

# **A STUDY OF THE MENSURATIONAL CHARACTERISTICS OF SOME IMPORTANT FOREST TYPES OF EASTERN NEWFOUNDLAND**

by  
G. Page and R.S. van Nostrand



**FOREST RESEARCH LABORATORY  
ST. JOHN'S, NEWFOUNDLAND  
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CANADIAN FORESTRY SERVICE  
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APRIL, 1970

A Study of the Mensurational Characteristics  
of Some Important Forest Types of Eastern  
Newfoundland

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## PREFACE

This report embodies the results of one of four allied projects designed to obtain mensurational information for the more important forest types within various Forest Sections of the island of Newfoundland. Similar reports have already been prepared for central Newfoundland (Bajzak, 1962), western Newfoundland (Bajzak, Bouzane, and Page, 1968), and northern Newfoundland (Page, Bouzane, Bajzak and van Nostrand, 1970).

The project was designed by R.S. van Nostrand and field work was carried out in 1962 by R.S. van Nostrand and J.P. Bouzane. Initial data analysis was carried out by R.S. van Nostrand, and has been completed, and the report written by G. Page in consultation with the co-author. The figures have been prepared by D. Durling.

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INTRODUCTION

Between 1960 and 1962 data were collected on the mensurational characteristics of the important forest types within each of the four main Forest Sections of the Island of Newfoundland (Rowe, 1959). The purpose of the work was to provide growth data for mature or semi-mature crops of the major merchantable forest types whose ecological characteristics had previously been described by Damman (1963, 1964, 1967).

Results obtained form a basis for more detailed investigations of growth trends in relation to crop and site conditions and provide useful information on various mensurational features such as rotation lengths and volume production for practical application by forest managers.

Reports have already been prepared giving the results of the studies in central Newfoundland - Forest Section B28a (Bajzak, 1962), western Newfoundland - Forest Section B28b (Bajzak, Bouzane, and Page, 1968), and northern Newfoundland - Forest Region B29 (Page, Bouzane, Bajzak and van Nostrand, 1970). This report presents results for Forest Section B30 in eastern Newfoundland.

In the report a brief description is given of vegetative characteristics, related soil conditions, and distribution of each forest type under consideration (after Damman, 1963, 1963), together with its major mensurational features. The latter include height/age and height/diameter curves, stem analyses, local form class merchantable volume and stock tables, basal area and stand tables, mean annual increment figures, and the stocking of regeneration. The forest types are subsequently compared on the basis of these characters, and the individual height/age curves related to site-index curves for balsam fir and black spruce compiled from data for all the forest types.

GENERAL DESCRIPTION OF EASTERN NEWFOUNDLAND

Forest Section B30 occupies the Avalon, Burin, and Bonavista peninsulas and parts of the adjacent southern and eastern coastlines of the island (Figure 1). Forest stands occur mostly in the central and northern parts of the Avalon Peninsula, in the central and western parts of the Bonavista Peninsula, and in the eastern coastal

strip. The southern Avalon Peninsula, the Burin Peninsula, and the south coast areas carry only scattered stands of scrub forest. In the south-central parts of the island Forest Section B30 grades into the barrens of Forest Section B31. In the east coast areas there is a gradual transition towards the more extensive and productive forests of Section B28a.

#### Soil and Climatic Conditions

Hadrynian rocks, consisting predominantly of slates, siltstones, conglomerates, and acid volcanics, underlie most of the sampled areas. The entire region was glaciated and is now covered by a layer of stony, often compacted, glacial till of varied thickness. Well-drained podzols and poorly-drained gleysols or gleyed podzols are the most common soils.

The climate of the area is strongly affected by maritime influences. Annual precipitation averages between 50 and 60 inches on the Avalon Peninsula and between 40 and 45 inches on the Bonavista Peninsula (Hare, 1952). Even in mid-winter as much as half of the precipitation falls as rain. Snowfall averages between 75 and 100 inches per annum on both peninsulas. Mean air temperatures in January are 24°F for St. John's and 22°F for Bonavista; in July, both places average 59°F. Summers are typically cool in common with all coastal areas of the island of Newfoundland. Winters are milder than in any other part of the island. The vegetative season (i.e. the date on which mean air temperature rises above 43°F) starts about May 15 and continues for approximately 160 days.

#### The Forests

Balsam fir (Abies balsamea (L.) Mill.) is the most abundant species on the Avalon Peninsula. Black spruce (Picea mariana (Mill.) BSP) is also a major component in many stands. On the Bonavista Peninsula (as in much of east-central Newfoundland), black spruce is the most common species, followed by balsam fir. Scattered white spruce (Picea glauca (Moench) Voss) and tamarack (Larix laricina (Du Roi) K. Koch) form minor components in many stands. White pine (Pinus strobus L.) occurs within Section B30 but is not common.

Hardwoods are less abundant and of lesser significance in Section B30 than in most other parts of the island. White birch (Betula papyrifera Marsh.) and trembling aspen (Populus tremuloides Michx.) are the most common species. Yellow birch (Betula alleghaniensis Britt.) and red maple (Acer rubrum L.) are also found on the Avalon Peninsula but not on the Bonavista Peninsula.

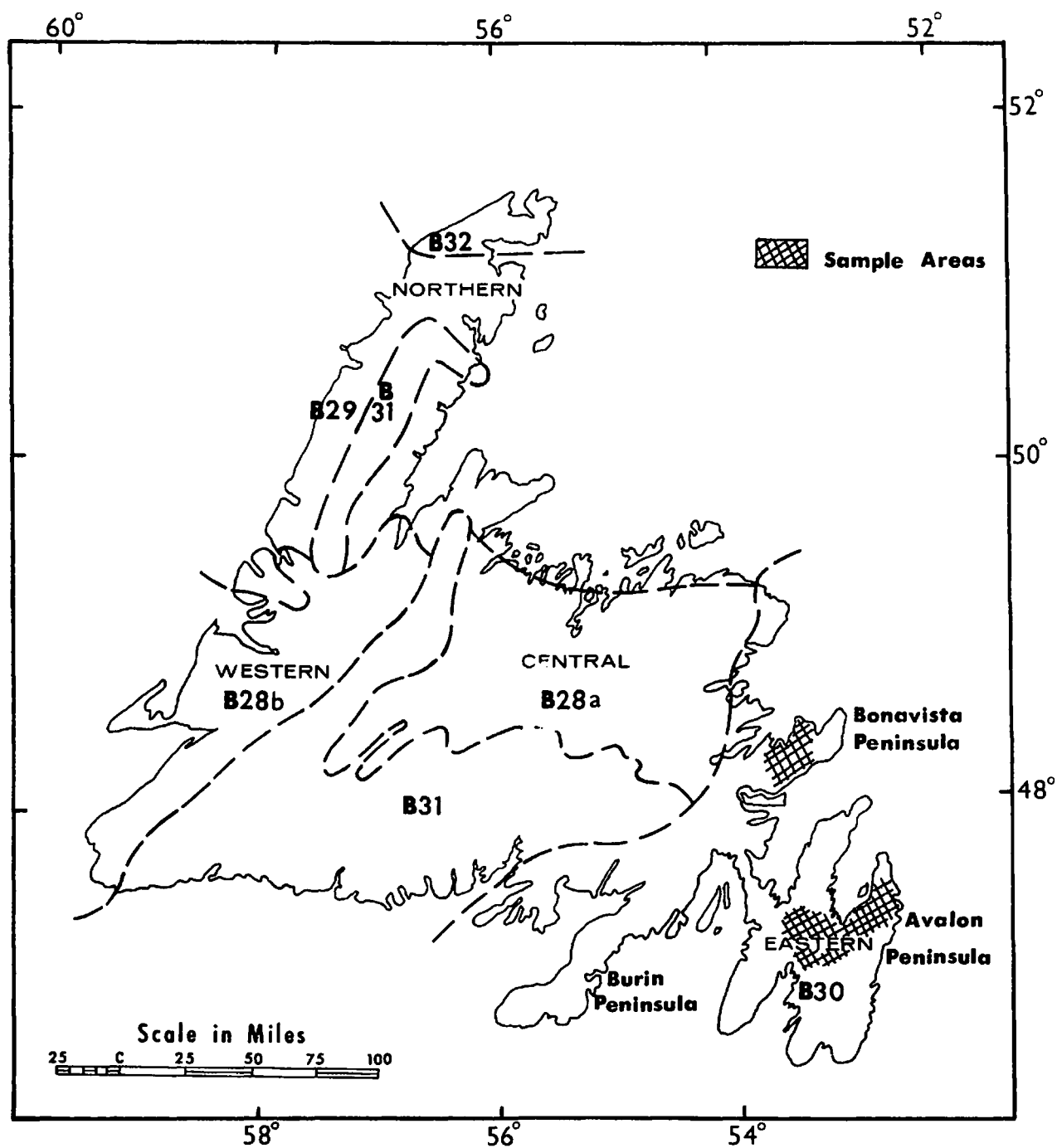


Fig. 1. MAP OF INSULAR NEWFOUNDLAND SHOWING FOREST REGIONS (After Rowe, 1959)

## METHODS

### Plot Location

Sampling was carried out in the central and north-eastern parts of the Avalon Peninsula and in the central part of the Bonavista Peninsula (see shaded areas, Figure 1).

Only the most important of the merchantable forest types were considered in this study. Stands which appeared to be at or approaching maturity, and which were not obviously over or understocked, were selected from aerial photographs. Suitable compass lines were determined by detailed examination of the photographs and subsequently located in the field. Forest type boundaries were mapped by walking the compass lines and recording appropriate positions where changes were observed.

Square 1/10 acre plots were laid out at random along those parts of each compass line which passed through suitable stands. In cases where a prospective plot centre was found to be less than one chain from a forest type boundary the plot was moved one chain ahead or to right or left, whichever position placed it furthest from the forest type boundary.

### Mensurational Techniques

#### (a) Plot Measurements

On each plot a complete tally was taken of living trees having a breast height diameter of more than 0.5 inches. Data were recorded by species and one-inch diameter classes. Standing dead trees were tallied separately.

Total height, breast height diameter, and crown class were recorded for two crop trees (more than 3.5 inches breast height diameter) of each of the softwood species that were present on each plot. Increment borings were taken at breast height on these same trees to permit the determination of age and radial increment during the previous ten years. No intermediate, suppressed, or obviously deformed trees were sampled.

#### (b) Stem Analyses

Stem analyses were carried out on dominant and/or co-dominant trees of a diameter close to the crop average for each of the three major softwood species (balsam fir, black spruce, and white spruce). Suitable trees were selected on the basis of a maximum of one per plot, and their breast height diameters were marked and measured before felling.

Each selected stem was cut at six inches above the root collar and the distance from breast height to the top of the tree was recorded. Discs were removed from the stem at one foot above the root collar, at breast height, at 4.5 feet above breast height, and at four foot intervals above this point to the top of the tree.

Average diameters inside and outside the bark were recorded and the total number of rings counted on each disc. Every tenth annual ring (counting inwards from the cambium) was marked on a radius of average length and the distance from the pith to each decade mark determined.

Form class data were collected from any suitable wind-thrown trees located on or near the sample plots. Species and total height were recorded, and each tree was marked at breast height and at half height above breast height to permit the diameters (inside and outside bark) to be measured at these points.

#### (c) Regeneration

Data on regeneration were obtained from every second sample plot. On appropriate plots a series of five contiguous milacre quadrats was marked out from the plot centre in the direction of the compass line. The tallest seedling of each species in each quadrat was recorded and classified in the following way:-

<u>Height Class</u>	<u>Height in Feet</u>
a	Less than 0.5
b	0.6 - 1.5
c	1.6 - 2.5
d	2.6 - 3.5
e	3.6 - 4.5
f	More than 4.5 (up to a maximum of 0.5" D.B.H.)

A complete count of all regeneration was recorded by individual species on the fifth quadrat. Seedlings of less than two years of age were excluded.

#### THE FOREST TYPES OF EASTERN NEWFOUNDLAND

Seven of the most important and productive forest types in eastern Newfoundland were sampled. The number of plots established in each type is listed in Table 1. Plots of the Hylocomium forest type covered a larger age range than did those of any other forest type, and they were therefore divided into two groups (ages 42-53 years, and 56-70 years). These two age groups have been treated as independent units as regards the mensurational data.

Table 1

NUMBER OF SAMPLES FROM INDIVIDUAL FOREST TYPES

Forest Type	Range of plot average ages (years)	Number of samples
Dryopteris type	50 - 71	7
Clintonia type	42 - 63	6
Hylocomium type	42 - 53	8
Hylocomium type	56 - 70	9
Pleurozium type	34 - 49	10
Dicranum-Nemopanthus type	45 - 51	6
Rubus - Vaccinium type	42 - 59	10
Cladonia - Kalmia type	42 - 55	26

A short description (from Damman, 1963, 1964) of stand and vegetative characteristics, related soil conditions, and distribution, is given for each forest type. Mensurational characteristics are recorded as follows:-

- (a) Height/diameter curves for individual softwood species
- (b) Height/age curves for individual softwood species
- (c) Local form class merchantable volume tables and stock tables
- (d) Stand and basal area tables
- (e) Stand and basal area diagrams
- (f) Stem analysis diagrams for individual softwood species
- (g) Stem analysis data tables

The height/age curves have been constructed from a combination of height/age data and stem analysis data. Points shown on the curves at ages below the quoted lower age limits for the various forest types are derived from stem analyses and from height/age data for individual trees whose ages are below the average ages of the plots concerned.

For each forest type the stem analysis diagrams and tables in the report are based on individual trees with a diameter close to the stand average.



## Dryopteris Forest Type

### Description

Balsam fir and balsam fir-white birch forests make up this type. Stands are typically open, and a luxuriant fern layer of Dryopteris spinulosa spp. americana covers the forest floor. The shrub layer consists of scattered Acer spicatum, Sambucus pubens, and Taxus canadensis. Herb and moss layers are poorly developed owing to the dense growth of ferns, but common species such as Cornus canadensis, Trientalis borealis, Rhytidiadelphus loreus, R. triquetrus, Hylocomium umbratum, Ribes glandulosa, and Solidago macrophylla are usually present.

Well-drained, dry to moist, nutrient-rich humic or orthic podzols are the typical soils on which this forest type is found. The lower B horizon is commonly dark brown, and almost crumbly in texture. This forest type is of relatively infrequent occurrence in eastern Newfoundland, forming a smaller proportion of the forests than in other parts of the island.

### Mensurational Characteristics

Balsam fir is the only softwood species normally present in stands of this forest type. Balsam fir stems have an average diameter of 6 inches at 35 feet, 10 inches at 46 feet, and 12 inches at 50 feet (Figure 2). Stands reach 38 feet at 40 years, 43 feet at 50 years, and 45 feet at 70 years (Figure 3).

Total softwood merchantable volume, composed entirely of balsam fir, averages 1,342 cubic feet per acre (Table 2). The number of living stems per acre (1-inch diameter class and above) totals 434, and basal area totals 113 square feet per acre (Table 3). In terms of number of stems, balsam fir constitutes 78% of the stands and white birch the remaining 22% (Figure 4). In terms of basal area the stands are 64% balsam fir and 36% white birch.

Volume growth of the typical balsam fir sample tree has been fairly rapid (Table 4, Figure 5), particularly between the ages of 40 and 50 years.

Balsam fir regeneration is abundant (Tables 26 and 27). All sample quadrats were stocked, and the number of young balsam fir stems averaged 18,250 per acre. These figures suggest that future stands on this site type will be more fully stocked than present stands.

Fig. 2

HEIGHT/DIAMETER CURVE  
DRYOPTERIS FOREST TYPE  
AGE CLASS: 50-71  
BALSAM FIR

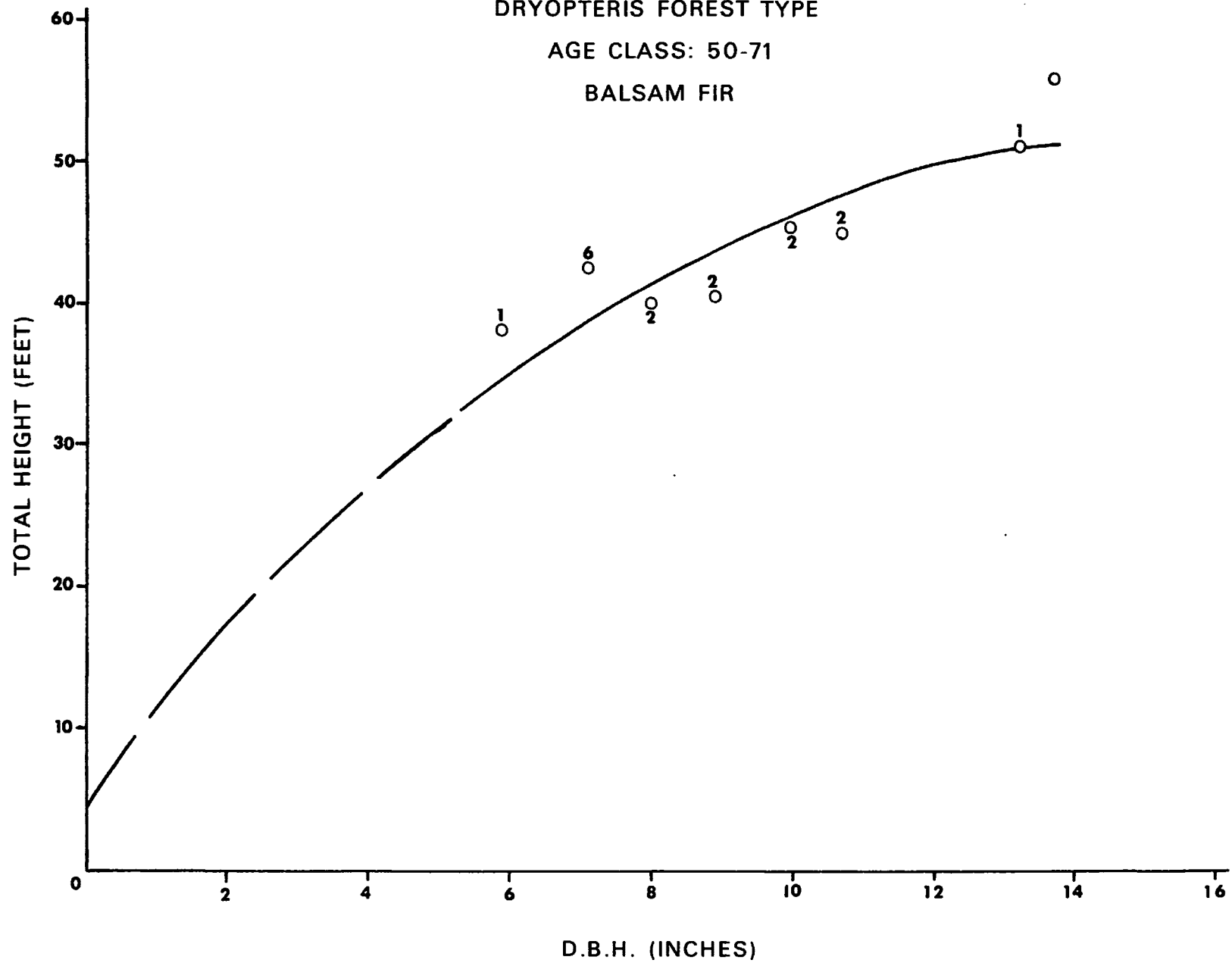


Fig. 3  
HEIGHT/AGE CURVE  
DRYOPTERIS FOREST TYPE  
AGE CLASS: 50-71  
BALSAM FIR

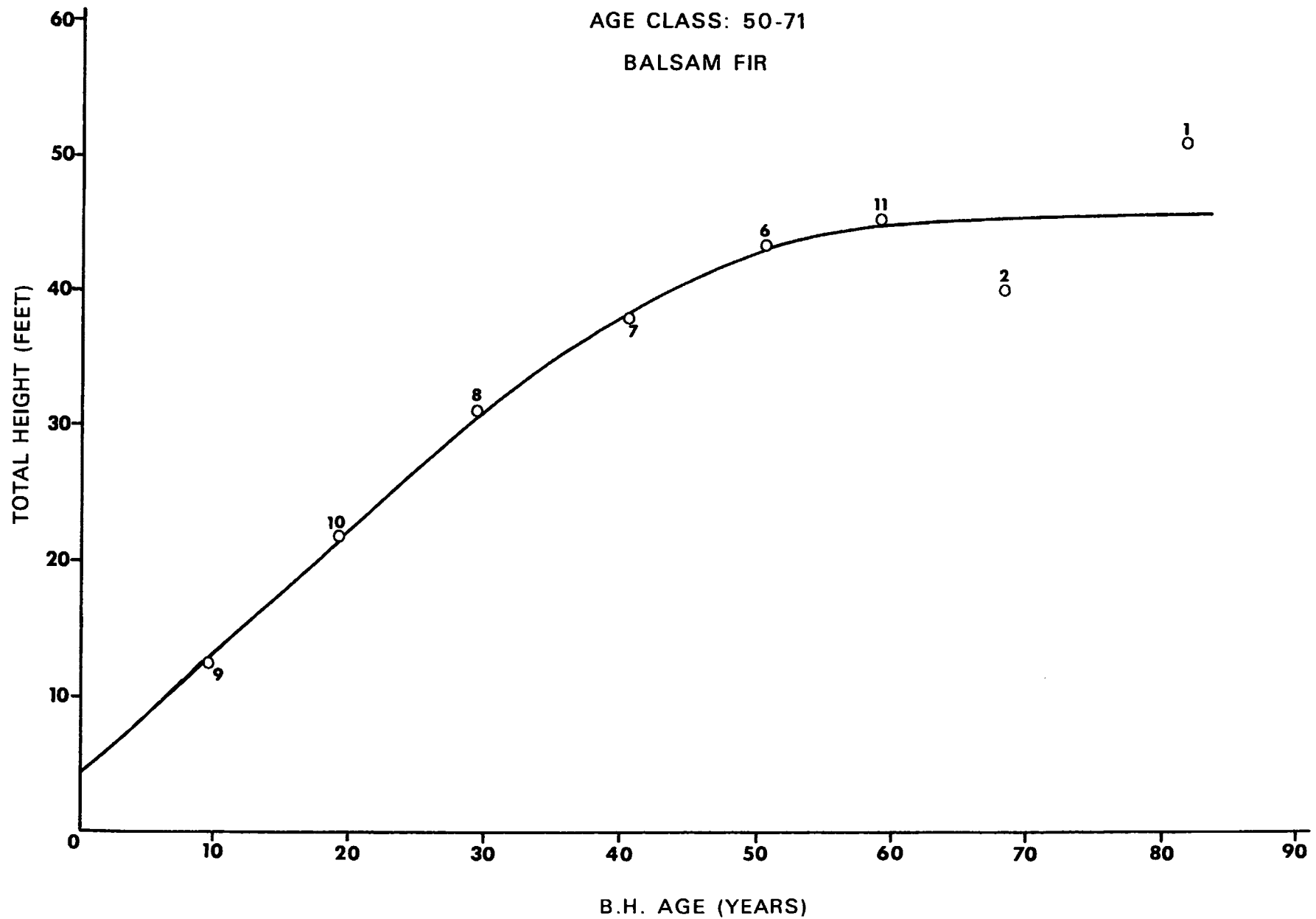


Table 2

LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

DRYOPTERIS FOREST TYPE

Age: 50 - 71

SPECIES		BALSAM FIR	
FORM CLASS		65	
D.B.H. (Inches)	Ht. Ft.	Merch. Vol.* Per Tree	Merch. Vol. Per Acre
		Cu. Ft.	Cu. Ft.
4	26	1.2	38
5	32	2.1	66
6	37	3.3	127
7	40	4.7	208
8	44	6.7	105
9	47	8.9	153
10	49	11.3	129
11	51	14.1	262
12	52	17.1	98
13	53	20.4	87
14	54	24.0	69
TOTAL			1342

\*Stump height one foot: Top diameter outside bark three inches

Table 3

STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

DRYOPTERIS FOREST TYPE

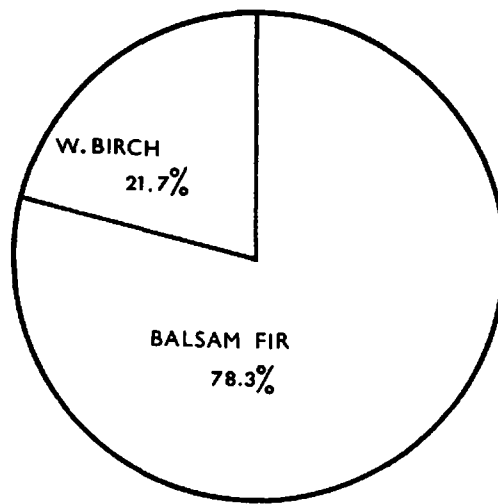
Age: 50-71

Number of Plots: 7

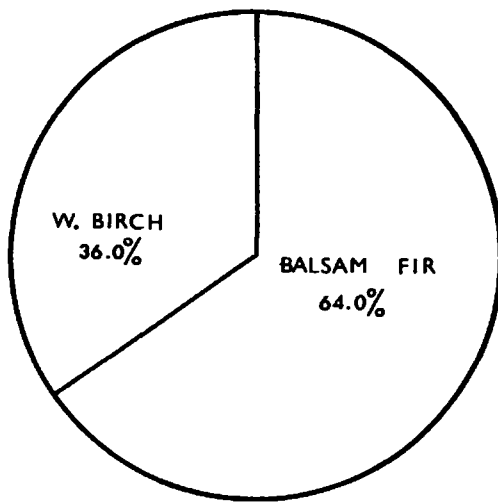
D.B.H. Classes	BALSAM FIR			WHITE BIRCH			TOTAL		
	No. of trees		Basal Area	No. of trees		Basal Area	No. of trees		Basal Area
	Living	Dead	Sq.Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*
1	47.1	17.1	.24	-	-	-	47.1	17.1	.24
2	32.9	21.4	.72	-	-	-	32.9	21.4	.72
3	38.6	20.0	1.89	1.4	-	.07	40.0	20.0	1.96
4	31.4	31.4	2.73	2.9	1.4	.25	34.3	32.8	2.98
5	31.4	22.9	4.27	1.4	-	.19	32.8	22.9	4.46
6	38.6	20.0	7.56	12.9	1.4	2.52	51.5	21.4	10.08
7	44.3	11.4	11.82	8.6	2.9	2.29	52.9	14.3	14.11
8	15.7	12.9	5.48	20.0	-	6.98	35.7	12.9	12.46
9	17.1	12.9	7.58	18.6	-	8.21	35.7	12.9	15.78
10	11.4	10.0	6.23	8.6	-	4.67	20.0	10.0	10.90
11	18.6	1.4	12.26	10.0	-	6.60	28.6	1.4	18.86
12	5.7	5.7	4.49	5.7	1.4	4.49	11.4	7.1	8.98
13	4.3	2.9	3.95	2.9	-	2.63	7.2	2.9	6.58
14	2.9	-	3.05	-	-	-	2.9	-	3.05
15	-	1.4	-	1.4	-	1.75	1.4	1.4	1.75
TOTAL	340.0	191.4	72.27	94.4	7.1	40.65	434.4	198.5	112.92

\*Living trees

Fig. 4 STAND TABLE DIAGRAMS: DRYOPTERIS  
FOREST TYPE



NUMBER OF STEMS



BASAL AREA

Fig. 5  
 STEM ANALYSIS DIAGRAM  
 DRYOPTERIS FOREST TYPE  
 AGE 50-71  
 BALSAM FIR

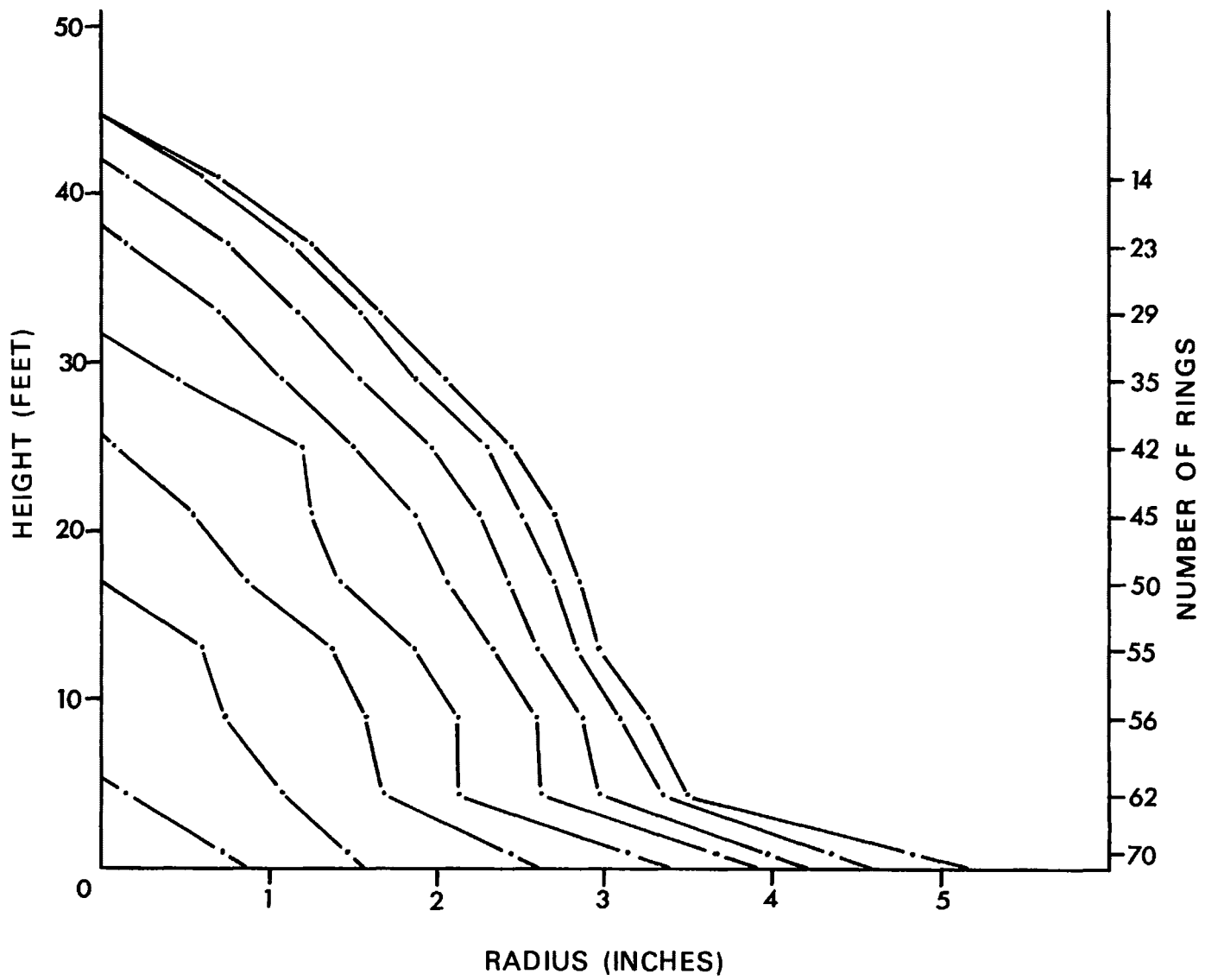


Table 4

STEM ANALYSIS DATA TABLE

DRYOPTERIS FOREST TYPE

Age Class: 50 - 71

		Balsam Fir (Fig. 5)	
Age at breast height (yrs)		62	
Diameter breast height (inches)		7.00	
Total height (feet)		44.70	
Total volume (cu. ft.)		5.997	
Merchantable volume (cu. ft.)		5.494	
Total volume increment by			
decades:-	1961-51	1.244	(20.7%)
	1951-41	1.235	(20.6%)
	1941-31	1.370	(22.8%)
	1931-21	1.060	(17.7%)
	1921-11	0.774	(12.9%)
	1911-01	0.282	(4.7%)
	1901-1891	0.032	(0.5%)
	1891-81	-	
	1881-71	-	
Merchantable volume increment			
1961-51		1.013	



## Clintonia Forest Type

### Description

This forest type consists of well-stocked stands of balsam fir, with an admixture of black spruce, white spruce, and white birch. Scattered Acer spicatum, Sambucus pubens, and Taxus canadensis form the shrub layer. Herbs such as Clintonia borealis, Cornus canadensis, Linnaea borealis, and Maianthemum canadense are common; ferns are scattered. The moss-layer, composed mainly of Hylocomium, Pleurozium, Rhytidiadelphus, and Dicranum, is well-developed and covers most of the forest floor.

This type is of limited occurrence in eastern Newfoundland, occupying well-drained, moist sites. Soils are typically orthic or humic podzols, commonly with mottling in the lower B horizon.

### Mensurational Characteristics

The height/diameter curves for balsam fir and white spruce (Figures 6 and 7) are similar in shape, but the balsam fir curve shows greater heights corresponding to given diameters than does the white spruce. For balsam fir a diameter of 6 inches corresponds to a height of 35 feet and a diameter of 10 inches to a height of 39 feet; for white spruce the same diameters correspond to heights of 31 and 35 feet. The balsam fir height/age curve (Figure 8) shows heights of 38 feet at 40 years, 39 feet at 50 years, and 40 feet at 70 years. Corresponding heights for white spruce (Figure 9) are 26, 30, and 33 feet.

