	Write Off
25	10	100	5												
5	0	0	0												
0	10	15	0												
etc.															
Totals															

The various compartment totals may then be tabulated to obtain the district merchantable type totals by cutting priority.

Tabulation of non-merchantable type acreage may be accomplished in the following manner:

Non-Merchantable Types*

Comp. No.	Type Acres								
	A	B	W	N	J	S	T	SB	Etc.
1									
Total									
2									
Total									

* 0-5" DBH

Deforested, non-productive and non-forest type acreages may be compiled as follows:

Comp. No.	Deforested Type Acres							Non-Productive Type Acres				Non-Forest Acres		
	G	UB	LB	Ax	Ox	D	LG	SX	TX	CX	SXS	F	I	Etc.
1														
Total														
2														
Total														

Tabulation of forest development information may be accomplished as follows:

Forest Development Summary

Description	Treatment Required - Acres					
	Planting	Release	TSI	Possible Planting		
				LB	UB	Offsite Types	Etc.

This table should be filed and kept available for seasonal use. Add to it as further information is gathered.

3. Annual Cut Computations

The field recommended annual cut for each compartment can be determined by dividing the total acreage of each merchantable type recommended for cutting by the recommended period of cut. Example: (See Page 18). However, the field annual cut figures must be compared with ideal area regulation cut. If there is an appreciable difference, it is necessary to adjust the field recommended cut where type condition will permit.

The area regulation annual cut is obtained by dividing the total acres of even aged type by the rotation age, and the total acres of uneven aged type by the cutting cycle. Example: (See Page 18).

Rotation age will vary with site. (See rotation ages by site index, Page VI.) Better sites capable of producing good saw timber should be held long enough to produce larger size products. Where there is much site variability within a given type, it will be necessary to analyze the various sites carefully

to arrive at the average rotation age.

Field Recommended Annual Cut

Example:	1422 Acres	A III'	Cut 0-5	$\frac{1422}{5}$	=	284 acres
	4550 Acres	A III'	Cut 0-15	$\frac{4550}{15}$	=	303 acres
	2380 Acres	A III''	Cut 0-5	$\frac{2380}{5}$	=	476 acres
	8250 Acres	A III''	Cut 0-15	$\frac{8250}{15}$	=	550 acres
	etc.			etc.		
	42 Acres	A IV'''	Cut 0-15	$\frac{42}{15}$	=	3 acres
Total	40,000 Acres Aspen Type					4,607 acres

Area Regulation Annual Cut

Example: 4500 Acres A IV

35,500 Acres A III Rotation Age = 45 years

50,000 Acres A II

Total 90,000 Acres Aspen Type

$\frac{90,000}{45}$ = 2,000 acres per year.

If adjustment is feasible, the 4,607 acres cut per year as shown in the first example should be reduced toward a cut of about 2,000 acres per year by reserving some of the type areas in better site which were slated for 0-15 year cut according to field recommendations.

In determining the acreage allowable cut, it must be kept in mind that our goal is to arrive at the acreage cut that will eventually provide the highest possible sustained yield while keeping losses at the lowest possible level. In some types, growing stock must be built up to improve production rates. The ratio of saw timber and pole timber to reproduction acreage is very important in this respect. An ideal ratio is in the neighborhood of 40% sawtimber and pole timber to 60% reproduction.

4. Conversion to Volume

Management control in the district is by type acreage; therefore, volume is of importance only for public information, attraction of industry, etc. Annual cut volume information by type is obtained by multiplying average per acre volumes by the type acreage. Average volumes per acre for the various types will be supplied by the staff in the form of stock tables based on previous survey information.

PREPARATION OF THE MANAGEMENT PLAN

Management policies will be established following an analysis of the information obtained from the survey and consultations with other land management agencies concerned in the district where the survey has been conducted, such as the Division of Game and Fish and the Division of State Parks. The district ranger will complete the management plan, drawing on the advice and assistance of area and regional personnel and the staff forester in charge of inventory. Management plans should be as brief as possible and still contain essential information. The suggested outline for the district management plan may be modified as varying conditions in the district require. In addition to the discussion, show statistical data by circle graphs and short tables where applicable. Following review by regional personnel and the staff forester, the completed management plan is submitted to St. Paul for approval.

The following management plan outline will be adequate for most districts:

Introduction:

One or two paragraphs of location, history, compartmentation, etc.

Land Ownership:

Ratio of State land to total acreage in district and brief discussion of any interesting factors.

Table 1

Kind of Land	Acres
Conservation	-
Trust Fund	-
Acquired - Forestry	-
Acquired - Game & Fish	-
Other Public	-
Private	-
Total	-

Type Classification:

What are the more important types? Give percentages of total forest area for two or three most important.

Table 2

Cover Type	Size Class (Acres) Saw	Pole	Repr.	Total	%
Aspen	-	-	-	-	-
Jack Pine	-	-	-	-	-
Nor. Pine	-	-	-	-	-
etc.*					
Total Tbr. Prod.	-	-	-	-	-
Deforested				-	-
Non-Productive				-	-
Total For. Land				-	-
Non-Forest				-	-

Volume:

Brief discussion of most important species and percent of total volume, etc. (One paragraph).

Table 3

Species	Cords	M Bd. Ft.
Aspen	-	-
Black Spruce	-	-
Balsam Fir	-	-
Other Species*	-	-
Total	-	-

*Lump together minor types and species.

Recommended Cut:

Brief discussion of past drain and allowable cut by important types and species. (One or two short paragraphs.) The recommended cut should be shown by compartments with a district total when more than one compartment is present.

Table 4

Cover Type	Recommended Annual Cut (Acres)
Aspen	-
Spruce	-
Jack Pine	-
Tamarack	-
etc.	-

Table 5

Species	Recommended Annual Cut	
	MBF	Cords
Aspen	-	-
Black Spruce	-	-
Balsam Fir	-	-
Other Species	-	-
Total	-	-

Management Methods:

Very brief discussion of cutting methods for each of the most important types.

Forest Development:

Brief discussion - amount of planting stock by species required,

nature of site preparation needed, release work, etc.

Table 6

	Acres
Planting	
Release	
TSI	
Possible Planting	

Markets:

Discussion of local markets, problems and possibilities. (One or two paragraphs.)

Multiple Use:

Recreation, game management and other pertinent considerations as applicable to State lands in the district. Discuss any possible campground locations, needed roads, lakeshore use, watershed problems, recommendation for game management, etc. (One to five brief paragraphs, depending on importance of multiple use in the district.)

USE OF MANAGEMENT DATA

The tools of management are the written management plan and the land use cards. Maximum use should be made of the completed land use cards to locate timber in the greatest need of cutting, to locate specific products in need of cutting, and to plan for planting and other state land management work. Changes in types due to cutting, fire, or other causes should be promptly entered on the card by correcting the original map and other entries.

Sorting of cards under the McBee system may require practice. Special instruction will be furnished where needed.

A cutting priority wall map of the district may be prepared on protection maps (scale ½" per mile). The forty acre tracts scheduled for cutting attention within a 15-year period may be colored as an aid to planning.

Detailed cutting plans and regulations are prescribed at the time each tract is appraised for sale based on type conditions at the time of appraisal. Extreme care must be used -- there is no way to correct error after cutting.

The Division of Forestry has been entrusted with the management of some five million acres of state land. This is not a simple task nor can it be accomplished without a considerable expenditure of time and effort. Let us be sure that this phase of Division responsibility receives the attention it deserves.

A P P E N D I X

RANGER DISTRICT FOREST SURVEY MANUAL

MINNESOTA
DIVISION OF FORESTRY
1960

F-248
(REV. 9-13-55)

IBM FOREST INVENTORY

MERCHANTABLE TYPE DATA SHEET

RA[illegible] 1/5 ACRE PLOT - 52.7 FEET

RADIUS 1/10 ACRE PLOT - 37.2 FEET

	COL. NO.		COL. NO.		COL. NO.
1. Description ___ ___ ___ ___	1-7	6. Acreage ___ ___	16-18	11. Site ( ) ___	27
2. Mgmt. Unit ___ ___	8-9	7. Class St. Own. ( ) ___	19	12. Forest Dev. ( ) ___	28
3. Comp. No. ___	10	8. Land Use ( ) ___	20	13. Type Cl. ( ) ___	29
4. Type No. ___	11	9. Unders'y ( ) ___ ___ ___ ___	21-24	14. Oper. ( ) ___	30
5. Cond. Class ( ) ___ ___ ___ ___	12-15	10. Stand Age ___ ___	25-26	15. Cause - Ac. Loss ( ) ___	31

