

# **REGENERATION TWO YEARS FOLLOWING MECHANIZED LOGGING**



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**by  
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QUEBEC REGION, QUEBEC  
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**FORESTRY BRANCH  
DEPARTMENT OF FISHERIES AND FORESTRY  
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## INTRODUCTION

Although extensive developments have taken place in the field of mechanical logging of pulpwood stands, little quantitative work by research silviculturalists has been carried out to assess the effects of the new logging systems on advance growth, on the degree of soil scarification, and on the quality and quantity of the residual regeneration on the cut-over. The scarceness of pertinent factual data is of increasing concern to foresters.

Any project dealing with mechanized logging in eastern Canada involves a vast field. In 1965, after meetings between officials of the Canada Department of Forestry, the Pulp and Paper Research Institute of Canada and several pulp and paper companies, a study was proposed (P.P.R.I.C. 65-2) to investigate the silvicultural implications of mechanical logging. Similar studies were set up by the Department of Forestry in New Brunswick and Quebec.

The initial results of all phases of this work have been published (Arnott, 1968; Croome, 1967; Webber et al., 1968). The purpose of this report is to cover the results of the second postcut survey taken of the eleven areas covered by the Quebec Research Laboratory. Although repetitious, the objectives, locations of research and methods employed are stated in order that the reader of this information report may have a complete account of the study without having to refer back to Internal Report Q-9 (Arnott, 1968).

## OBJECTIVES

### These are:

- a) to assess the damage to the advance growth caused by mechanized equipment;
- b) to determine the effects of mechanical logging on the quantity and quality of regeneration on the cutovers;
- c) to assess the degree of soil scarification caused by the logging equipment; and
- d) to set up a series of such surveys in a range of major forest types and logging system combinations.

## THE STUDY AREAS

All but one of the eleven study areas reported herein were established in the summer of 1966 by members of the Forest Research Laboratory, Quebec. With the exception of areas 6, 8, and 9, all areas were remeasured 6 to 8 weeks following the logging operation in late summer of 1966. Areas 6, 8, and 9 were remeasured in June 1967. Area 11 was established in October 1965 and remeasured in June 1966. The second postcut measurement of all 11 areas took place in June and July, 1968.

The approximate location of the eleven study areas is shown in Figure 1. More detailed information on forest section longitude, latitude, company ownership and locality is given in Table 1. Detailed location maps and aerial photographs of each area are registered in the project file.

There were major differences in forest type and stand composition between all areas, and for this reason, a brief description of each is given in Table 2.

## METHODS

The method consisted of establishing sample plots on the uncut stand. These plots were remeasured immediately following the logging operation. Subsequent remeasurements of these plots took place in the 3rd year, 1968, and will be taken again during the 5th and 10th year after logging.

The sampling design was developed by the P.P.R.I.C. The design employed in area 10 was different. It was the original method established in 1965 for testing the suitability of the sampling procedure. It was subsequently revised for the 1966 field season, reducing the area from eight to four acres and the size of the sample plots within the block from 1/10th acre plots to 1/50th acre strip plots. Detailed accounts of this original sampling design are registered in the project file.

On the other ten study blocks, a minimum area of four acres<sup>1)</sup> was chosen. It was rectangular in shape and was sampled using a system of strips and milacre quadrats. These areas were selected on sites typical of machine operating conditions. Each one was located so that it incorporated all the usual characteristics of the logging system with the wood going to one landing.

The most common dimension of study area was 5 x 8 chains (Figure 2). Four strips, 20 links wide, were randomly located within a  $1\frac{3}{4}$  chain grid. Each strip was divided into 8 plots, one chain long, and staked in the field. To determine the stand table all trees greater than one inch d.b.h.

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1) In three instances, smaller areas were selected.

were tallied for each of the 32 plots.

The amount and distribution of advance growth up to three inches d.b.h. was based on a milacre quadrat tally. Five groups, of 10 milacres each, were randomly distributed on each traverse line which was the centre line of the tally strip. Four such lines on a 5 x 8 chain study area gave a total of 200 milacre quadrats. A tree seedling count was taken on the first quadrat of each group of ten and a presence/absence tally per species was taken on the remaining nine. On all quadrats, advance growth and trees by species were recorded using the following height classes; 0-6.5", 6.6"-18.5", 18.6"-36.5", 36.6"-54.5", 54.6"-0.5" d.b.h., 0.6"-1.5" d.b.h. and 1.6"-2.5" d.b.h. Each milacre strip was permanently marked so that they could be easily located after logging. A description of each logging operation is given in Table 3.

In the postcut sampling each strip was relocated from the original stakes or, if these had been destroyed, by chaining. The strip plots were retallied in the same manner as in the precut tally. The groups of milacre quadrats were similarly relocated and tallied.

## RESULTS

The initial results were presented as a series of case histories of each of the 11 areas (Arnott, 1968). Each was described as to the stand (all stems in the 3" d.b.h. class and above) and advance growth (all stems smaller than d.b.h. class 3"). To have a continuous study record, these data for the second postcut measurement are presented in Tables 4 to 14.

Of immediate interest are the changes in the distribution of the

coniferous advance growth following logging together with the regeneration which has become established since the logging operation. The quantity and distribution of the coniferous advance growth before, immediately following, and 2 years after logging are illustrated in Figures 3 to 13.

#### DISCUSSION

The initial reduction in stem density and distribution immediately following logging has already been given for these areas (Arnott, 1968) and is shown in Figures 3 to 13. What is of immediate concern is to know how much natural reproduction has taken place and how much of the advance growth left after logging remains.

The new reproduction is given in Table 15. Many areas have regenerated to some extent. In areas 5 to 10 where no new germinants have appeared, there was already a sufficiently high density of advance growth after the logging operation. Lack of any seed source has prevented black spruce regeneration on Area 3. New germinants have appeared on all other areas, ranging in density from 250 to 27,190 stems per acre. These have resulted primarily from natural seeding in from the cone-bearing slash. All spruce-fir associations have reproduced primarily to fir and at times to the exclusion of spruce. Despite the fact that little scarification took place on Area 8, some mineral soil must have been exposed to provide a suitable jack pine seedbed as indicated by 1,600 new seedlings per acre, however, their distribution is very patchy (Table 11 B).

Although advance growth stem density was greatly reduced as a result of logging, there were very few study areas where numbers were



reduced below 1,000 per acre. However the distribution of all residual advance growth immediately after the logging operation was not always satisfactory with areas 8 a failure<sup>1)</sup>, 1, 7, 9 and 11 moderately stocked, 3, 5 and 6 well stocked and only areas 2, 4 and 10 fully stocked. This total stocking has generally improved over two years as a result of new reproduction. It remains to be seen whether this new reproduction will survive in sufficient numbers to fully stock all areas.

Based on the degree of exposure and the amount of slash covering the advance growth, it was concluded that less than 67 per cent of each of these eleven cutovers was favourable to the survival of the advance growth remaining after logging (Webber et al. 1968). As predicted, the per cent stocking of advance growth has diminished (Figures 3 to 13), the only noticeable exception being area 9. This shall be explained later.

Advance growth stocking has generally been reduced in all height classes, except the first, where the increase arises from reproduction. The increased stocking in height classes 2 and 3, two years after logging, are the result of an error inherent in the sampling procedure. The method required that no logging slash be disturbed in postcut measurements but that it should be left in situ. With the initial postcut measurement taking place immediately following logging, the advance growth was often buried under dense, needle-bearing slash. Although every effort was made to count all postcut advance growth, some were unavoidably overlooked on

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1) Stocking standards by; Candy, R.H. 1951. Reproduction on cutover and burned over land in Canada. Can. Dep. Resour. and Department, For. Res. Div., Silv. Res. Note No. 92.

first count, but were found at later postcut measurements when the slash had become less dense.

The consistently higher stocking of the second postcut measurement of Area 9 is partly due to the above factor and partly due to the fact that many of the pickets marking the sample quadrats were found to be missing at the second remeasurement. The quadrats were obviously not re-located on the exact position of the former, leading to higher counts (Figure 11).

If the management objective is to have the cutovers stocked to conifers, irregardless of species composition and size class then, with the exception of areas 1 and 8, this objective was met. On the basis of Candy's stocking standards, all areas but 1 and 8 fall into the full-or well stocked classes.

It is too soon to predict what types of forest structure will develop from these cutovers. Also, whether or not these areas have regenerated to satisfactory stocking levels is a matter of conjecture and depends on the specific stocking standard employed.

This report only covers the interim results of this study. No definite conclusion can be reached concerning the total effect which mechanized logging systems have on advance growth and regeneration of these boreal forest types until a third postcut measurement is made in two years time.

REFERENCES

- Arnott, J.T. 1968. Silvicultural implications of mechanical logging.  
Establishment report: Q-138 Can. Dept. For. Rur. Dev., Quebec  
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- Croome, G.C.R. 1967. Silvicultural implications of mechanical logging.  
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- Webber, B., Arnott, J.T., Weetman, G.F., and Croome, G.C.R. 1968. Advance  
growth destruction slash coverage and ground conditions in logging  
operations in eastern Canada. Woodlands Rept. No. 8., Pulp Pap.  
Res. Inst. Can. pp. 109.