Total softwood merchantable volume averages 2,597 cubic feet per acre (Table 5). Total number of living stems were 1,932 per acre, and basal area was 201 square feet per acre (Table 6). Balsam fir forms 71% of the stands in terms of number of stems per acre (Figure 10); black and white spruce make up 16%, and white birch 12%. In terms of basal area fir forms 68% of the stands, the spruces 26%, and white birch 6%.

The balsam fir and white spruce sample trees have shown similar rates of volume growth (Table 7, Figs. 11 and 12). Regeneration is abundant. Sample quadrats were 80% stocked (Table 26) and there were an average of 26,900 young softwood stems, mostly balsam fir, per acre (Table 27).

Fig. 6  
HEIGHT/DIAMETER CURVE  
CLINTONIA FOREST TYPE  
AGE CLASS: 42-63  
BALSAM FIR

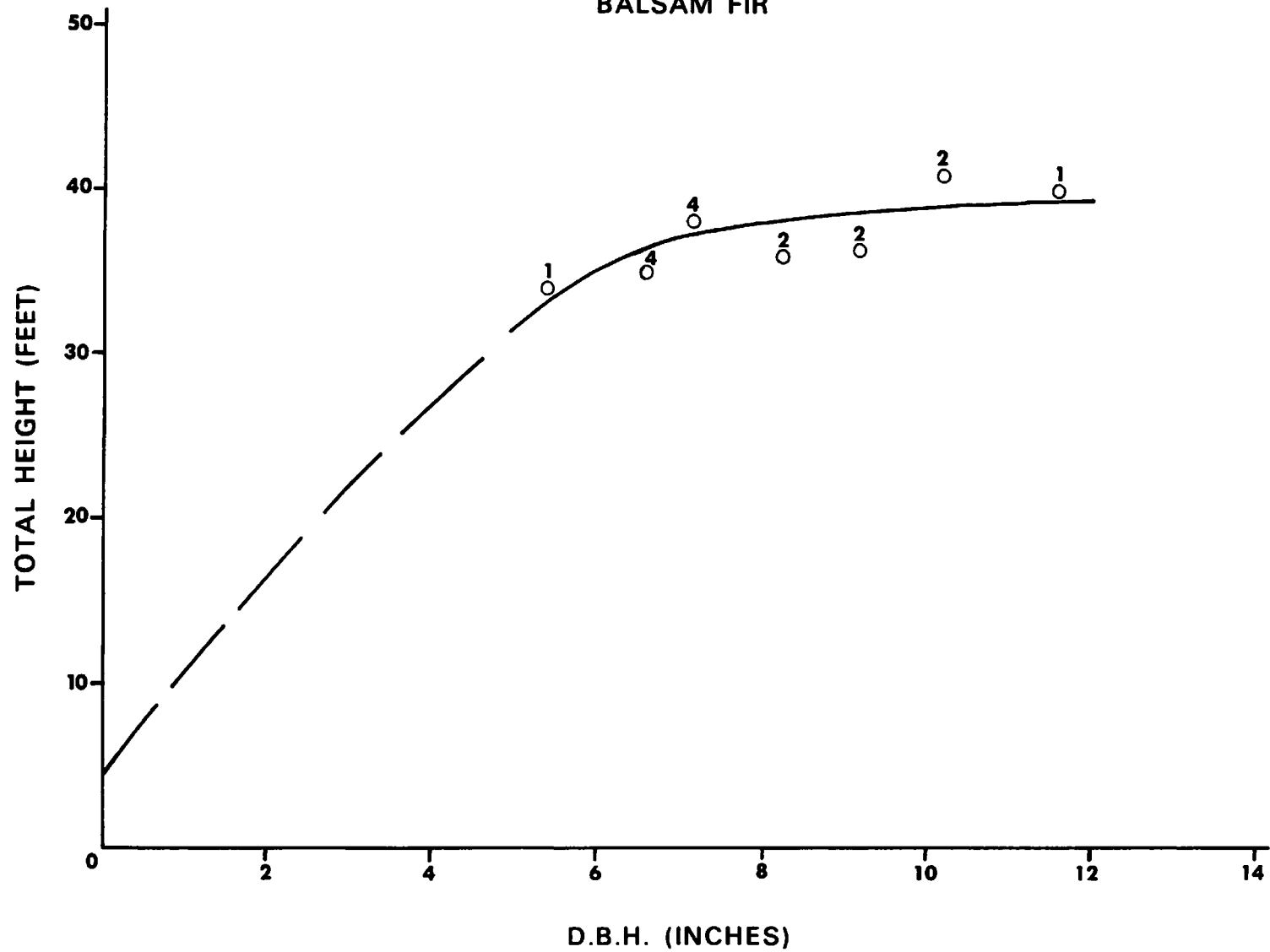


Fig. 7  
HEIGHT/DIAMETER CURVE  
CLINTONIA FOREST TYPE  
AGE CLASS: 42-63  
WHITE SPRUCE

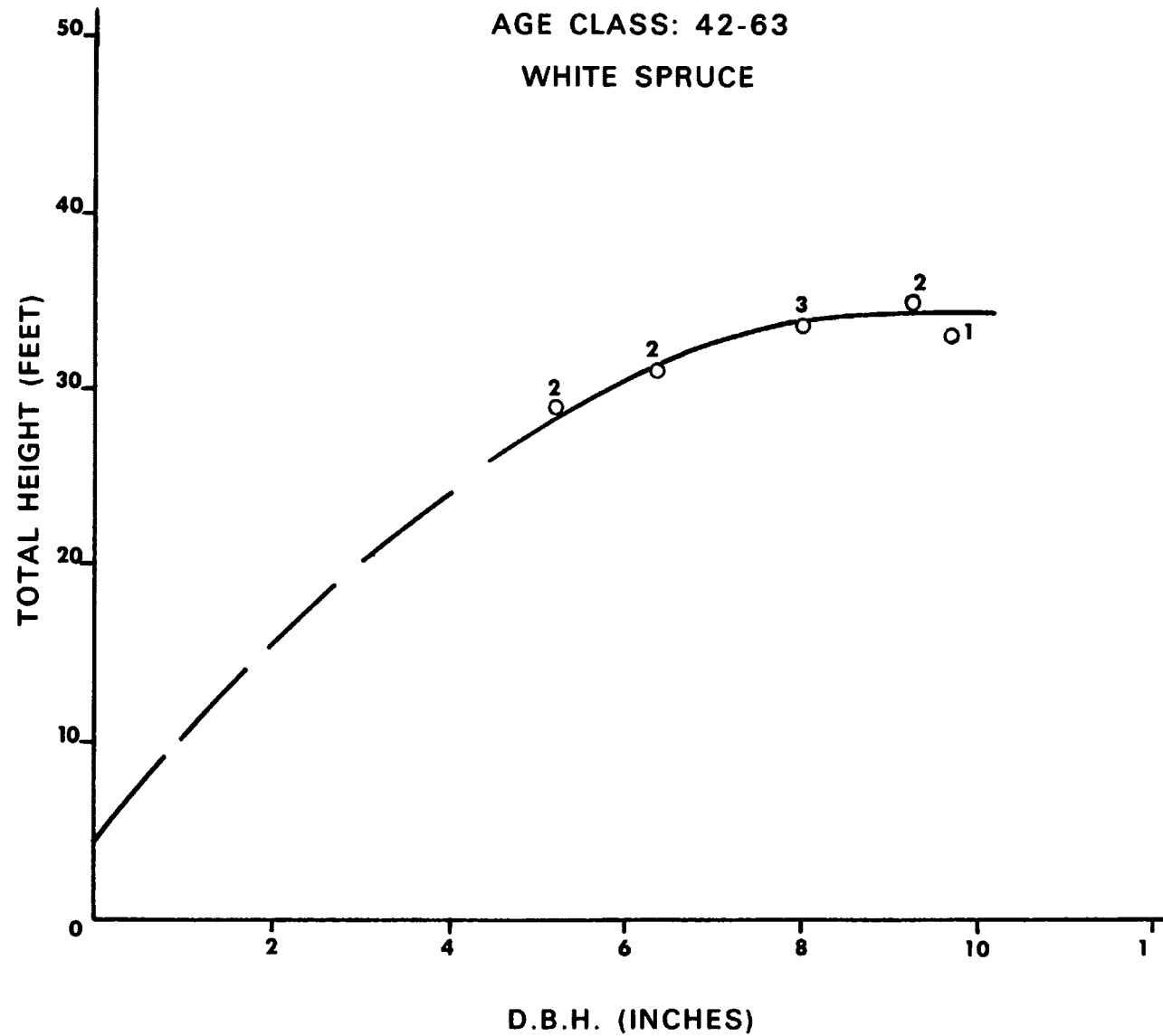


Fig. 8  
HEIGHT/AGE CURVE  
CLINTONIA FOREST TYPE  
AGE CLASS: 42-63  
BALSAM FIR

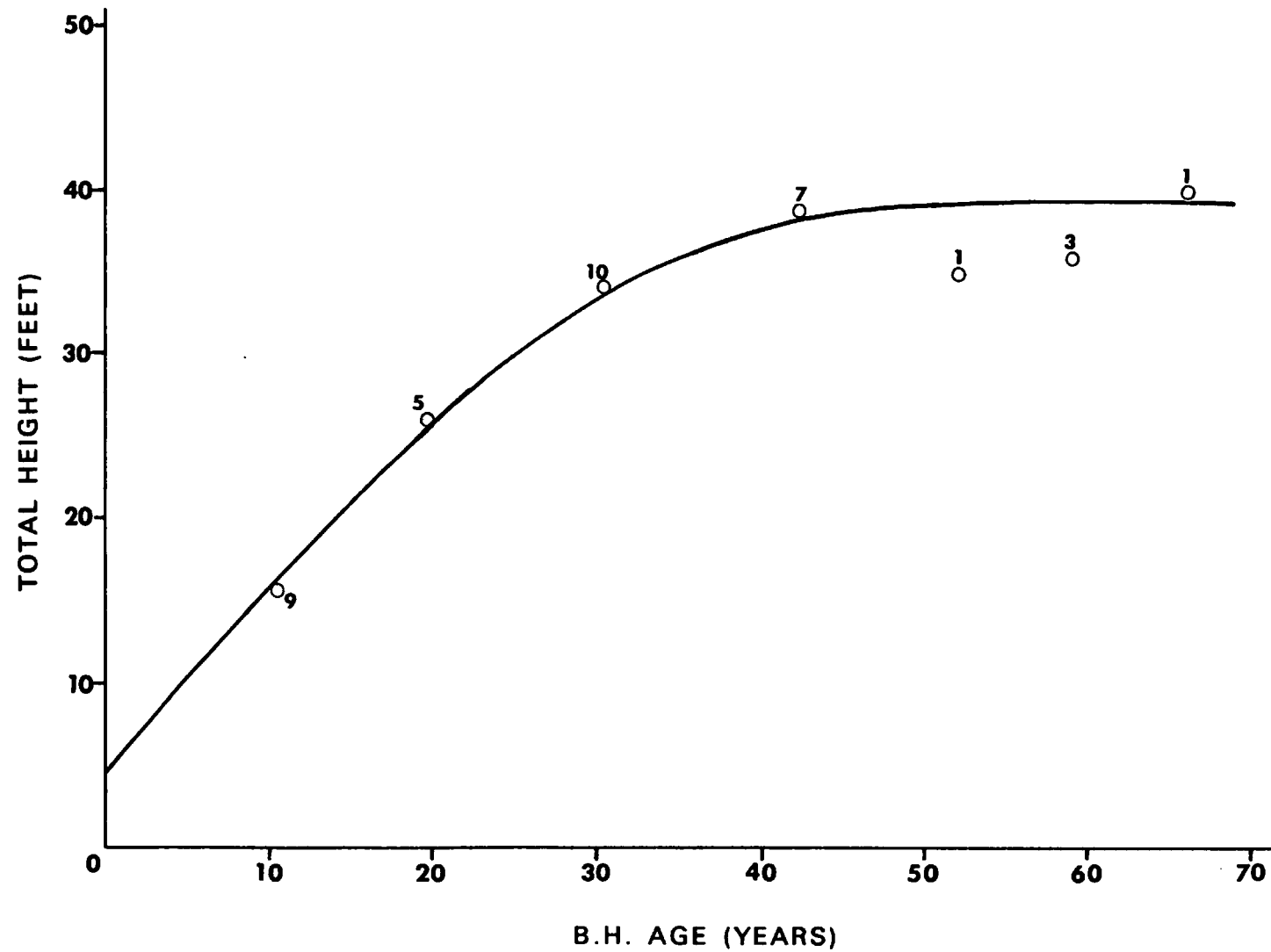


Fig. 9  
HEIGHT/AGE CURVE  
CLINTONIA FOREST TYPE  
AGE CLASS: 42-63  
WHITE SPRUCE

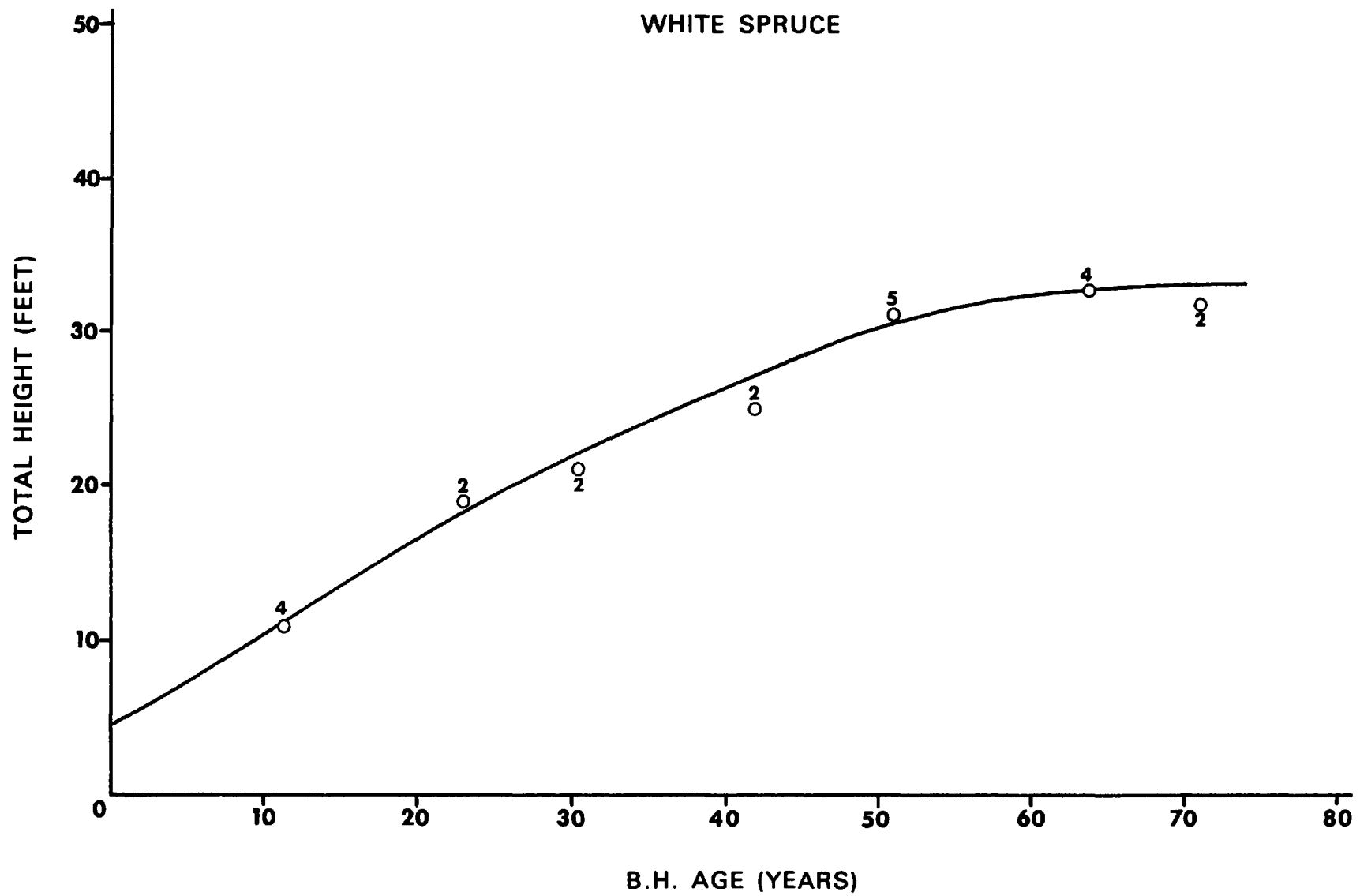


Table 5

## LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

## CLINTONIA FOREST TYPE

Age: 42 - 63

SPECIES FORM CLASS		BALSAM FIR 68		BLACK SPRUCE 68				WHITE SPRUCE 57	
D.B.H. (Inches)	Ht. Ft.	Merch. Vol.* Per Tree Cu. Ft.	Merch. Vol. Per Acre Cu. Ft.	Ht. Ft.	Merch. Vol.* Per Tree Cu. Ft.	Merch. Vol. Per Acre Cu. Ft.	Ht. Ft.	Merch. Vol.* Per Tree Cu. Ft.	Merch. Vol. Per Acre Cu. Ft.
4	25	1.2	206	29	.9	33	23	.9	15
5	30	2.0	327	33	1.7	28	27	1.6	45
6	34	3.1	346	35	2.8	51	30	2.4	52
7	37	4.4	403	37	4.1	41	32	3.5	82
8	39	6.0	250	39	5.7	10	34	4.9	65
9	40	7.8	104	40	7.7	13	35	6.5	54
10	41	9.8	196	-	-	-	36	8.3	55
11	41	11.9	40	-	-	-	36	10.3	34
12	-	-	-	-	-	-	36	12.5	83
13	-	-	-	-	-	-	37	15.0	25
14	-	-	-	-	-	-	-	-	-
15	43	23.2	39	-	-	-	-	-	-
TOTAL			1191			176			510

\*Stump height one foot: Top diameter outside bark three inches

Table 6

STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

CLINTONIA FOREST TYPE

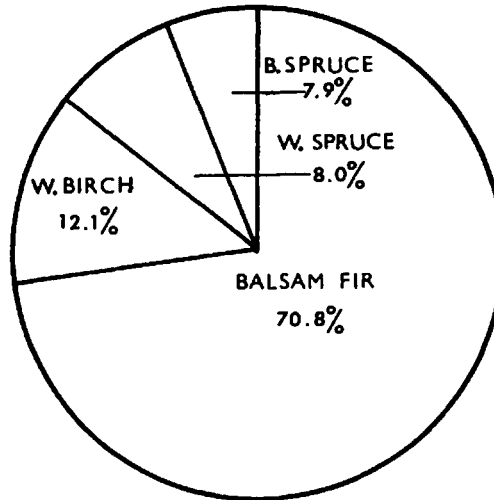
Age: 42 - 63

Number of Plots: 6

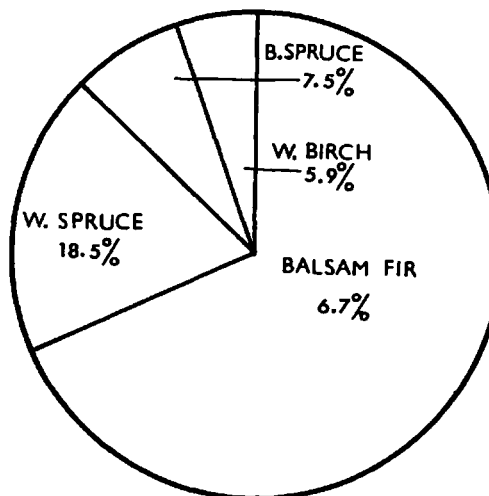
D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			WHITE SPRUCE			WHITE BIRCH			TOTAL		
	No. of trees		Basal Area	No. of trees		Basal Area	No. of trees		Basal Area	No. of trees		Basal Area	No. of trees		Basal Area
	Living	Dead	Sq. Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*
1	291.7	211.7	1.46	16.7	21.7	.08	8.3	28.3	.04	40.0	23.3	.20	356.7	285.0	1.78
2	261.7	121.7	5.76	23.3	11.7	.51	8.3	16.7	.18	80.0	28.3	1.76	373.3	178.4	8.21
3	211.7	41.7	10.37	30.0	3.3	1.47	10.0	16.7	.49	58.3	6.7	2.86	310.0	68.4	15.19
4	171.7	11.7	14.94	36.7	6.7	3.19	16.7	5.0	1.45	40.0	3.3	3.48	265.1	26.7	23.06
5	163.3	6.7	22.21	16.7	1.7	2.27	28.3	6.7	3.85	11.7	-	1.59	220.0	15.1	29.92
6	111.7	1.7	21.89	18.3	1.7	3.59	21.7	3.3	4.25	3.3	-	.65	155.0	6.7	30.38
7	91.7	1.7	24.48	10.0	-	2.67	23.3	3.3	6.23	1.7	1.7	.45	126.7	6.7	33.83
8	41.7	-	14.54	1.7	-	.58	13.3	5.0	4.65	-	-	-	56.7	5.0	19.77
9	13.3	1.7	5.89	1.7	-	.74	8.3	6.7	3.68	-	-	-	23.3	8.4	10.31
10	20.0	-	10.90	-	-	-	6.7	-	3.63	1.7	-	.91	28.4	-	15.44
11	3.3	-	2.20	-	-	-	3.3	-	2.20	-	-	-	6.6	-	4.40
12	-	-	-	-	-	-	6.7	1.7	5.23	-	-	-	6.7	1.7	5.23
13	-	-	-	-	-	-	1.7	-	1.54	-	-	-	1.7	-	1.54
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	1.7	-	2.05	-	-	-	-	-	-	-	-	-	1.7	-	2.05
TOTAL	1383.5	398.6	136.69	155.1	46.8	15.10	156.6	93.4	37.42	236.7	63.3	11.90	1931.9	602.1	201.11

\*Living trees.

**Fig. 10 STAND TABLE DIAGRAMS: CLINTONIA  
FOREST TYPE**



**NUMBER OF STEMS**



**BASAL AREA**



Fig. 11  
STEM ANALYSIS DIAGRAM  
CLINTONIA FOREST TYPE  
AGE: 42-63  
BALSAM FIR

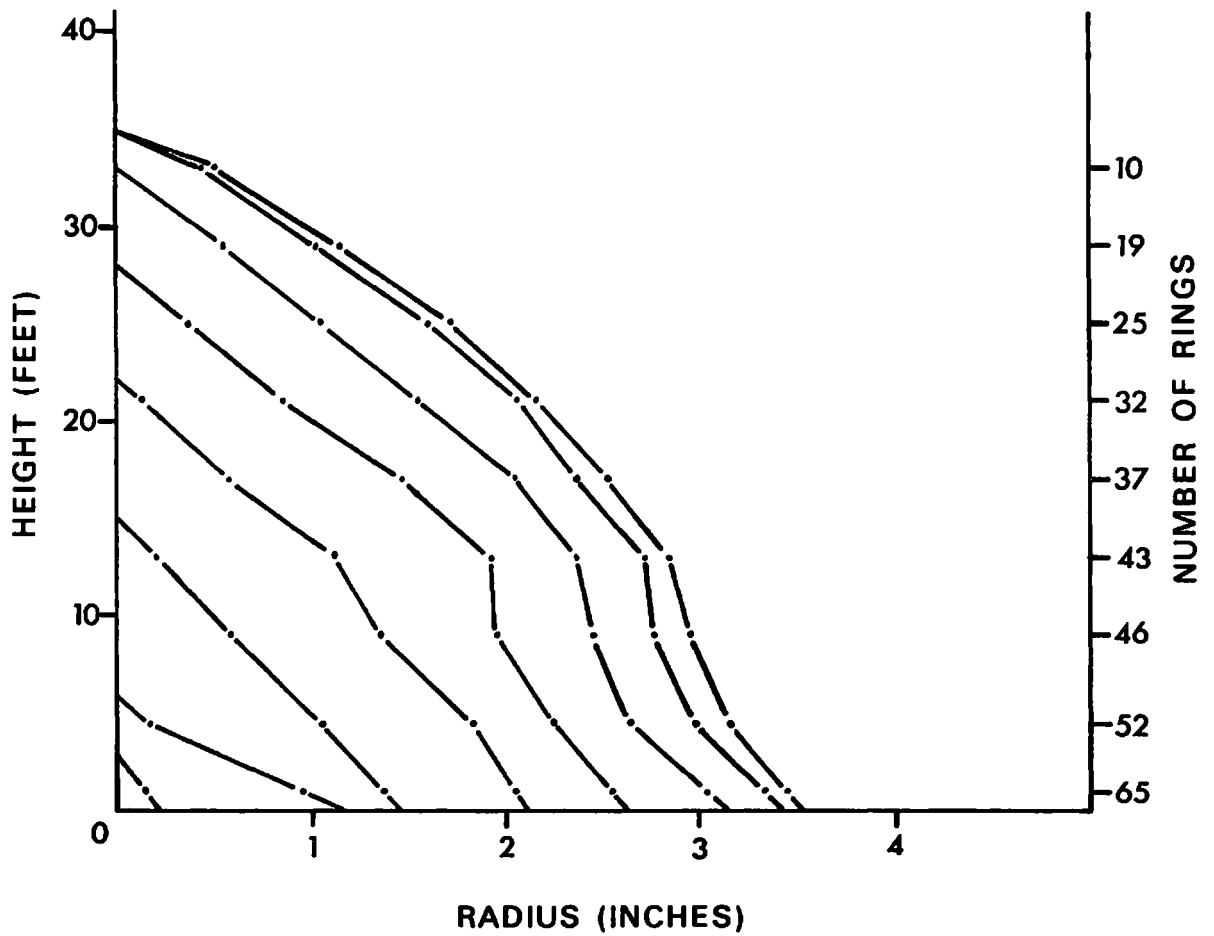


Fig. 12  
STEM ANALYSIS DIAGRAM  
CLINTONIA FOREST TYPE  
AGE: 42-63  
WHITE SPRUCE

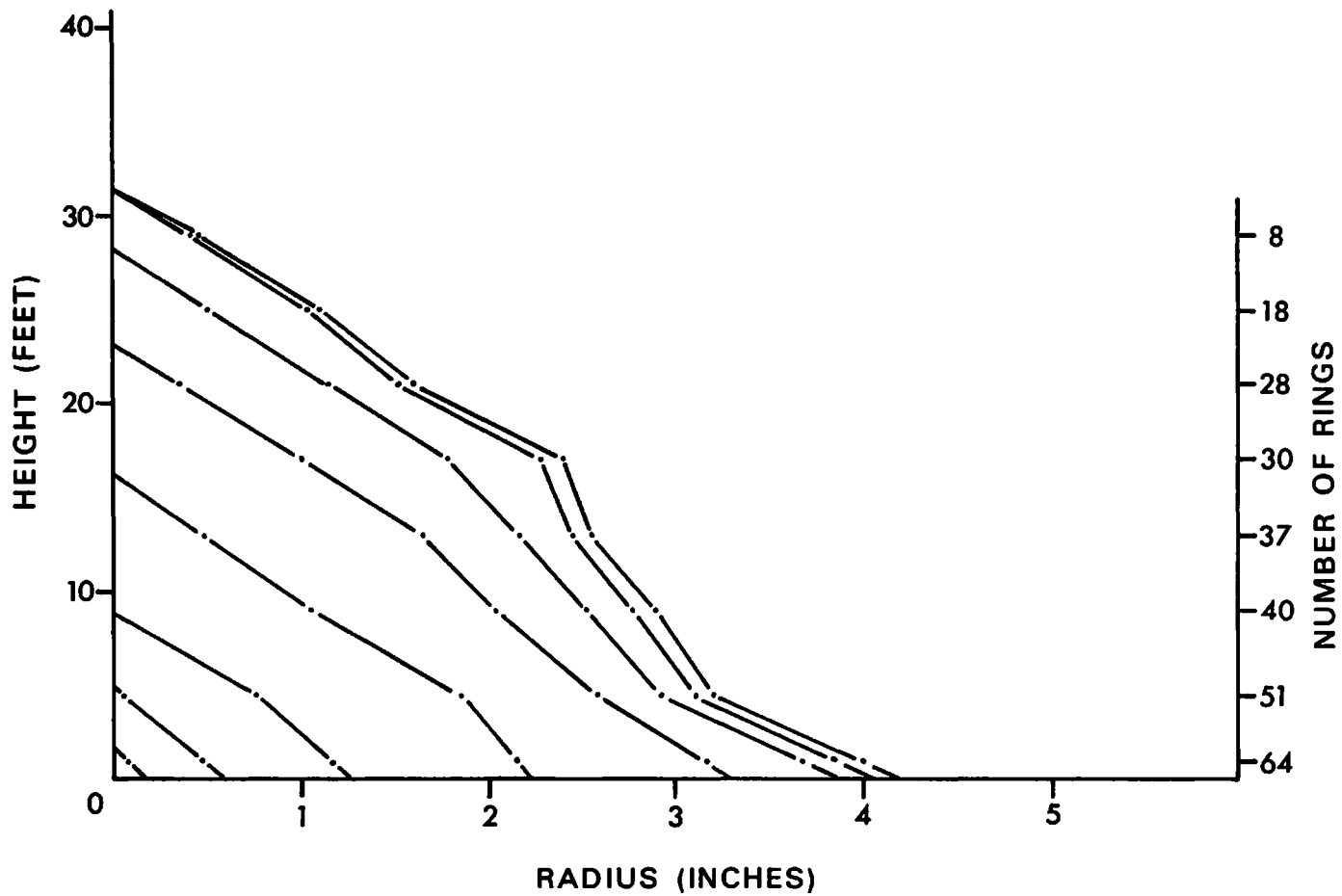


Table 7

STEM ANALYSIS DATA TABLE

CLINTONIA FOREST TYPE

Age Class: 42 - 63

	Balsam Fir (Fig. 11)	White Spruce (Fig. 12)
Age at breast height (yrs)	52	51
Diameter breast height (inches)	6.30	6.40
Total height (feet)	33.90	31.20
Total Volume (cu. ft.)	3.994	3.733
Merchantable volume (cu. ft.)	3.479	3.202
Total volume increment by decades:-		
1961-51	1.088 (27.2%)	0.770 (20.6%)
1951-41	1.139 (28.5%)	1.064 (28.5%)
1941-31	0.926 (23.2%)	1.205 (32.3%)
1931-21	0.594 (14.9%)	0.562 (15.1%)
1921-11	0.189 (4.7%)	0.118 (3.2%)
1911-01	0.057 (1.4%)	0.014 (0.4%)
1901-1891	0.001	-
1891-81	-	-
1881-71	-	-
Merchantable volume increment 1961-51	0.800	0.511

### Hylocomium Forest Type

#### Description

This type consists of well-stocked balsam fir forests. Scattered stems of black spruce, white spruce, and white birch are also usually present. Shrubs and herbs are rare or absent. A moss carpet covers the entire forest floor. Hylocomium splendens is the dominant moss species, and Sphagnum capillaceum clumps also occur frequently.

This is a common forest type and stands are widely distributed throughout the sample area on moist to fairly wet sites. Soils are typically gleyed podzols or seepage gleysols.

#### Mensurational Characteristics

Height/diameter curves for balsam fir in the two age classes, 42-53 and 56-70, are very similar (Figs. 13 and 14), with a diameter of 6 inches corresponding to a height of 37 to 38 feet and a diameter of 8 inches to a height of 40 to 42 feet. Black spruce data were inadequate to permit the construction of separate height/diameter curves for the two age classes; the combined curve (Fig. 15) shows a height of 38 feet corresponding to a diameter of 6 inches and a height of 41 feet corresponding to a diameter of 8 inches. There are markedly different patterns of balsam fir height growth in the two age classes (Figs 16 and 17). The younger age class shows more rapid early growth, reaching a height of  $37\frac{1}{2}$  feet at 40 years and 39 feet at 50 years. In the older age class, height growth appears more steady, with stands attaining 25 feet at 40 years, 30 feet at 50 years, and 38 feet at 70 years. The combined curve for black spruce (Fig. 18) shows heights of 32 feet at 40 years,  $36\frac{1}{2}$  feet at 50 years, and  $39\frac{1}{2}$  feet at 70 years.

Merchantable softwood volume totals 2,694 cubic feet per acre in the younger age class (Table 8) and 2,525 cubic feet per acre in the older age class (Table 9). There are an average of 2,701 living stems per acre in the younger age class (Table 10) and 1,889 stems per acre in the older stands (Table 11). Corresponding basal areas are 215 and 190 square feet per acre.

In the younger age class, balsam fir forms 86% of the stands in terms of number of stems and 79% in terms of basal area (Fig. 19); in the older age class fir forms 93% of the stands in terms of number of trees and 89% in terms of basal area. The spruces form between 5 and 7% of the number of trees and between 7 and 12% of the basal area in both age classes.

Stem analyses (Tables 12 and 13, Figs 20, 21, 22 and 23) show that the volume increment of the balsam fir trees has been slightly more rapid than that of the black spruce trees in both age classes.

Regeneration is good, with 88% of the sample quadrats stocked (Table 26). There are an average of 40,440 young balsam fir stems per acre (Table 27), together with 2,500 white birch.