CUMULATIVE 1/5 ACRE TALLY SHEET

NO. OF PLOTS

VOLUME IN TENTHS OF CORDS PER ACRE

DBH	SPEC.	NUMBER OF 8 FOOT BOLTS (3" TOP DIA.) PER TREE 1	2	3	DEFECT - CORDS SPECIES	%
4		0 1 1 1 1 2 2 2 3 3 3 4 4	1 1 2 2 3 4 4 5 6 6 7 7	1 2 3 4 5 6 6 7 8		
		4 4 5 5 5 6 6 6 7 7 7 7 8	8 9 9 10 10 11 12 12 13 13 14 15	9 10 11 12 13 14 15 15 16		
		8 8 9 9 9 10 10 10 10 11 11 11 12	15 16 16 17 18 18 19 20 20 21 21 22	17 18 19 20 21 22 23 24 25		
		12 12 13 13 13 13 14 14 15 15 15 15 16	23 23 24 24 25 26 26 27 27 28 29 29	25 26 27 28 29 30 31 32 33		
		0 1 1 1 1 2 2 2 3 3 3 4 4	1 1 2 2 3 4 4 5 6 6 7 7	1 2 3 4 5 6 6 7 8		
		4 4 5 5 5 6 6 6 7 7 7 7 8	8 9 9 10 10 11 12 12 13 13 14 15	9 10 11 12 13 14 15 15 16		
		8 8 9 9 9 10 10 10 10 11 11 11 12	15 16 16 17 18 18 19 20 20 21 21 22	17 18 19 20 21 22 23 24 25		
		0 1 1 1 1 2 2 2 3 3 3 4 4	1 1 2 2 3 4 4 5 6 6 7 7	1 2 3 4 5 6 6 7 8	4	5
6		1 2 3 4 5 6 6 7 8 9 10 11 12	1 2 4 5 6 7 8 10 11 12 13 14	2 4 5 7 9 11 13 14	2 5 7 10 12 14	3 6 9
		13 14 15 16 17 18 18 19 20 21 22 23 24	16 17 18 19 20 22 23 24 25 26 28 29	16 18 20 22 23 25 27 29	17 19 22 24 26 29	12 15 18
		25 26 27 28 29 30 31 31 32 33 34 35 36	30 31 32 34 35 36 37 38 40 41 42 43	31 32 34 36 38 40 41 43	31 34 36 38 41 43	21 24 27
		37 38 39 40 41 42 43 43 44 45 46 47 48	44 46 47 48 49 50 52 53 54 55 56 58	45 47 49 50 52 54 56 58	46 48 50 53 55 58	30 33 36
		1 2 3 4 5 6 6 7 8 9 10 11 12	1 2 4 5 6 7 8 10 11 12 13 14	2 4 5 7 9 11 13 14	2 5 7 10 12 14	3 6 9
		13 14 15 16 17 18 18 19 20 21 22 23 24	16 17 18 19 20 22 23 24 25 26 28 29	16 18 20 22 23 25 27 29	17 19 22 24 26 29	12 15 18
		25 26 27 28 29 30 31 31 32 33 34 35 36	30 31 32 34 35 36 37 38 40 41 42 43	31 32 34 36 38 40 41 43	31 34 36 38 41 43	21 24 27
		1 2 3 4 5 6 6 7 8 9 10 11 12	1 2 4 5 6 7 8 10 11 12 13 14	2 4 5 7 9 11 13 14	2 5 7 10 12 14	3 6 9

DBH	SPEC.	NUMBER OF 8 FOOT BOLTS (4" OR LARGER) PER TREE 1	2	3	4	5	6	7	8
6		1 2 3 4 5 6 6 7 8 9	1 3 4 6 7 9 10 12 13 15 16	2 4 6 9 11 13 15 17 19 22	3 6 9 12 14 17 20 23 26 29 32	4 8 12			
		10 11 12 13 14 15 16	18 19 21 22 24 25 27 28	24 26 28 30 32 35 37 39 41	35 37 40 43 46 49 52 55 58	15 19 23			
		17 18 18 19 20 21	30 31 33 34 36 37 39 40	43 45 48 50 52 54 56 58 60	60 63 66 69 72 75 78 80 83	27 31 35 39			
		22 23 24 25 26 27	42 43 45 46 48 49 51 52	63 65 67 69 71 73 76 78 80	85 88 90 93 96 98 101 104	42 46 50 54			
		1 2 3 4 5 6 6 7 8 9	1 3 4 6 7 9 10 12 13 15	2 4 6 9 11 13 15 17 19 22	3 6 9 12 14 17 20 23 26 29	4 8 12 15 19			
		10 11 12 13 14 15	16 18 19 21 22 24 25 27	24 26 28 30 32 35 37 39 41	32 35 37 40 43 46 49 52 55	23 27 31 35			
		16 17 18 18 19	28 30 31 33 34 36 37 39	43 45 48 50 52 54 56 58 60	58 60 63 66 69 72 75 78 80	39 42 46 50 54			
		1 2 3 4 5 6 6 7	1 3 4 6 7 9 10 12 13 15	2 4 6 9 11 13 15 17 19	3 6 9 12 14 17 20 23 26 29	4 8 12 15 19 23			
		8 9 10 11 12 13	16 18 19 21 22 24 25 27	22 24 26 28 30 32 35 37	32 35 37 40 43 46 49 52 55	27 31 35 39 42 46			
		1 2 3 4 5 6 6	1 3 4 6 7 9 10 12 13 15	2 4 6 9 11 13 15 17 19	3 6 9 12 14 17 20 23 26 29	4 8 12 15 19 23 27			
		7 8 9 10 11 12 13	16 18 19 21 22 24 25 27	22 24 26 28 30 32 35 37	32 35 37 40 43 46 49 52	31 35 39 42 46 50			
8		2 3 5 6 8 10 11	2 5 7 10 12 15 17 20 22	3 7 10 14 17 21 24 28	5 9 14 18 23 28 32 37 41 46	6 12 17 23 29	6	7	
		13 14 16 18 19	25 27 30 32 35 37 40	31 35 38 42 45 49 52	51 55 60 65 69 74 78 83 88	35 41 46 52	7 14 21	8 16	
		21 22 24 26 27	42 45 47 50 52 55 57	56 60 63 66 70 73 77	92 97 101 106 111 115 120 125	58 64 70 76	28 34	24 33	
		29 30 32 34 35	60 62 64 67 69 72 74	80 84 87 91 94 98 101	129 134 138 143 147 152 157	81 87 93 99	41 48	41 49	
		2 3 5 6 8 10	2 5 7 10 12 15 17 20	3 7 10 14 17 21 24 28	5 9 14 18 23 28 32 37 41	6 12 17 23 29	7 14 21	8 16	
		11 13 14 16 18	22 25 27 30 32 35 37	31 35 38 42 45 49	46 51 55 60 65 69 74 78	35 41 46 52 58	28 34	24 33	
		19 21 22 24	40 42 45 47 50 52 55	52 56 60 63 66	83 88 92 97 101 106 111 115	64 70 76 81 87	41 48	41 49	
		2 3 5 6 8	2 5 7 10 12 15 17 20	3 7 10 14 17 21 24	5 9 14 18 23 28 32 37 41	6 12 17 23 29	7 14 21	8 16 24	
		10 11 13 14	22 25 27 30 32 35 37	28 31 35 38 42 45	46 51 55 60 65 69 74 78	35 41 46 52 58	28 34 41	33 41 49	
		2 3 5 6 8	2 5 7 10 12 15 17 20	3 7 10 14 17 21 24	5 9 14 18 23 28 32 37	6 12 17 23 29	7 14 21	8 16 24	
		10 11 13 14	22 25 27 30 32 35	28 31 35 38 42 45	41 46 51 55 60 65 69 74	35 41 46 52 58	28 34 41	33 41 49	
10		2 5 7 10	4 7 11 15 18 22 26	5 10 15 20 25 30	7 13 20 26 33 40 46 53	8 17 25 33 42	10 20 30	12 24 36	
		12 15 17 20	29 33 37 40 44 48	35 41 46 51 56 61	59 66 73 79 86 92 99 106	50 58 67 75 83	40 50 60	48 60 72	
		22 25 27	51 55 59 62 66 70	66 71 76 81 86 91	112 119 126 132 139 145	92 100 108 117	70 80 90	84 96 108	
		2 5 7 10	4 7 11 15 18 22 26	5 10 15 20 25 30	7 13 20 26 33 40 46	8 17 25 33 42	10 20 30 40	12 24 36	
		12 15 17	29 33 37 40 44	35 41 46 51 56 61	53 59 66 73 79 86 92	50 58 67 75 83	50 60 70 80	48 60 72	
		2 5 7 10	4 7 11 15 18 22	5 10 15 20 25 30	7 13 20 26 33 40 46	8 17 25 33 42	10 20 30 40	12 24 36 48	
		2 5 7	4 7 11 15 18 22	5 10 15 20 25 30	7 13 20 26 33 40 46	8 17 25 33 42	10 20 30 40	12 24 36	8
12		4 7 11	5 10 15 20 25 30	7 14 21 28 34 41	9 18 27 36 45 54 63	11 23 34 45 56 68	14 27 41 54	16 32 49	18
		14 18 21	35 40 45 50 55	48 55 62 69 76	72 81 90 99 108 117	79 90 101 113 124	68 81 95 108	65 81 97	36
		4 7 11	5 10 15 20 25	7 14 21 28 34 41	9 18 27 36 45 54	11 23 34 45 56 68	14 27 41 54 68	16 32 49	18 36
		4 7 11	5 10 15 20 25	7 14 21 28 34 41	9 18 27 36 45 54	11 23 34 45 56 68	14 27 41 54 68	16 32 49	18 36
		4 7 11	5 10 15 20 25	7 14 21 28 34 41	9 18 27 36 45 54	11 23 34 45 56 68	14 27 41 54 68	16 32 49	18 36
14		5 10	7 13 20 27	9 18 27 36 45	12 23 35 47 58 70	15 29 44 58 73 87	18 35 53 70 88	21 42 63	24 47
		15 20	34 40 47	54 63 72 81 90	81 93 105 116 128	102 117 131 146 160	105 123 140 158	84 105 126	71 95
		5 10	7 13 20 27	9 18 27 36 45	12 23 35 47 58	15 29 44 58 73 87	18 35 53 70 88	21 42 63	24 47
		5 10	7 13 20 27	9 18 27 36 45	12 23 35 47 58	15 29 44 58 73 87	18 35 53 70 88	21 42 63	24 47
16				11 22 33 44 55	14 29 44 58 72	18 36 54 72 90 108	22 44 66 87 109	26 52 78 104	29 59
				11 22 33 44 55	14 29 44 58 72	18 36 54 72 90 108	22 44 66 87 109	26 52 78 104	29 59
				11 22 33 44 55	14 29 44 58 72	18 36 54 72 90 108	22 44 66 87 109	26 52 78 104	29 59
18				14 27 40 54 68	18 35 52 70 88	22 44 66 88 110 132	27 53 80 106 133	32 63 95 127	36 72
				14 27 40 54 68	18 35 52 70 88	22 44 66 88 110 132	27 53 80 106 133	32 63 95 127	36 72
20				16 32 48 64	21 42 62 83 104	26 52 78 104 130 156	32 63 95 126 158	38 76 113 151	43 85
				16 32 48 64	21 42 62 83 104	26 52 78 104 130 156	32 63 95 126 158	38 76 113 151	43 85
22					24 49 74 98	31 61 92 122 153 184	37 74 111 148 185 222	44 88 132 177	50 100 150
					24 49 74 98	31 61 92 122 153 184	37 74 111 148 185 222	44 88 132 177	50 100 150
24						36 71 107 142 178 214 249	43 86 128 171 216 257	51 102 153 204	58 115 173
						36 71 107 142 178 214 249	43 86 128 171 216 257	51 102 153 204	58 115 173