Table 1. Location of Study Areas

Study Area	Forest <u>1</u> / Section	Long.	Lat.	Company	Base Camp, Locality
1	B.1a	48°50'	71°40'	Price Bros.	Camp 5, Brûlé R.
2	B.1a	48°50'	71°40'	Price Bros.	Camp 5, Lac Barnabé
3	B.1a	48°50'	71°40'	Price Bros.	Camp 5, Lac Barnabé
4	B.1a	47°40'	71°10'	Price Bros.	Pikauba, Lac Rond
5	B.1a	47°40'	71°10'	Price Bros.	Pikauba, Cr. Jean-Marie
6	B.1a	47°10'	70°50'	Ste. Anne Paper	Camp 115, Lac Fortin
7	B.1a	47°10'	70°50'	Ste. Anne Paper	Camp 115, Ste. Anne R.
8	B. 7	47°50'	74°40'	James Maclaren	Camp 6, Lac Long
9	B. 7	47°20'	74°40'	James Maclaren	Pine Lake, Camp J.-P. Raby
10	L. 5	45°30'	71°20'	Domtar	Scotstown
11	L. 4	46°00'	75°10'	James Maclaren	Camp 26, Lac Simon

1/ Rowe, J.S. 1959. Forest regions of Canada. - Canada, Department Northern Affairs and National Resources, Forestry Branch, Forest Res. Div.  
Bull. 123.

Table 2. Description of the Eleven Study Areas

Study Area	Association	Age (years)	Site <sup>1/</sup> Class	Soil Type	Elevation (ft. above sea level)	Aspect	Exposure	Drainage	Slope (%)
1	Black spruce-balsam fir on a <u>Hypnum</u> site type	bS-97 bF-90	II	Glacial till origin; 10 inch organic layer covers a silt loam soil	900	South-east	Moderate	Impeded	2
2	Black spruce on a <u>Kalmia-Ledum</u> site type	bS-126	III	Fluvioglacial origin; 8 inch organic layer covers a very stony, sandy loam soil	700	West	Severe	Impeded	2
3	Black spruce on a <u>Calliergon-Vaccinium</u> site type	bS-124	II	Fluvioglacial origin; a 4 inch organic layer covers a very stony, sandy loam soil	700	West	Severe	Good	3
4	Balsam fir-black spruce on a <u>Hymnum-Hylocomium</u> site type	bF-132 bS-153	II	Till origin; a 12 inch organic layer covers a coarse-textured, sandy soil	3000	East	Severe	Severely Impeded	2
5	Balsam fir-black spruce on a <u>Hymnum-Hylocomium</u> site type	bF-131 bS-146	II	Till origin; a 5 inch organic layer covers a coarse, well drained sandy soil	2700	North-west	Moderate	Good	12
6	Balsam fir-black spruce on a <u>Hylocomium-Oxalis</u>	bF-69 bS-98	II	Till origin; a 5 inch organic layer covers a very stony sandy loam soil	3000	North	Severe	Good	5

Continued

Table 2. Concluded

7	Balsam fir-white spruce-white birch on a <u>Cornus-Mian-thum</u> site type	bF-79 wS-96	I	Till origin; a 4 inch organic layer covers a sandy loam soil	500	North	Severe	Good	10
8	Jack pine-black spruce on a <u>Kalmia-Vaccinium</u> site type	jP-62 bS-51	III	Esker; a 2 inch organic layer covers a coarse, gravelly sand	1800	East	Moderate	Very Good	15
9	Black spruce on a <u>Sphagnum-Ledum</u> site type	bS-122	IV	Glacial drift origin; a 10 inch organic layer covers a sandy loam soil	1200	South	Slight	Severely Impeded	4
10	Balsam fir-red spruce-yellow birch on a <u>Tiarella</u> site type	bF-93 <b>rs-115</b>	--	Till origin; a 4 inch deep organic layer covers a heavy textured, gleyed soil	1300	South-east	Slight	Impeded	3
11	Balsam fir-spruce-maple association on a <u>Dryopteris</u> site type	bF-60	--	Till plain; a 3 inch organic layer covers a sandy loam soil	1100	North-east	Slight	Good	7

1/ Linteau, A. 1955. Forest site classification of the northeastern coniferous section, boreal forest region, Quebec Canada, Dept. Northern Affairs and National Resources, Forestry Branch, Forest Res. Div. Bull 118.

Table 3. Description of Logging Operation

Study Area	Time of Logging	Logging System	Forwarder used	Mean. No. Trees/Load	Av. d.b.h. of Trees (inches)
1	June	T.L.-R.T. <sup>1/</sup>	Tree Farmer C4B	10	6.6
2	August	T.L.-R.T.	Tree Farmer C4B	7-10	7.5
3	August	T.L.-R.T.	Tree Farmer C4B	10	6.9
4	July	T.L.-R.T.	Tree Farmer C4B	10-15	6.6
5	July	T.L.-R.T.	Timberjack 215	10-15	6.9
6	September	Shortwood	Bombardier J-5	--	--
7	August	T.L.-R.T.	Tree Farmer C4B	10	7.8
8	September	T.L.-R.T.	Timberjack D-4	10	6.7
9	September	T.L.-R.T.	Haugh S-7	10	6.4
10	November	T.L.-R.T.	Tree Farmer C4B + Timberjack 215	10-12	7.6
11	August	T.L.	Horse	1-2	6.9

<sup>1/</sup> T.L.-R.T.; Tree Length - Rubber Tired Skidder.

Table 4A. Area 1; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Trees per acre)			
3	8	8	17
4	4		4
5			
6			
7			
8			
9			
10			
Total	12	8	21



Table 4B. Advance Growth on Area 1; postcut stem density, 1968

POSTCUT (2)

Size	Black	Balsam	Black Spruce	White	Trembling	Hardwoods
Class	Spruce	Fir	+ Balsam Fir	Birch	Aspen	
(Stems per acre)						
1	625	375	1,000	25,125		25,125
2	625	375	1,000	4,750		4,750
3	500	125	625		125	125
4	250		250			
5						
1" d.b.h.	17	8	25			
2" d.b.h.	17	4	21			
Total	2,034	887	2,921	29,875	125	30,000

Table 4C. Advance Growth on Area 1; postcut per cent stocking, 1968

POSTCUT (2)

Size	Black	Balsam	Black Spruce	
Class	Spruce	Fir	+ Balsam Fir	Hardwoods
(Per cent stocking)				
1	17.5	17.5	33.8	68.8
2	11.3	16.3	22.5	23.8
3	11.3	6.3	16.3	3.8
4	2.5	2.5	5.0	
5				
1" d.b.h.	1.3	2.5	3.8	
2" d.b.h.	3.8	1.3	5.0	
Total	28.8	31.3	50.0	70.0

Table 54. Area 2; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Trees per acre).			
3	3	2	5
4	5	3	8
5			
6			
7			
8			
9			
10			
Total	8	5	13

Table 5B. Advance Growth on Area 2; postcut stem density, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Number of stems per acre)			
1	667		667
2	810		810
3	2,095	95	2,190
4	333		333
5	95		95
1" d.b.h.	238		238
2" d.b.h.			
Total	4,238	95	4,333

Table 5C. Advance Growth on Area 2; postcut per cent stocking, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Per cent stocking)			
1	23.3		23.3
2	48.6	1.0	48.6
3	42.4	0.5	42.9
4	27.1		27.1
5	13.8		13.8
1" d.b.h.	18.6		18.6
2" d.b.h.	7.1		7.1
Total	72.9	1.0	72.9

Table 6A. Area 3; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Trees per acre)			
3			
4			
5			
6			
7			
8			
9			
10			
Total	0	0	0

Table 6B. Advance Growth on Area 3; postcut stem density, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir	White Birch
(Stems per acre)				
1	650		650	200
2	1,250		1,250	
3	900		900	
4	50		50	
5				
1" d.b.h.				
2" d.b.h.				
Total	2,850	0	2,850	200

Table 6C. Advance Growth on Area 3; postcut per cent stocking, 1968

POSTCUT (2)

Size	Black	Balsam	Black Spruce	White
Class	Spruce	Fir	+ Balsam Fir	Birch
(Per cent stocking)				
1	34.0	0.5	34.0	8.5
2	52.5	0.5	52.5	2.0
3	36.5	1.5	37.0	
4	3.5	0.5	4.0	
5	0.5		0.5	
1" d.b.h.				
2" d.b.h.				
Total	59.5	2.5	60.0	8.5



Table 7A. Area 4; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir	White Birch
	(Trees per acre)			
3		10	10	
4		13	13	
5		2	2	2
6				
7				
8				
9				
10				
Total	0	25	25	2

Table 7B. Advance Growth on Area 4; postcut stem density, 1968  
 POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Stems per acre)			
1	3,437	2,625	6,062
2	3,250	3,375	6,625
3	1,687	562	2,249
4	62	125	187
5		62	62
1" d.b.h.	46	48	94
2" d.b.h.	15	23	38
Total	8,497	6,820	15,317

Table 70. Advance Growth on Area 4; postcut per cent stocking, 1968  
 POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Per cent stocking)			
1	56.3	53.1	76.9
2	63.1	58.1	78.1
3	40.6	33.8	54.4
4	11.3	13.1	21.3
5	3.8	5.6	9.4
1" d.b.h.	4.4	1.3	5.0
2" d.b.h.	1.3	3.1	4.4
Total	70.0	66.9	83.8

Table 8A. Area 5; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Trees per acre)			
3	23	63	86
4	11	34	45
5	2	28	30
6	3	8	11
7		3	3
8		2	2
9		3	3
10			
11			
12		2	2
Total	39	143	182

Table 8B. Advance Growth on Area 5; postcut stem density, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Stems per acre)			
1	850	4,100	4,950
2	1,050	4,550	5,600
3	900	1,300	2,200
4	200	350	550
5	50	150	200
1" d.b.h.	77	272	349
2" d.b.h.	11	125	136
Total	3,138	10,847	13,985