Fig. 13  
HEIGHT/DIAMETER CURVE  
HYLOCOMIUM FOREST TYPE  
AGE CLASS: 42-53  
BALSAM FIR

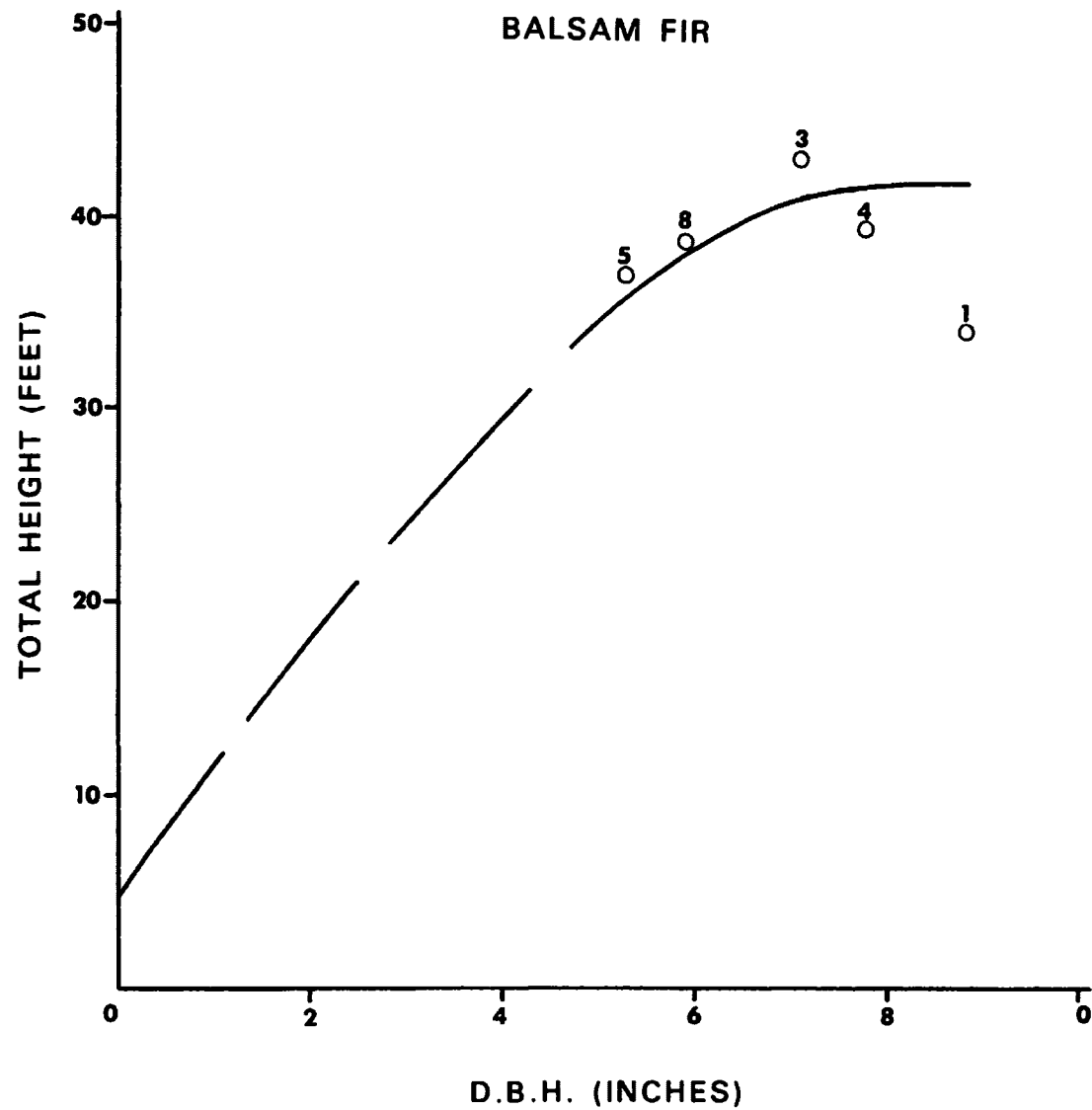


Fig. 14  
HEIGHT/DIAMETER CURVE  
HYLOCOMIUM FOREST TYPE  
AGE CLASS: 56-70  
BALSAM FIR

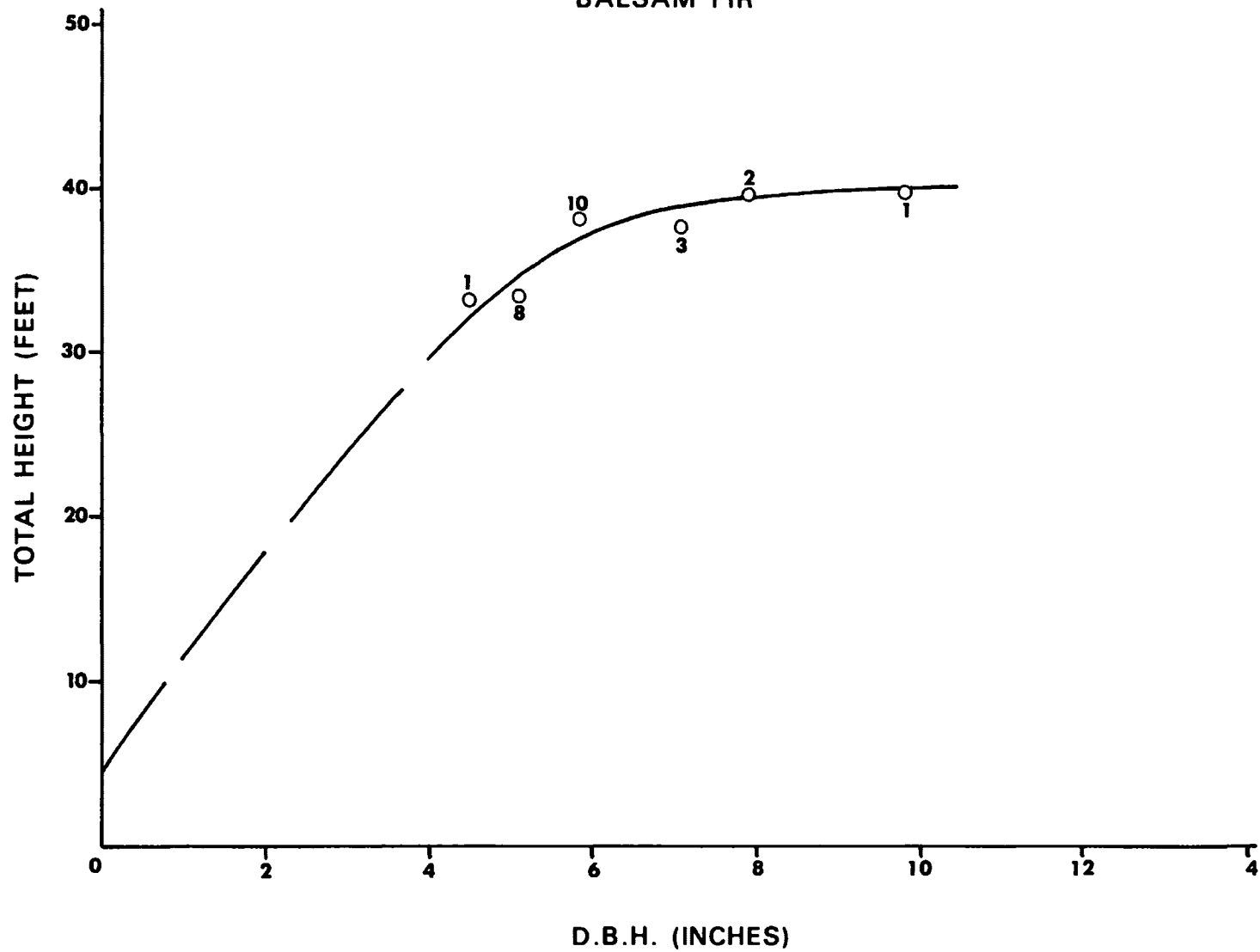


Fig. 15  
HEIGHT/DIAMETER CURVE  
HYLOCOMIUM FOREST TYPE  
AGE CLASSES: 42-53 & 56-70  
BLACK SPRUCE

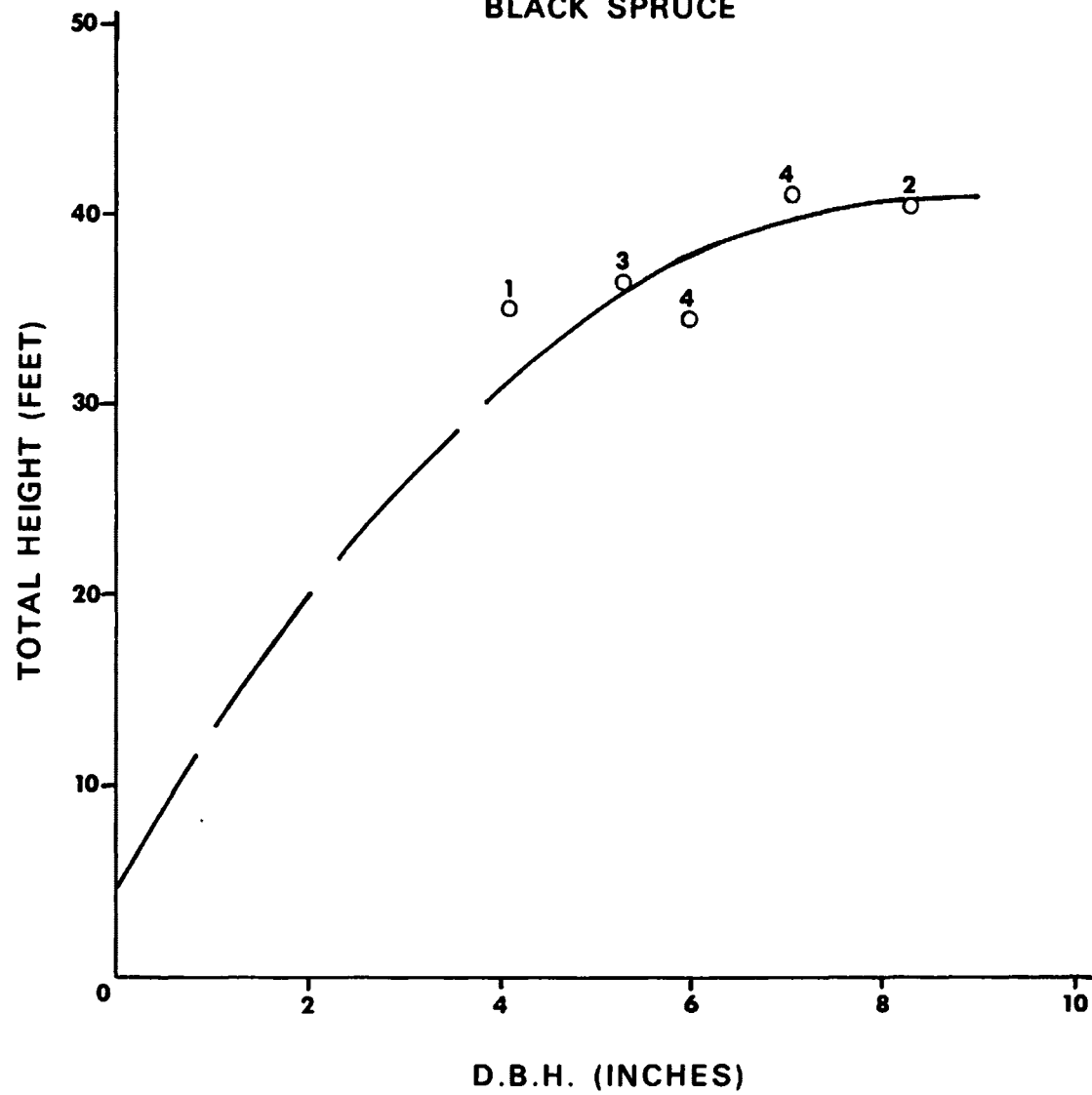




Fig. 16  
HEIGHT/AGE CURVE  
HYLOCOMIUM FOREST TYPE  
AGE CLASS: 42-53  
BALSAM FIR

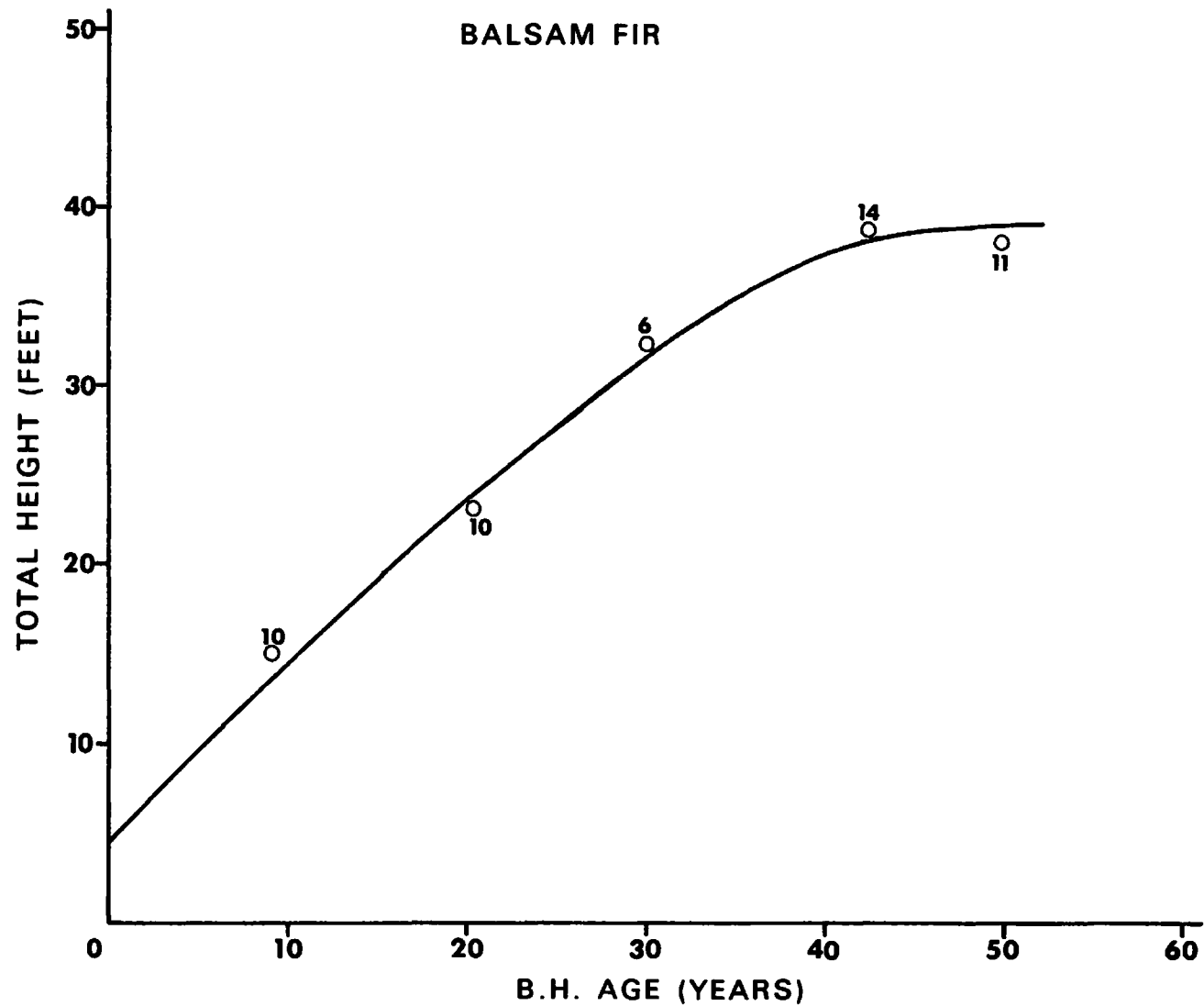


Fig. 17  
HEIGHT/AGE CURVE  
HYLOCOMIUM FOREST TYPE  
AGE CLASS: 56-70  
BALSAM FIR

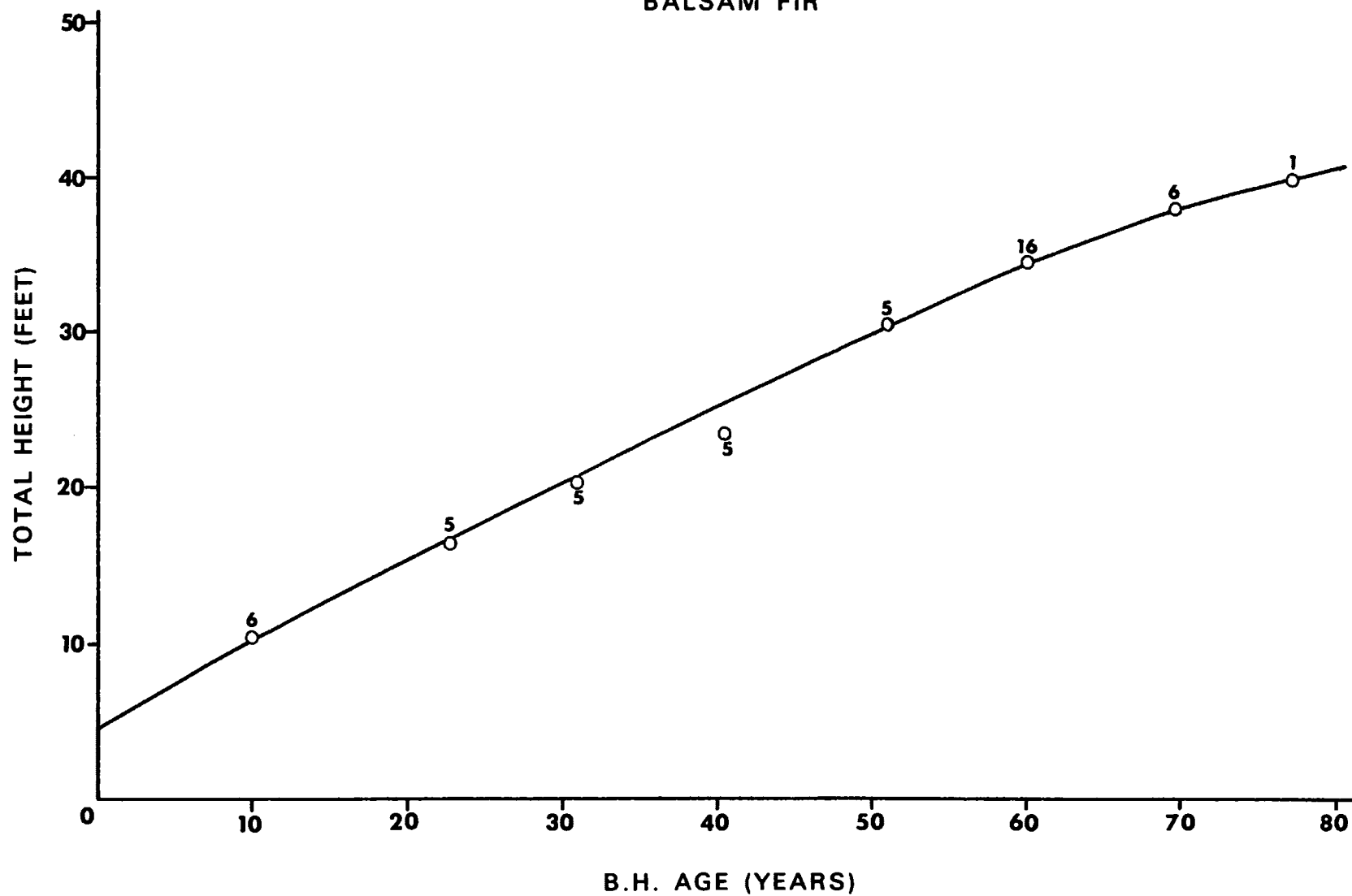


Fig. 18

HEIGHT/AGE CURVE

HYLOCOMIUM FOREST TYPE

AGE CLASSES: 42-53 & 56-70

BLACK SPRUCE

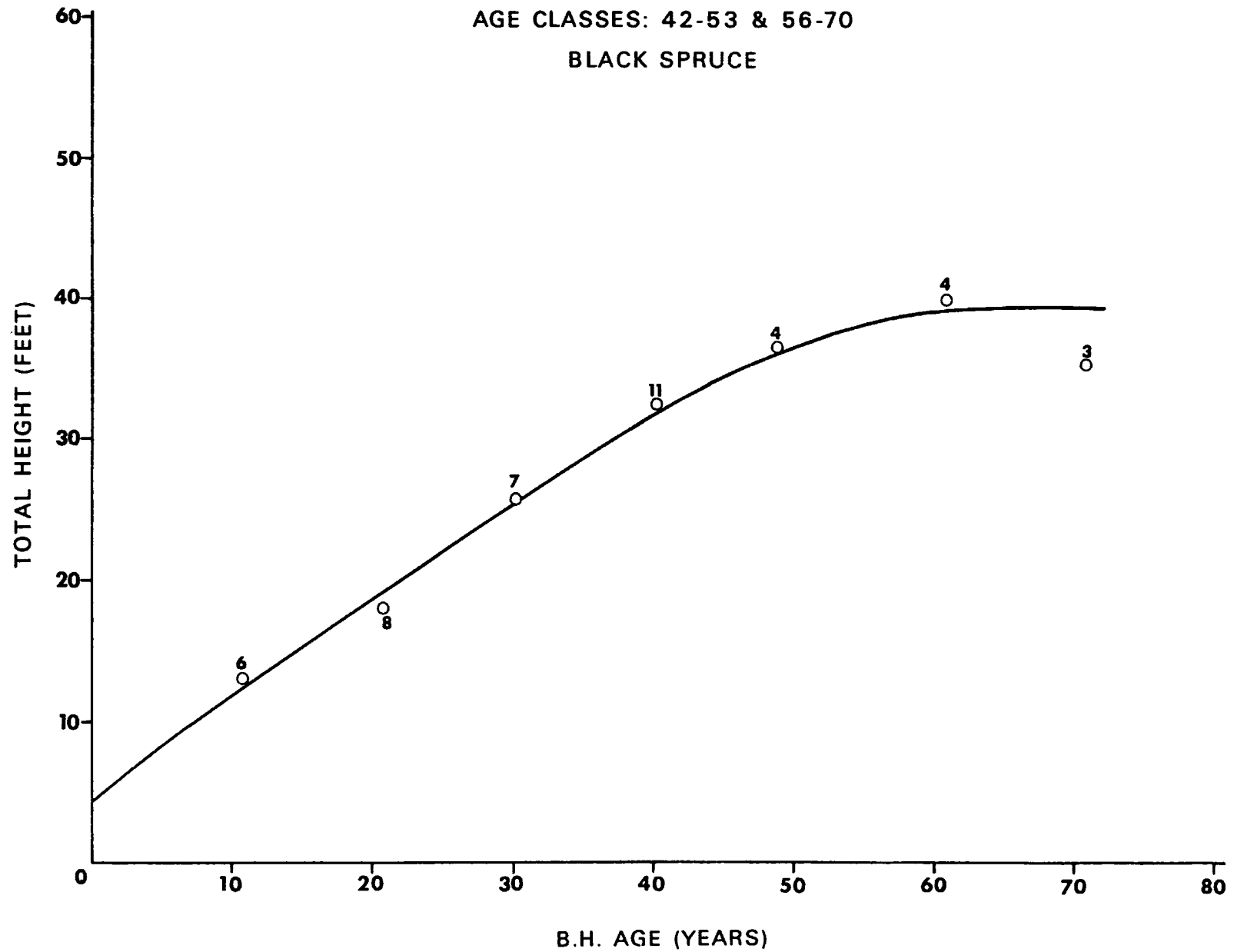


Table 8

## LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

## HYLOCOMIUM FOREST TYPE

Age: 42 - 53

SPECIES		BALSAM FIR			BLACK SPRUCE			WHITE SPRUCE			LARCH		
FORM CLASS		70			70			70			70		
D.B.H. (Inches)	Ht. Ft.	Merch. Vol.*		Ht. Ft.	Merch. Vol.*		Ht. Ft.	Merch. Vol.*		Ht. Ft.	Merch. Vol.*		Ht. Ft.
		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.	
4	30	1.3	457	29	.9	10	29	.9	10	29	.9	1	
5	36	2.2	580	33	1.7	40	33	1.7	17	33	1.7	2	
6	40	3.5	459	37	3.0	34	37	3.0	38	-	-	-	
7	43	5.0	338	40	4.5	28	40	4.5	51	-	-	-	
8	46	7.0	245	41	6.2	16	41	6.2	47	-	-	-	
9	48	9.3	70	-	-	-	43	8.0	20	-	-	-	
10	50	12.0	75	-	-	-	45	10.2	51	-	-	-	
11	51	14.8	56	-	-	-	-	-	-	-	-	-	
12	52	18.0	23	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	50	20.0	26	-	-	-	
TOTAL		2303			128			260			3		

\*Stump height one foot: Top diameter outside bark three inches.

Table 9

LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

HYLOCOMIUM FOREST TYPE

Age: 56 - 70

SPECIES		BALSAM FIR		BLACK SPRUCE			WHITE SPRUCE			LARCH		
FORM CLASS		70		70			70			70		
D.B.H.	Ht.	Merch. Vol.*	Merch. Vol.	Merch. Vol.*	Merch. Vol.		Merch. Vol.*	Merch. Vol.		Merch. Vol.*	Merch. Vol.	
(Inches)	Ft.	Per Tree	Per Acre	Per Tree	Per Acre		Per Tree	Per Acre		Per Tree	Per Acre	
		Cu. Ft.	Cu. Ft.	Cu. Ft.	Cu. Ft.		Cu. Ft.	Cu. Ft.		Cu. Ft.	Cu. Ft.	
4	31	1.3	409	30	.9	8	30	.9	-	-	-	-
5	34	2.2	445	34	1.8	24	34	1.8	2	-	-	-
6	37	3.3	451	37	3.0	43	37	3.0	-	-	-	-
7	39	4.6	465	40	4.5	60	40	4.5	5	-	-	-
8	40	6.1	230	42	6.3	35	42	6.3	7	-	-	-
9	41	8.0	133	-	-	-	-	-	-	-	-	-
10	42	10.2	147	-	-	-	-	-	-	-	-	-
11	42	12.3	27	-	-	-	-	-	-	-	-	-
12	42	14.7	16	-	-	-	-	-	-	42	16.4	18
TOTAL			2323			170			14			18

\*Stump height one foot: Top diameter outside bark three inches.

Table 10

## STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

## HYLOCOMIUM FOREST TYPE

Age: 42 - 53

Number of Plots: 8

D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			WHITE SPRUCE			WHITE BIRCH			TOTAL		
	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal
	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*
1	442.5	762.5	2.21	16.3	25.0	.08	5.0	8.8	.03	23.8	28.8	.12	487.6	825.1	2.44
2	575.0	278.8	12.65	10.0	2.5	.22	11.3	20.0	.25	63.8	11.3	1.40	660.1	312.6	14.52
3	455.0	40.0	22.30	8.8	-	.43	10.0	11.3	.49	30.0	2.5	1.47	503.8	53.8	24.69
4	351.3	16.3	30.56	11.3	-	.98	11.3	6.3	.98	15.0	2.5	1.31	388.9	25.1	33.83
5	263.8	5.0	35.87	23.8	-	3.23	10.0	-	1.36	10.0	1.3	1.36	307.6	6.3	41.82
6	131.3	7.5	25.73	11.3	-	2.21	12.5	-	2.45	11.3	-	2.21	166.4	7.5	32.60
7	67.5	1.3	18.02	6.3	-	1.67	11.3	-	3.00	12.5	1.3	3.34	97.6	2.6	26.03
8	35.0	2.5	12.22	2.5	-	.87	7.5	1.3	2.62	6.3	3.8	2.18	51.3	7.6	17.89
9	7.5	-	3.32	-	-	-	2.5	-	1.11	6.3	-	2.76	16.3	-	7.19
10	6.3	3.8	3.41	-	-	-	5.0	-	2.73	2.5	-	1.36	13.8	3.8	7.50
11	3.8	-	2.48	-	-	-	-	-	-	-	1.3	-	3.8	1.3	2.48
12	1.3	-	.98	-	-	-	-	-	-	-	-	-	1.3	-	.98
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	1.3	-	1.34	-	-	-	1.3	-	1.34
15	-	-	-	-	-	-	-	-	-	1.3	-	1.53	1.3	-	1.53
TOTAL	2340.3	1117.7	169.75	90.3	27.5	9.69	87.7	47.7	16.36	182.8	52.8	19.04	2701.1	1245.7	214.84

\*Living trees.

Table 11

STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

HYLOCOMIUM FOREST TYPE

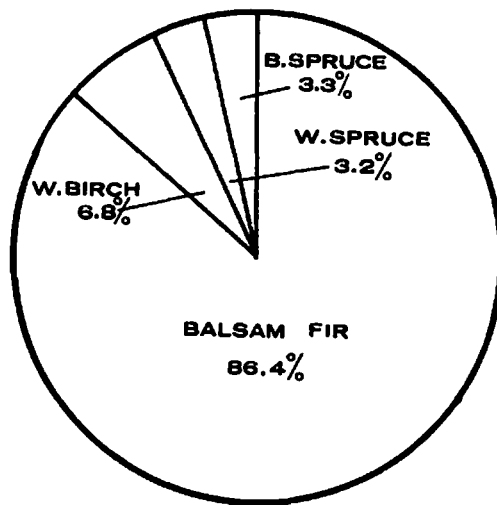
Age: 56 - 70

Number of Plots: 9

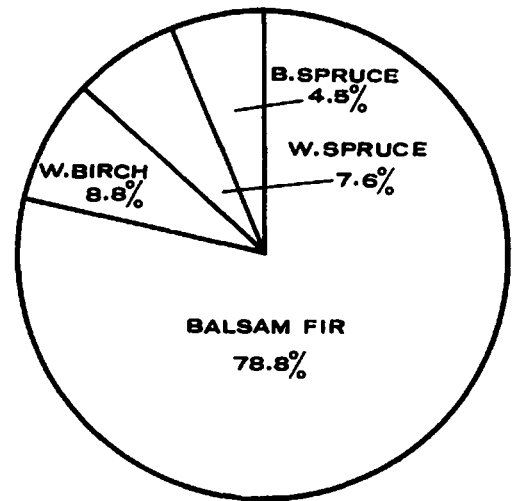
D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			WHITE SPRUCE			WHITE BIRCH			TOTAL		
	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal
	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*	Living	Dead	Sq. Ft.*
1	132.2	663.3	.66	2.2	1.1	.01	-	-	-	4.4	-	.02	138.8	664.4	.69
2	354.4	573.3	7.80	10.0	4.4	.22	2.2	1.1	.05	7.8	3.3	.17	374.4	582.1	8.24
3	451.1	137.8	22.10	7.8	-	.38	3.3	3.3	.16	3.3	1.1	.16	465.5	142.2	22.80
4	314.4	66.7	27.36	8.9	2.2	.77	-	1.1	-	-	2.2	-	323.3	72.2	28.13
5	202.2	30.0	27.50	13.3	-	1.81	1.1	1.1	.15	6.7	1.1	.91	223.3	32.2	30.37
6	136.7	15.6	26.79	14.4	1.1	2.83	-	-	-	5.6	2.2	1.09	156.7	18.9	30.71
7	101.1	2.2	27.00	13.3	1.1	3.56	1.1	-	.30	4.4	-	1.19	119.9	3.3	32.05
8	37.8	5.6	13.18	5.6	-	1.94	1.1	-	.39	3.3	-	1.16	47.8	5.6	16.67
9	16.7	3.3	7.37	-	-	-	-	-	-	1.1	1.1	.49	17.8	4.4	7.86
10	14.4	1.1	7.87	-	-	-	-	-	-	1.1	-	.61	15.5	1.1	8.48
11	2.2	1.1	1.47	-	-	-	-	-	-	1.1	1.1	.73	3.3	2.2	2.20
12	1.1	-	.87	-	-	-	-	-	-	1.1	-	.87	2.2	-	1.74
TOTAL	1764.3	1500.0	169.97	75.5	9.9	11.52	8.8	6.6	1.05	39.9	12.1	7.40	1888.5	1528.6	189.94

\*Living trees.