SAPLING TALLY 1/50 ACRE PLOT - RADIUS 16.6 FT.					
SPEC.					
2" DBH					
4" DBH					

OTHER PIECE PRODUCTS	
SPECIES	TALLY

CODING DATA	
SPECIES	COL. NO.
Aspen	32-37
Black Spr.	38-43
Balsam	44-48
Jack Pine	49-53
Tamarack	54-58
White Spr.	59-62
Balm Gil.	63-67
White Pine	68-71
Norway Pine	72-75
Paper Birch	76-79

SPECIES	GR. VOL.	C.P.	NET VOLUME - CORDS	COL. NO.

IBM Card Code - Col. 80 — 1

IBM FOREST INVENTORY

VOLUME IN HUNDREDS OF BOARD FEET (SCRIBNER) PER ACRE

	NUMBER OF 16-FOOT LOGS (6" OR LARGER) PER TREE							DEFECT	
	1/2	1	1 1/2	2	2 1/2	3	3 1/2	SPEC.	%
10	1 1 2 3 3 4 5 6 6 7 8 8 9 10 11 11 12 13 13 14 15 15 16 17	2 3 4 6 7 9 10 12 13 15 16 18 19 21 22 24 25 27 28 30 31 33 34 36 37 39 40 42 43 45	2 4 6 8 10 12 14 16 31 33 35 37 39 41 43 45 47 49 51 53	2 5 7 10 12 15 17 20 22 25 27 29 32 34 37 39 42 44 47 49 52 54 56 59 61	3 6 9 11 14 17 20 23 26 28 31 34 37 40 46 48 51	3 6 9 12 16 19 22 25 28 31 34 37	3 7 10 13		
	1 1 2 3 3 4 5 6 6 7 8 8 9 10 11 11 12 13 13	2 3 4 6 7 9 10 12 13 15 16 18 19 21 22 24 25 27 28 30 31 33 34	2 4 6 8 10 12 14 16 18 20 21 23 25 27 29 31 33 35 37 39 41	2 5 7 10 12 15 17 20 22 25 27 29 32 34 37 39 42	3 6 9 11 14 17 20 23 26 28 31 34 37	3 6 9 12 16 19 22 25 28	3 7 10		
	1 1 2 3 3 4 5 6 6 7 8 8 9	2 3 4 6 7 9 10 12 13 15 16 18 19 21 22	2 4 6 8 10 12 14 16 18 20 21 23 25 27	2 5 7 10 12 15 17 20 22 25 27 29 32	3 6 9 11 14 17 20 23 26	3 6 9 12 16 19	3 7		
	1 1 2 3 3 4 5	2 3 4 6 7 9 10 12	2 4 6 8 10 12 14 16	2 5 7 10 12 15 17	3 6 9 11 14	3 6 9	3		
12	1 3 4 6 7 8 10 11 13 14 15 17 18 20 21 22 24 25	2 5 7 10 12 14 17 19 22 24 29 29 31 34 36 38 41 43 46 48 50 53 55 58 60 62 65 67 70	3 6 9 12 15 19 22 25 28 31 34 37 40 44 47 50 53 56 59 62 65 68 71 75 78 81 84 87 90	4 7 11 15 19 23 26 30 34 38 41 45 49 52 56 60 64 67 71 75 79 83 86 90 94	4 9 13 18 22 27 31 35 39 44 49 53 58 62 67 71 76	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80	5 11 16 22 27 32 38 43		
	1 3 4 6 7 8 10 11 13 14 15 17 18 20	2 5 7 10 12 14 17 19 22 24 29 29 31 34 36 38 41 43 46 48	3 6 9 12 15 19 22 25 28 31 34 37 40 44 47 50 53 56 59 62	4 7 11 15 19 23 26 30 34 38 41 45 49 52 56 60 64 67 71	4 9 13 18 22 27 31 35 39 44 49 53 58	5 10 15 20 25 30 35 40 45 50 55 60	5 11 16 22 27 32		
	1 3 4 6 7 8 10 11 13 14	2 5 7 10 12 14 17 19 22 24 29 29 31 34	3 6 9 12 15 19 22 25 28 31 34 37 40 44	4 7 11 15 19 23 26 30 34 38 41 45 49	4 9 13 18 22 27 31 35 39	5 10 15 20 25 30 35 40	5 11 16 22		
	1 3 4 6 7 8	2 5 7 10 12 14 17 19	3 6 9 12 15 19 22 25	4 7 11 15 19 23 26 30	4 9 13 18 22	5 10 15 20	5 11	4	
14	2 4 6 8 10 12 14 16 18 20 22 24 26 28	4 7 10 14 18 21 24 28 32 35 38 42 46 49 52 56 60 63 66	5 10 14 19 24 29 34 38 43 48 53 58 62 67 72 77 82 86 91	6 12 17 23 29 35 41 46 52 58 64 70 75 81 87 93 99	7 14 21 28 35 42 49 56 63 70 78 85	8 16 24 32 40 48 56 64 72 80 88 96	9 17 26 35 42 52	9 18 27 36 45 53	
	2 4 6 8 10 12 14 16 18 20	4 7 10 14 18 21 24 28 32 35 38 42 46	5 10 14 19 24 29 34 38 43 48 53 58 62	6 12 17 23 29 35 41 46 52 58 64 70	7 14 21 28 35 42 49 56	8 16 24 32 40 48 56 64	9 17 26 35	9 18 27 36	
	2 4 6 8 10 12 14 16 18	4 7 10 14 18 21 24 28 32 35 38 42 46	5 10 14 19 24 29 34 38 43 48 53 58 62	6 12 17 23 29 35 41 46 52 58 64 70	7 14 21 28 35 42 49 56	8 16 24 32 40 48 56 64	9 17 26 35	9 18 27 36	
	2 4 6 8 10	4 7 10 14 18 21 24	5 10 14 19 24 29 34	6 12 17 23 29 35	7 14 21 28	8 16 24 32	9 17	9 18	4 1/2 5
16	3 5 8 11 14 16 19 22 24	5 9 14 19 23 28 33 37 42 46 51 56	6 13 19 26 32 39 45 52 58 64 71 77	8 15 24 32 40 47 55 63 71 79 87 95	10 19 29 38 48 57 67 76	11 22 34 45 56 67 78 90	13 25 38 50	14 28 42 56	
	3 5 8 11 14 16 19 22 24	5 9 14 19 23 28 33 37 42 46 51 56	6 13 19 26 32 39 45 52 58 64 71 77	8 15 24 32 40 47 55 63 71 79 87 95	10 19 29 38 48 57 67 76	11 22 34 45 56 67 78 90	13 25 38 50	14 28 42 56	
	3 5 8 11 14	5 9 14 19 23 28	6 13 19 26 32 39	8 15 24 32 40 47	10 19 29 38	11 22 34 45	13 25	14 28	
	3 5 8 11 14	5 9 14 19 23 28	6 13 19 26 32 39	8 15 24 32 40 47	10 19 29 38	11 22 34 45	13 25	14 28	
18	4 7 11 14 18 22 25	6 12 18 24 30 37 43 49 55 61 69	8 17 25 34 42 50 59 67 76 84 92	10 21 31 41 52 62 72 83 93 104 114	12 25 37 50 62 74 87 99	15 29 44 58 73 88 102	16 32 48 65	18 36 53 71	
	4 7 11 14	6 12 18 24 30 37	8 17 25 34 42 50	10 21 31 41 52 62	12 25 37 50	15 29 44 58	16 32	18 36	
	4 7 11 14	6 12 18 24 30 37	8 17 25 34 42 50	10 21 31 41 52 62	12 25 37 50	15 29 44 58	16 32	18 36	
	4 7 11 14	6 12 18 24 30 37	8 17 25 34 42 50	10 21 31 41 52 62	12 25 37 50	15 29 44 58	16 32	18 36	
20	4 9 14 18 22 27 32	8 16 23 31 39 47 55 62 70 78 86	11 21 32 42 53 64 74 85 95 106 117	13 26 39 52 66 79 92 105 118 131 144	16 32 48 63 79 95 111 127 143	18 37 55 73 92 110 128	20 41 61 81	23 45 68 90	25 50 75 100 27
	4 9 14 18	8 16 23 31 39 47	11 21 32 42 53 64	13 26 39 52 66 79	16 32 48 63 79	18 37 55 73	20 41	23 45	25 50 27
	4 9 14 18	8 16 23 31 39 47	11 21 32 42 53 64	13 26 39 52 66 79	16 32 42 63 79	18 37 55 73	20 41	23 45	25 50 27
	4 9 14 18	8 16 23 31 39	11 21 32 42 53 64	13 26 39 52 66 79	16 32 42 63 79	18 37 55 73	20 41	23 45	25 50 27
22	6 11 17 22	10 19 29 39 48	13 26 39 52 66	16 33 49 66 82 98	20 39 59 78	23 45 68 90	25 50	28 56	31 62 33
	6 11 17 22	10 19 29 39 48	13 26 39 52 66	16 33 49 66 82 98	20 39 59 78	23 45 68 90	25 50	28 56	31 62 33
	6 11 17 22	10 19 29 39 48	13 26 39 52 66	16 33 49 66 82 98	20 39 59 78	23 45 68 90	25 50	28 56	31 62 33
24	7 14 21	12 24 35 47 59	16 32 48 64 80	20 40 60 80 100	24 47 71 94	27 55 82 110	31 61	34 69	38 75 41
	7 14 21	12 24 35 47 59	16 32 48 64 80	20 40 60 80 100	24 47 71 94	27 55 82 110	31 61	34 69	38 75 41
	7 14 21	12 24 35 47 59	16 32 48 64 80	20 40 60 80 100	24 47 71 94	24 55 82 110	31 61	34 69	38 75 41
26	8 16 25	14 28 42 56 70	19 38 57 76 95	24 48 72 96 120 143	28 57 85 113	33 65 98 131	36 73	41 82	45 90 49
	8 16 25	14 28 42 56 70	19 38 57 76 95	24 48 72 96 120 143	28 57 85 113	33 65 98 131	36 73	41 82	45 90 49
28	10 20 29	17 33 50 66	22 45 67 90 112	28 55 84 112 140 168	33 66 100 133	38 76 115 153	43 86	48 96	53 57
	10 20 29	17 33 50 66	22 45 67 90 112	28 55 84 112 140 168	33 66 100 133	38 76 115 153	43 86	48 96	53 57
30	11 23 34	19 38 57 77	26 52 78 104	32 65 97 130 162	39 77 116 154	44 89 133 177	50 100	56 111	61 67
	11 23 34	19 38 57 77	26 52 78 104	32 65 97 130 162	39 77 116 154	44 89 133 177	50 100	56 111	61 67
32	13 26 39	22 44 66 88	30 60 90 120	37 75 112 149 186	44 89 133 178	51 102 153 204	57 114	64 128	71 78
	13 26 39	22 44 66 88	30 60 90 120	37 75 112 149 186	44 89 133 178	51 102 153 204	57 114	64 128	71 78
34	15 29	25 50 75 100	34 68 102 136	42 85 127 169 212 254	50 101 151 202	58 116 174 232	65 129	73 146	81 89
36	16 33	28 56 85 113	38 77 115 153	48 96 143 191 239	57 114 170 227	65 131 196 261	73 146	82 164	92 101
38	18 36	32 63 95 127	43 86 128 171	53 107 160 214 267	63 127 190 254	73 146 219 293	82 164	92 184	103 115
40	20 40	35 70 105	48 95 143 190	59 118 177 237 296	70 141 211 281	82 163 245 326	91 182	103 205	116 129
42	22 44	39 78 117 155	53 106 158 211	65 130 196 261 326	78 155 232 310	90 180 270 360	101 202	113 225	129 145

MANAGEMENT PLANS:
(CUTTING, FOREST DEV., ETC.)

ESTIMATOR:

DATE:

CODING DATA

CONIFERS	COL. NO.	HARDWOODS
W. PINE	32-37	ASPEN
N. PINE	38-43	PAPER BI.
J. PINE	44-48	ASH
TAMARACK	49-53	ELM
W.SPR.	54-58	BASSW'D
BALS FIR	59-62	YELL. BI.
	63-67	BALM GIL.
	68-71	MAPLE
	72-75	WH. OAK
	76-79	RED OAK

CONIFER SUMMARY

SPEC.	GROSS VOL.	C.P.	NET VOLUME - CBF	COL. NO.
				Col. 80
				2
CEDAR POSTS				63-67
CEDAR POLES				68-71
CEDAR TIES				72-75
CEDAR-CUTTING PRIORITY				76

CEDAR TALLY

DBH	6	8	10	12	14	16			
POSTS									
POLES 16'									
POLES 20'									
POLES [illegible]									
POLES 35'									
TIES									

HARDWOOD SUMMARY

SPEC.	GROSS VOL.	C.P.	NET VOLUME - CBF	COL. NO.
				Col. 80
				3

TABLE 2

COMPOSITE CORDWOOD VOLUME TABLE
4 INCH-TOP DIAMETER

NUMBER OF 8 FOOT STICKS PER TREE

D.B.H. Inches	8 Foot Sticks Per Cord	1		2		3		4		5		6		7		8	
		Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord	Vol. Per Tree	Trees Per Cord
4	150	.004	250	.008	125												
5	110	.010	100	.018	56	.027	37										
6	85	.018	56	.030	33	.043	23	.058	17								
7	65	.025	40	.039	26	.056	18	.074	14	.093	11						
8	50	.032	31	.050	20	.070	14	.092	11	.116	9	.138	7				
9	40	.040	25	.061	16	.085	12	.112	9	.140	7	.168	6				
10	35	.049	20	.074	14	.101	10	.132	8	.167	6	.200	5	.239	4	.270	4
11	30	.059	17	.087	12	.119	8	.155	6	.195	5	.233	4	.280	4	.320	3
12	25	.070	14	.100	10	.138	7	.180	6	.225	4	.271	4	.324	3	.365	3

NOTE: Trees per cord rounded off to nearest whole tree.

SPECIES VARIATION:

1. Reduce volume from this table 15% to 20% for Black Spruce and Balsam. (Sticks per cord portion of this table is satisfactory for Black Spruce and Balsam without change.)
2. No correction is necessary for other species utilized to a 4" top, such as aspen and jack pine.

TABLE 3

Table No. 6 from Bulletin #1104 Composite Table: gross volume in rough cords to a variable top diameter inside bark, by number of bolts.