Table 8C. Advance Growth on Area 5; postcut per cent stocking, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir
(Per cent stocking)			
1	13.0	57.5	61.5
2	21.0	63.5	67.5
3	8.0	43.0	45.5
4	6.0	18.0	22.5
5	3.0	9.5	12.0
1" d.b.h.	6.5	21.5	26.0
2" d.b.h.	2.0	10.0	11.5
Total	33.0	77.5	81.0

Table 9A. Area 6; Stand Table for all Trees over 2.5" d.b.h. 1968

POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce Balsam Fir	White Birch
(Trees per acre)				
3		35	35	5
4		37	37	5
5		10	10	2
6				2
7				
8				2
9				
10				2
Total	0	82	82	18

Table 9B. Advance Growth on Area 6; postcut stem density, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam fir	Black Spruce + Balsam fir	White Birch	Trembling Aspen	Hardwoods
(Stems per acre)						
1	762	42,571	43,333	1,190	48	1,238
2	286	2,857	3,143			
3	143	143	286			
4						
5						
1" d.b.h.	2	10	12			
2" d.b.h.		12	12	2		2
Total	1,193	45,593	46,786	1,192	48	1,240



Table 9C. Advance Growth on Area 6; postcut per cent stocking, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam fir	Black Spruce + Balsam Fir	White Birch	Trembling Aspen	Hardwoods
(Per cent stocking)						
1	9.0	99.5	99.5	18.1	1.0	18.1
2	4.8	45.2	46.2	1.4	1.0	1.4
3	2.4	8.6	10.5	1.4		1.4
4		1.0	1.0			
5		1.0	1.0			
1" d.b.h.		1.0	1.0			
2" d.b.h.		0.5	0.5			
Total	11.4	99.5	99.5	20.0	1.0	20.0

Table 10A. Area 7; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h. Class (inch)	White Spruce	Balsam Fir	White Spruce + Balsam Fir	Yellow Birch	White Birch	Hardwoods
(Trees per acre)						
3		25	25	5	6	11
4		13	13	2		2
5		2	2			
6		2	2		3	3
7		2	2		5	5
8					2	2
9					3	3
10				2	2	4
11				2		2
12				1		1
13						
14						
15				1		1
16						
Total	0	44	44	13	21	34

Table 10B. Advance Growth on Area 7; postcut stem density, 1968

POSTCUT (2)

Size	White	Balsam	White	Yellow	Trembling	Hardwoods
Class	Spruce	Fir	Birch	Birch	Aspen	
(Stems per acre)						
1		5,450	2,800		100	2,900
2		700			150	150
3		250			50	50
4					200	200
5		100				
1" d.b.h.		39	2	2	6	10
2" d.b.h.		28		6		6
Total		6,567	2,802	8	506	3,316

Table 10C. Advance Growth on Area 7; postcut per cent stocking, 1968

POSTCUT (2)

Size Class	White Spruce	Balsam Fir	White Spruce + Balsam Fir	White Birch	Yellow Birch	Trembling Aspen	Hardwoods
(Per cent stocking)							
1	1.0	58.5	59.5	21.5		1.0	21.5
2	2.0	26.5	28.0	4.0		4.5	8.0
3	0.5	15.0	15.5	1.5		6.0	7.5
4	1.0	3.0	3.5	1.0		4.5	5.5
5		2.0	2.0			3.0	3.0
1" d.b.h.	0.5	1.5	2.0	0.5		0.5	1.0
2" d.b.h.		2.5	2.5	0.5	0.5		0.5
Total	4.5	65.0	67.0	25.0	0.5	11.5	30.0

Table 11A. Area 8; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Jack Pine	Black Spruce + Balsam Fir + Jack Pine
(Trees per acre)				
3	8	2	3	13
4	5		2	7
5	3			3
6	8			8
7	3		2	5
8			2	2
9				
10				
Total	27	2	9	38

Table 11B. Advance Growth on Area 8; postcut stem density, 1968

POSTCUT (2)

Size	Black	Balsam	Jack	Total
Class	Spruce	Fir	Pine	
(Stems per acre)				
1	150		1,600	1,750
2	200			200
3	200			200
4				
5	50			50
1" d.b.h.	30	2		32
2" d.b.h.	17	3	2	22
Total	647	5	1,602	2,254

Table 11C. Advance Growth on Area 8; postcut per cent stocking, 1968  
 POSTCUT (2)

Size	Black	Balsam	Jack	Total
Class	Spruce	Fir	Pine	
(Per cent stocking)				
1	14.0	1.5	15.5	29.0
2	17.5	1.0		18.0
3	15.0	1.0		15.0
4	4.5			4.5
5	4.0	0.5		3.5
1" d.b.h.	3.0			2.5
2" d.b.h.	2.5			2.5
Total	31.5	3.0	15.5	46.5

Table 12A. Area 9; Stand Table for all Trees over 2.5" d.b.h., 1968  
 POSTCUT (2)

D.b.h. Class (inch)	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir	White Birch
(Trees per acre)				
3	94		94	
4	44	2	46	2
5	20		20	
6	5		5	
7				
8				
9				2
10				
Total	163	2	165	4



Table 12B. Advance Growth on Area 9; postcut stem density, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir	White Birch
(Stems per acre)				
1	550		550	1,050
2	950	50	1,000	
3	400		400	
4	200		200	
5	50		50	
1" d.b.h.	177	9	186	16
2" d.b.h.	113	6	119	2
Total	2,440	65	2,505	1,068

Table 12C. Advance Growth on Area 9; postcut per cent stocking, 1968

POSTCUT (2)

Size Class	Black Spruce	Balsam Fir	Black Spruce + Balsam Fir	White Birch
(Per cent stocking)				
1	32.0	3.5	33.5	31.5
2	35.0	0.5	35.5	1.5
3	25.0	1.0	25.5	
4	13.5		13.5	
5	9.0		9.0	
1" d.b.h.	14.0	0.5	14.0	
2" d.b.h.	9.5	0.5	9.5	
Total	66.0	6.0	68.0	31.5

Table 13A. Area 10; Stand Table for all Trees over 2.5" d.b.h. 1968

POSTCUT (2)

D.b.h. Class (inch)	Red Spruce	Balsam Fir	Cedar	Birches	Maples
	(Trees per acre)				
3			1	1	
4		1		1	
5				1	
6				1	
7				1	
8				2	
9					
10				1	
11				2	
12					
13				1	
14					
15				1	
16					
17					
18				1	
Total		1	1	13	

Table 13B. Advance Growth on Area 10; postcut stem density, 1968

POSTCUT (2)

Size	Red	Balsam	Red Spruce +	Birches	Trembling	Sugar	Hardwoods
Class	Spruce	Fir	Balsam Fir		Aspen	Maple	
(Stems per acre)							
1	5,125	14,188	19,313	2,438	63	1,063	3,564
2	1,438	5,688	7,126	1,500	313	1,063	2,875
3		313	313	250	500		750
4							
5							
1" d.b.h.		3	3	1			1
2" d.b.h.		1	1	3			3
Total	6,563	20,193	26,756	4,192	876	2,126	7,194

Table 13C. Advance Growth on Area 10; postcut per cent stocking, 1968

POSTCUT (2)

Size	Red	Balsam	Red Spruce +	Birches	Sugar	Trembling	Hardwoods
Class	Spruce	Fir	Balsam Fir		Maple	Aspen	
(Per cent stocking)							
1	44.4	88.1	89.4	46.3	39.4	10.0	73.1
2	28.8	66.3	70.0	50.6	40.6	30.0	78.8
3	1.9	7.5	8.1	26.9	17.5	23.1	49.4
4		1.3	1.3		1.9	1.9	4.4
5		0.6	0.6	0.6			0.6
1" d.b.h.							
2" d.b.h.							
Total	52.5	90.0	91.5	63.8	60.0	43.8	89.4

Table 144. Area 11; Stand Table for all Trees over 2.5" d.b.h., 1968

POSTCUT (2)

D.b.h.	White and	Balsam	Cedar*	Maples	Yellow
Class	Red Spruce	Fir			Birch
(inch)					
	(Trees per acre)				
3		83		14	2
4	2	64		26	
5	2	62		14	
6	2	31		10	
7	2	7	2	5	2
8				2	2
9					
10			2		
11			2	2	
12					
13					
14			5		
15					
16			2		
17					
			2		

Continued

Table 14A. Area 11; Stand Table for all Trees over 2.5" d.b.h., 1968  
Concluded

POSTCUT (2)					
D.b.h.	White and	Balsam	Cedar*	Maples	Yellow
Class (inch)	Red Spruce	Fir			Birch
(Trees per acre)					
18			2		
19					
20					
Total	8	247	15	73	6

\* Birch and Cedar not included in Internal Report Q-9

Table 14B. Advance Growth on Area 11; postcut stem density, 1968

POSTCUT (2)

Size	Red	Balsam	Red Spruce +	Yellow	Red
Class	Spruce	Fir	Balsam Fir	Birch	Maple
(Stems per acre)					
1	615	3,769	4,384	2,077	3,154
2				231	77
3					77
4					77
5					
1" d.b.h.	5	24	29		5
2" d.b.h.	3	62	65	8	14
Total	623	3,855	4,478	2,316	3,404



Table 14C. Advance Growth on Area 11; postcut per cent stocking, 1968

POSTCUT (2)

Size Class	Red Spruce	Balsam Fir	Red Spruce + Balsam Fir	Cedar	Yellow Birch	Red Maple	Hardwoods
(Per cent stocking)							
1	13.1	66.2	66.2		43.1	55.4	72.3
2	4.6	11.5	16.9	0.8	17.7	23.8	36.9
3		0.8	0.8		0.8	8.5	8.5
4	0.8		0.8			3.9	3.1
5	0.8	0.8	0.8			2.3	2.3
1" d.b.h.	0.8	2.3	3.1				
2" d.b.h.	1.5	3.9	5.4		0.8	1.5	2.3
Total	20.0	71.5	71.5	0.8	45.4	62.3	77.7



FIGURE 1. LOCATION OF STUDY AREAS.