Fig. 19 STAND TABLE DIAGRAMS: HYLOCOMIUM  
FOREST TYPE

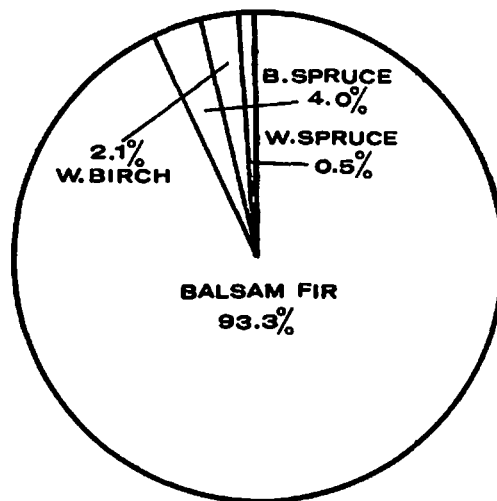


AGE  
42-53

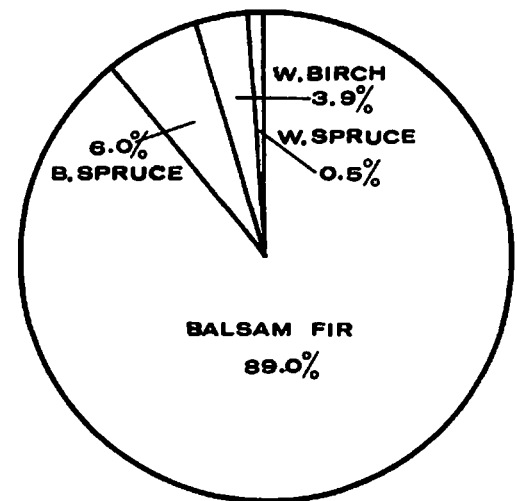


NUMBER  
OF STEMS

BASAL  
AREA



AGE  
56-70





## BALSAM FIR

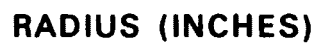


Fig. 21  
 STEM ANALYSIS DIAGRAM  
 HYLOCOMIUM FOREST TYPE  
 AGE: 42-53  
 BLACK SPRUCE

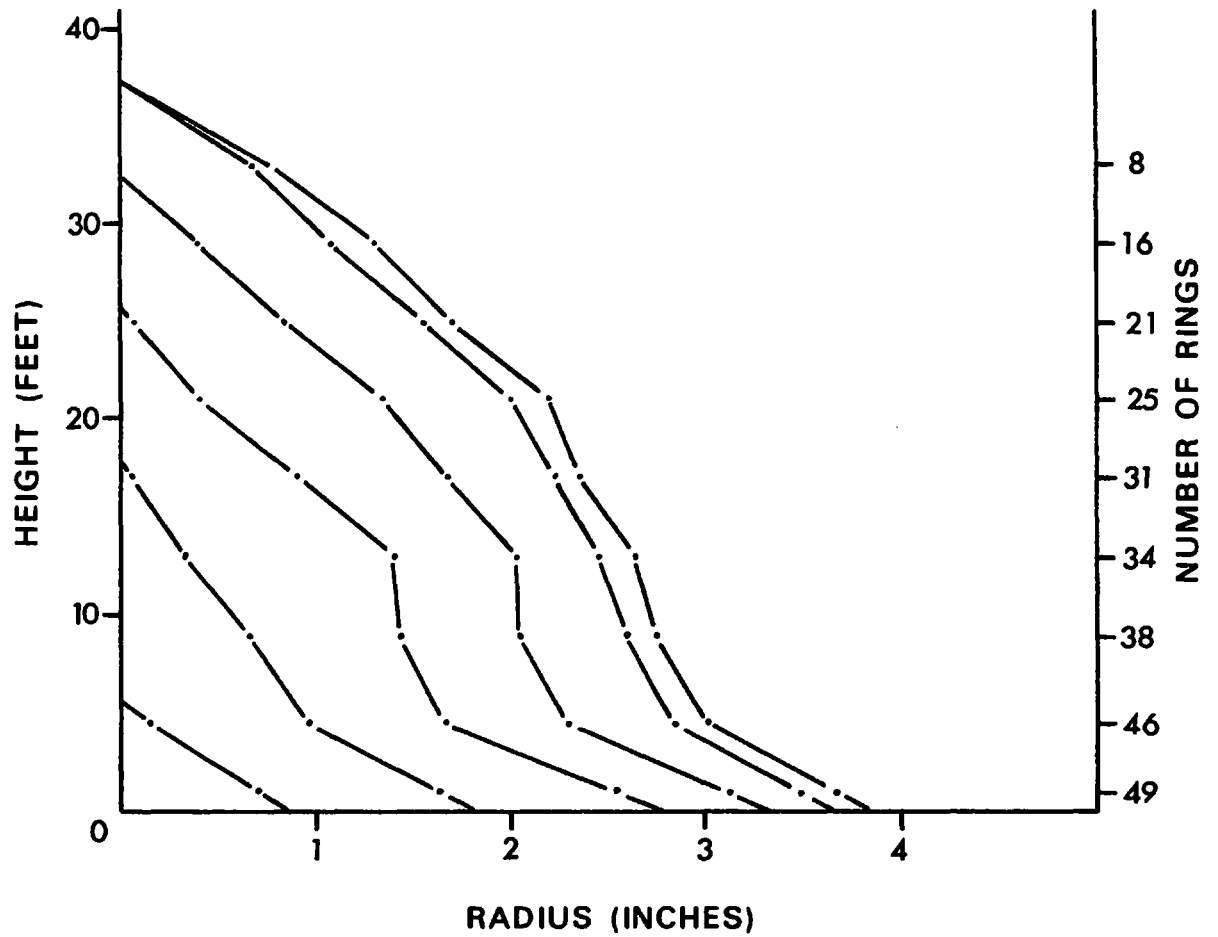


Table 12

STEM ANALYSIS DATA TABLE

HYLOCOMIUM FOREST TYPE

Age Class: 42 - 53

	BALSAM FIR (Fig. 20)	BLACK SPRUCE (Fig. 21)
Age at breast height (yrs)	48	46
Diameter breast height (inches)	5.53	6.00
Total height (feet)	41.70	37.40
Total volume (cu. ft.)	3.669	3.725
Merchantable volume (cu. ft.)	2.527	2.802
Total volume increment by decades:-		
1961-51	1.700 (46.3%)	1.483 (39.8%)
1951-41	1.262 (34.4%)	1.169 (31.4%)
1941-31	0.589 (16.1%)	0.790 (21.2%)
1931-21	0.098 ( 2.7%)	0.262 ( 7.0%)
1921-11	0.015 ( 0.4%)	0.031 ( 0.8%)
1911-01	0.005 ( 0.1%)	-
1901-1891	-	-
1891-81	-	-
1881-71	-	-
Merchantable volume increment 1961-51	0.983	0.898

Fig. 22  
STEM ANALYSIS DIAGRAM  
HYLOCOMIUM FOREST TYPE  
AGE: 56-70  
BALSAM FIR

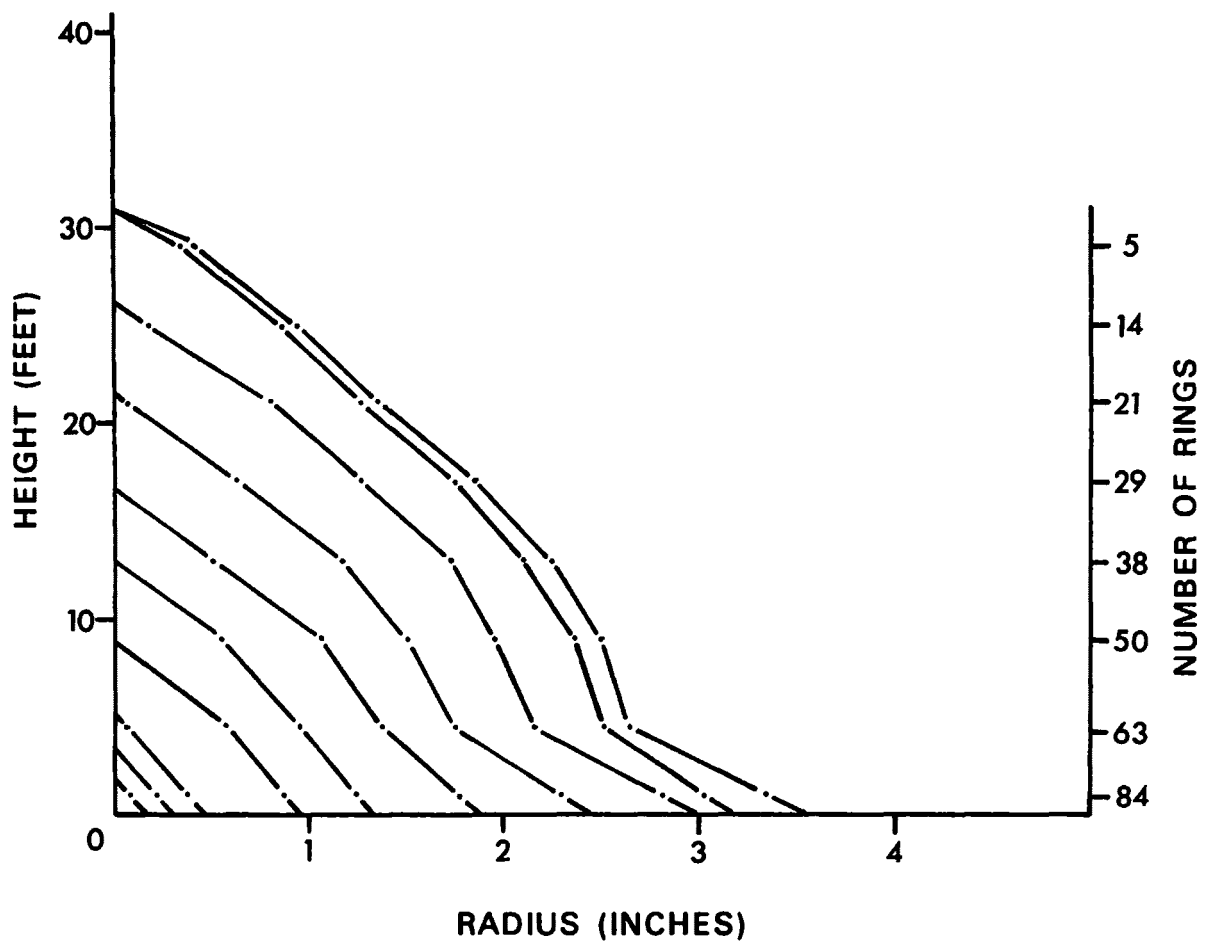


Fig. 23  
STEM ANALYSIS DIAGRAM  
HYLOCOMIUM FOREST TYPE  
AGE: 56-70  
BLACK SPRUCE

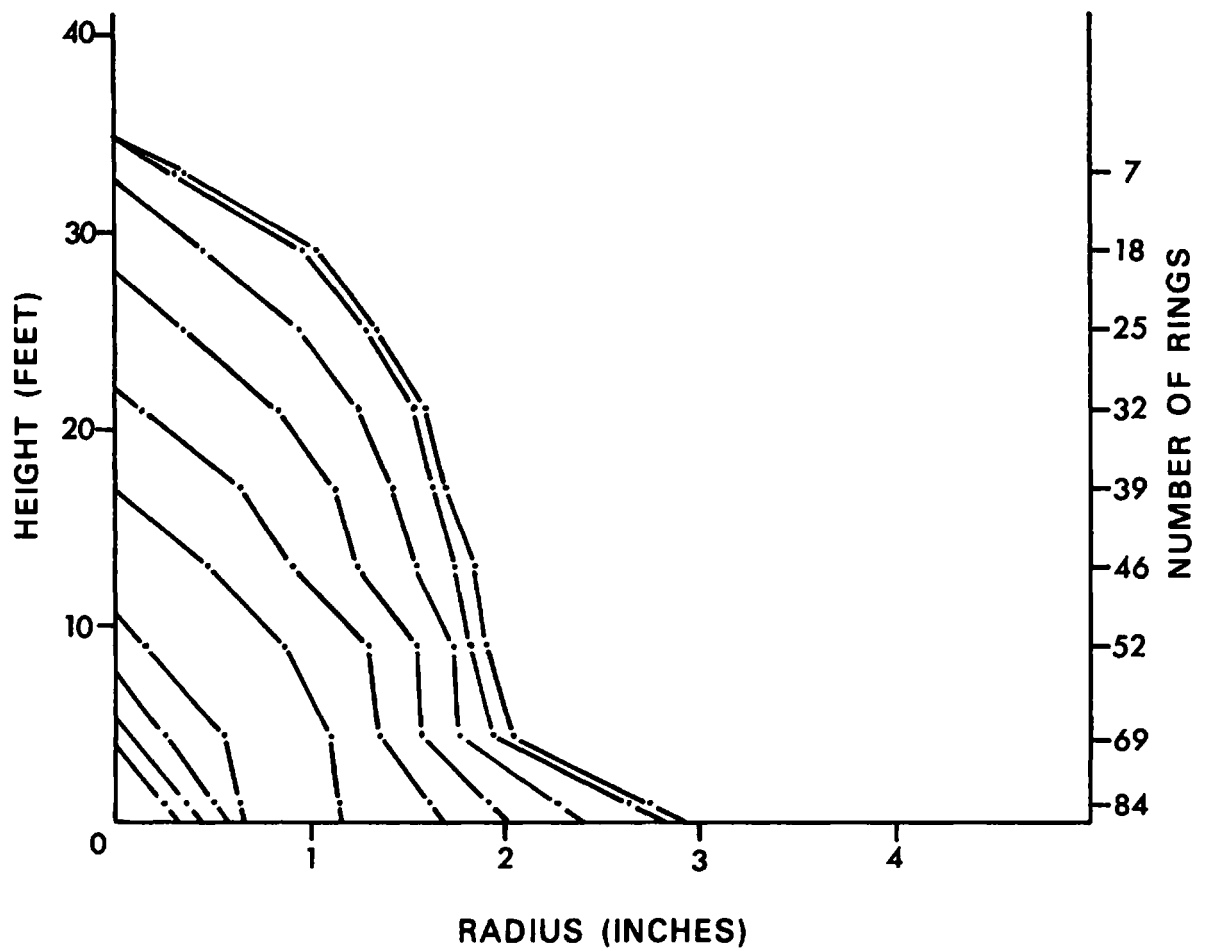


Table 13

STEM ANALYSIS DATA TABLE

HYLOCOMIUM FOREST TYPE

Age Class: 56 - 70

	BALSAM FIR (Fig. 22)	BLACK SPRUCE (Fig. 23)
Age at breast height (yrs)	63	69
Diameter breast height (inches)	5.30	4.10
Total height (feet)	30.80	34.80
Total volume (cu. ft.)	2.518	2.002
Merchantable volume (cu. ft.)	1.848	1.196
Total volume increment by decades:-		
1961-51	0.821 (32.6%)	0.524 (26.2%)
1951-41	0.750 (29.8%)	0.515 (25.7%)
1941-31	0.463 (18.4%)	0.379 (18.9%)
1931-21	0.285 (11.3%)	0.310 (15.5%)
1921-11	0.123 (4.9%)	0.223 (11.1%)
1911-01	0.067 (2.7%)	0.031 (1.5%)
1901-1891	0.006 (0.2%)	0.012 (0.6%)
1891-81	0.003 (0.1%)	0.005 (0.2%)
1801-71	-	0.003 (0.1%)
Merchantable volume increment 1961-51	0.480	0.228

## Pleurozium Forest Type

### Description

Well-stocked stands of balsam fir, with an admixture of white spruce, make up this type. Small amounts of black spruce and white birch are usually also present. Shrubs and herbs are rare or absent. A moss carpet, dominated by Pleurozium schreberi, completely covers the forest floor.

This forest type is of widespread occurrence throughout the sample area. It is found on well-drained dry to moist sites. Soils are typically orthic or humic podzols, occasionally with slight mottling in the A<sub>2</sub> horizon.

### Mensurational Characteristics

The balsam fir height/diameter curve (Fig. 24) shows heights of 36 and 37 feet corresponding to diameters of 6 inches and 8 inches; for white spruce (Fig. 25) these diameters correspond to heights of 30 and 33 feet. The balsam fir height/age curve (Fig. 26) reaches a height of 35 feet at 40 years and 38 feet at 50 years. White spruce height development is slower (Fig. 27), reaching 29 feet at 40 years and 31 feet at 50 years.

Softwood merchantable volume totals 2,890 cubic feet per acre (Table 14). There are an average of 2,646 living stems per acre (Table 15) and a basal area of 236 square feet per acre. Balsam fir constitutes 79% of the stands in terms of number of stems (Fig. 28) and 78% in terms of basal area. The spruces form an additional 15% of the number of stems and 18% of the basal area. The white spruce sample tree has shown more rapid volume growth than the balsam fir sample tree (Figs 29 and 30, Table 16).

Balsam fir regeneration is reasonably good; 70% of the sample quadrats were stocked (Table 26) and there are an average of 8,800 young balsam fir stems per acre (Table 27).

Fig. 24  
HEIGHT/DIAMETER CURVE  
PLEUROZIUM FOREST TYPE  
AGE CLASS: 34-49  
BALSAM FIR

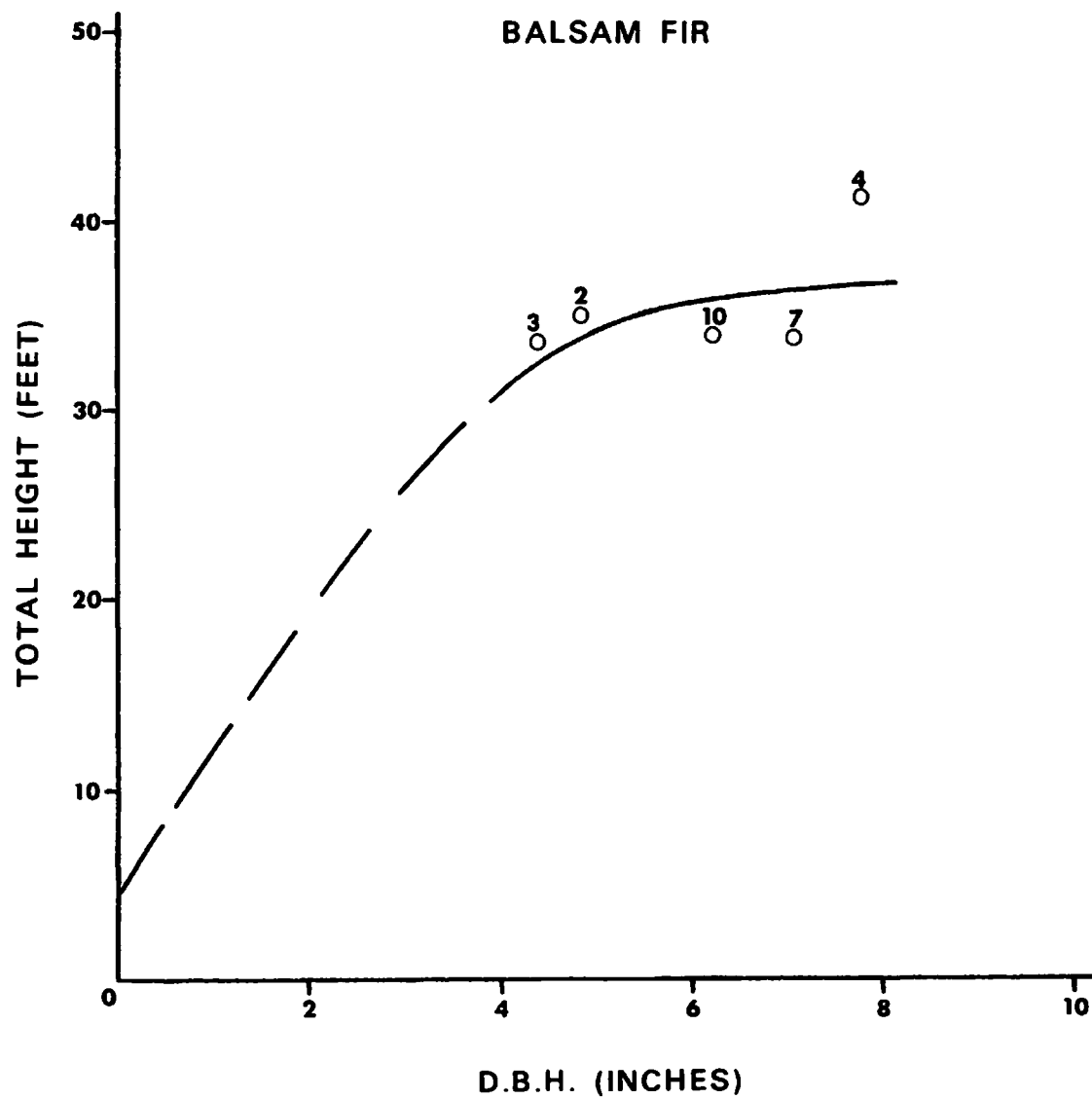




Fig. 25  
HEIGHT/DIAMETER CURVE  
PLEUROZIUM FOREST TYPE  
AGE CLASS: 34-49  
WHITE SPRUCE

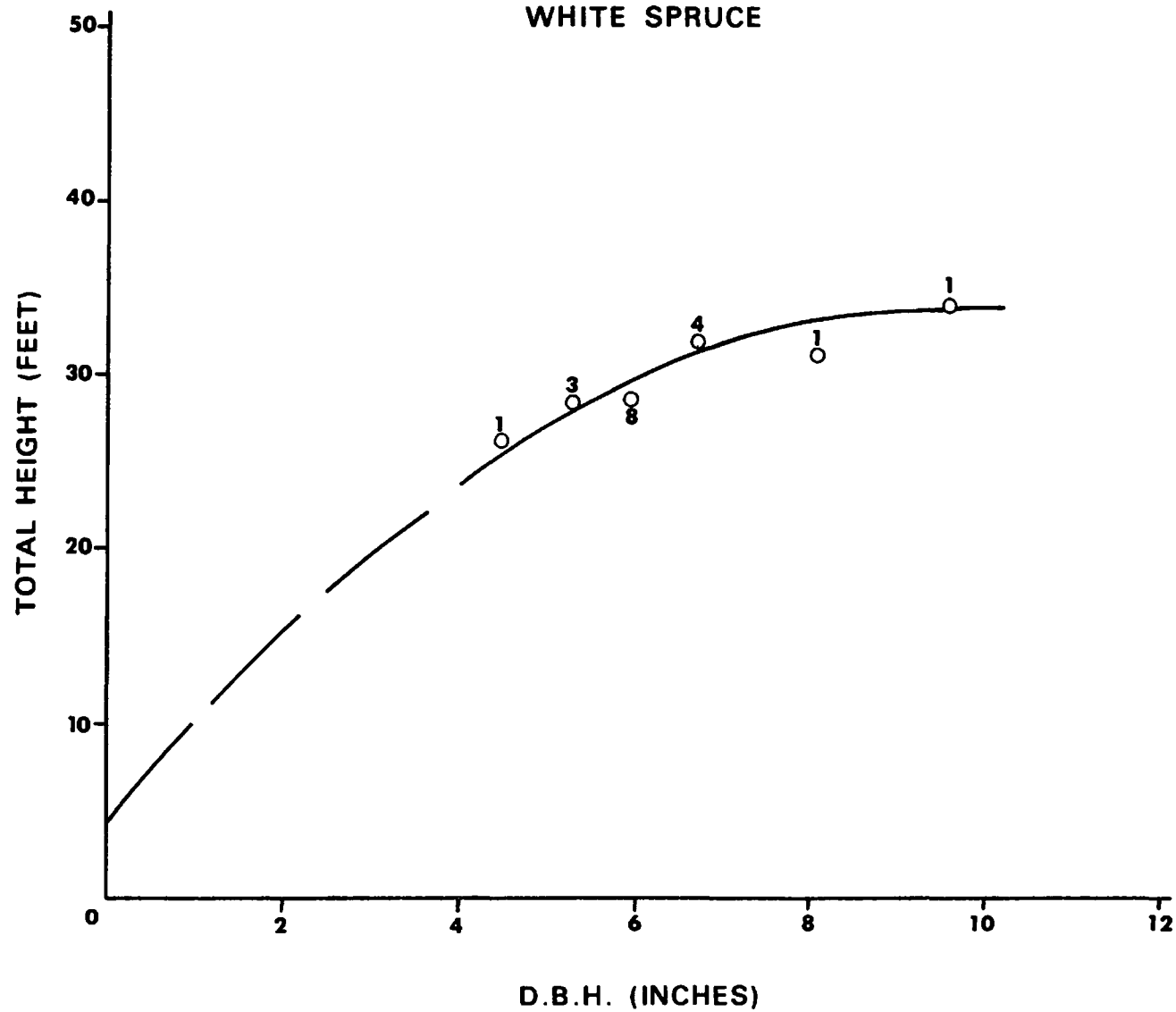


Fig. 26  
HEIGHT/AGE CURVE  
PLEUROZIUM FOREST TYPE  
AGE CLASS: 34-49  
BALSAM FIR

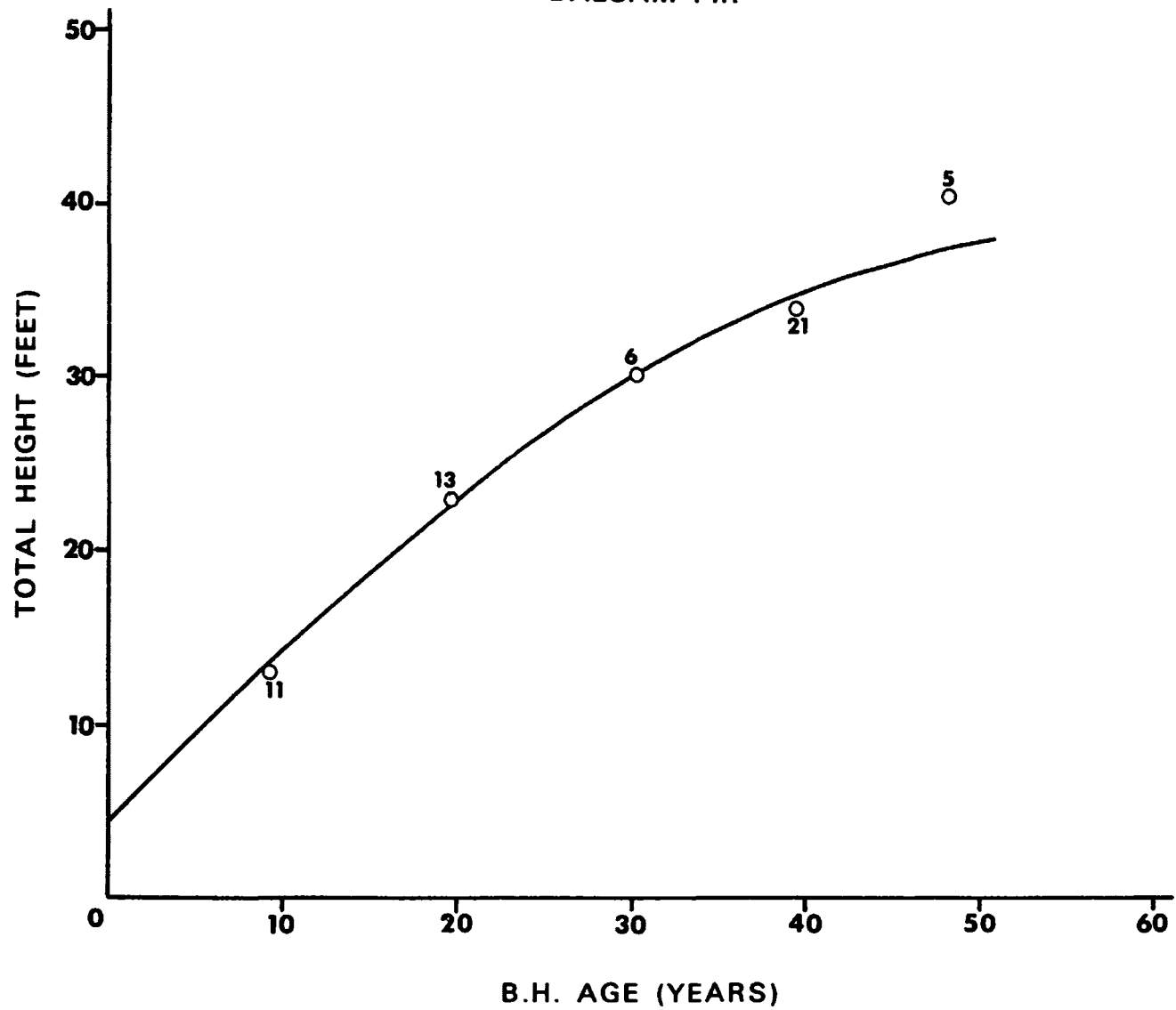


Fig. 27  
HEIGHT/AGE CURVE  
PLEUROZIUM FOREST TYPE  
AGE CLASS: 34-49  
WHITE SPRUCE

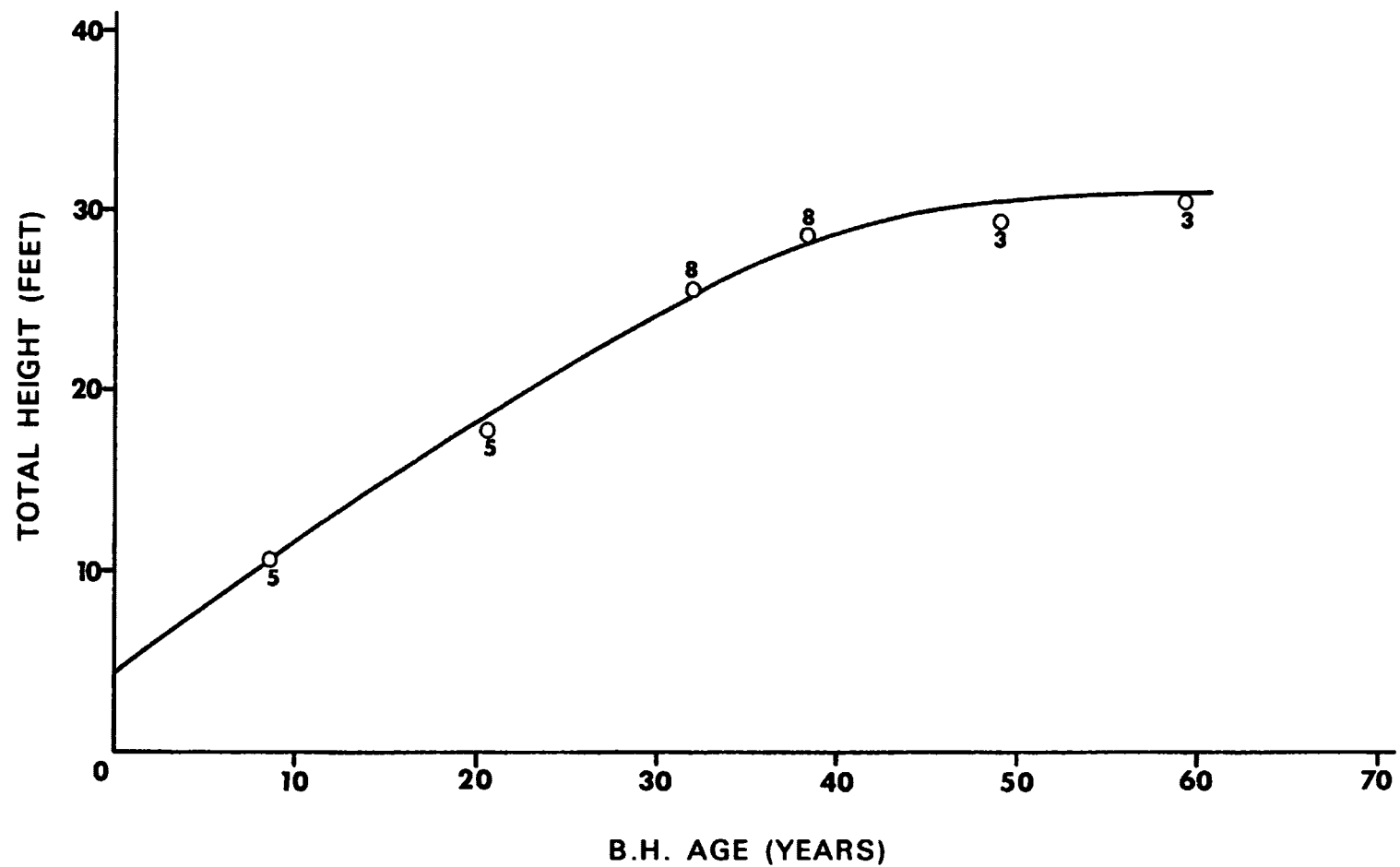


Table 14

LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

PLEUROZIUM FOREST TYPE

Age: 34 - 49

SPECIES FORM CLASS		BALSAM FIR 70		BLACK SPRUCE 60			WHITE SPRUCE 60		
		Merch. Vol.*	Merch. Vol.	Merch. Vol.*		Merch. Vol.	Merch. Vol.*		Merch. Vol.
D.B.H. (Inches)	Ht. Ft.	Per Tree Cu. Ft.	Per Acre Cu. Ft.	Ht. Ft.	Per Tree Cu. Ft.	Per Acre Cu. Ft.	Ht. Ft.	Per Tree Cu. Ft.	Per Acre Cu. Ft.
4	27	1.2	379	25	.9	14	25	.9	69
5	31	2.0	600	27	1.6	27	27	1.6	101
6	35	3.2	714	29	2.4	19	29	2.4	84
7	37	4.4	493	30	3.4	20	30	3.4	48
8	38	5.8	174	31	4.7	19	31	4.7	19
9	39	7.6	53	-	-	-	32	6.1	18
10	39	9.5	29	-	-	-	-	-	-
11	-	-	-	-	-	-	32	9.5	10
TOTAL			2442			99			349

\*Stump height one foot: Top diameter outside bark three inches.