Diameter Breast High Inches	Volume when number of bolts is:							
	1	2	3	4	5	6	7	8
4	.007	.011						
5	.011	.019	.022					
6	.017	.028	.040	.047				
7	.023	.038	.053	.068	.076			
8	.031	.050	.068	.087	.106	.116		
9	.040	.065	.088	.109	.130	.153	.170	
10	.049	.082	.111	.133	.160	.188	.211	
11	.060	.100	.137	.165	.190	.221	.250	.270
12	.070	.121	.165	.198	.225	.260	.300	.330
13	.082	.143	.197	.236	.268	.305	.350	.42
14	.095	.167	.228	.273	.311	.353	.40	.47
15	.107	.193	.262	.318	.364	.41	.46	.52
16	.122	.220	.300	.367	.42	.47	.53	.59
18	.155	.282	.382	.47	.55	.60	.65	.73
20	.194	.353	.48	.59	.68	.76	.81	.89
22	.240	.44	.60	.73	.84	.93	1.00	1.07
24	.288	.52	.72	.88	1.00	1.12	1.21	1.28

Figures above the line in the upper part of the table are to a minimum top diameter (inside bark) of 3.0 or more, but less than 4.0 inches. (Spruce & Bals.) Other top diameters are variable but not less than 4.0 inches.

TABLE 4

GEVORKLANTZ & OLSEN - BULLETIN 1104 COMPOSITE VOLUME TABLES FOR TIMBER AND THEIR APPLICATION IN THE LAKE STATES

TABLE NO. 1 COMPOSITE TABLE: Gross Volume in Bd. Ft. (Scribner Rule) by number of 16' logs

Volume when number of 16' logs is

D.B.H. Inches	½	1	1½	2	2½	3	3½	4	5
8	10	16	24	31					
9	13	23	31	39	46				
10	17	30	40	49	57	62			
11	22	38	51	62	71	78			
12	28	48	66	78	89	100	108		
13	34	59	81	96	112	126	138	145	
14	40	70	96	116	141	160	170	178	
15	47	81	113	137	166	188	204	220	
16	54	93	129	158	191	224	248	263	
17	63	106	148	182	218	257	285	308	340
18	72	122	168	207	248	292	325	355	395
19	81	137	190	234	280	328	368	405	455
20	90	156	212	262	317	366	415	450	520
22	111	194	262	328	392	450	510	560	660
24	137	236	319	400	470	550	620	690	800
26	165	281	381	480	565	650	740	820	950
28	195	331	450	560	670	760	860	960	1120
30	227	383	520	650	770	890	1000	1110	1290
32	260	440	600	740	890	1020	1150	1280	1470
34	294	500	680	840	1010	1160	1300	1460	1670
36	330	565	770	960,	1140	1310	1480	1650	1900

Above a 1' stump to a point on the stem where merchantability is limited by branches, defect or deformity. Top diameters are variable, minimum being 8.0 inches inside bark for hardwoods other than aspen and 6.0 inches inside bark for conifers and aspen. Figures above the line, the upper portion of the table, show volume to a top diameter of 6.0 inches or more, but less than 8.0 inches, and hence are applicable only to softwoods.

AVERAGE LOGS PER M FT.

D.B.H. inches	Logs per M.Ft.	D.B.H. inches	Logs per M. Ft.
8	50	20	8
10	35	22	7
12	25	24	6
14	17	26	5
16	13	28	4
18	10	30	3

ANGLE GAUGE
IBM FOREST INVENTORY
MERCHANTABLE TYPE DATA SHEET

STATE OF MINNESOTA
DEPARTMENT OF CONSERVATION
DIVISION OF FORESTRY

	COL. NO.		COL. NO.		COL. NO.
1. [DESC]RIPTION ______	1-7	6. ACREAGE ______	16-18	11. SITE ( ) ___	27
2. AREA ______	8-9	7. COMP. NO. ______	19	12. FOREST DEV. ( ) ___	28
3. DISTRICT ______	10	8. LAND USE ( ) ______	20	13. STAND VIGOR ( ) ___	29
4. TYPE NO. ______	11	9. UNDERS'Y ( ) ______	21-24	14. OPERABILITY ( ) ___	30
5. COND. CLASS ( ) ______	12-15	10. STAND AGE ______	25-26	15. REC. DEV. ( ) ___	31

CUMULATIVE 104.18 MINUTE ANGLE GAUGE TALLY SHEET

SPEC.	NO. CULL TREES	VOL. IN CDS. - MERCHT. STEMS UNDER 5" D.B.H. TO 3" TOP: 1-8' STICK	2-8' STICKS	3-8' STICKS	TOTAL ÷ NO. OF SAMPLES - DEFECT DEDUCTION = NET CDS./ACRE	0-5 NON-MERCHT. SPEC.	NO. OF TREES	NO. OF PLOTS
		1 2 2 3 4 5 6 6 7 8 9 10 10 11 12 13 14 14 15 16	1 2 4 5 6 8 9 10 11 13 14 15 16 18 19 20 21 23 24 25	2 3 5 6 8 10 11 13 15 16 18 19 21 22				
		1 2 2 3 4 5 6 6 7 8 9 10 10 11 12 13 14 14 15 16	1 2 4 5 6 8 9 10 11 13 14 15 16 18 19 20 21 23 24 25	2 3 5 6 8 10 11 13 15 16 18 19 21 22				
		1 2 2 3 4 5 6 6 7 8	1 2 4 5 6 8 9 10 11 13	2 3 5 6 8 10 11				

VOL. IN CDS. - MERCHANTABLE STEMS OVER 5" D.B.H. TO 4" TOP — NO. OF 8' STICKS PER TREE

SPEC.	NO. CULL TREES	1	2	3	4	5	6	7	8	TOTAL ÷ NO. OF SAMPLES - DEFECT DEDUCTION = NET CDS./ACRE
		1 2 2 3 4 5 6 7 8 8 9 10 11 12 13 13 14 15 16 17	1 3 4 6 7 8 10 11 13 14 16 17 18 20 21 23 24 25 27 28 29 31 32 34 35 37 38 40 41 42	2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82	2 5 7 10 12 15 17 20 22 25 27 30 32 35 37 40 42 45 47 50 52 55 57 60 62 64 67 69 72 74 77 79 82 84 87 89 92 94 97 99	3 6 9 12 15 18 20 23 26 29 32 35 38 41 44 47 50 53 56 58 61 64 67 70 73 76 79 82 85 88	3 7 10 13 17 20 24 27 30 34 37 40 44 47 50 54 57 60 64 67	4 8 11 15 19 23 27 30 34 38 42 46 49 53 57	4 8 12 17 21 25 29 33 37 42	
		1 2 2 3 4 5 6 7 8 8 9 10 11 12 13 13 14 15 16 17	1 3 4 6 7 8 10 11 13 14 16 17 18 20 21 23 24 25 27 28 29 31 32 34 35 37 38 40 41 42	2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82	2 5 7 10 12 15 17 20 22 25 27 30 32 35 37 40 42 45 47 50 52 55 57 60 62 64 67 69 72 74 77 79 82 84 87 89 92 94 97 99	3 6 9 12 15 18 20 23 26 29 32 35 38 41 44 47 50 53 56 58 61 64 67 70 73 76 79 82 85 88	3 7 10 13 17 20 24 27 30 34 37 40 44 47 50 54 57 60 64 67	4 8 11 15 19 23 27 30 34 38 42 46 49 53 57	4 8 12 17 21 25 29 33 37 42	
		1 2 2 3 4 5 6 7	1 3 4 6 7 8 10 11 13 14 16 17	2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32	2 5 7 10 12 15 17 20 22 25 27 30 32 35 37 40	3 6 9 12 15 18 20 23 26 29 32 35	3 7 10 13 17 20 24 27	4 8 11 15 19 23	4 8 12 17	
		1 2 2 3 4 5 6 7	1 3 4 6 7 8 10 11 13 14 16 17	2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32	2 5 7 10 12 15 17 20 22 25 27 30 32 35 37 40	3 6 9 12 15 18 20 23 26 29 32 35	3 7 10 13 17 20 24 27	4 8 11 15 19 23	4 8 12 17	
		1 2 2 3 4 5 6 7	1 3 4 6 7 8 10 11 13 14 16 17	2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32	2 5 7 10 12 15 17 20 22 25 27 30 32 35 37 40	3 6 9 12 15 18 20 23 26 29 32 35	3 7 10 13 17 20 24 27	4 8 11 15 19 23	4 8 12 17	
		1 2 2 3 4 5 6 7	1 3 4 6 7 8 10 11 13 14 16 17	2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32	2 5 7 10 12 15 17 20 22 25 27 30 32 35 37 40	3 6 9 12 15 18 20 23 26 29 32 35	3 7 10 13 17 20 24 27	4 8 11 15 19 23	4 8 12 17	