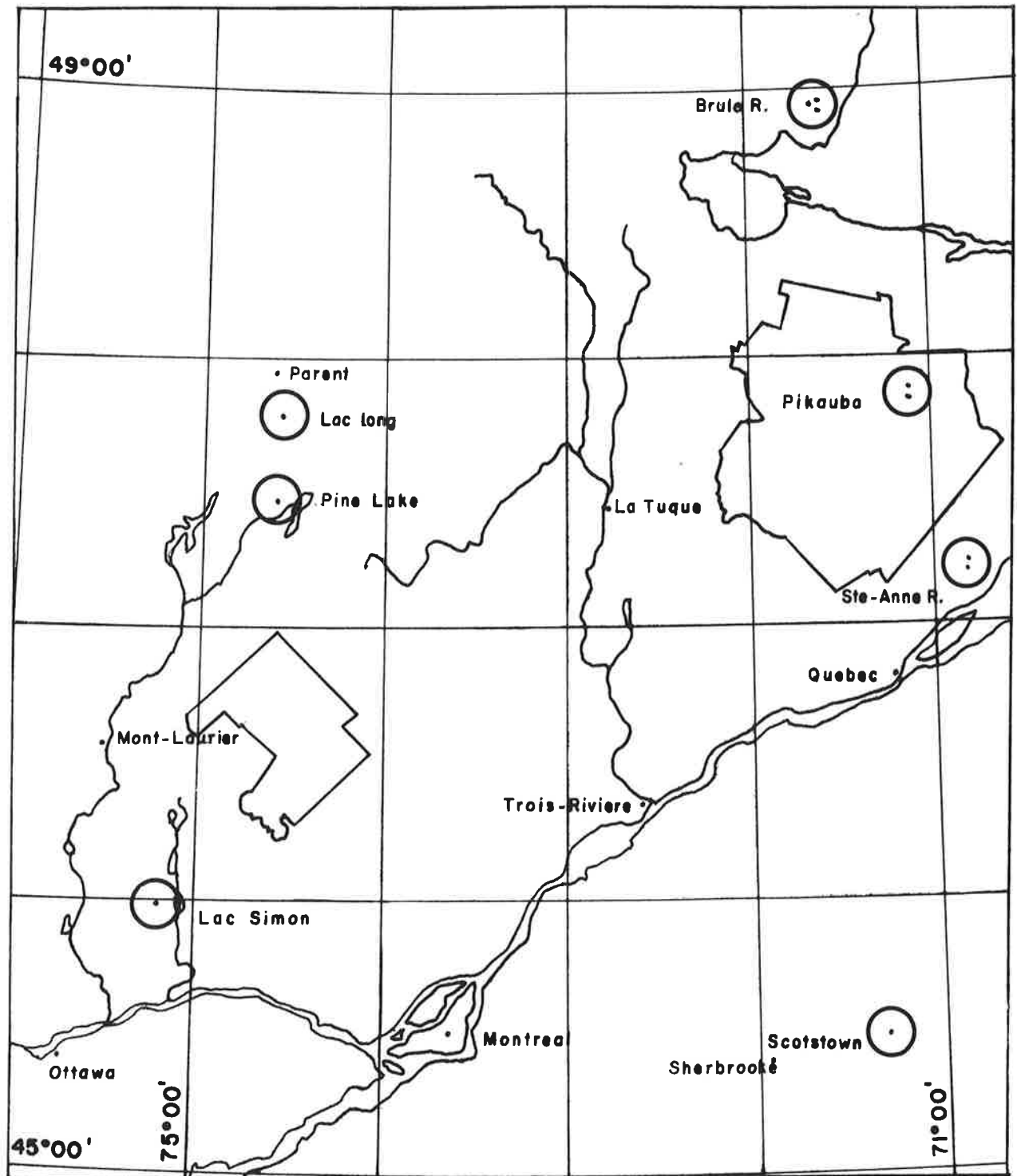
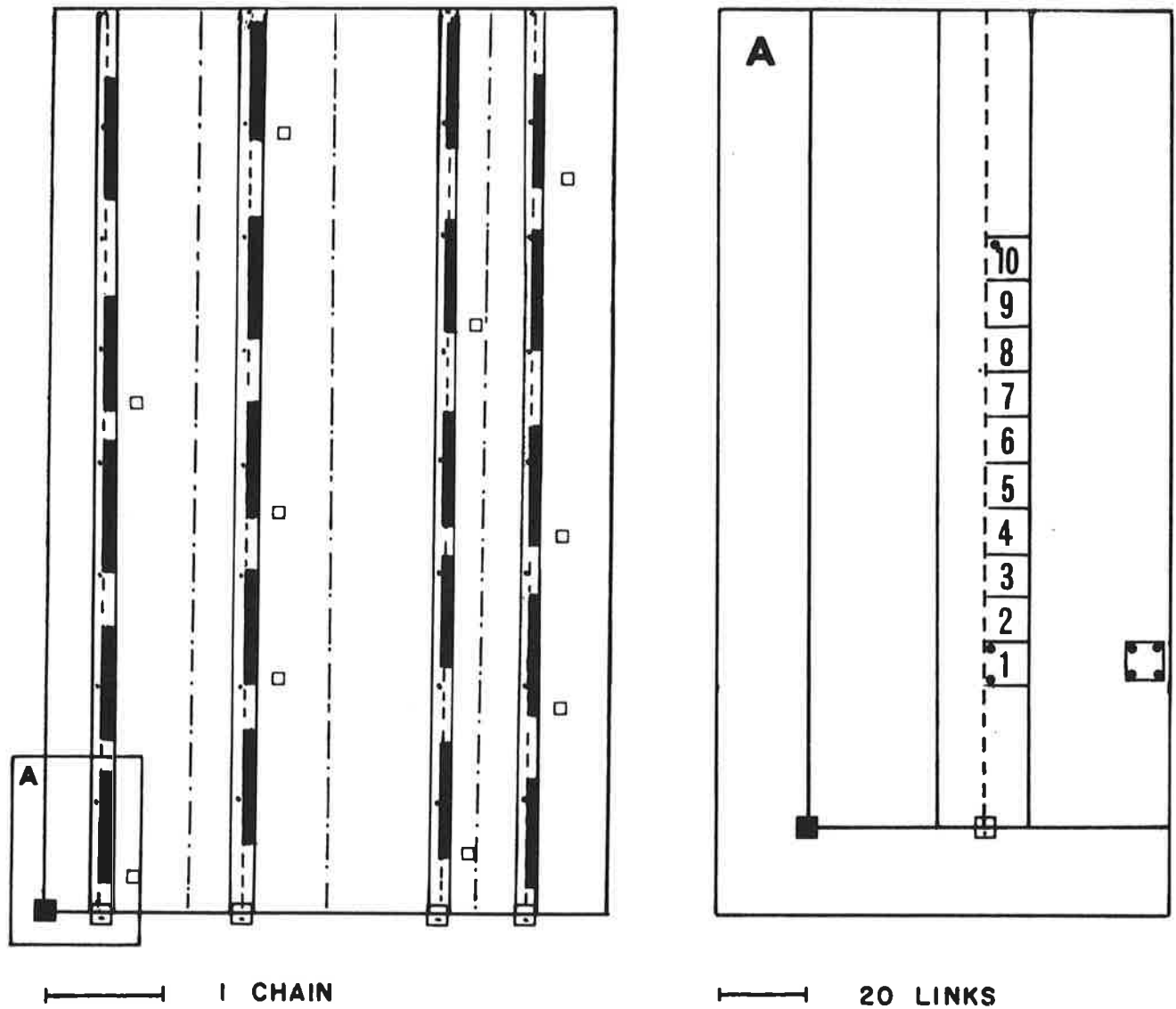
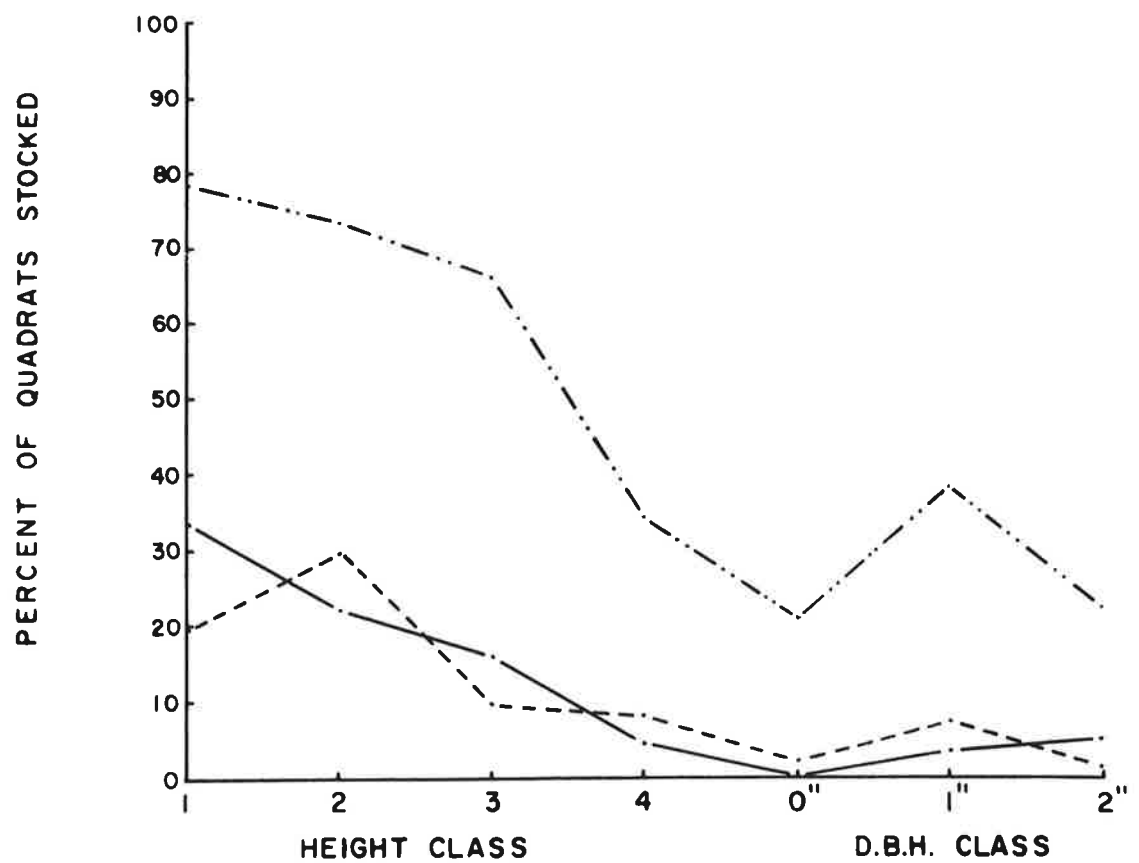
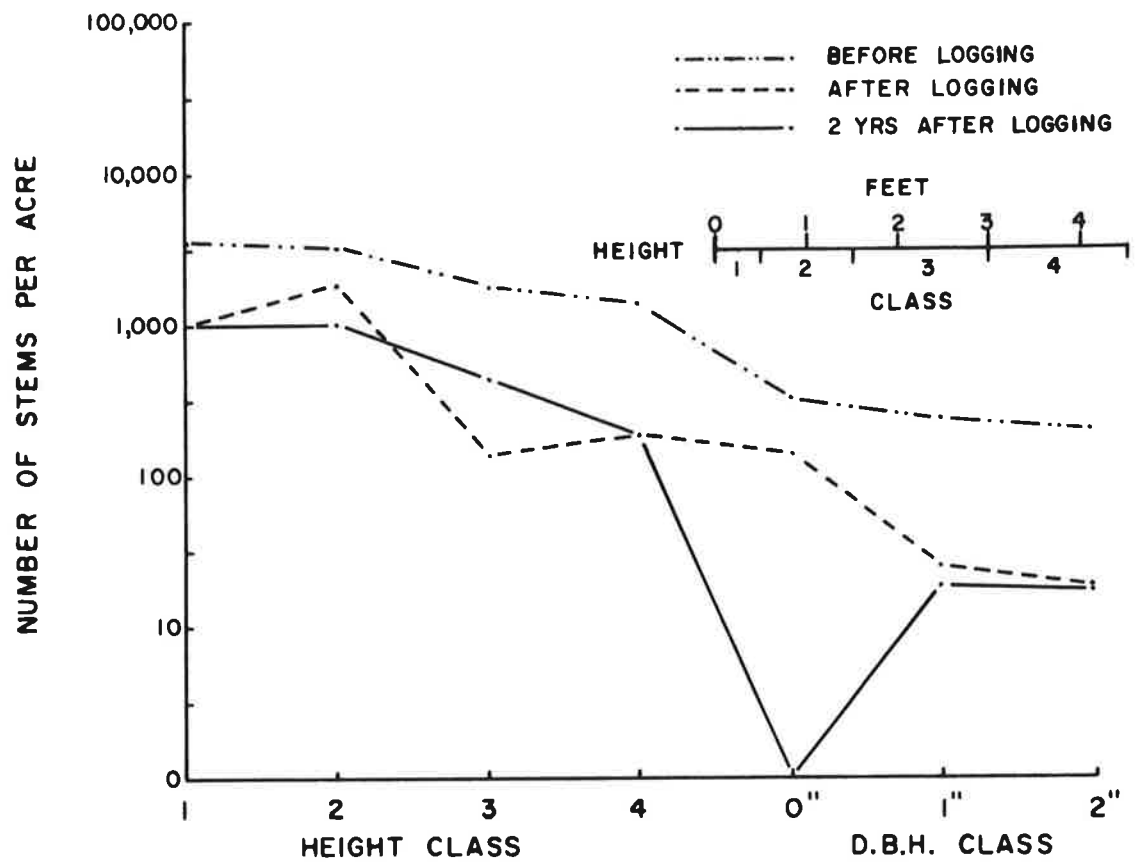