Table 15

## STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

## PLEUROZIUUM FOREST TYPE

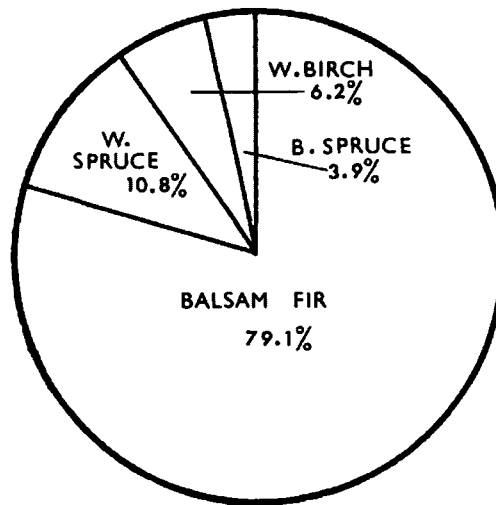
Age: 34 - 49

Number of Plots: 10

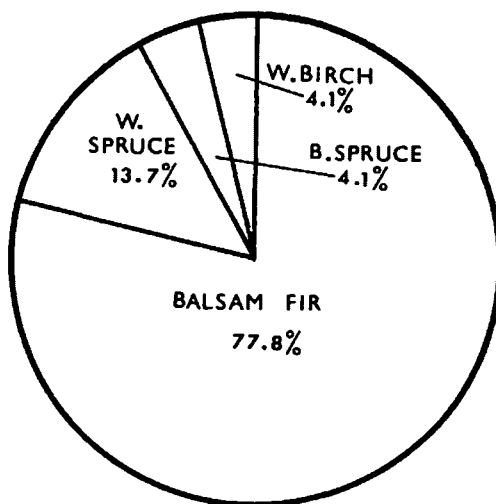
D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			WHITE SPRUCE			WHITE BIRCH			TOTALS		
	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal	No. of trees		Basal
	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*
1	398.0	426.0	1.99	14.0	21.0	.07	2.0	60.0	.01	12.0	46.0	.06	426.0	555.0	2.13
2	373.0	250.0	8.21	21.0	1.0	.46	27.0	124.0	.59	59.0	52.0	1.30	480.0	431.0	10.56
3	332.0	113.0	16.27	16.0	1.0	.78	61.0	79.0	2.99	50.0	7.0	2.45	459.0	201.0	22.49
4	316.0	41.0	27.49	16.0	-	1.39	77.0	41.0	6.70	21.0	3.0	1.83	430.0	86.0	37.41
5	300.0	11.0	40.80	17.0	-	2.31	63.0	11.0	8.57	11.0	-	1.50	391.0	22.0	53.18
6	223.0	5.0	43.71	8.0	-	1.57	35.0	-	6.86	4.0	-	.78	270.0	5.0	52.92
7	112.0	3.0	29.90	6.0	-	1.60	14.0	3.0	3.74	4.0	-	1.07	136.0	6.0	36.31
8	30.0	-	10.47	4.0	-	1.40	4.0	3.0	1.40	2.0	-	.70	40.0	3.0	13.97
9	7.0	-	3.09	-	-	-	3.0	-	1.33	-	-	-	10.0	-	4.42
10	3.0	-	1.64	-	-	-	-	1.0	-	-	-	-	3.0	1.0	1.64
11	-	-	-	-	-	-	1.0	-	.66	-	-	-	1.0	-	.66
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	1.0	-	-	-	-	-	-	-	-	-	-	-	1.0	-
<hr/>															
TOTAL	2094.0	850.0	183.57	102.0	23.0	9.58	287.0	322.0	32.85	163.0	108.0	9.69	2646.0	1311.0	235.69

\*Living trees

**Fig. 28 STAND TABLE DIAGRAMS: PLEUROZIUM  
FOREST TYPE**



**NUMBER OF STEMS**



**BASAL AREA**

Fig. 29  
STEM ANALYSIS DIAGRAM  
PLEUROZIUM FOREST TYPE  
AGE: 34-49  
BALSAM FIR

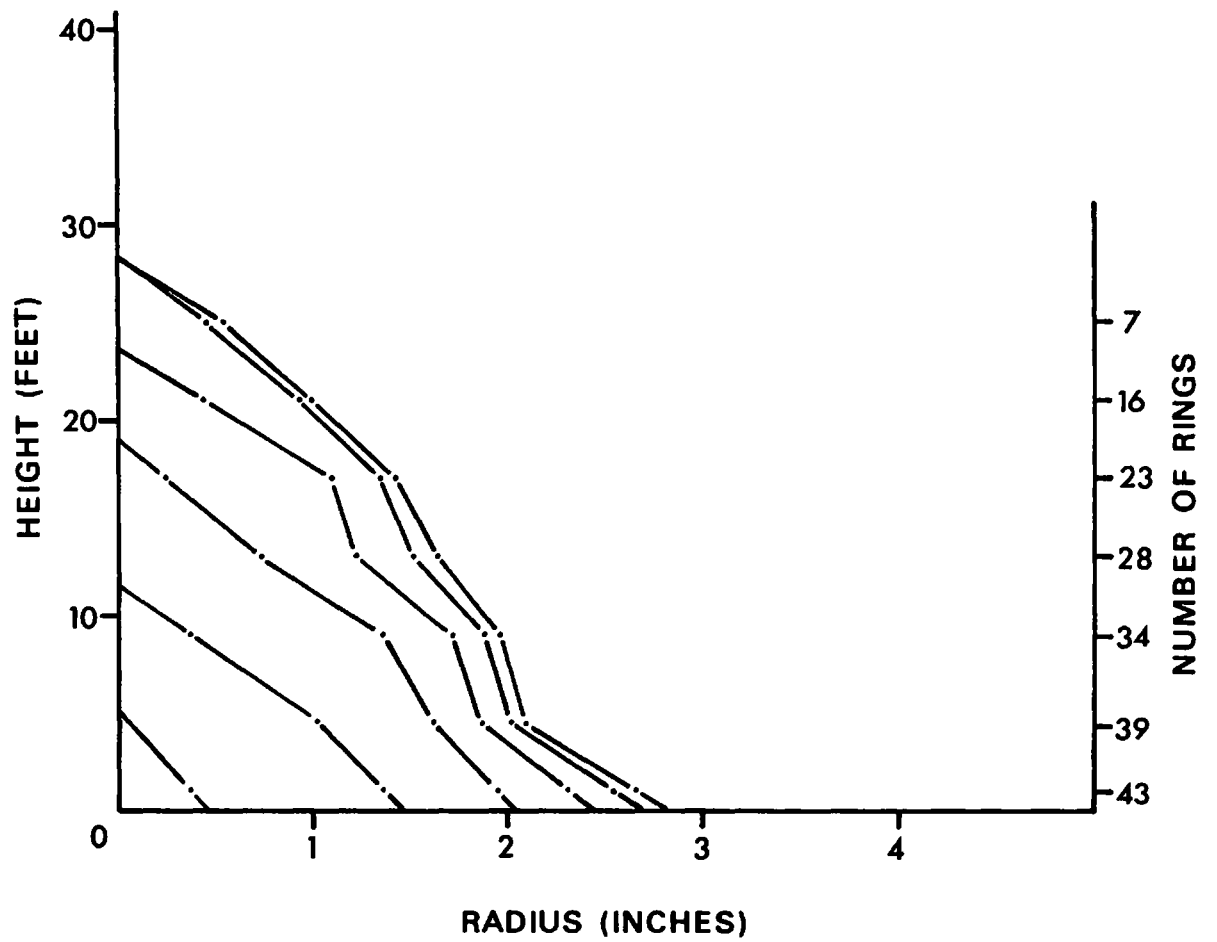


Fig. 30  
STEM ANALYSIS DIAGRAM  
PLEUROZIUM FOREST TYPE  
AGE: 34-49  
WHITE SPRUCE

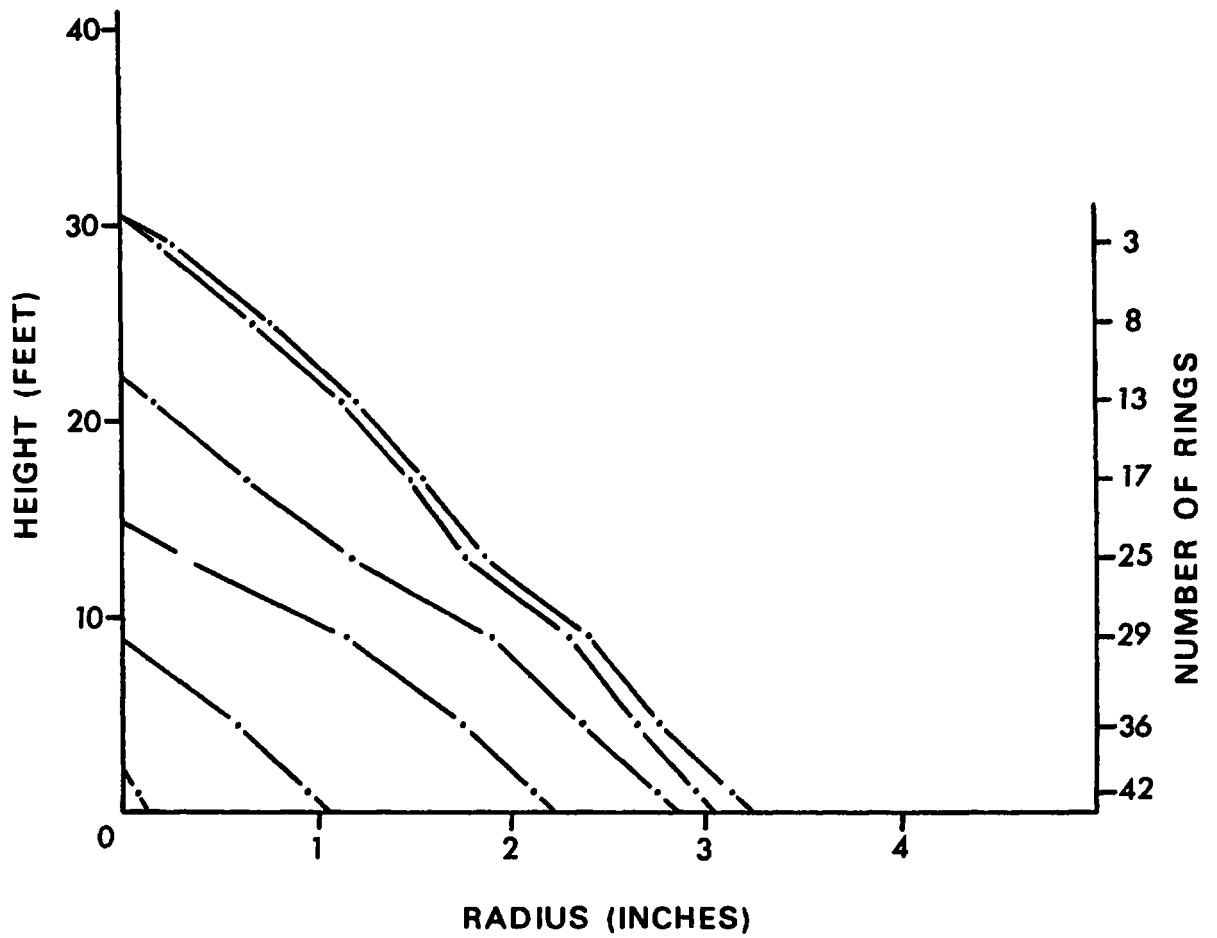




Table 16

STEM ANALYSIS DATA TABLE

PLEUROZIUM FOREST TYPE

Age Class: 34 - 49

	BALSAM FIR (Fig. 29)	WHITE SPRUCE (Fig. 30)
Age at breast height (yrs)	39	36
Diameter breast height (inches)	4.20	5.54
Total height (feet)	28.20	30.40
Total volume (cu. ft.)	1.534	2.244
Merchantable volume (cu. ft.)	0.921	1.396
Total volume increment by decades:-		
1961-51	0.410 (26.7%)	0.808 (36.0%)
1951-41	0.438 (28.6%)	0.772 (34.4%)
1941-31	0.469 (30.6%)	0.581 (25.9%)
1931-21	0.208 (13.6%)	0.083 ( 3.7%)
1921-11	0.009 ( 0.6%)	-
1911-01	-	-
1901-1891	-	-
1891-81	-	-
1881-71	-	-
Merchantable volume increment 1961-51	0.156	0.276

## Dicranum-Nemopanthus Forest Type

### Description

This type is composed of well-stocked stands of black spruce, with an admixture of balsam fir. Scattered larch and white birch also occur in most stands. The shrub layer is normally well-developed and occasionally dense. The major species are Nemopanthus mucronatus, Viburnum cassinoides, and Alnus crispa; Kalmia angustifolia and Vaccinium angustifolium are also present in some of the more open stands. Herbs are rare or absent and the moss layer is poorly developed, being composed mainly of Dicranum scoparium.

This is a common forest type in eastern Newfoundland, occupying very moist to wet sites on stony or rocky tills. Soils are typically gleysols with abundant mottling throughout the profile.

### Mensurational Characteristics

Diameters of 6 and 8 inches correspond to heights of 31 and 34 feet for balsam fir (Fig. 31) and 33 and 37 feet for black spruce (Fig. 32). Height/age curves for the two species (Figs. 33 and 34) are similar, reaching about 29 feet at 40 years, 31-32 feet at 50 years, and 33 feet at 60 years.

Total softwood merchantable volume averages 1,537 cubic feet per acre (Table 17). There are a total of 2,442 living stems per acre (Table 18) and a basal area of 157 square feet per acre. Black spruce constitutes 64%, balsam fir 15% and larch 4% of the number of stems (Fig. 35); corresponding figures for basal area are 13%, 79% and 4%.

The balsam fir sample tree has grown more rapidly in volume than the black spruce sample tree (Figs. 36 and 37, Table 19). Regeneration is only moderately good, with 54% of the sample quadrats stocked (Table 26). There are an average of 2,300 young balsam fir stems per acre (Table 27); no black spruce regeneration was recorded.

Fig. 31  
HEIGHT/DIAMETER CURVE  
DICRANUM-NEMOPANTHUS FOREST TYPE  
AGE: 45-51  
BALSAM FIR

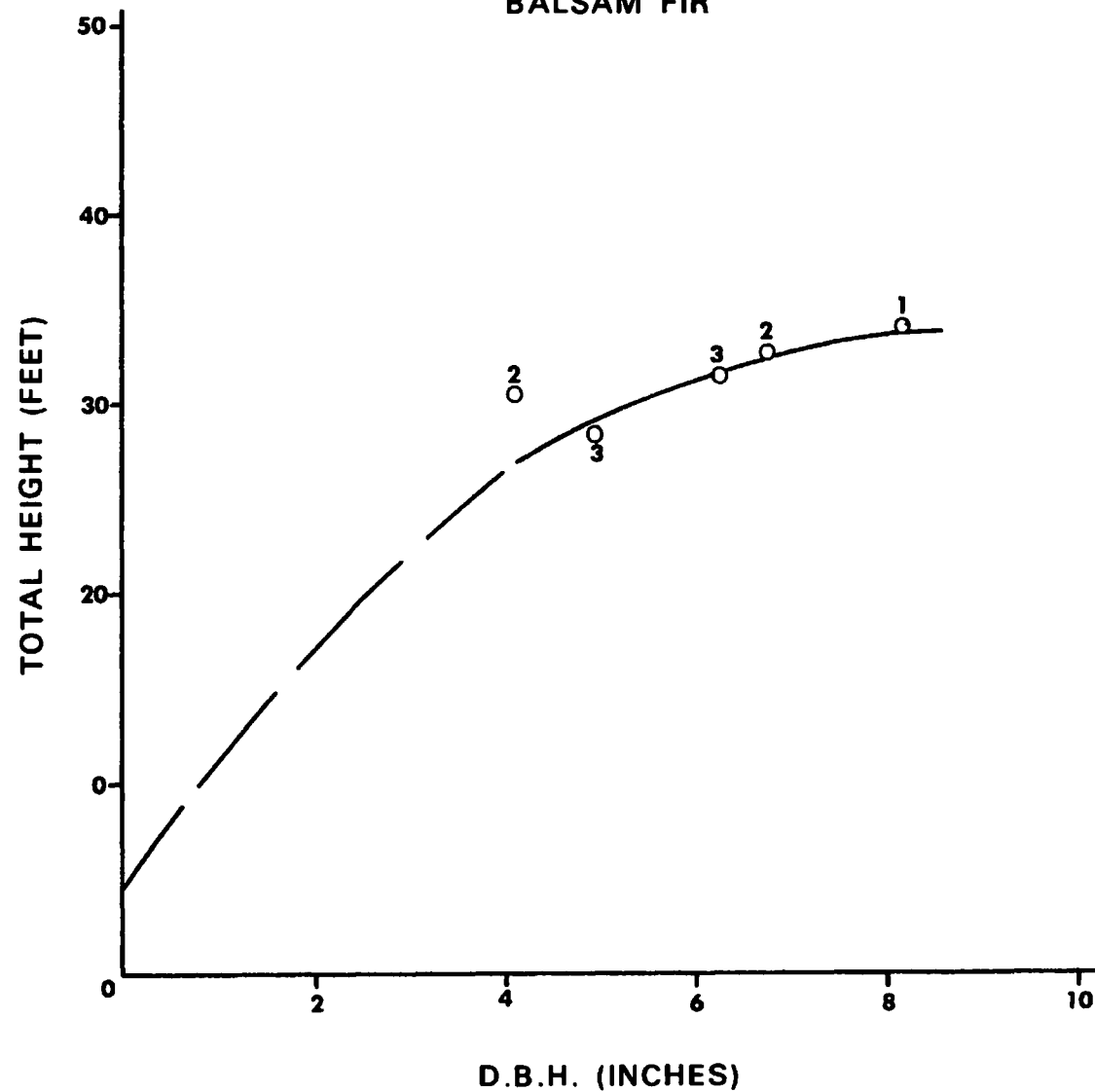


Fig. 32  
HEIGHT/DIAMETER CURVE  
DICRANUM-NEMOPANTHUS FOREST TYPE  
AGE CLASS: 45-51  
BLACK SPRUCE

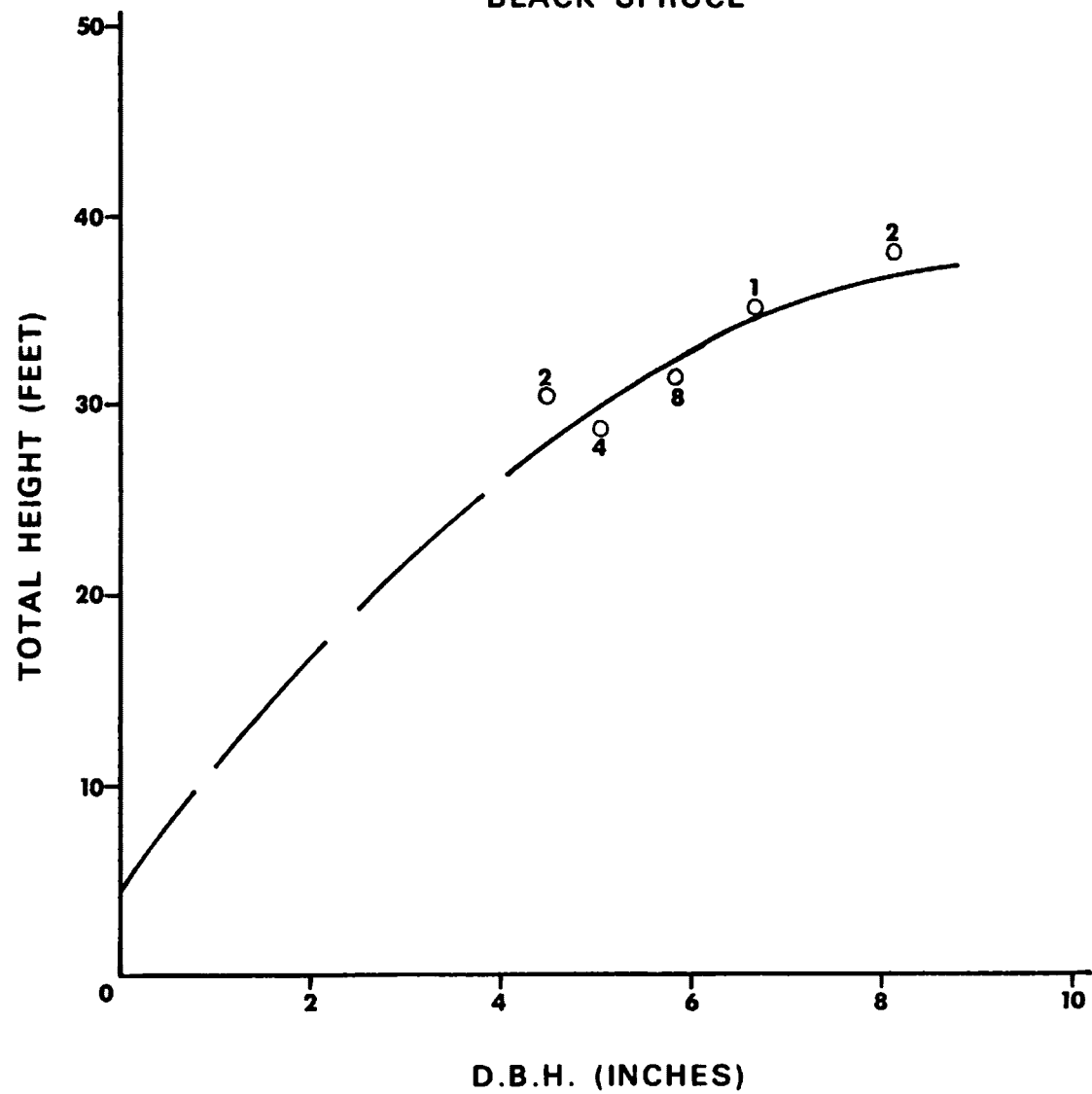


Fig. 33  
HEIGHT/AGE CURVE  
DICRANUM-NEMOPANTHUS FOREST TYPE  
AGE CLASS: 45-51  
BALSAM FIR

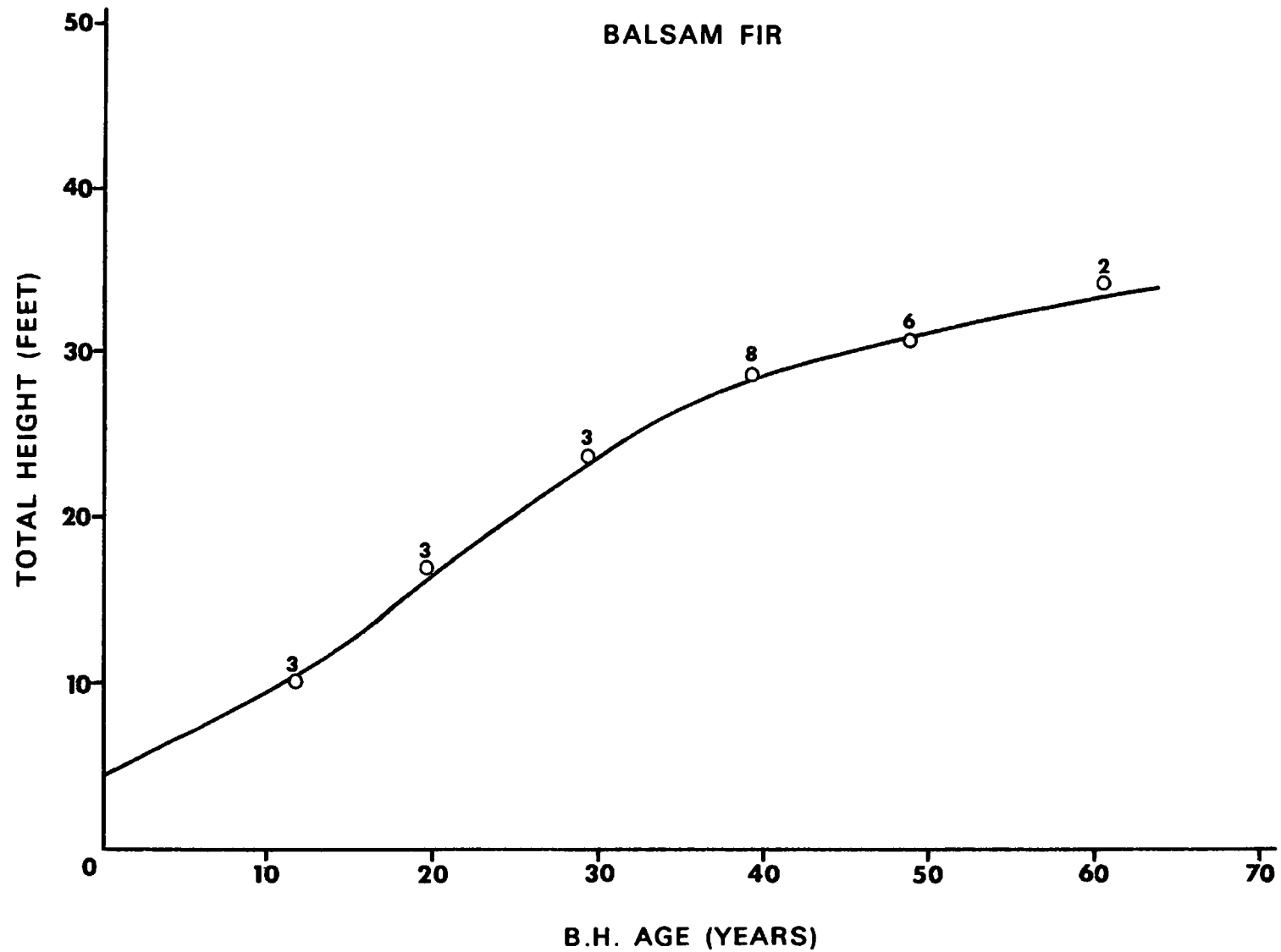


Fig. 34  
HEIGHT/AGE CURVE  
DICRANUM-NEMOPANTHUS FOREST TYPE  
AGE CLASS: 45-51  
BLACK SPRUCE

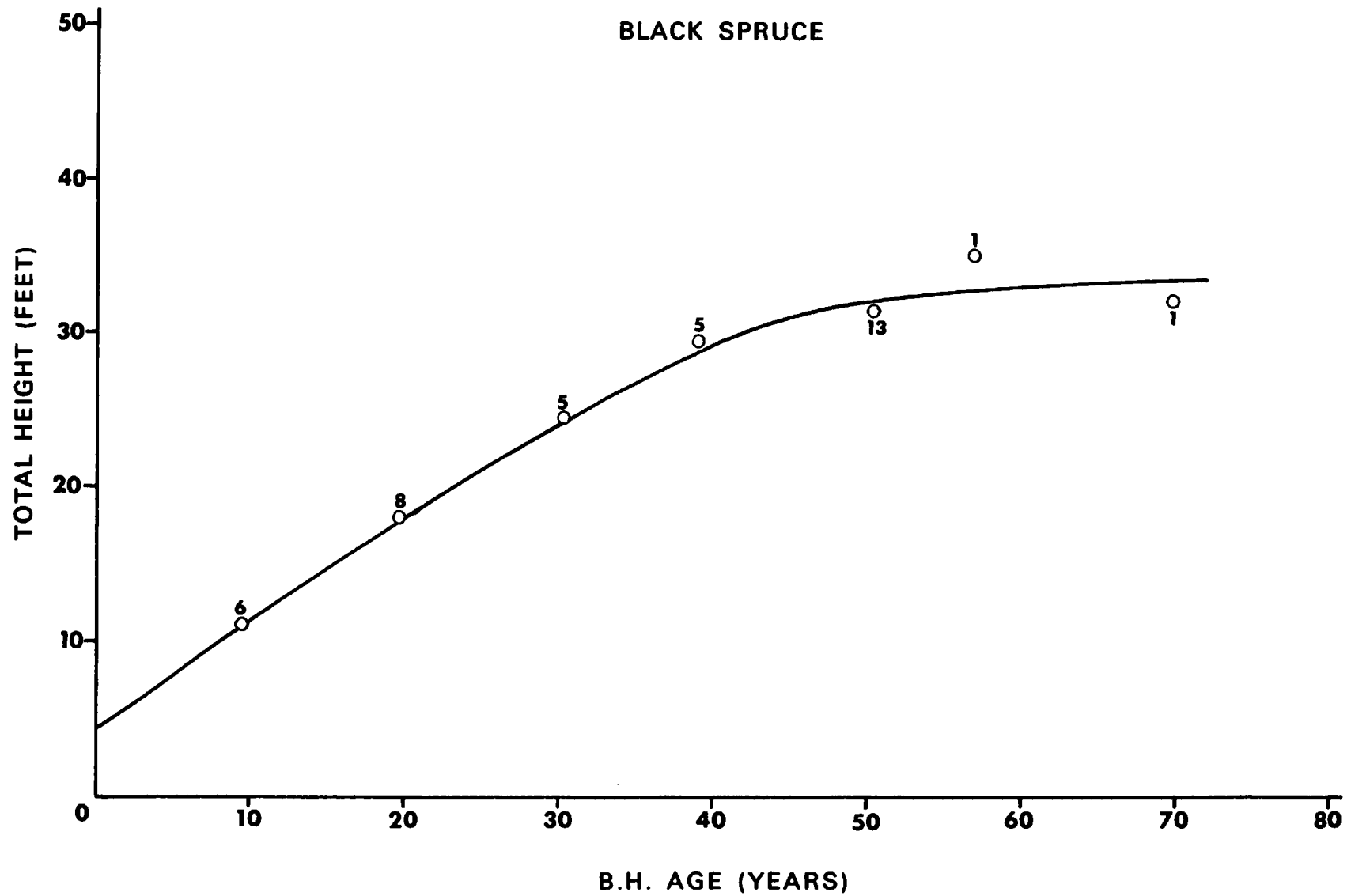


Table 17

LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

DICRANUM-NEMOPANTHUS FOREST TYPE

Age: 45 - 51

SPECIES		BALSAM FIR		BLACK SPRUCE			LARCH		
FORM CLASS		60		70			70		
D.B.H. (Inches)	Ht. Ft.	Merch. Vol.*	Merch. Vol.	Ht. Ft.	Merch. Vol.*	Merch. Vol.	Ht. Ft.	Merch. Vol.*	Merch. Vol.
		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.
4	27	1.2	48	26	.9	281	26	.9	9
5	30	2.0	43	29	1.5	440	29	1.5	20
6	31	2.9	24	32	2.6	347	32	2.6	13
7	33	4.0	53	35	3.9	163	-	-	-
8	34	5.3	27	37	5.6	19	-	-	-
9	35	6.8	23	39	7.6	13	-	-	-
10	36	8.3	14	-	-	-	-	-	-
TOTAL			232			1263			42

\*Stump height one foot: Top diameter outside bark three inches.

Table 18

STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

DICRANUM-NEMOPANTHUS FOREST TYPE

Age: 45 - 51

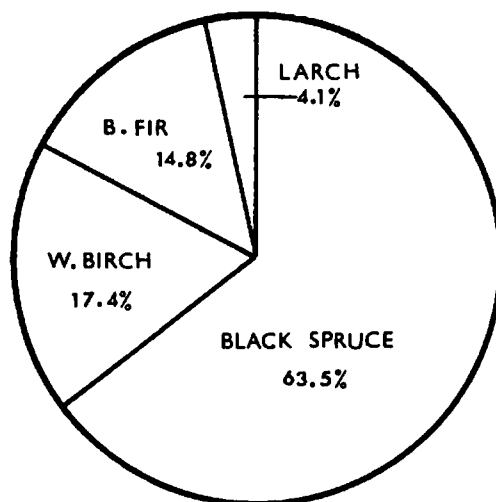
Number of Plots: 6

D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			LARCH			WHITE BIRCH			TOTALS		
	No.of trees		Basal Area Sq.Ft.*	No.of trees		Basal Area Sq.Ft.*	No.of trees		Basal Area Sq.Ft.*	No.of trees		Basal Area Sq.Ft.*	No.of trees		Basal Area Sq.Ft.*
	Living	Dead		Living	Dead		Living	Dead		Living	Dead		Living	Dead	
1	148.3	10.0	.74	290.0	98.3	1.45	15.0	11.7	.08	271.7	48.3	1.36	725.0	168.3	3.63
2	91.7	-	2.02	233.3	48.3	5.13	28.3	10.0	.62	113.3	10.0	2.49	466.6	68.3	10.26
3	28.3	1.7	1.39	245.0	25.0	12.01	28.3	-	1.39	31.7	3.3	1.55	333.3	30.0	16.34
4	40.0	-	3.48	311.7	23.3	27.12	10.0	-	.87	8.3	-	.73	370.0	23.3	32.20
5	21.7	-	2.95	293.3	1.7	39.89	13.3	-	1.81	1.7	-	.23	330.0	1.7	44.88
6	8.3	-	1.63	133.3	-	26.13	5.0	-	.98	-	-	-	146.6	-	28.74
7	13.3	-	3.56	41.7	-	11.13	-	-	-	-	-	-	55.0	-	14.69
8	5.0	-	1.75	3.3	-	1.16	-	-	-	-	-	-	8.3	-	2.91
9	3.3	-	1.47	1.7	-	.74	-	-	-	-	-	-	5.0	-	2.21
10	1.7	-	.91	-	-	-	-	-	-	-	-	-	1.7	-	.91
TOTAL	361.6	11.7	19.90	1553.3	196.6	124.76	99.9	21.7	5.75	426.7	61.6	6.36	2441.5	291.6	156.77

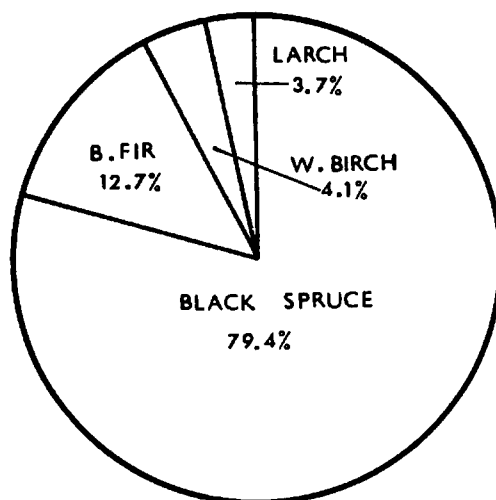
\*Living trees.