VOL. IN HUNDREDS BD. FT. SCRIBNER TO 6" TOP (MOST CONIFERS & ASPEN) — NO. OF 16' LOGS PER TREE

SPEC.	NO. CULL TREES	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	5	TOTAL ÷ NO. OF SAMPLES - DEFECT DEDUCTION = NET BD. FT./ACRE
		3 6 9 12 14 17	5 10 16 21 26 31 36 42 47	7 14 22 29 36 43 50 58 65 72 79 86 94 101 108 115 122 129	9 18 27 36 45 54 63 72 81 90 99 108 117 121 135 144 153 162	11 22 33 44 55 66 77 88 99 110 121 132 143 154 165 176 187 197	13 26 39 52 65 78 91 104 117 130 143 156	15 30 45 60 75 90 105 120 135	16 33 50 66 82 99 116 132 149		
		3 6 9 12 14 17	5 10 16 21 26 31 36 42 47	7 14 22 29 36 43 50 58 65 72 79 86 94 101 108 115 122 129	9 18 27 36 45 54 63 72 81 90 99 108 117 121 135 144 153 162	11 22 33 44 55 66 77 88 99 110 121 132 143 154 165 176 187 197	13 26 39 52 65 78 91 104 117 130 143 156	15 30 45 60 75 90 105 120 135	16 33 50 66 82 99 116 132 149		
		3 6 9 12 14 17	5 10 16 21 26 31 36 42 47	7 14 22 29 36 43 50 58 65 72 79 86 94 101 108 115 122 129	9 18 27 36 45 54 63 72 81 90 99 108 117 121 135 144 153 162	11 22 33 44 55 66 77 88 99 110 121 132 143 154 165 176 187 197	13 26 39 52 65 78 91 104 117 130 143 156	15 30 45 60 75 90 105 120 135	16 33 50 66 82 99 116 132 149		
		3 6 9 12	5 10 16 21 26 31	7 14 22 29 36 43 50 58 65 72 79 86	9 18 27 36 45 54 63 72 81 90 99 108	11 22 33 44 55 66 77 88 99 110 121 132	13 26 39 52 65 78 91 104	15 30 45 60 75 90	16 33 50 66 82 99		
		3 6 9 12	5 10 16 21 26 31	7 14 22 29 36 43 50 58 65 72 79 86	9 18 27 36 45 54 63 72 81 90 99 108	11 22 33 44 55 66 77 88 99 110 121 132	13 26 39 52 65 78 91 104	15 30 45 60 75 90	16 33 50 66 82 99		

VOL. IN HUNDREDS BD. FT. SCRIBNER TO 8" TOP (HARDWOODS & OLD GROWTH PINE)

SPEC.	NO. CULL TREES	1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	5	
		3 6 9 12 15 19	6 12 18 24 30 36 42 48 54	8 17 26 34 42 51 60 68 76 85 94 102 110 118 127	11 22 33 44 55 66 77 88 99 110 121 132 143 154 165	14 27 40 54 68 81 94 108 122 135 148 162 175 189 202 215 229 242	16 32 48 64 80 96 112 128 144 160 176 192	18 37 56 74 92 111 130 148 166 185	21 42 63 84 105 126 147 159 180	26 51 76 102 128 153	
		3 6 9 12 15 19	6 12 18 24 30 36 42 48 54	8 17 26 34 42 51 60 68 76 85 94 102 110 118 127	11 22 33 44 55 66 77 88 99 110 121 132 143 154 165	14 27 40 54 68 81 94 108 122 135 148 162 175 189 202 215 229 242	16 32 48 64 80 96 112 128 144 160 176 192	18 37 56 74 92 111 130 148 166 185	21 42 63 84 105 126 147 159 180	26 51 76 102 128 153	
		3 6 9 12 15 19	6 12 18 24 30 36 42 48 54	8 17 26 34 42 51 60 68 76 85 94 102 110 118 127	11 22 33 44 55 66 77 88 99 110 121 132 143 154 165	14 27 40 54 68 81 94 108 122 135 148 162 175 189 202 215 229 242	16 32 48 64 80 96 112 128 144 160 176 192	18 37 56 74 92 111 130 148 166 185	21 42 63 84 105 126 147 159 180	26 51 76 102 128 153	
		3 6 9 12	6 12 18 24 30 36	8 17 26 34 42 51 60 68 76 85	11 22 33 44 55 66 77 88 99 110	14 27 40 54 68 81 94 108 122 135 148 162	16 32 48 64 80 96 112 128	18 37 56 74 92 111 130	21 42 63 84 105 126	26 51 76 102	
		3 6 9 12	6 12 18 24 30 36	8 17 26 34 42 51 60 68 76 85	11 22 33 44 55 66 77 88 99 110	14 27 40 54 68 81 94 108 122 135 148 162	16 32 48 64 80 96 112 128	18 37 56 74 92 111 130	21 42 63 84 105 126	26 51 76 102	
		3 6 9 12	6 12 18 24 30 36	8 17 26 34 42 51 60 68 76 85	11 22 33 44 55 66 77 88 99 110	14 27 40 54 68 81 94 108 122 135 148 162	16 32 48 64 80 96 112 128	18 37 56 74 92 111 130	21 42 63 84 105 126	26 51 76 102	

MANAGEMENT PLANS:

ESTIMATOR:
DATE:

CORDWOOD SUMMARY — IBM CARD CODE - COL. 80 1

SPECIES	VOL./A.	C.P.	NET VOL./TYPE-CORDS	COL. NO.
ASPEN				32-37
B. SPR.				38-43
BALSAM				44-48
J. PINE				49-53
TAM.				54-58
W. SPR.				59-62
BALM'GIL.				63-67
N.&W.PINE				68-71
CEDAR				72-75
P. BIR.				76-79

CEDAR TALLY

D.B.H.	7' POSTS	TIES	POLES 16'	20'	25'	30'	35'	40'
6								
8								
10								
12								
14								
16+								

Note: FIXED RADIUS PLOTS MAY BE USED TO ESTIMATE PIECE PRODUCTS
1/10 ACRE PLOT RADIUS 37.2'; 1/5 ACRE PLOT RADIUS 52.7'

OTHER PIECE PRODUCTS

SPEC.				

SAMPLE TREE DATA

TREE NO.	SPEC.	D.B.H.	TOTAL HEIGHT	MERCH. HEIGHT	AGE	CROWN CLASS

CONIFER SAWLOG & CEDAR SUMMARY

SPECIES	NET VOL./A.	C.P.	NET VOL./TYPE	C.B.F.	COL. NO.
W. PINE					32-37
N. PINE					38-43
J. PINE					44-48
TAM.					49-53
W. SPRUCE					54-58
BAL. FIR					59-62
CEDAR POSTS					63-67
CEDAR POLES					68-71
CEDAR TIES					72-75
CEDAR CUTTING PRIORITY					76
CED (BF)					77-79

COL. 80 2

HARDWOOD SAWLOG SUMMARY

SPECIES	NET VOL./A.	C.P.	NET VOL./TYPE	C.B.F.	COL. NO.
ASPEN					32-37
P. BIRCH					38-43
ASH					44-48
ELM					49-53
BASSW'D.					54-58
YEL. BIR.					59-62
BALM'GIL.					63-67
MAPLE					68-71
W. OAK					72-75
RED OAK					76-79

COL. 80 3

DEER BROWSE TALLY

TALLY ONE CYLINDRICAL PLOT ON 1/100 ACRE (11.8' RADIUS) 0 TO 7' HIGH AT CENTER OF EACH VOLUME SAMPLE

PLOT NO.	BROWSE SPECIES: ALDER	MT. ASH	ALL CHERRIES	RED OSIER DOGWOOD	OTHER DOGWOODS	ELDERBERRY	HAZEL	HONEYSUCKLE	JUNEBERRY	MT. MAPLE	SUMAC	WILLOW	BLACK ASH	ASPEN	BALSAM	BASSWOOD	BIRCH	W. CEDAR	RED MAPLE	HARD MAPLE	JACK PINE	WHITE PINE	BURR OAK	OTHER OAK

RECORD AVAILABLE BROWSE FOR EACH OF ABOVE SPECIES (DISREGARD OTHERS) AS (1) LIGHT, LESS THAN 10%; (2) MEDIUM, 10 TO 50%; OR (3) HEAVY, MORE THAN 50% OF CYLINDER VOLUME

REMARKS:

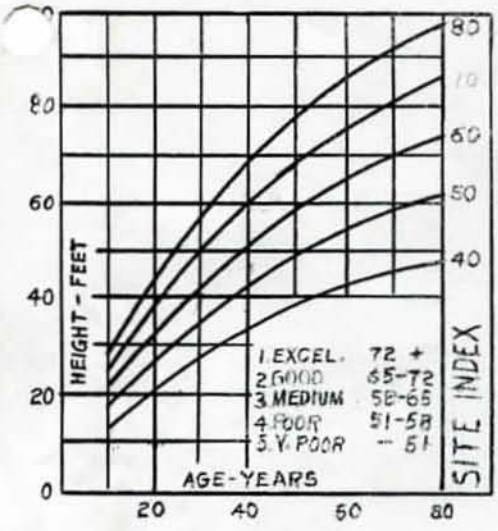
TABLE 6

ROTATION AGE BY SITE INDEX
From Lake States Species Bulletin and
Unpublished Work of Gevorkiantz