FIGURE 2. SAMPLING DESIGN FOR 4-ACRE STUDY AREA.

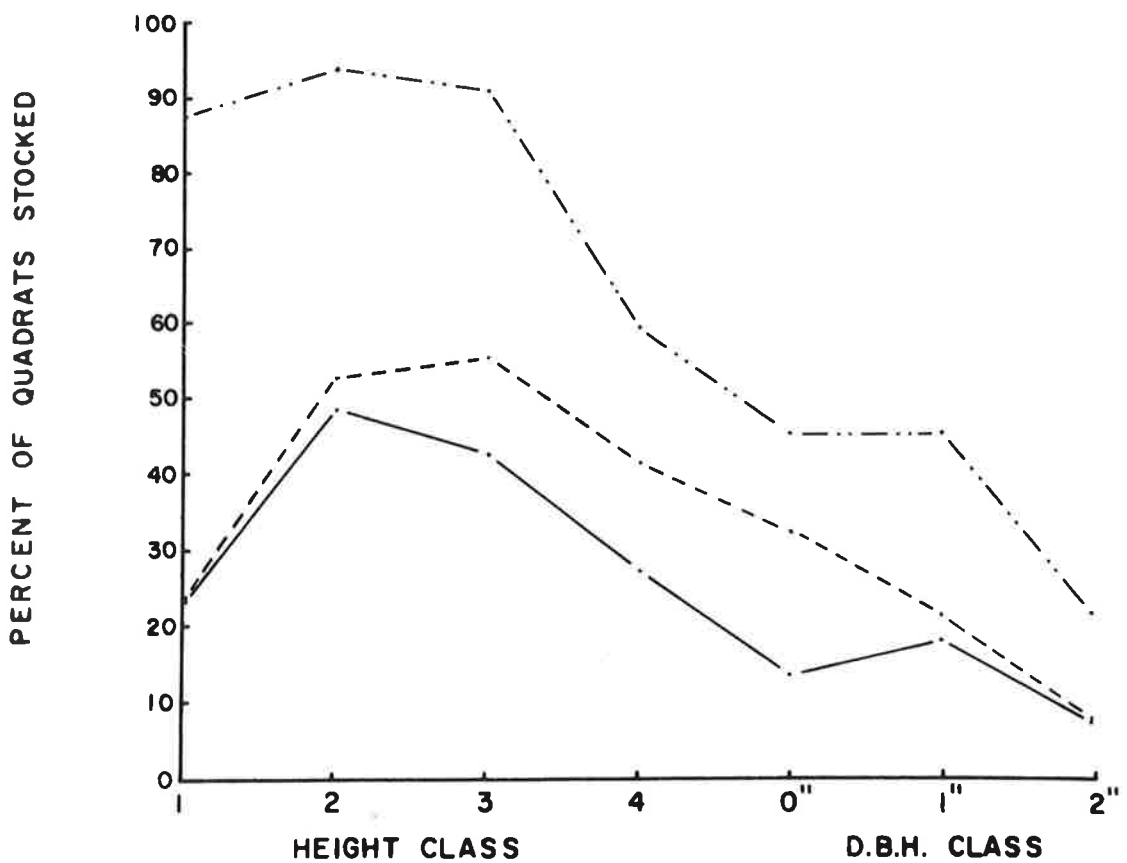
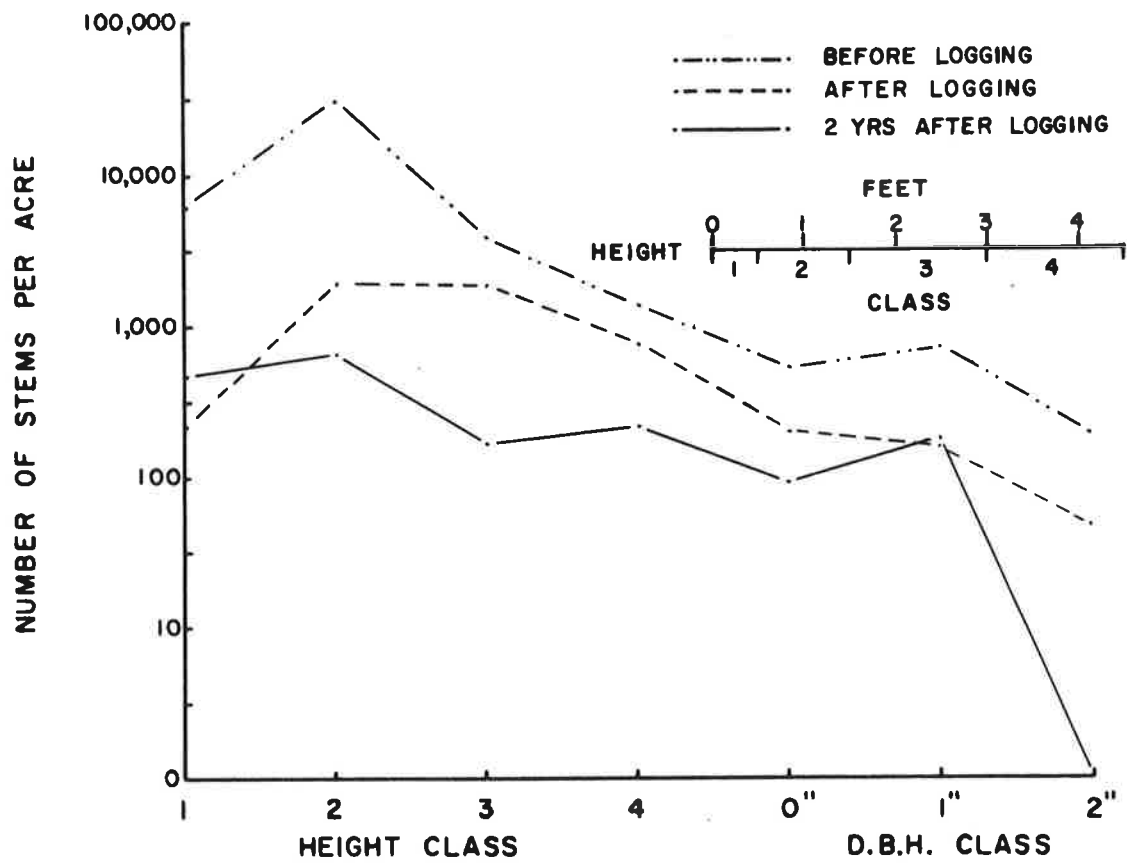