**Fig. 35 STAND TABLE DIAGRAMS: DICRANUM-  
NEMOPANTHUS FOREST TYPE**



**NUMBER OF STEMS**



**BASAL AREA**

Fig. 36  
 STEM ANALYSIS DIAGRAM  
 DICRANUM-NEMOPANTHUS FOREST TYPE  
 AGE: 45-51  
 BALSAM FIR

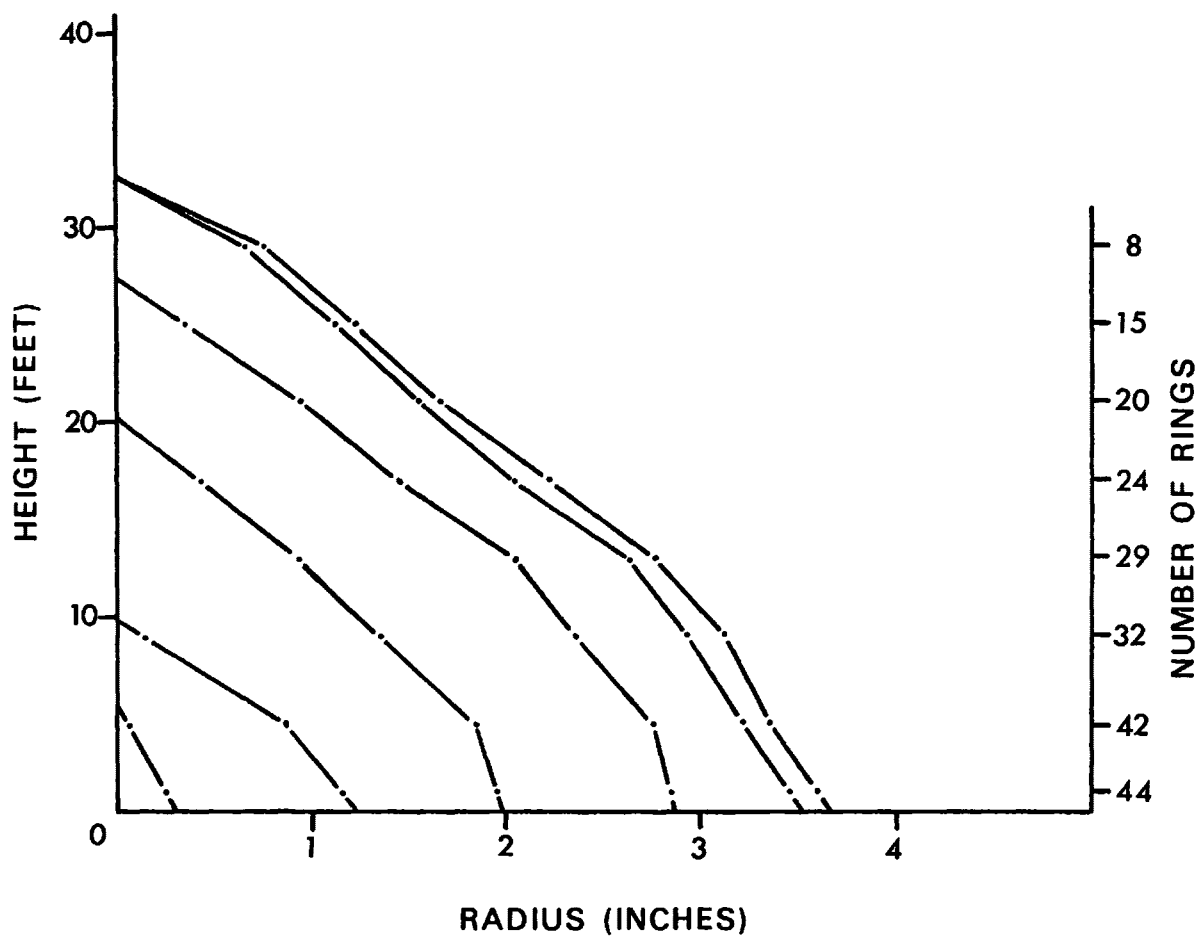


Fig. 37  
 STEM ANALYSIS DIAGRAM  
 DICRANUM-NEMOPANTHUS FOREST TYPE  
 AGE: 45-51  
 BLACK SPRUCE

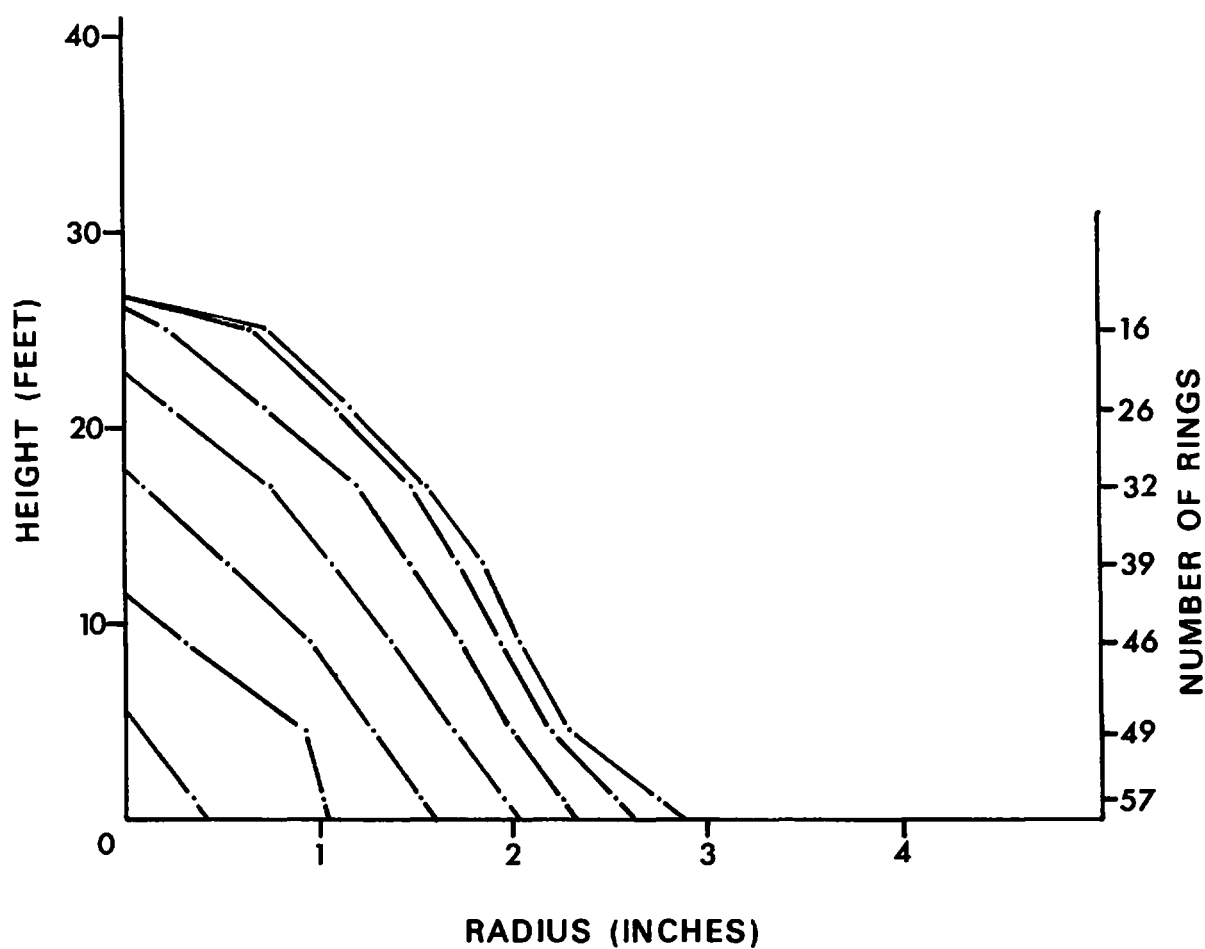


Table 19

STEM ANALYSIS DATA TABLE

DICRANUM-NEMOPANTHUS FOREST TYPE

Age Class: 45 - 51

	BALSAM FIR (Fig. 36)	BLACK SPRUCE (Fig. 37)
Age at breast height (yrs)	42	49
Diameter breast height (inches)	6.71	4.59
Total height (feet)	33.30	26.60
Total volume (cu. ft.)	3.756	1.736
Merchantable volume (cu. ft.)	2.723	0.990
Total volume increment by decades:-		
1961-51	1.445 (38.5%)	0.431 (24.8%)
1951-41	1.524 (40.6%)	0.486 (28.0%)
1941-31	0.642 (17.1%)	0.425 (24.5%)
1931-21	0.142 ( 3.8%)	0.251 (14.5%)
1921-11	0.003 ( 0.1%)	0.135 ( 7.8%)
1911-01	-	0.008 ( 0.5%)
1901-1891	-	-
1891-81	-	-
1881-71	-	-
Merchantable volume increment 1961-51	0.867	0.179

## Rubus-Vaccinium Forest Type

### Description

Stands of this type are usually moderately well-stocked and composed of black spruce with an admixture of balsam fir and white birch. Scattered larch and trembling aspen are also present in many stands. The shrub layer is well-developed in most stands, and consists of Nemopanthus mucronatus, Viburnum cassinoides, V. edule, Alnus crispa, Cornus stolonifera, and occasionally Acer rubrum. Herbs and ferns such as Lycopodium lucidulum, Viola incognita, Solidago macrophylla, Dryopteris spinulosa, D. disjuncta, and Athyrium filix-femina are abundant. The moss layer, composed mainly of Dicranum undulatum, D. majus, Rhytidiadelphus loreus, and R. triquetrus, is incomplete and does not cover the whole forest floor.

This forest type is fairly common in eastern Newfoundland, occurring on wet sites in rocky tills. Soils are usually seepage gleysols, with abundant mottling and sometimes a slight muck accumulation at the surface.

### Mensurational Characteristics

The balsam fir height/diameter curve (Fig. 38) shows heights of 32 and 37½ feet corresponding to diameters of 6 and 8 inches; for black spruce (Fig. 39), heights of 35 and 38 feet correspond to these same diameters. Early height growth of balsam fir is more rapid than that of black spruce (Figs 40 and 41), but ultimate heights attained by the two species are the same. The fir height/age curve shows heights of 32½, 35½, and 38 feet at 40, 50, and 60 years of age, respectively. At these same ages the black spruce curve shows heights of 30, 34½, and 38 feet.

Softwood merchantable volume totals 1,622 cubic feet per acre (Table 20). The number of living stems averages 1,913 per acre (Table 21), and basal area averages 156 square feet per acre. Black spruce constitutes 48%, balsam fir 11%, larch 3%, and white birch 26% of the stands in terms of number of stems (Fig. 42); in terms of basal area, black spruce forms 64%, balsam fir 14%, larch 5% and birch 15% of the stands.

The balsam fir stem analysis tree has shown more rapid volume growth than the black spruce tree (Figs 43 and 44, Table 22). Regeneration is moderately good, with 60% of the sample quadrats stocked (Table 26) and a total of 6,200 young balsam fir and black spruce stems per acre (Table 27).

Fig. 38  
HEIGHT/DIAMETER CURVE  
RUBUS-VACCINIUM FOREST TYPE  
AGE CLASS: 42-59  
BALSAM FIR

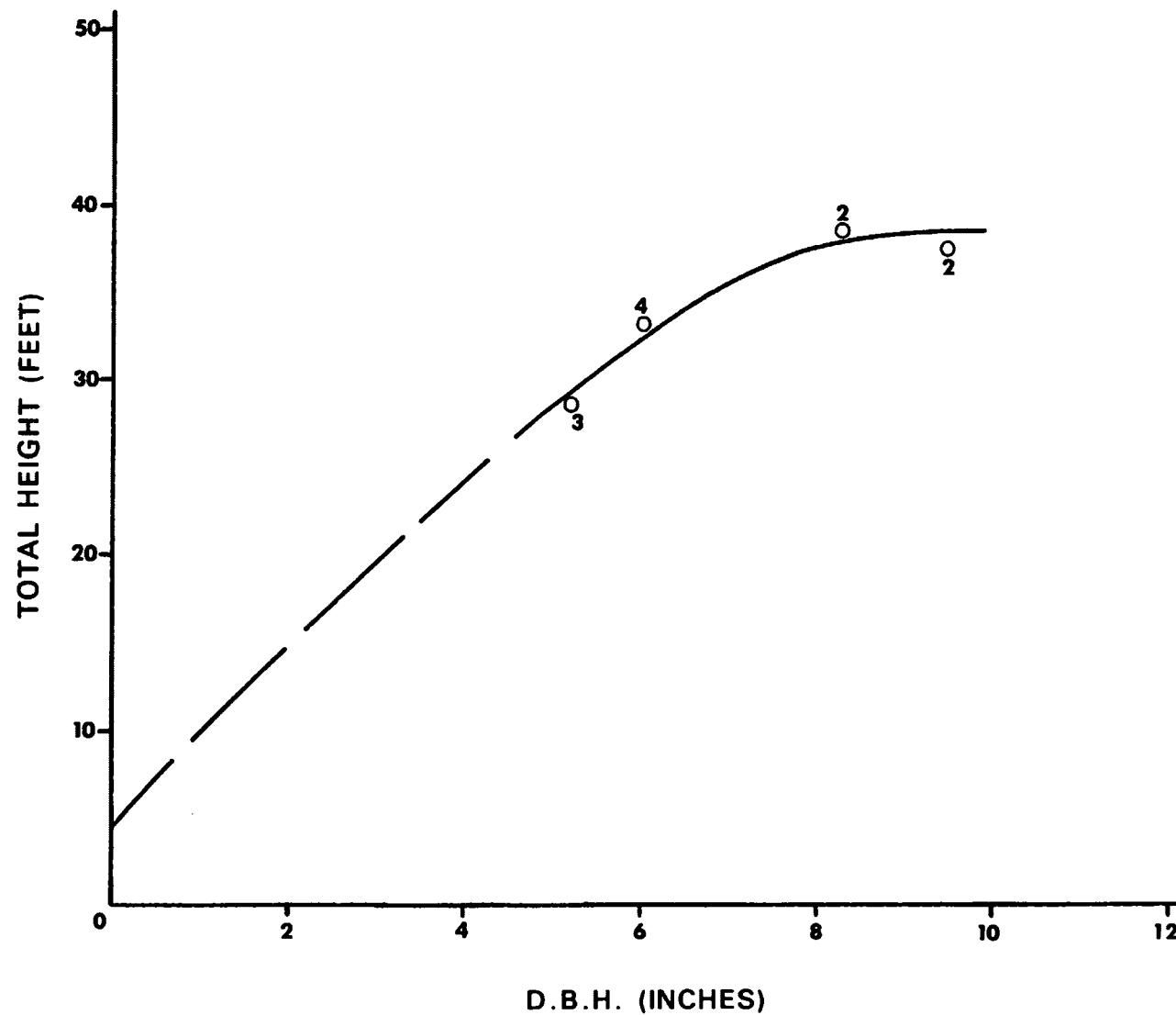


Fig. 39  
HEIGHT/DIAMETER CURVE  
RUBUS-VACCINIUM FOREST TYPE  
AGE CLASS: 42-59  
BLACK SPRUCE

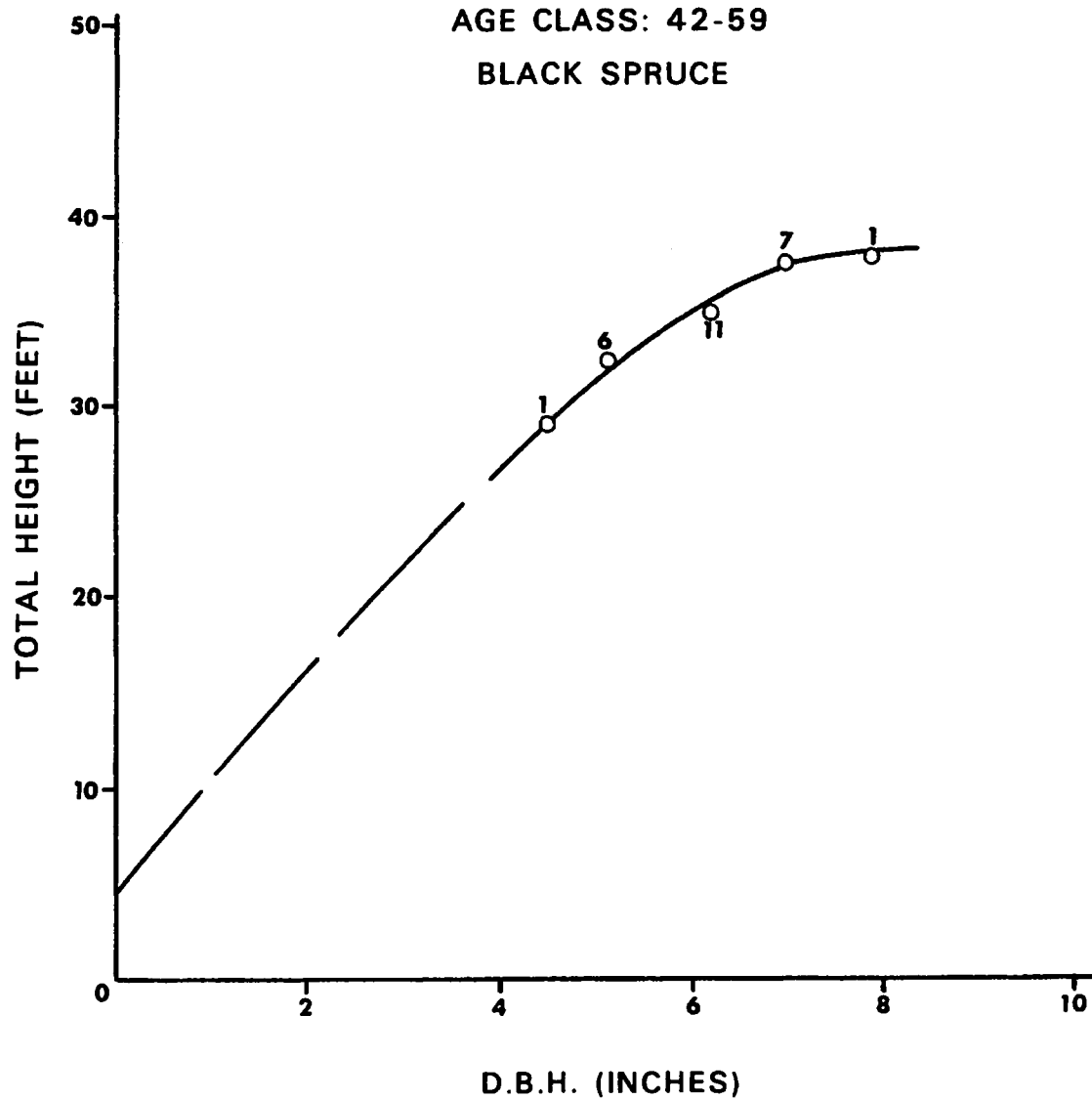


Fig. 40  
HEIGHT/AGE CURVE  
RUBUS-VACCINIUM FOREST TYPE  
AGE CLASS: 42-59  
BALSAM FIR

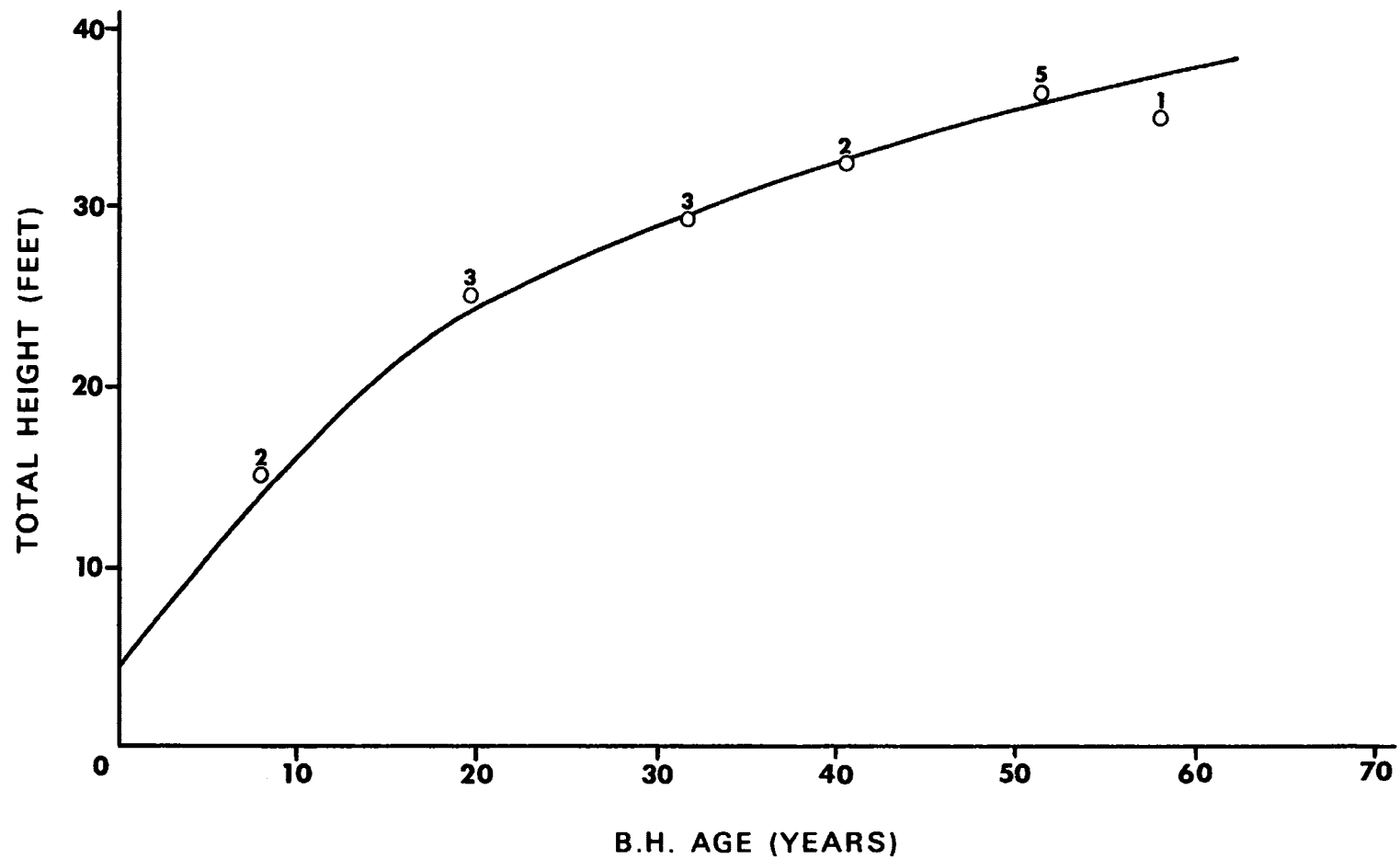




Fig. 41  
HEIGHT/AGE CURVE  
RUBUS-VACCINIUM FOREST TYPE  
AGE CLASS: 42-59  
BLACK SPRUCE

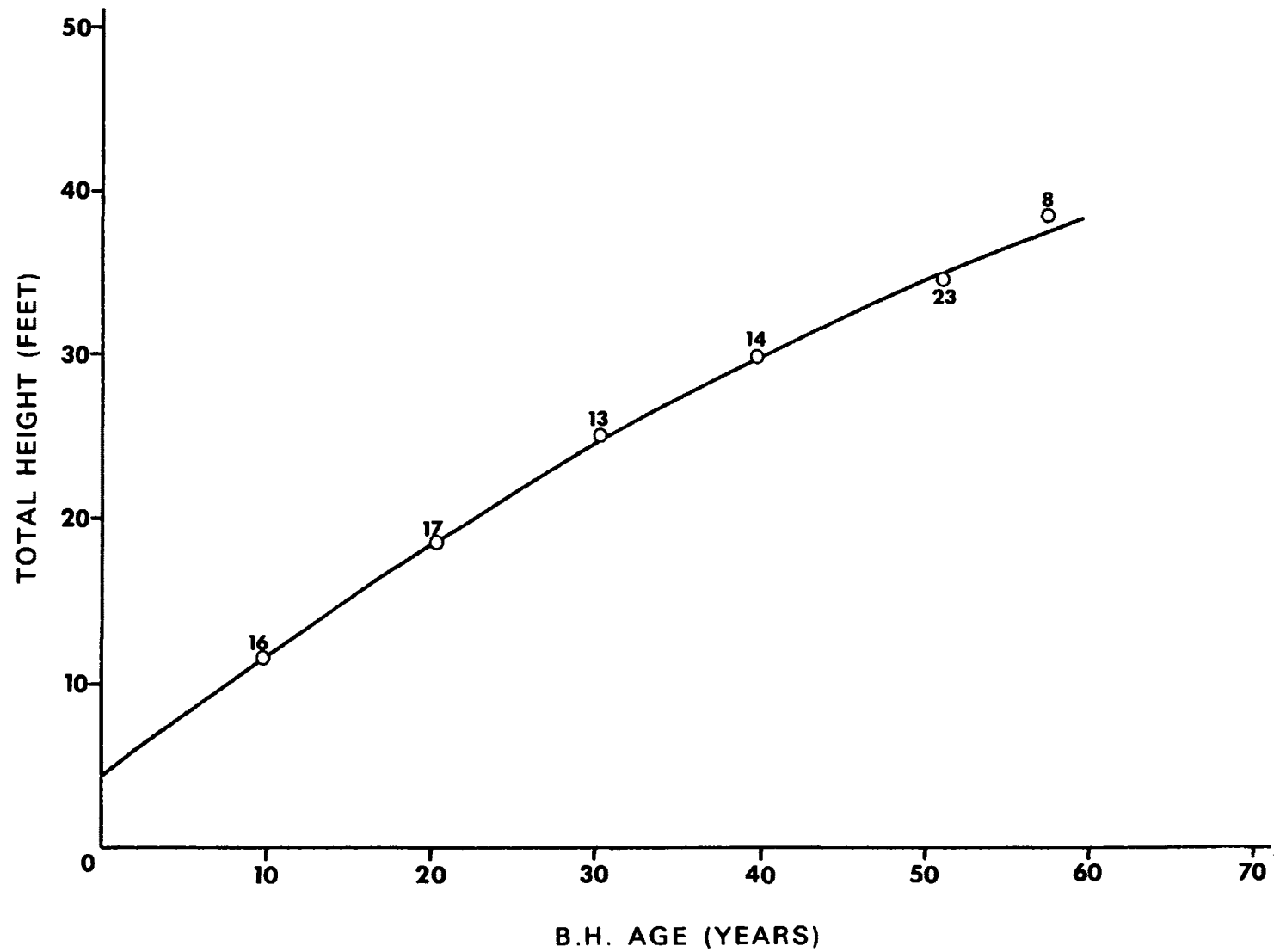


Table 20

## LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

## RUBUS-VACCINIUM FOREST TYPE

Age: 42 - 59

SPECIES		BALSAM FIR			BLACK SPRUCE			LARCH		
FORM CLASS		65			70			70		
D.B.H.	Ht.	Merch. Vol.*	Merch. Vol.		Merch. Vol.*	Merch. Vol.		Merch. Vol.*	Merch. Vol.	
(Inches)	Ft.	Per Tree	Per Acre	Ht.	Per Tree	Per Acre	Ht.	Per Tree	Per Acre	
		Cu. Ft.	Cu. Ft.	Ft.	Cu. Ft.	Cu. Ft.	Ft.	Cu. Ft.	Cu. Ft.	
4	24	1.1	29	28	.9	126	28	.9	6	
5	28	1.9	42	32	1.7	258	32	1.7	9	
6	32	2.9	35	34	2.7	362	34	2.7	14	
7	34	4.1	29	37	4.2	281	37	4.2	21	
8	37	5.9	65	38	5.7	154	38	5.7	17	
9	39	7.5	53	40	7.8	39	40	7.8	8	
10	42	9.8	10	41	10.0	10	-	-	-	
11	44	12.2	24	-	-	-	41	12.0	12	
12	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	42	17.5	18	
TOTAL			287			1230			105	

\*Stump height one foot: Top diameter outside bark three inches.