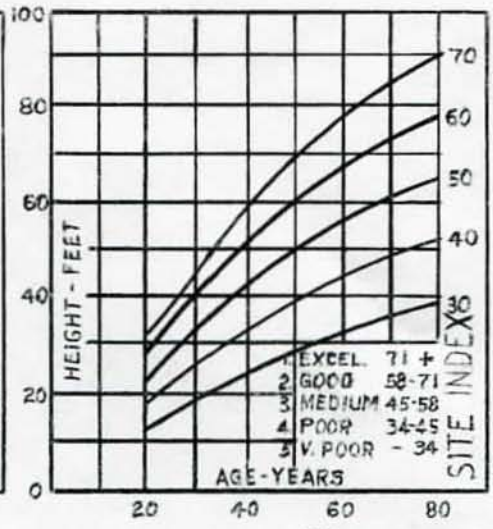
Cover Type	Site Index	Rotation Age
Aspen	50 (Poor)	40
	60 (Med.)	50
	70 (Good)	60
White Pine	50 (Poor)	100
	60 (Med.)	120
	70 (Good)	140
Norway Pine	40 (Poor)	100
	52 (Med.)	100
	60 (Good)	140
Jack Pine	40 (Poor)	50
	53 (Med.)	60
	66 (Good)	70
Black Spruce	26 (Poor)	140
	33 (Med.)	120
	39 (Good)	100
Tamarack	32 (Poor)	120
	42 (Med.)	100
	52 (Good)	90
Balsam Fir	35 (Poor)	40
	45 (Med.)	50
	55 (Good)	60
White Spruce	40 (Poor)	80
	50 (Med.)	100
	60 (Good)	120
White Cedar	20 (Poor)	120
	30 (Med.)	100
	40 (Good)	90
Paper Birch	43 (Poor)	60
	51 (Med.)	80
	60 (Good)	100
Northern Hdwd. (Use Red Oak Site Curve)	45 (Poor)	100
	55 (Med.)	120
	65 (Good)	140
Bottomland Hwd. (Use Red Oak Site Curve)	45 (Poor)	100
	55 (Med.)	110
	65 (Good)	120
Oak	42 (Poor)	95
	55 (Med.)	110
	65 (Good)	120