# LEGEND

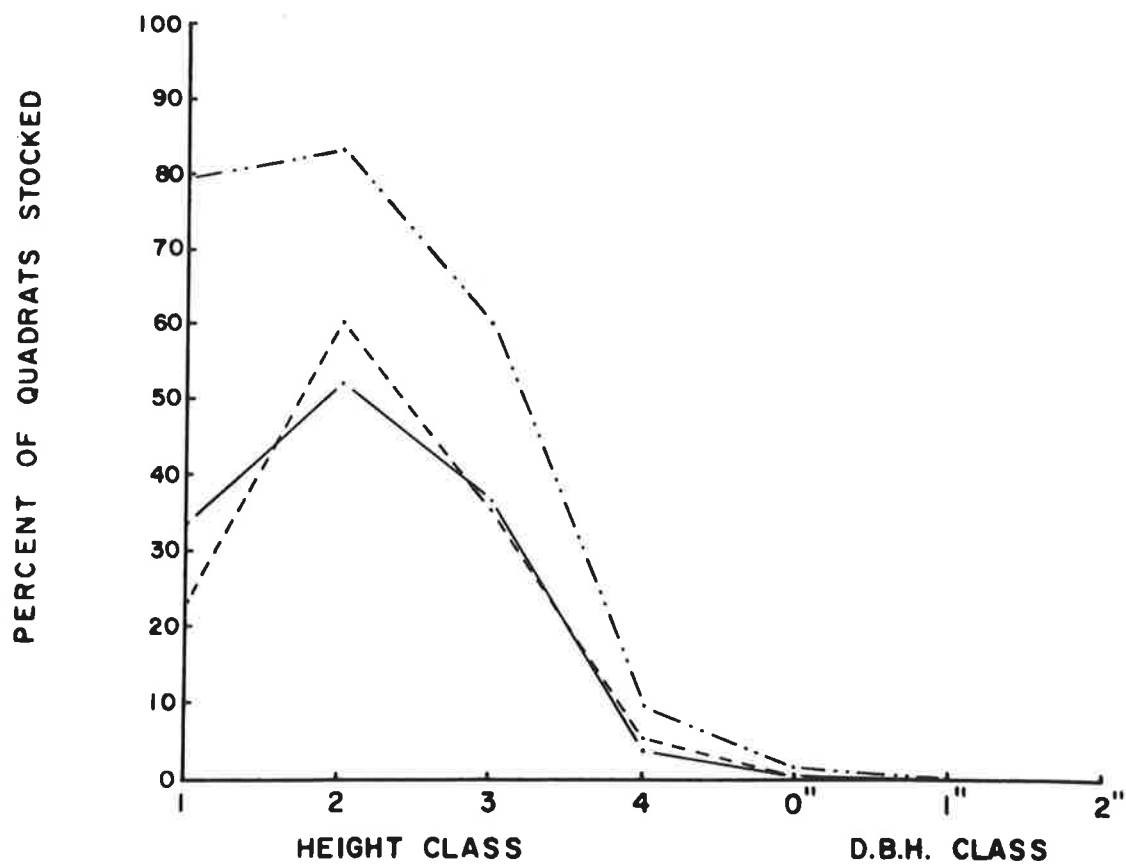
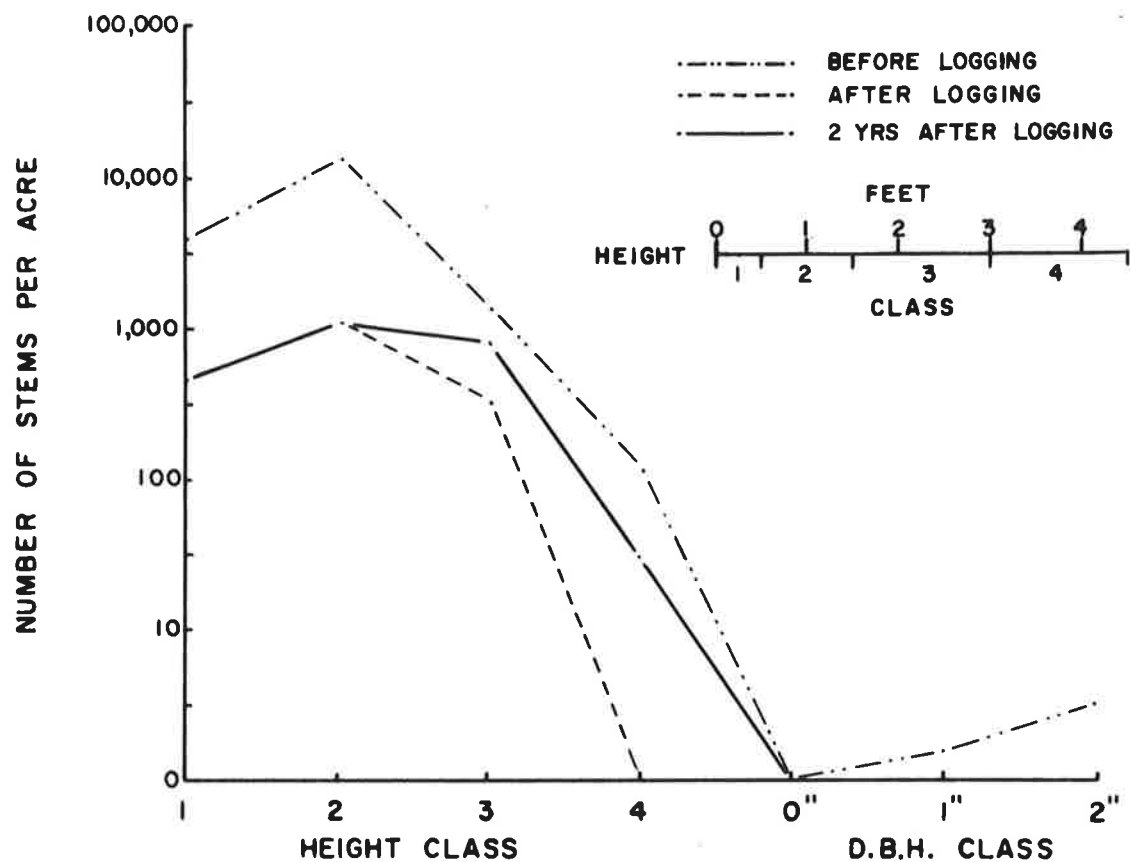
- PAINTED POST (2 FT.)
- PAINTED POST (4 FT.)
- ALUMINIUM PICKET
- EXTRA QUADRAT
- CORNER POST WITH ALUMINIUM PLAQUE
- . - . GRID
- - - TRAVERSE LINE
- ▬ 10 MILACRE STRIP



**FIGURE 3. ADVANCE GROWTH ON AREA 1 ; STEM NUMBER AND DISTRIBUTION BEFORE, IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**



**FIGURE 4. ADVANCE GROWTH ON AREA 2 ; STEM NUMBER AND DISTRIBUTION BEFORE, IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**



**FIGURE 5. ADVANCE GROWTH ON AREA 3 ; STEM NUMBER AND DISTRIBUTION BEFORE , IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**