Table 21

STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

RUBUS-VACCINIUM FOREST TYPE

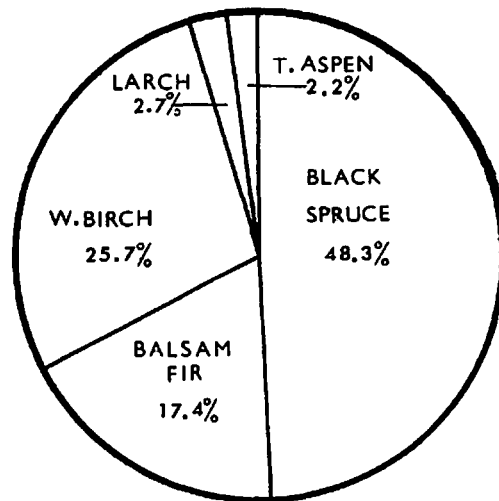
Age: 42 - 59

Number of Plots: 10

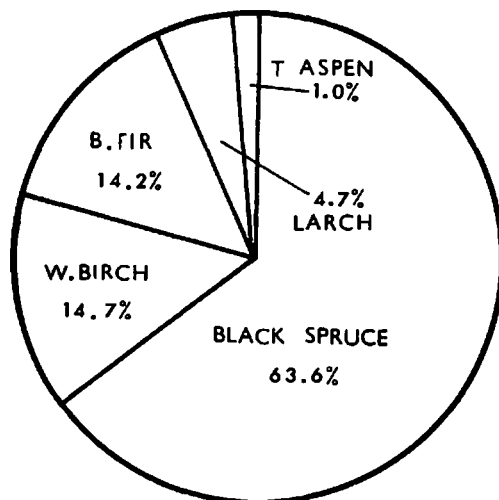
D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			LARCH			T. ASPEN			WHITE BIRCH			TOTALS																				
	No.of trees		Basal Area	No.of trees		Basal Area	No.of trees		Basal Area	No.of trees		Basal Area	No.of trees		Basal Area	No.of trees		Basal Area																		
	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*																		
1	143.0	16.0	.72	137.0	62.0	.69	6.0	14.0	.03	7.0	10.0	.04	185.0	75.0	.93	497.0	180.0	2.51																		
2	69.0	5.0	1.52	121.0	37.0	2.66	9.0	4.0	.30	16.0	4.0	.35	134.0	37.0	2.95	362.0	89.0	7.97																		
3	36.0	2.0	1.76	149.0	17.0	7.30	10.0	2.0	.49	13.0	1.0	.64	84.0	3.0	4.12	302.0	25.0	14.80																		
4	26.0	1.0	2.26	140.0	1.0	12.18	7.0	2.0	.61	5.0	-	.44	35.0	2.0	3.05	220.0	6.0	19.15																		
5	22.0	-	2.99	152.0	4.0	20.67	5.0	-	.68	1.0	-	.14	23.0	-	3.13	207.0	4.0	28.15																		
6	12.0	-	2.35	134.0	3.0	26.26	5.0	-	.98	-	-	-	17.0	1.0	3.33	168.0	4.0	32.92																		
7	7.0	-	1.87	67.0	-	17.88	5.0	-	1.34	-	-	-	10.0	-	2.67	89.0	-	23.77																		
8	11.0	-	3.84	27.0	-	9.42	3.0	-	1.05	-	-	-	7.0	-	2.44	48.0	-	16.75																		
9	7.0	-	3.09	5.0	-	2.21	1.0	-	.44	-	-	-	1.0	-	.44	14.0	-	6.18																		
10	1.0	-	.55	1.0	-	.55	-	-	-	-	-	-	-	-	-	2.0	-	1.10																		
11	2.0	-	1.32	-	-	-	1.0	-	.66	-	-	-	-	1.0	-	3.0	1.0	1.98																		
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																		
13	-	-	-	-	-	-	1.0	-	.92	-	-	-	-	-	-	1.0	-	0.92																		
TOTAL																			336.0	24.0	22.27	933.0	124.0	99.33	53.0	22.0	7.40	42.0	15.0	1.61	496.0	119.0	23.06	1913.0	309.0	156.20

\*Living trees

Fig. 42 STAND TABLE DIAGRAMS: RUBUS-  
VACCINIUM FOREST TYPE



NUMBER OF STEMS



BASAL AREA

Fig. 43  
 STEM ANALYSIS DIAGRAM  
 RUBUS-VACCINIUM FOREST TYPE  
 AGE: 42-59  
 BALSAM FIR

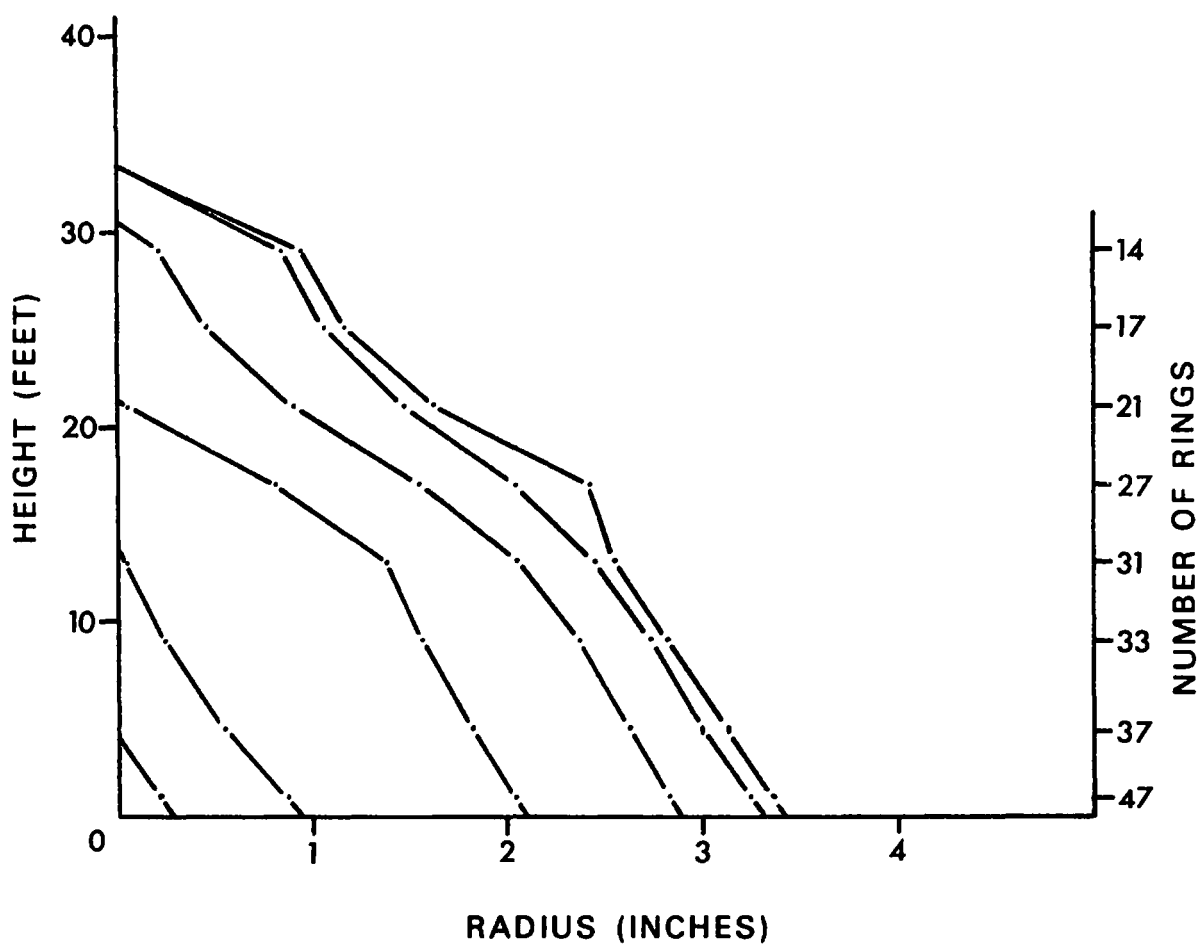


Fig. 44  
STEM ANALYSIS DIAGRAM  
RUBUS-VACCINIUM FOREST TYPE  
AGE: 42-59  
BLACK SPRUCE

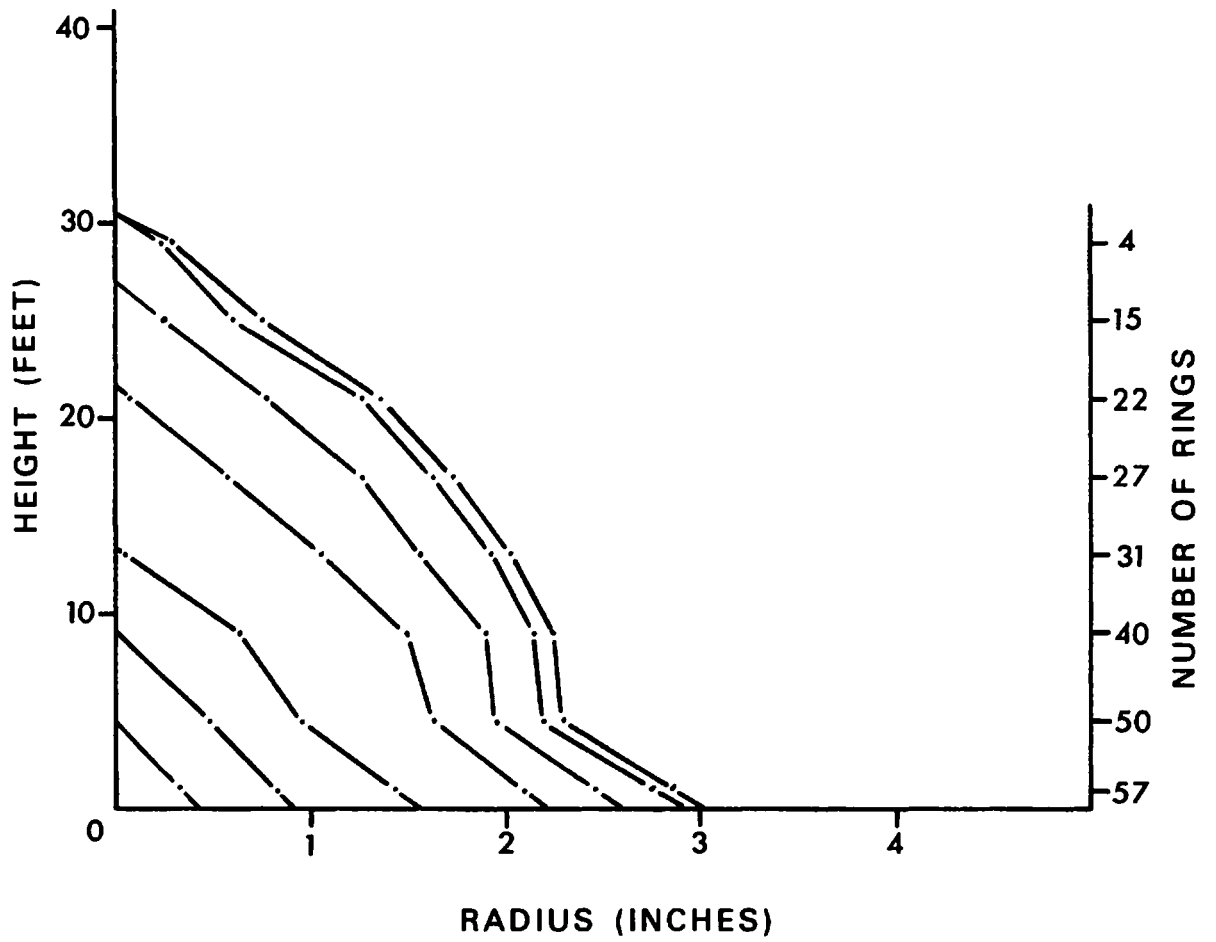


Table 22

STEM ANALYSIS DATA TABLE

RUBUS-VACCINIUM FOREST TYPE

Age Class: 42 - 59

	BALSAM FIR (Fig. 43)	BLACK SPRUCE (Fig. 44)
Age at breast height (yrs)	37	50
Diameter breast height (inches)	6.25	4.59
Total height (feet)	33.70	30.05
Total volume (cu. ft.)	3.343	2.026
Merchantable volume (cu. ft.)	2.806	1.465
Total volume increment by decades:-		
1961-51	1.069 (32.0%)	0.577 (28.5%)
1951-41	1.285 (38.4%)	0.625 (30.8%)
1941-31	0.920 (27.5%)	0.589 (29.1%)
1931-21	0.076 (2.3%)	0.173 (8.5%)
1921-11	0.003 (0.1%)	0.056 (2.8%)
1911-01	-	0.006 (0.3%)
1901-1891	-	-
1891-81	-	-
1881-71	-	-
Merchantable volume increment 1961-51	0.729	0.323

## Cladonia-Kalmia Forest Type

### Description

Stands of this type that were sampled were mostly well-stocked; however, open stands are also common (Damman, 1964). Black spruce is the major component, together with lesser amounts of balsam fir and white birch. Scattered stems of larch and trembling aspen also occur. The shrub layer is usually well-developed, consisting predominantly of Kalmia angustifolia, Vaccinium angustifolium, Rhododendron canadense, and Ledum groenlandicum. Cladonia spp. are always present. Dicranum and Pleurozium are the most common mosses.

This forest type is common on the Bonavista Peninsula, and also in much of central Newfoundland (Forest Section B28a). It does not occur under the higher rainfall conditions of the Avalon Peninsula. Typical soils occupied by this type are dry and coarse-textured. The soil profile is usually an iron humus podzol; ortstein formation is fairly common.

### Mensurational Characteristics

The balsam fir height/diameter curve (Fig. 45) shows heights of 35 and 42 feet corresponding to diameters of 6 and 8 inches. For black spruce (Fig. 46), heights of 33 and 37 feet correspond to these same diameters. Height/age curves for balsam fir and black spruce are generally similar (Figs. 47 and 48), although the fir shows somewhat better height growth beyond a breast height age of about 40 years. Balsam fir reaches heights of 31, 35, and 36½ feet at 40, 50, and 60 years of age, respectively; black spruce shows heights of 30, 32, and 34 feet at these same ages.

Softwood merchantable volume totals 1,654 cubic feet per acre (Table 23). There are an average of 2,551 living stems per acre (Table 24), and a basal area of 176 square feet per acre. Black spruce forms 74% of the stands in terms of number of stems and 81% in terms of basal area (Fig. 49). Balsam fir forms an additional 13% of the number of stems and 11% of the basal area.

The balsam fir sample tree has shown much more rapid volume growth than the black spruce tree (Figs. 50 and 51, Table 25). Regeneration is only moderately good, with 68% of the sample quadrats stocked (Table 26) and an average of 2,450 softwood stems, mostly balsam fir, per acre (Table 27).



Fig. 45  
HEIGHT/DIAMETER CURVE  
CLADONIA-KALMIA FOREST TYPE  
AGE CLASS: 42-55  
BALSAM FIR

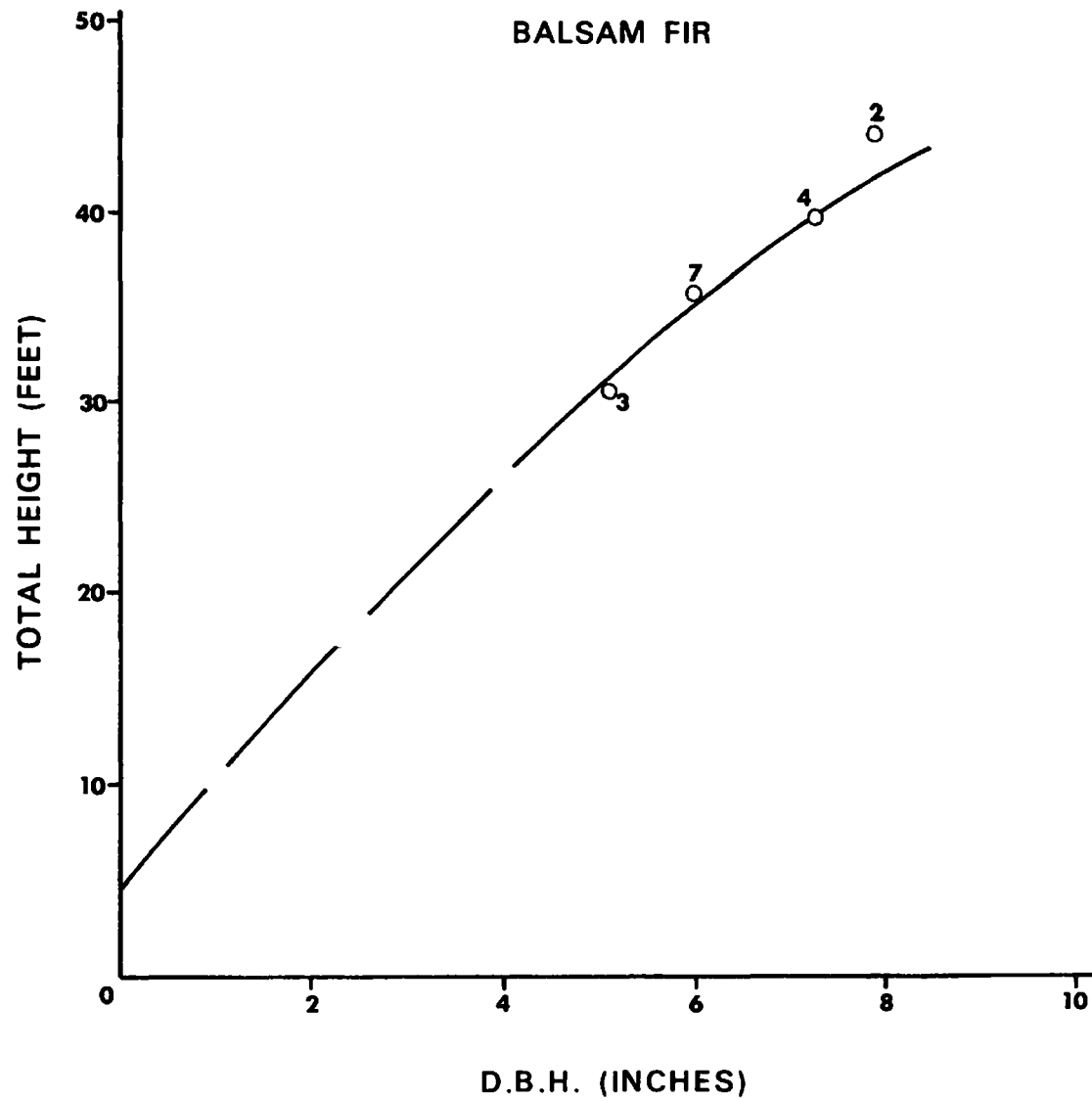


Fig. 46  
HEIGHT/DIAMETER CURVE  
CLADONIA-KALMIA FOREST TYPE  
AGE CLASS: 42-55  
BLACK SPRUCE

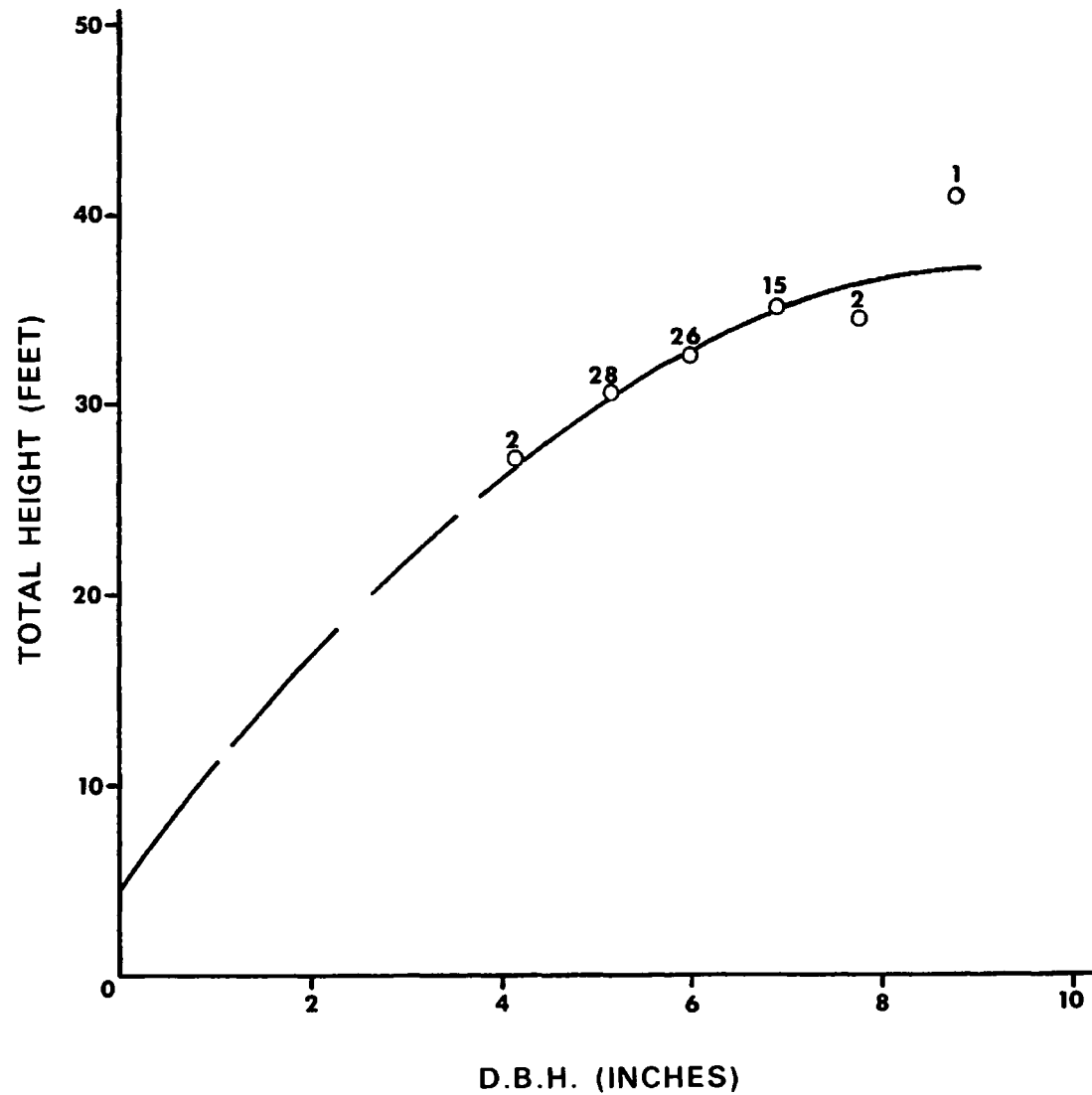


Fig. 47  
HEIGHT/AGE CURVE  
CLADONIA-KALMIA FOREST TYPE  
AGE CLASS: 42-55  
BALSAM FIR

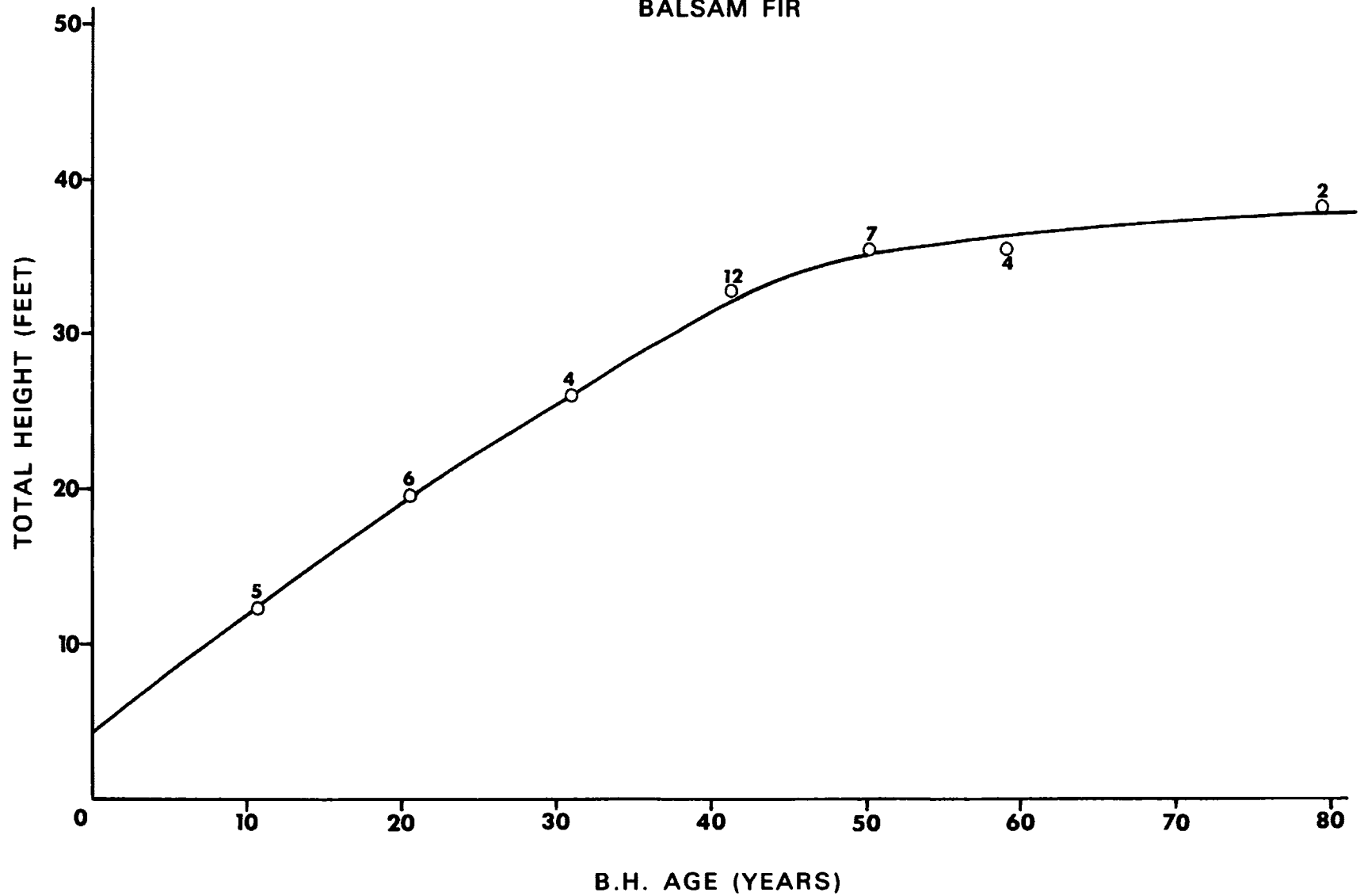


Fig. 48  
HEIGHT/AGE CURVE  
CLADONIA-KALMIA FOREST TYPE  
AGE CLASS: 42-55  
BLACK SPRUCE

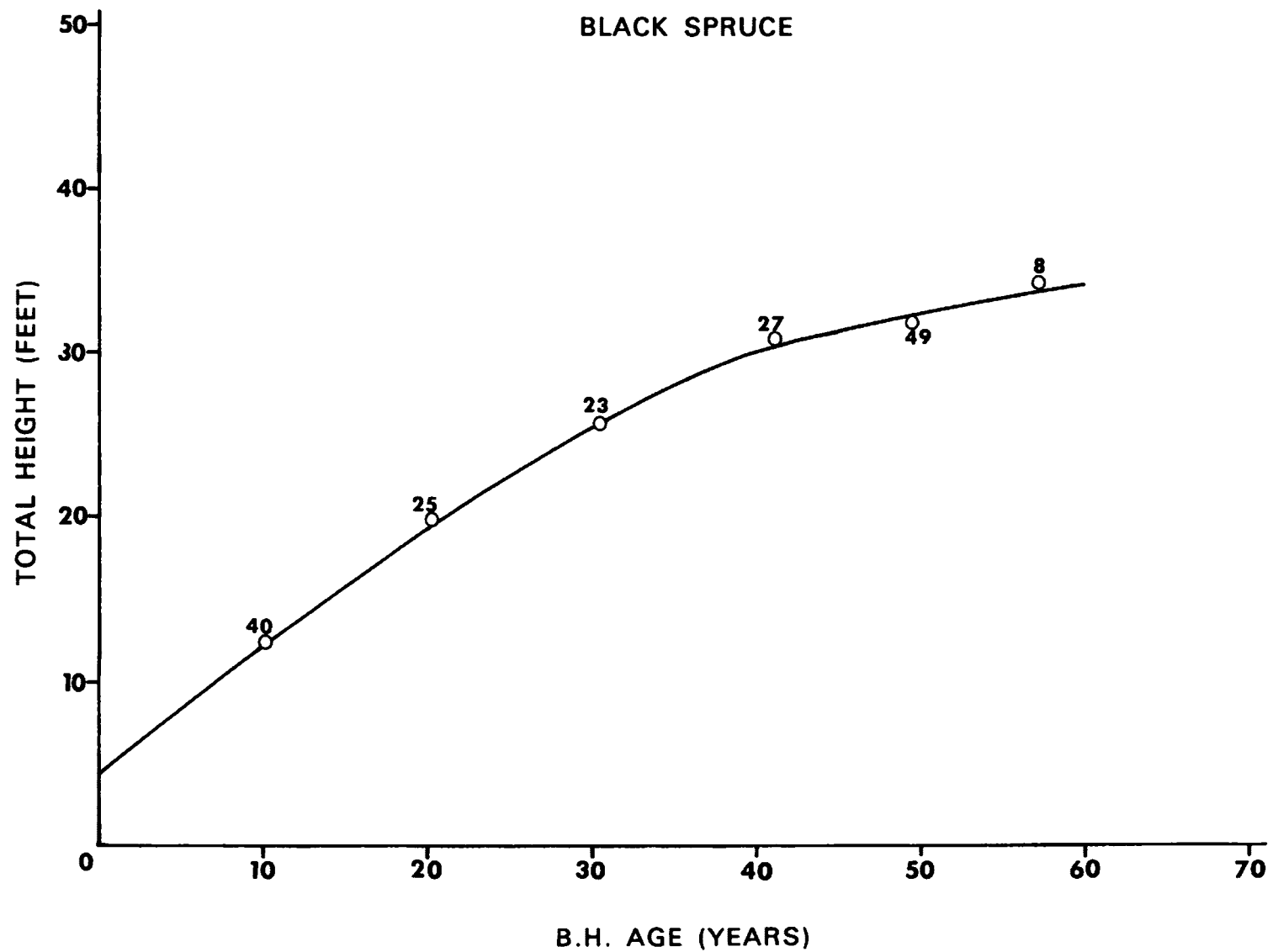


Table 23

## LOCAL FORM CLASS MERCHANTABLE VOLUME TABLES AND STOCK TABLES

## CLADONIA-KALMIA FOREST TYPE

Age: 42 - 55

SPECIES		BALSAM FIR		BLACK SPRUCE				LARCH	
FORM CLASS		65		68				68	
D.B.H. (Inches)	Ht. Ft.	Merch. Vol.*	Merch. Vol.	Ht. Ft.	Merch. Vol.*	Merch. Vol.	Ht. Ft.	Merch. Vol.*	Merch. Vol.
		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.		Per Tree Cu. Ft.	Per Acre Cu. Ft.
4	26	1.2	46	24	.9	379	24	.9	3
5	31	2.0	55	29	1.6	477	29	1.6	3
6	36	3.2	43	32	2.5	312	32	2.5	8
7	40	4.7	34	35	3.9	177	35	3.9	1
8	43	6.5	20	37	5.5	40	-	-	-
9	46	8.7	20	39	7.5	12	-	-	-
10	48	11.1	4	-	-	-	-	-	-
11	-	-	-	-	-	-	42	12.5	5
12	51	16.8	6	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	53	23.7	9	-	-	-	-	-	-
TOTAL			237			1397			20

\*Stump height one foot: Top diameter outside bark three inches.

Table 24

## STAND TABLE AND BASAL AREA PER ACRE BY SPECIES

## CLADONIA-KAIMIA FOREST TYPE

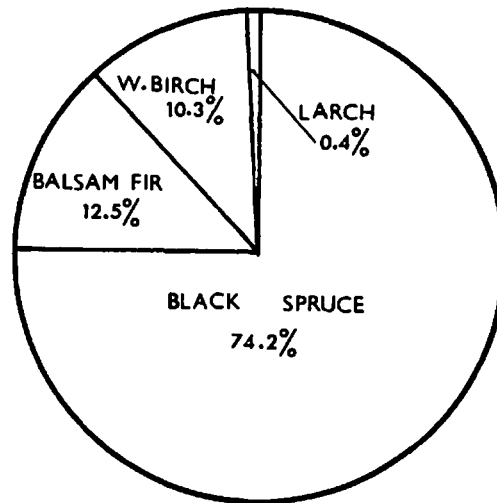
Age: 42 - 55

Number of Plots: 26

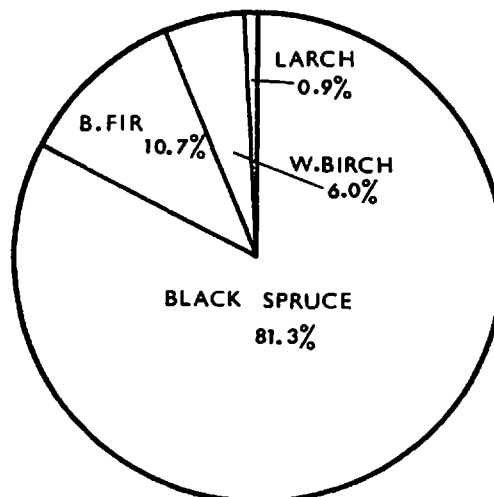
D.B.H. Classes	BALSAM FIR			BLACK SPRUCE			LARCH			WHITE BIRCH			TOTALS		
	No.of trees		Basal	No.of trees		Basal	No.of trees		Basal	No.of trees		Basal	No.of trees		Basal
	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*	Living	Dead	Sq.Ft.*
1	116.9	11.2	.58	308.4	110.0	1.54	-	1.5	-	70.8	68.8	.35	496.1	191.5	2.47
2	69.6	5.0	1.53	356.1	34.2	7.84	-	1.9	-	88.5	38.8	1.95	514.2	79.9	11.32
3	48.1	2.3	2.36	379.6	6.9	18.60	1.5	1.9	.08	67.3	10.0	3.30	496.5	21.1	34.34
4	38.5	1.2	3.35	421.5	.8	36.67	3.1	.4	.27	28.5	1.9	2.48	491.6	4.3	42.77
5	27.3	.4	3.71	298.1	1.2	40.54	1.9	.4	.26	9.6	-	1.31	336.9	2.0	45.82
6	13.5	.8	2.64	125.0	1.2	24.50	3.1	.4	.60	4.2	-	.83	145.8	2.4	28.57
7	7.3	1.2	1.95	45.4	.4	12.12	.4	-	.10	.4	-	.10	53.5	1.6	14.27
8	3.1	-	1.07	7.3	-	2.55	-	-	-	.4	-	.13	10.8	-	3.75
9	2.3	-	1.02	1.5	-	.68	-	-	-	.4	.4	.17	4.2	.4	1.87
10	.4	-	.21	-	-	-	-	-	-	-	-	-	.4	-	0.21
11	-	-	-	-	-	-	.4	-	.25	-	-	-	.4	-	0.25
12	.4	-	.30	-	-	-	-	-	-	-	-	-	.4	-	0.30
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	.4	-	.41	-	-	-	-	-	-	-	-	-	.4	-	0.41
TOTAL	327.8	22.1	19.13	1942.9	154.7	145.04	10.4	6.5	1.56	270.1	119.9	10.62	2551.1	303.2	176.35

\*Living trees.