TABLE NO. 7
SITE INDEX CURVES
LAKE STATES FOREST EXP. STATION

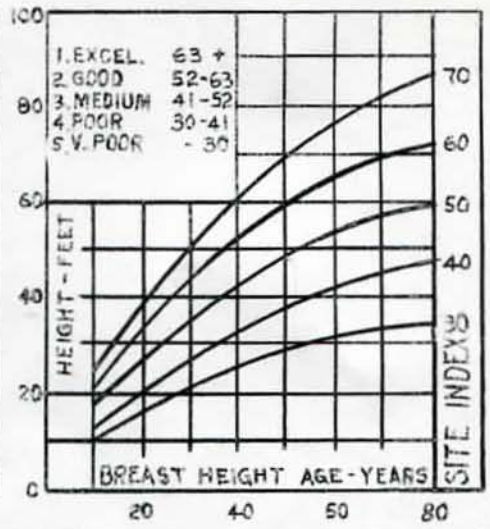
ASPEN TECH. NOTE 464



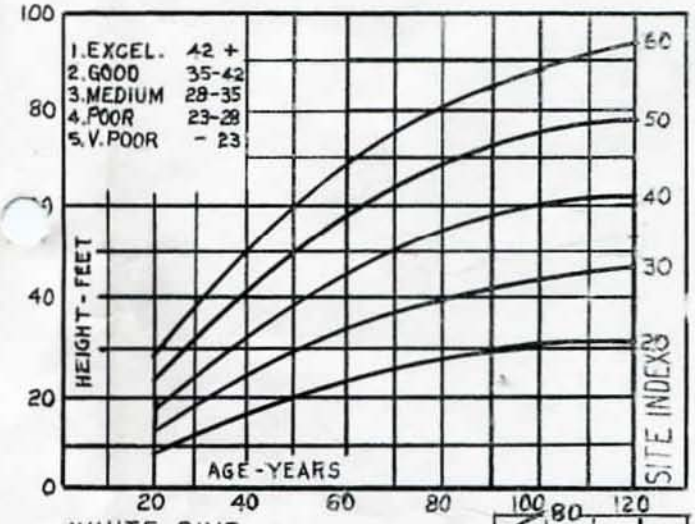
JACK PINE TECH. NOTE 463



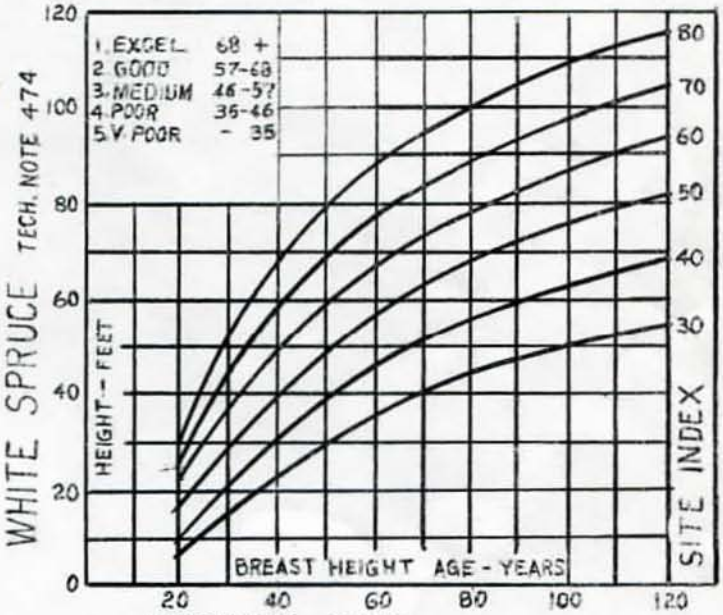
BALSAM FIR TECH. NOTE 465



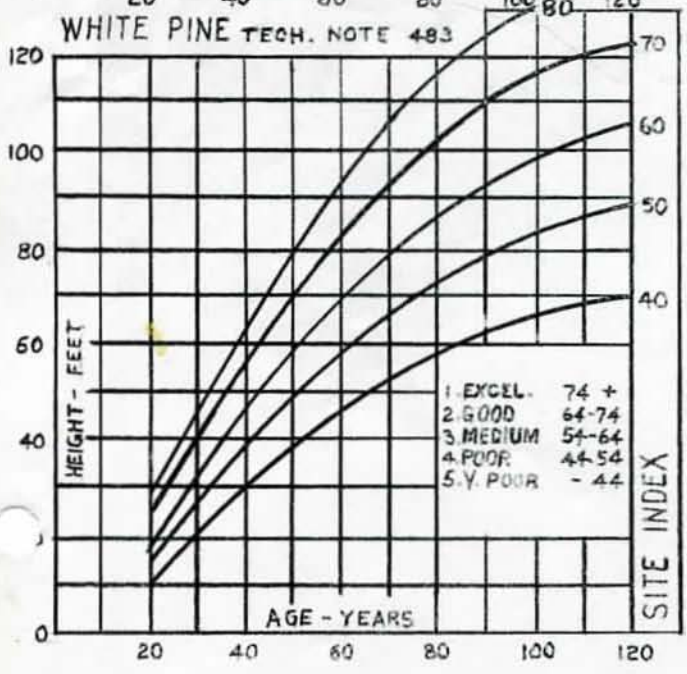
BLACK SPRUCE TECH. NOTE 473



WHITE SPRUCE TECH. NOTE 474



WHITE PINE TECH. NOTE 483



NORWAY PINE TECH. NOTE 484

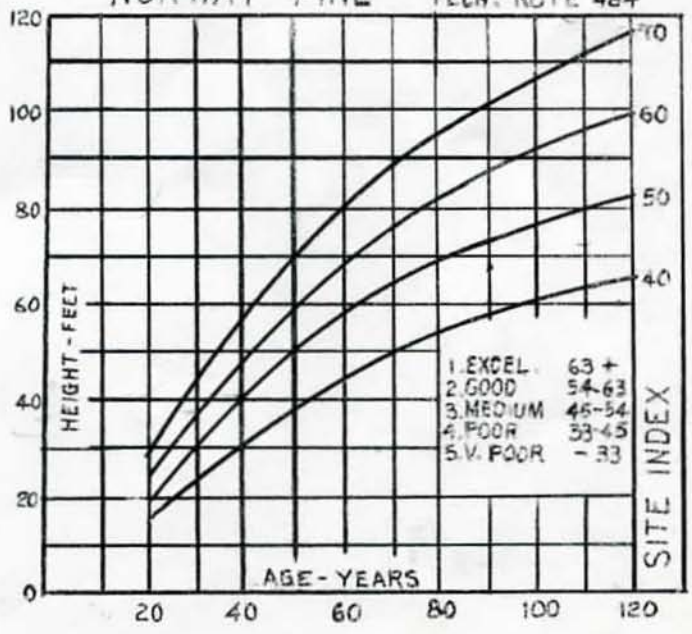
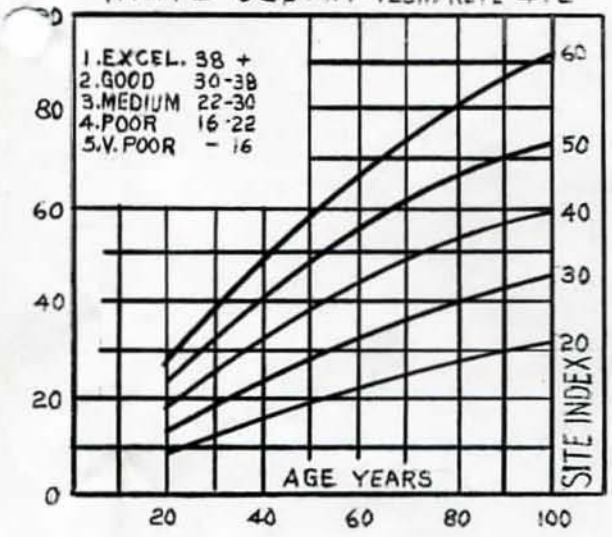
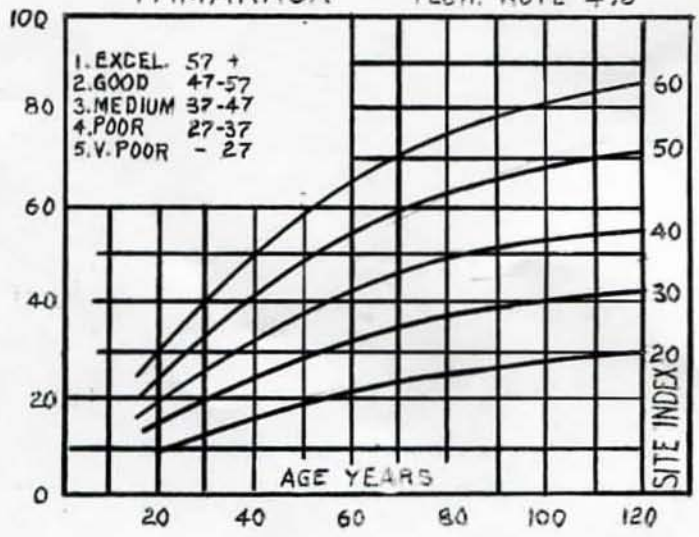


TABLE NO. 7 (Continued)

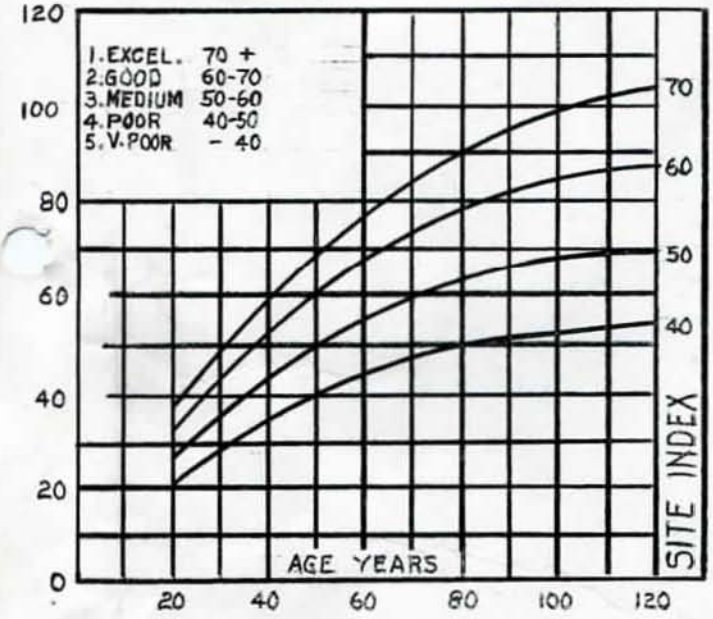
WHITE CEDAR TECH. NOTE 472



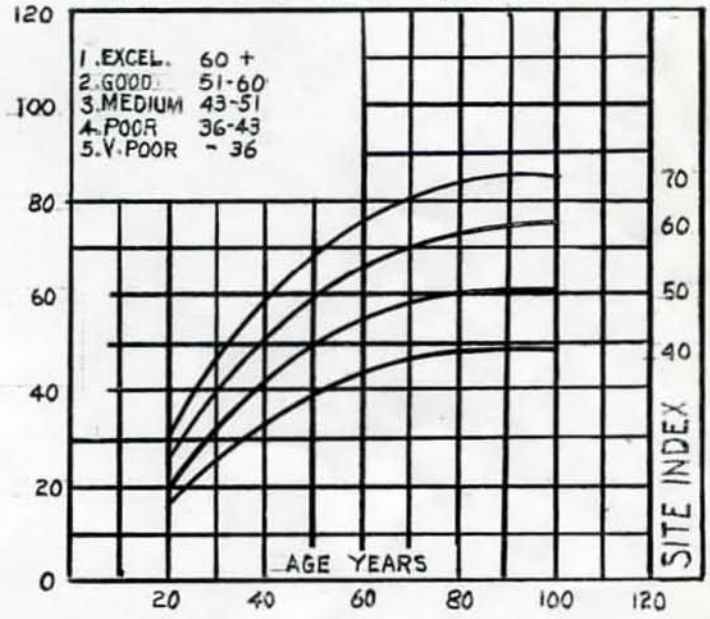