Fig. 49 STAND TABLE DIAGRAMS: CLADONIA-  
KALMIA FOREST TYPE



NUMBER OF STEMS



BASAL AREA

Fig. 50

STEM ANALYSIS DIAGRAM  
CLADONIA-KALMIA FOREST TYPE

AGE: 42-55

BALSAM FIR

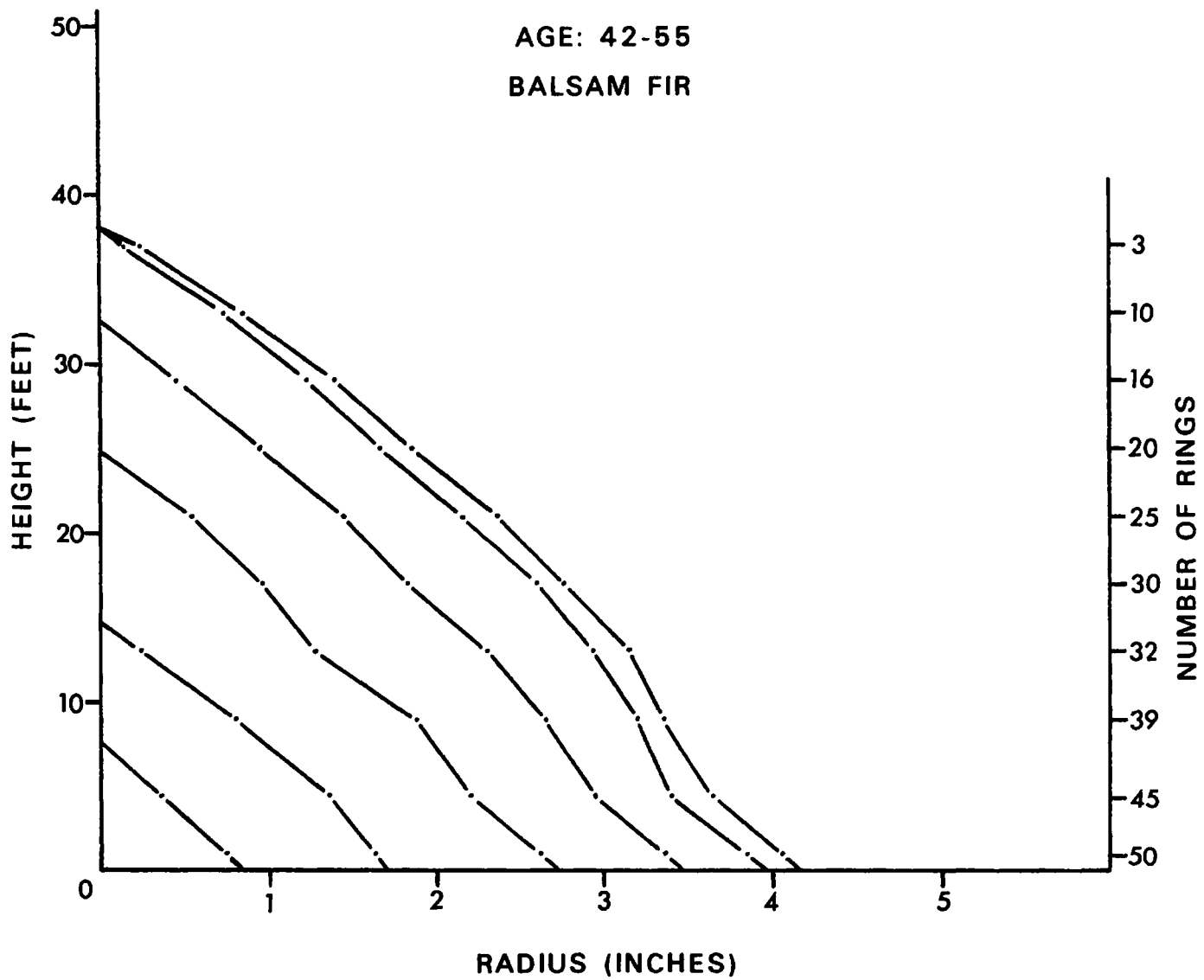




Fig. 51  
STEM ANALYSIS DIAGRAM  
CLADONIA-KALMIA FOREST TYPE  
AGE: 42-55  
BLACK SPRUCE

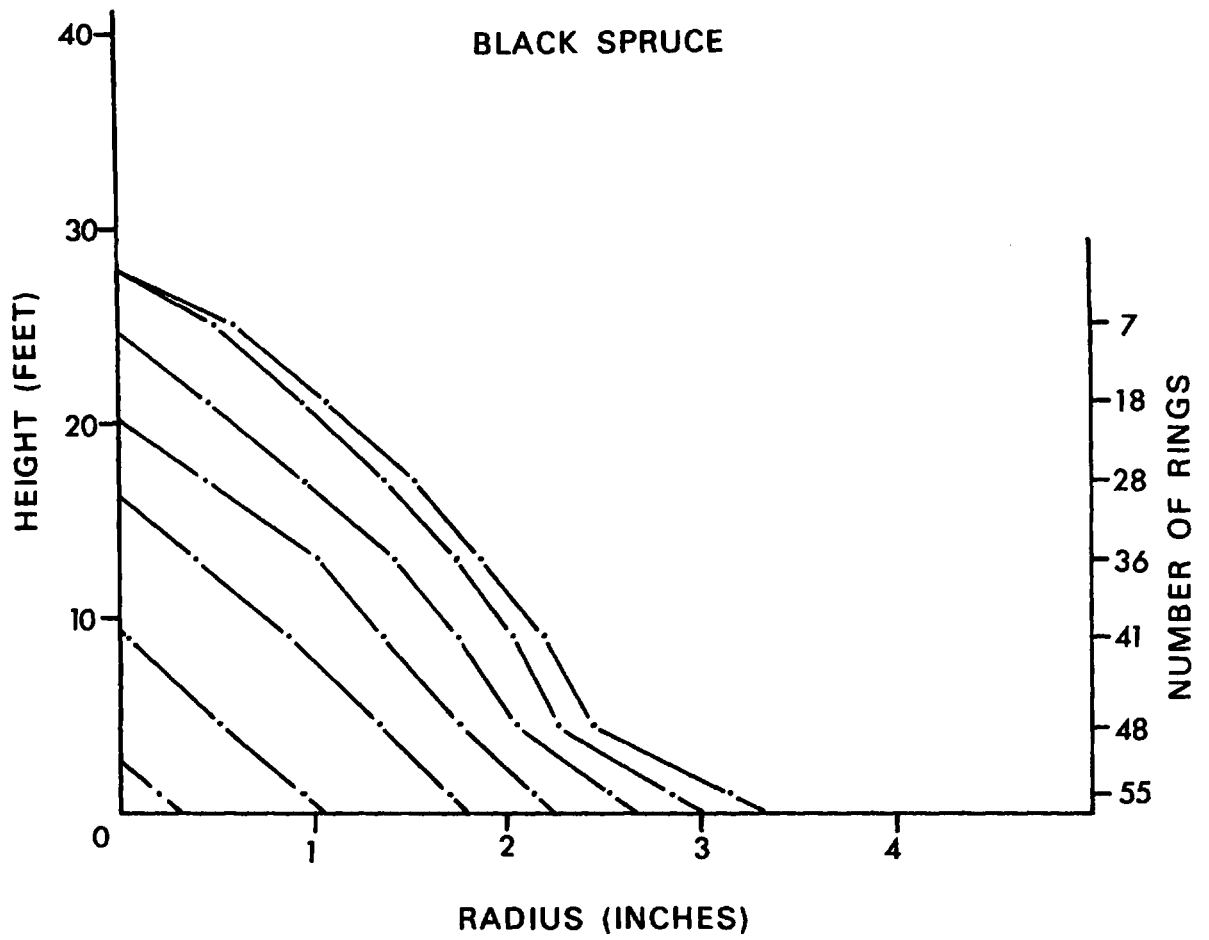


Table 25

STEM ANALYSIS DATA TABLE

CLADONIA-KALMIA FOREST TYPE

Age Class: 42 - 55

	BALSAM FIR (Fig. 50)	BLACK SPRUCE (Fig. 51)
Age at breast height (yrs)	45	48
Diameter breast height (inches)	7.30	4.90
Total height (feet)	38.00	27.90
Total volume (cu. ft.)	5.008	1.840
Merchantable volume (cu. ft.)	3.886	1.136
Total volume increment by decades:-		
1961-51	1.893 (37.8%)	0.536 (29.1%)
1951-41	1.682 (33.6%)	0.482 (26.2%)
1941-31	1.052 (21.0%)	0.405 (22.0%)
1931-21	0.337 ( 6.7%)	0.340 (18.5%)
1921-11	0.044 ( 0.9%)	0.074 ( 4.0%)
1911-01	-	0.003 ( 0.2%)
1901-1891	-	-
1891-81	-	-
1881-71	-	-
Merchantable volume increment 1961-51	1.191	0.238

Table 26

PERCENT STOCKING OF REGENERATION BY INDIVIDUAL FOREST TYPES

Forest Type	% Quadrats Stocked							Total Stocked
	bF	bF+bS	bF+wB	bF, bS +wB	bS	wS	wB	
Dryopteris	90	-	10	-	-	-	-	100
Clintonia	73	7	-	-	-	-	-	80
Hylocomium	78	-	10	-	-	-	-	88
Pleurozium	67	-	-	-	-	3	-	70
Dicranum- Nemopanthus	40	7	7	-	-	-	-	54
Rubus- Vaccinium	28	20	-	12	-	-	-	60
Cladonia- Kalmia	42	9	2	-	11	-	4	68

Table 27

NUMBER OF STEMS OF REGENERATION PER ACRE BY HEIGHT CLASSES  
FOR INDIVIDUAL FOREST TYPES

Species	Number of Stems Per Acre						Total
	<0.5	0.6-1.5'	1.6-2.5'	2.6-3.5'	3.6-4.5'	> 4.5	
<u>Dryopteris Type</u>							
bF	10,750	7,500	-	-	-	-	18,250 18,250
<u>Clintonia Type</u>							
bF	20,000	4,000	2,300	300	-	-	26,600
bS	300	-	-	-	-	-	300 26,900
<u>Hylocomium Type</u>							
bF	36,600	3,600	-	-	120	120	40,440
wB	2,500	-	-	-	-	-	2,500 42,940
<u>Pleurozium Type</u>							
bF	8,800	-	-	-	-	-	8,800 8,800
<u>Dicranum-Nemopanthus Type</u>							
bF	2,000	300	-	-	-	-	2,300 2,300
<u>Rubus-Vaccinium Type</u>							
bF	2,400	400	600	200	-	-	3,600
bS	2,000	-	-	400	-	200	2,600 6,200
<u>Cladonia-Kalmia Type</u>							
bF	2,000	360	-	-	-	-	2,360
bS	90	-	-	-	-	-	90
wB	90	-	270	-	-	-	360 2,810

## DISCUSSION

All stands sampled during this study were at or approaching maturity, and the age ranges of the samples were similar for most of the forest types. Valid comparisons can therefore be made between the types that were sampled.

Merchantable volume figures (Table 28, Fig. 52) show the Pleurozium type to be the most productive, containing 2,890 cubic feet per acre at an average breast height age of only 42 years. The Clintonia and Hylocomium types also contain volumes in excess of 2,500 cubic feet per acre. The Cladonia-Kalmia, Rubus-Vaccinium, and Dicranum-Nemopanthus types are markedly less productive, with merchantable volumes between 1500 and 1650 cubic feet per acre. The Dryopteris type has an average merchantable volume of 1340 cubic feet per acre. Figures quoted for the latter four types are averages for merchantable stands only; unmerchantable stands of these same four types are also of common occurrence in eastern Newfoundland.

The ranking of the forest types in relation to productivity, as given above, is in agreement with the ranking of the mean annual increment figures in Table 28. Stands of the Pleurozium type have the highest average volume and the lowest average age. As a result increment figures are considerably higher than those for the other forest types. The older age class of the Hylocomium type has a slightly lower merchantable volume and a markedly lower mean annual increment than the younger age class of this type. This is considered evidence of the onset of decadence in the older stands. It is also clear that maximum mean annual increment occurs in this forest type at a breast height age of not more than 50 years. The mean annual increment of the Dryopteris type is much below that of the other types because of a low merchantable volume and an average age greater than that of most of the other types.

Basal area (Fig. 53) ranges from an average of 236 square feet per acre in the Pleurozium type to an average of 113 square feet per acre in the Dryopteris type. The ranking of the types in terms of basal area is the same as that for merchantable volume. Basal area figures given above are all higher, in most cases considerably higher, than those quoted by Page (1970) for fully-stocked stands of the same forest types; this is believed due to the restriction of sampling in this study to merchantable stands only. However, the ranking of the types on the basis of site-index and basal area is in agreement with that presented by Page (1970).

With the exception of the Dryopteris type, stands of all the forest types appear to be fully-stocked, with average numbers of stems per acre ranging from 1889 to 2701. The Dryopteris type has an average of only 434 stems per acre and does not appear to be making complete utilization of the site.

Table 28

VOLUME AND VOLUME INCREMENT PER ACRE BY INDIVIDUAL FOREST TYPES

Forest Type	Age Class	Average breast height age of sample plots	Merchantable volume per acre (cu. ft.)	Mean annual increment (cu. ft.) based on breast height age	Mean annual increment (cu.ft.) based on breast height age + 10 years*
Dryopteris type	50-71	59.43	1342	22.58	19.33
Clintonia type	42-63	51.00	2597	50.92	42.57
Hylocomium type	42-53	47.38	2694	56.86	46.95
Hylocomium type	56-70	63.11	2525	40.01	34.54
Pleurozium type	34-49	41.90	2890	68.97	55.68
Dicranum- Nemopanthus type	45-51	48.50	1537	31.69	26.27
Rubus- Vaccinium type	42-59	50.00	1622	32.44	27.03
Gladonia- Kalmia type	42-55	49.35	1654	33.52	27.87

\*....Examination of stem analyses and previous experience in eastern Newfoundland has shown that an average of 10 years is required for the softwood species in most merchantable forest types to reach breast height.

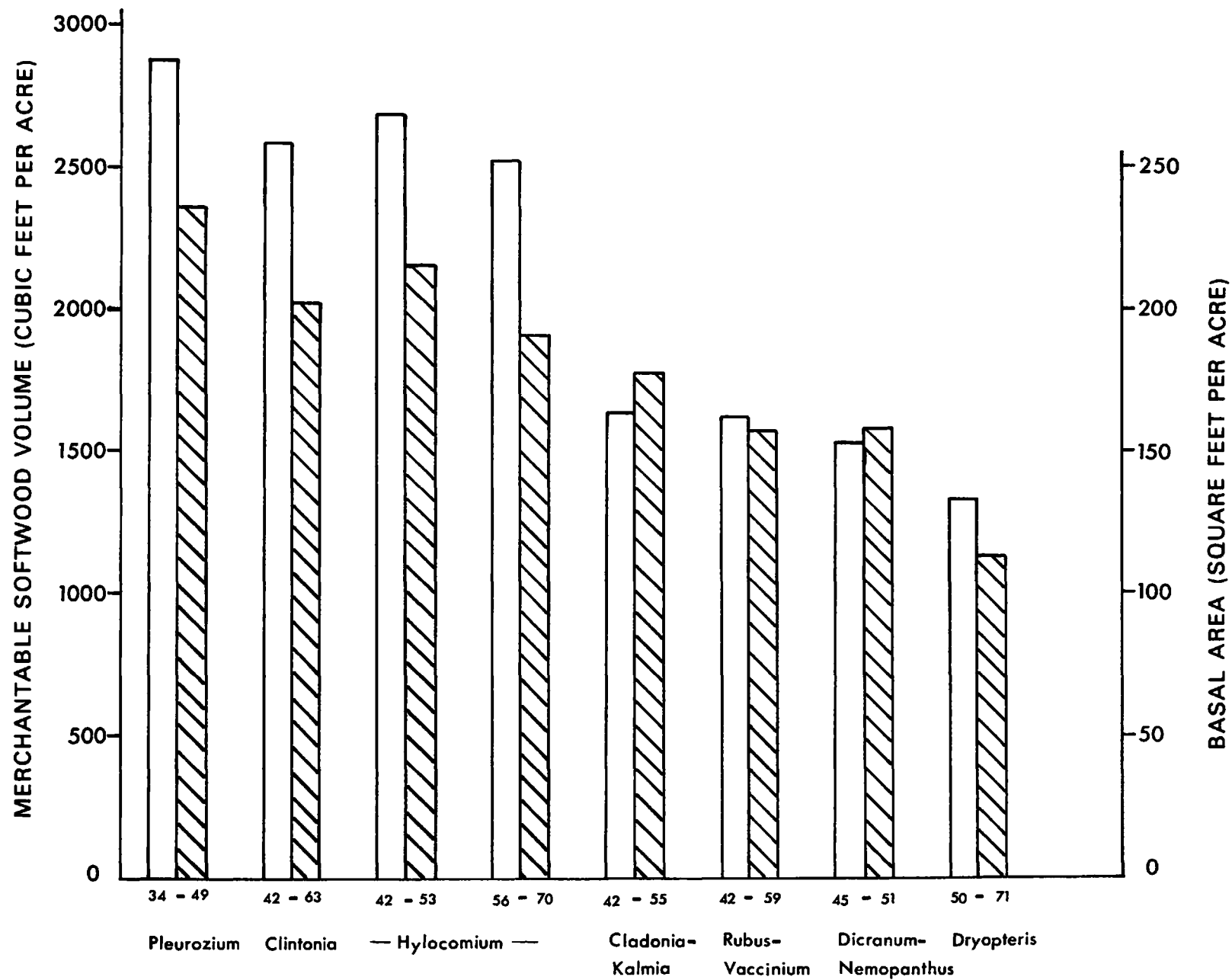


Fig. 52 VOLUMES AND BASAL AREAS FOR INDIVIDUAL FOREST TYPES

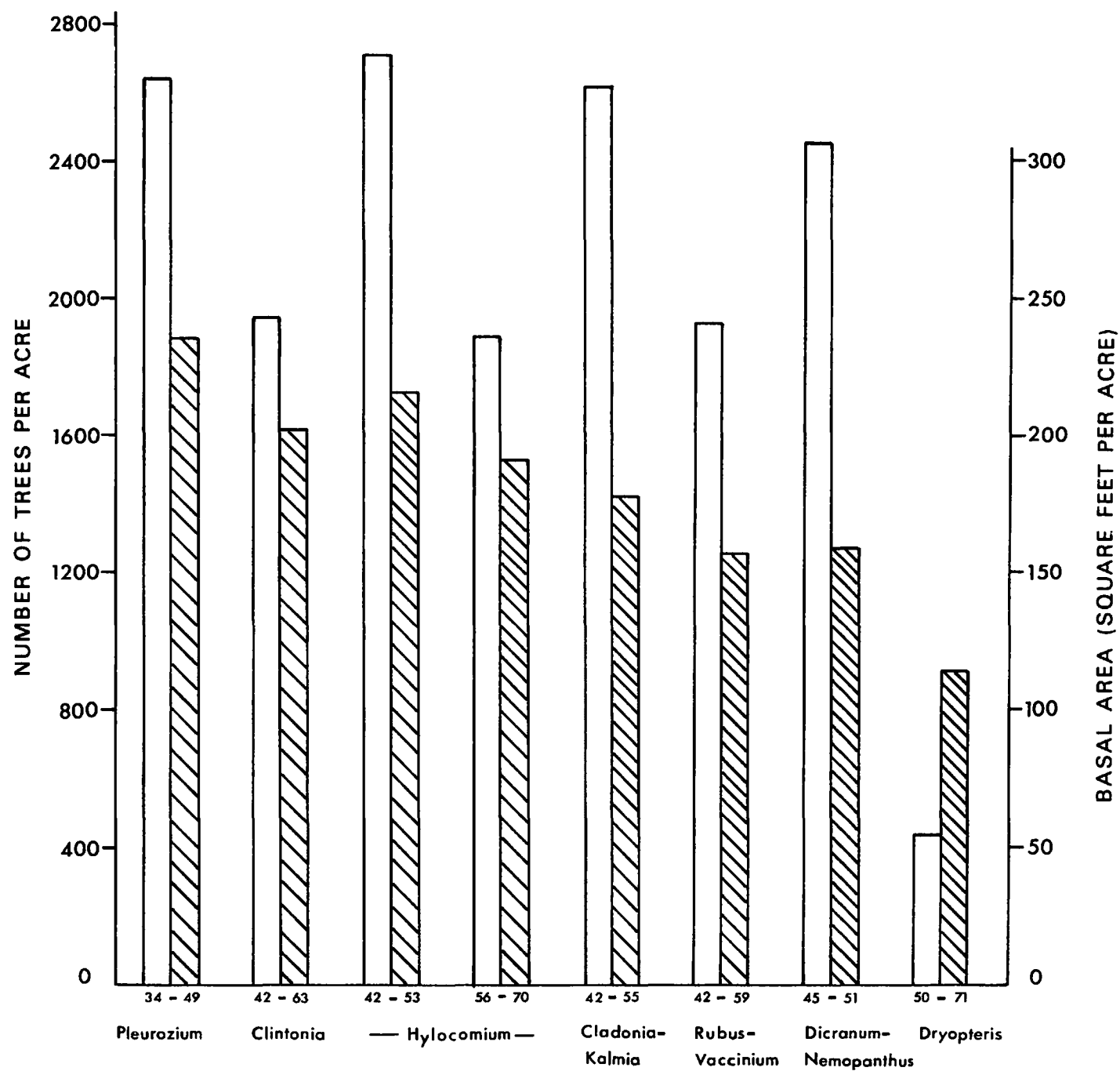


Fig. 53 NUMBER OF STEMS AND BASAL AREAS FOR INDIVIDUAL FOREST TYPES



Fig. 54 BALSAM FIR SITE-INDEX CURVES  
(ALL FOREST TYPES)

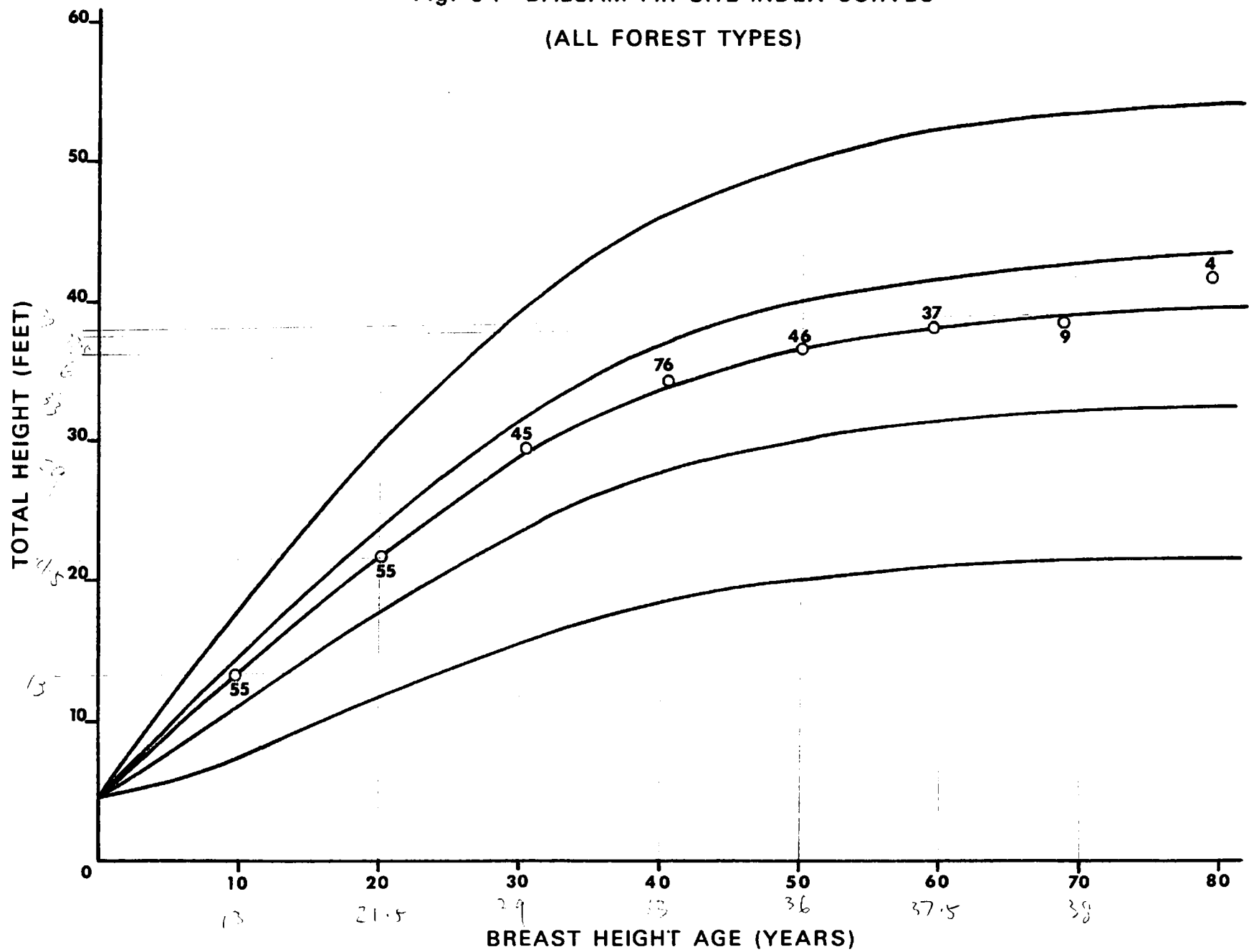
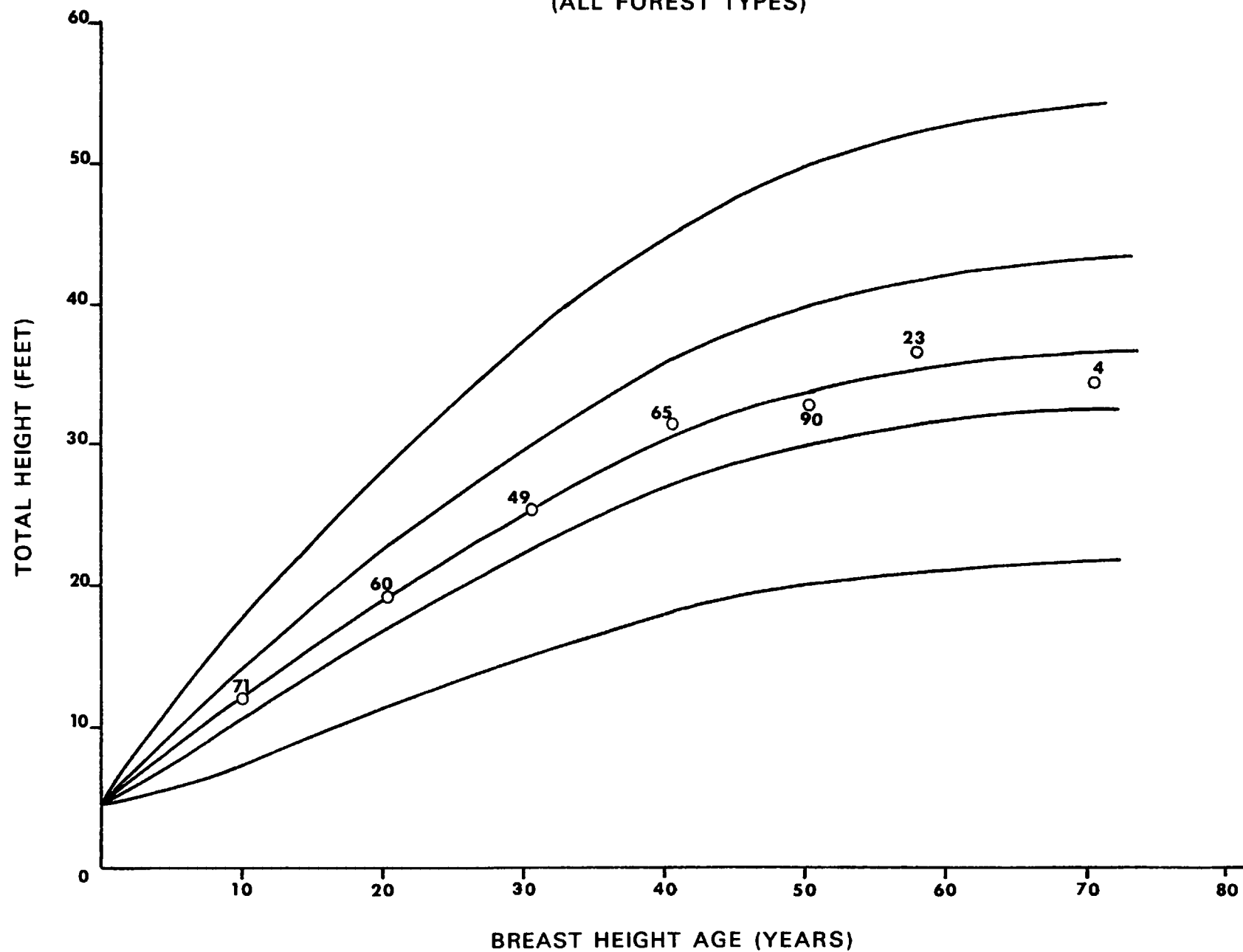


Fig. 55 BLACK SPRUCE SITE-INDEX CURVES  
(ALL FOREST TYPES)



The overall pattern of height growth is similar in all the forest types. Very little height growth occurs beyond a breast height age of about 40 to 50 years. The Dryopteris, Clintonia, Hylocomium, and Fleurozium types show the most rapid height growth with stems in the Dryopteris type ultimately reaching the greatest heights. In general, trees in the faster growing forest types have greater heights corresponding to given diameters than trees in the slower growing types. The Cladonia-Kalmia type is an exception, however, with a height/diameter relationship similar to that of the Dryopteris type. This apparent anomaly may be partly due to the fact that the Cladonia-Kalmia type occurs on coarse-textured soils and was sampled only on the Bonavista Peninsula where climatic conditions show similarities with conditions in central Newfoundland. In most of the forest types black and white spruce grow more slowly in height than balsam fir; however, they ultimately achieve heights similar to those of the fir. The spruces also have lesser heights corresponding to given diameters than balsam fir.

Within any given forest type, individual black spruce trees usually show slower volume growth than balsam fir trees of a similar age. The volume increment of individual white spruce trees is usually similar to, or somewhat better than that of comparable fir trees.

As has already been noted, there is considerable similarity in shape between the height/age curves from each of the forest types. Data from all the types have therefore been used to construct two sets of site-index curves, for balsam fir and for black spruce (Figs 54 and 55). The normal procedure for constructing site-index curves from height/age data was followed (Bruce and Schumacher, 1950). Curves for both species show a marked reduction in height growth beyond a breast height age of about 40 years. This flattening of the site-index curves was noted earlier by Page (1963), and appears to be a characteristic feature of stand development in eastern Newfoundland. Although early height development is at least as good as that recorded for other forest sections of the island, later height growth is very much slower. As a result, stands with a dominant height in excess of 50 feet are of very infrequent occurrence in Forest Section B30. Agreement between the site-index curves and the height/age curves for individual forest types is reasonably good. Using a reference age of 50 years, the maximum difference between an individual height/age curve and the appropriate site-index curve is approximately 8 feet at 80 years.

Regeneration is at least moderately abundant in most of the forest types, and fully-stocked second-growth stands should develop without difficulty. Regeneration is less abundant in the Dicranum-Nemopanthus and Cladonia-Kalmia types than in the other types. Sufficient seedlings are present to form fully-stocked stands in both types, but when some allowance is made for probable future mortality the present indication is that future stands will be patchy (as they

are now in many cases), with fully stocked areas interspersed with more open, shrub-dominated, areas. The regeneration consists almost entirely of balsam fir in all forest types. As a result, second-growth stands are likely to contain a higher proportion of fir than present stands, unless black spruce is favoured by fire or artificial seeding. The abundant balsam fir regeneration in stands of the *Dryopteris* type is worthy of special note. Present stands of this type are relatively open, with an average density of only 430 stems per acre. Barring excessive disturbance, future stands of this type should be much better stocked and probably more productive.

#### SUMMARY AND CONCLUSIONS

Mensurational data for seven of the most important forest types in eastern Newfoundland were collected in 1962. On each sample plot a diameter tally was carried out and measurements of height, diameter, and age were taken on selected dominant and co-dominant trees. Additional trees were used to supply stem analysis and form class data.

Height/diameter and height/age curves, stand and basal area tables, local form class merchantable volume tables, and stock tables have been prepared for each forest type. Certain selected stem analysis trees have been reconstructed in diagrammatic form.

Conclusions have been drawn from these data as follows:-

- (1) Merchantable volume, volume increment, basal area, height/age, and height/diameter data all indicate that for practical purposes the forest types can be divided into the following groups which represent meaningful differences in productivity:
  - (a) *Pleurozium*, *Hylocomium*, and *Clintonia* forest types
  - (b) *Dicranum-Nemopanthus* and *Rubus-Vaccinium* forest types;  
possibly also the *Cladonia-Kalmia* forest type
  - (c) *Dryopteris* forest type

Present indications are that future stands of the *Dryopteris* type will be more fully stocked than present stands. This type may then have an average productivity similar to the forest types in group (a) above. The productivity of the *Cladonia-Kalmia* type is similar to that of the *Dicranum-Nemopanthus* and *Rubus-Vaccinium* types. However, its ecological relationships differ markedly from those of the other two types (it occupies sites with coarse-textured soils, and is not found on the Avalon Peninsula) and it should therefore be kept separate for most purposes.

(2) The older age class of the *Hylocomium* type has a lower merchantable volume, and a markedly lower mean annual increment, than the younger age class of this same type. Some of the older stands are probably becoming decadent. Maximum mean annual increment occurs at a breast height age of not more than 50 years in this type. The other more productive forest types probably reach their maximum mean annual increments at a similar age; this in turn may explain the high increment figures obtained for the *Pleurozium* type, where the sample plots had an average breast height age of 42 years.

(3) Individual balsam fir and white spruce sample trees show similar rates of volume increment. Individual black spruce trees show slower volume growth, although they ultimately reach sizes comparable to trees of the other two species.

(4) Individual height/age curves for balsam fir and for black spruce in each of the forest types correspond reasonably well to one another and to the site-index curves constructed from data for all the forest types. The greatest differences between the two types of curves occur at an age of about 80 years.

(5) Site-index curves for balsam fir and for black spruce both show a marked reduction in height growth beyond a breast height age of about 40 years, even though early growth is at least as rapid as in other parts of Newfoundland. The flattened shape of the curves appears to be a characteristic feature of stand development in eastern Newfoundland. As a result, only rarely do stands exceed 50 feet in height.

(6) Regeneration is at least moderately good in all the forest types; however, somewhat patchy second-growth stands are considered likely to develop in the *Dicranum-Nemopanthes* and *Cladonia-Kalmia* forest types. Future stands will probably contain a higher proportion of balsam fir than present stands, unless black spruce is favoured by fire or artificial seeding. Provided they do not suffer from excessive disturbance, future stands of the *Dryopteris* type will probably be more fully stocked than present stands.

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