TAMARACK TECH. NOTE 498

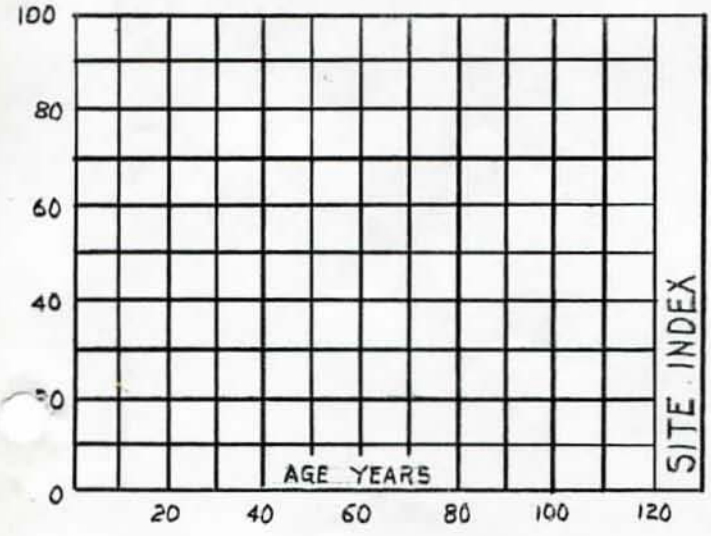


RED OAK TECH. NOTE 485



PAPER BIRCH ONTARIO LANDS & FOR. REP. 24





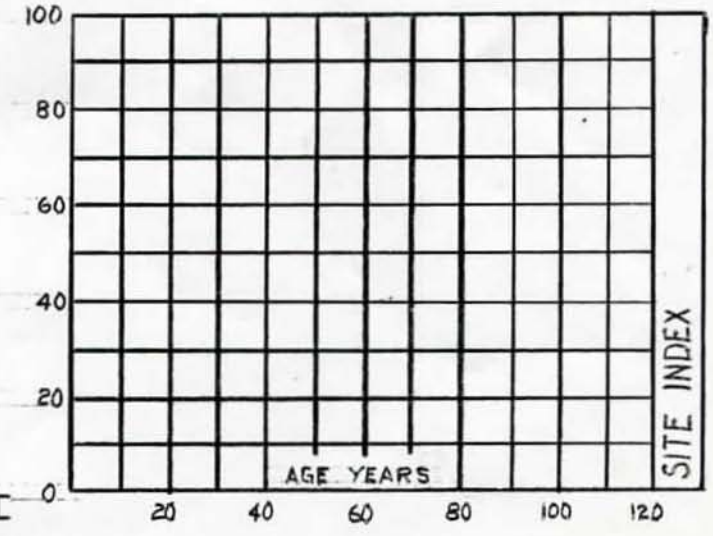


TABLE 8

TOP UTILIZATION STANDARDS

Top diameter utilization of trees will vary in accordance with markets available. However, the following top diameter utilization may be assumed for estimating and classification of timber types:

Species	Sawlogs or poles Top diameter	Pulpwood or posts Top Diameter
Aspen, Balm of Gilead, Jack Pine, White & Norway Pine	6 inches	4 inches
Black & White Spruce, Balsam	6 inches	3 inches
Cedar	5 inches	3 inches
Tamarack	8 inches	4 inches
Basswood	6 inches	-
Other Hardwoods	8 inches	-