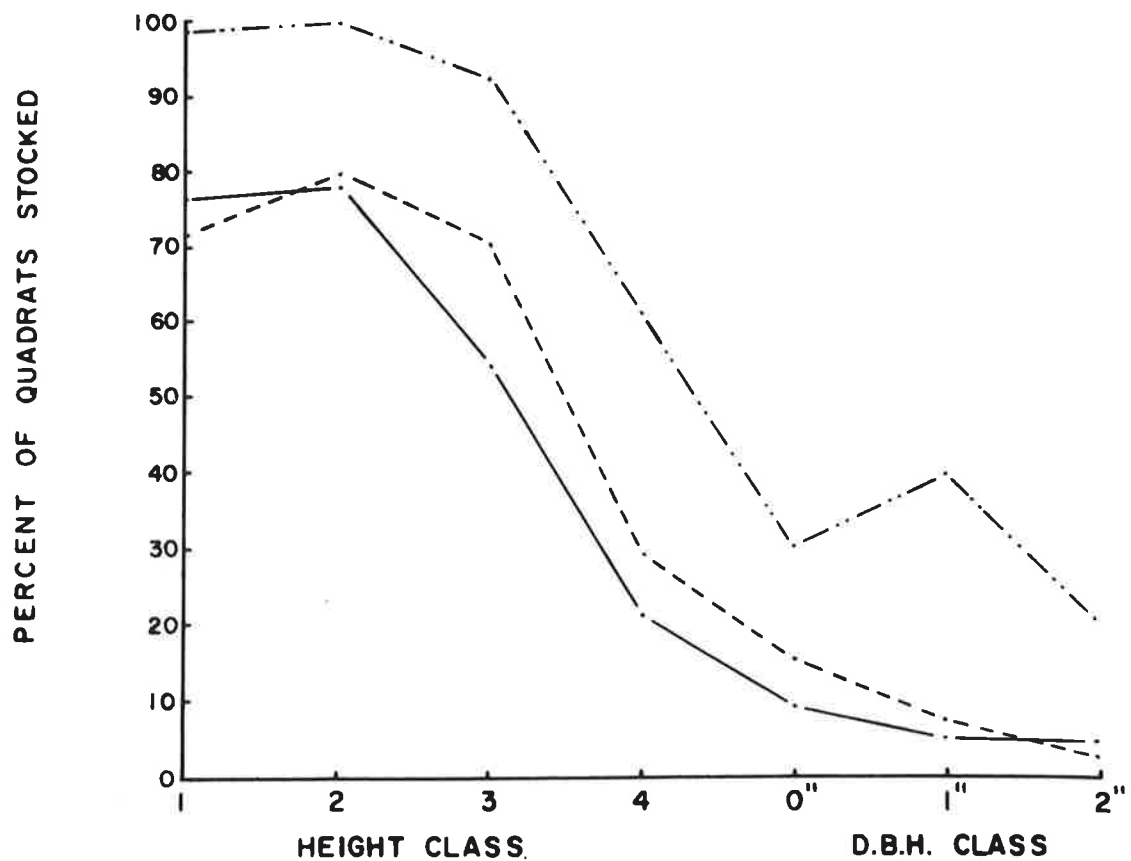
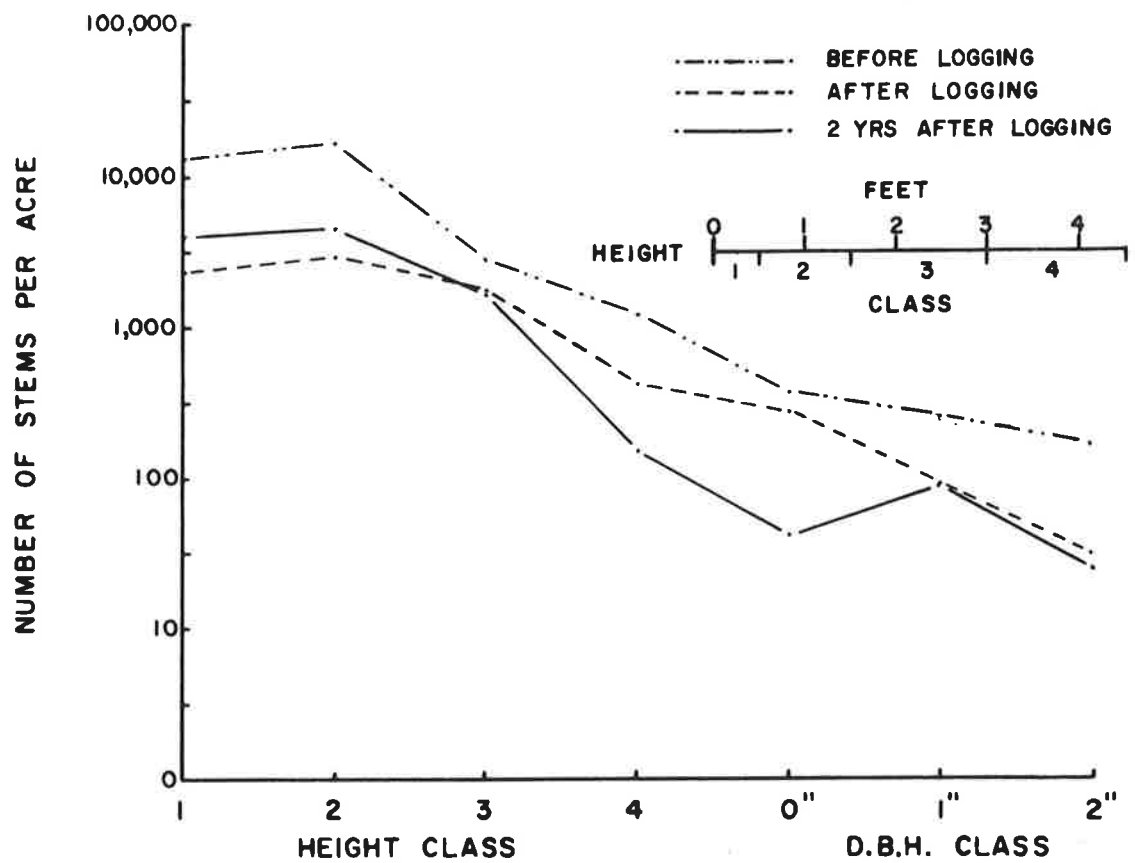
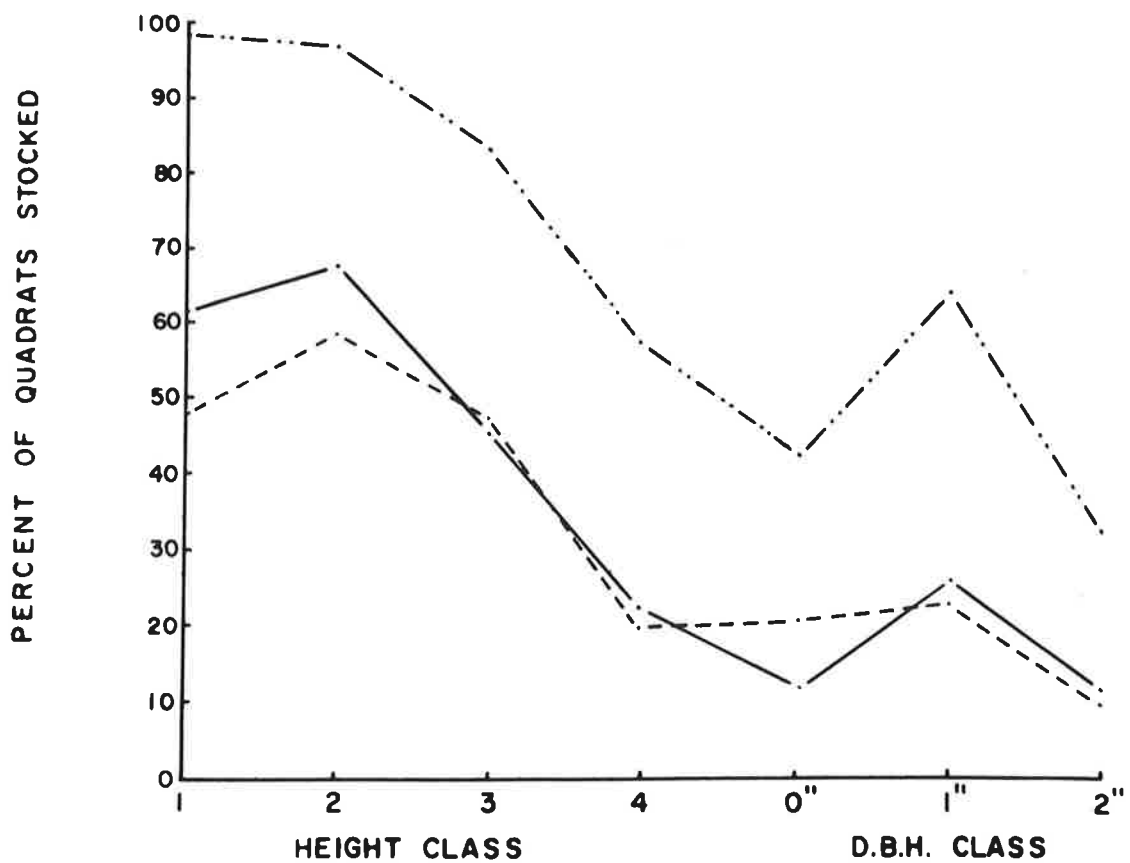
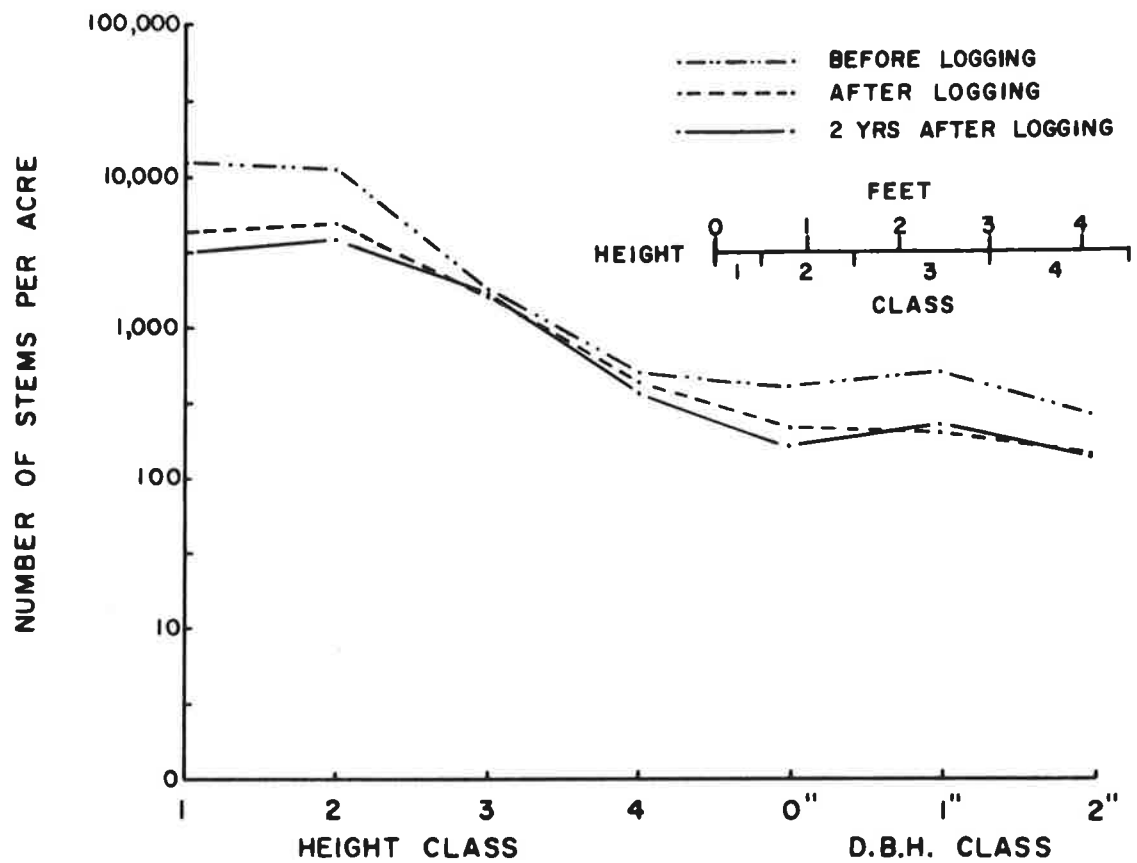
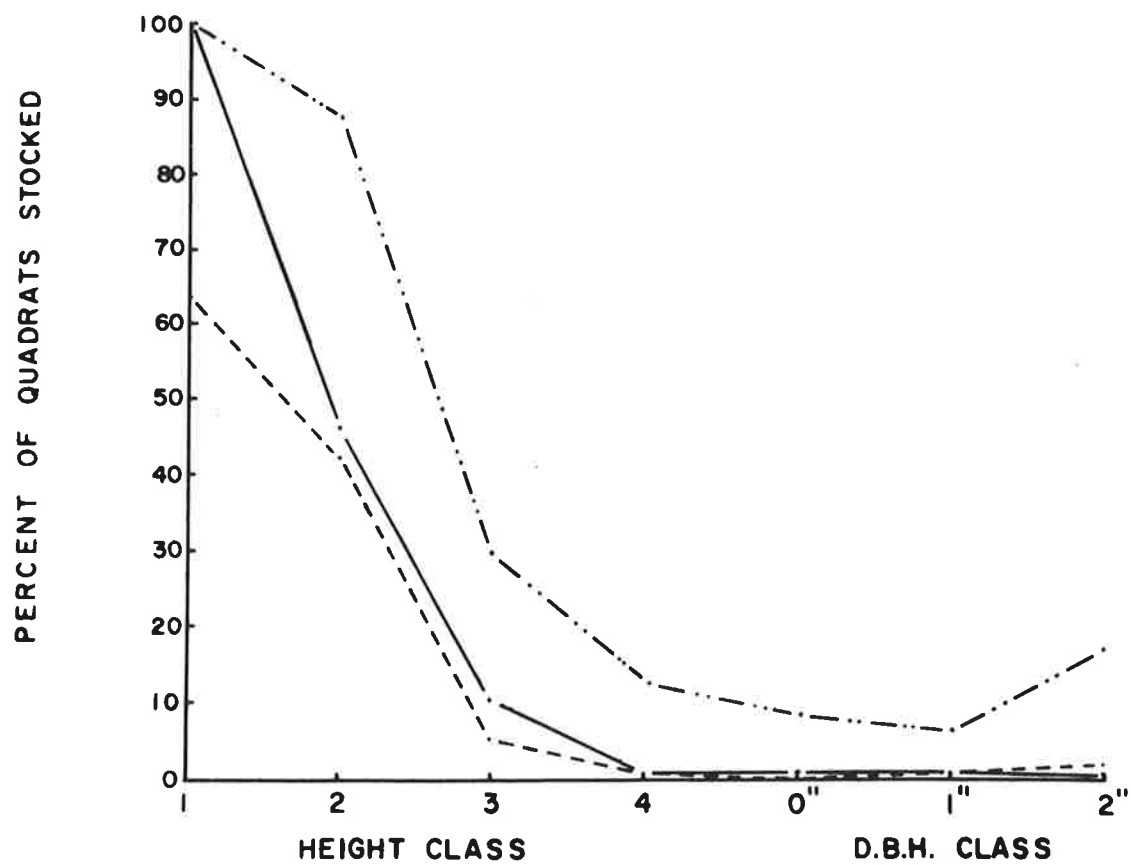
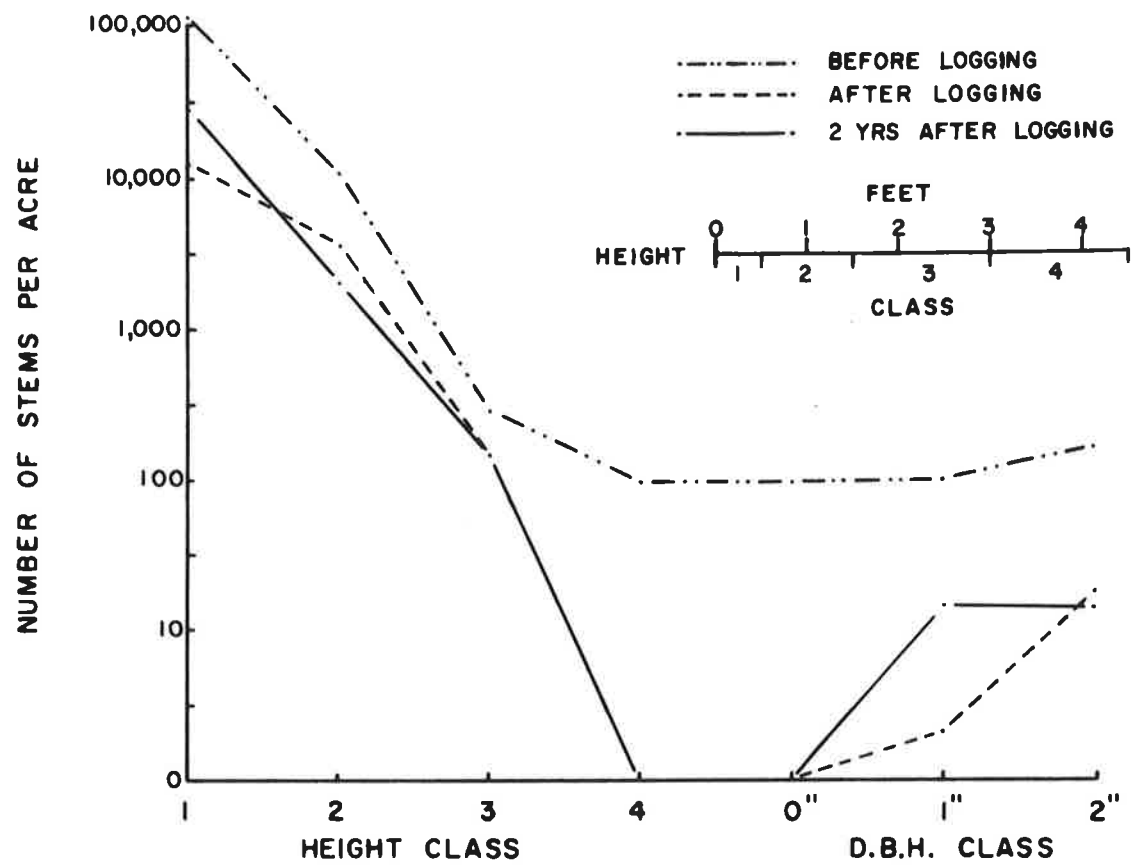


FIGURE 6. ADVANCE GROWTH ON AREA 4 ; STEM NUMBER AND DISTRIBUTION BEFORE , IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING





**FIGURE 7. ADVANCE GROWTH ON AREA 5 ; STEM NUMBER AND DISTRIBUTION BEFORE, IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**



**FIGURE 8. ADVANCE GROWTH ON AREA 6 ; STEM NUMBER AND DISTRIBUTION BEFORE, IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**

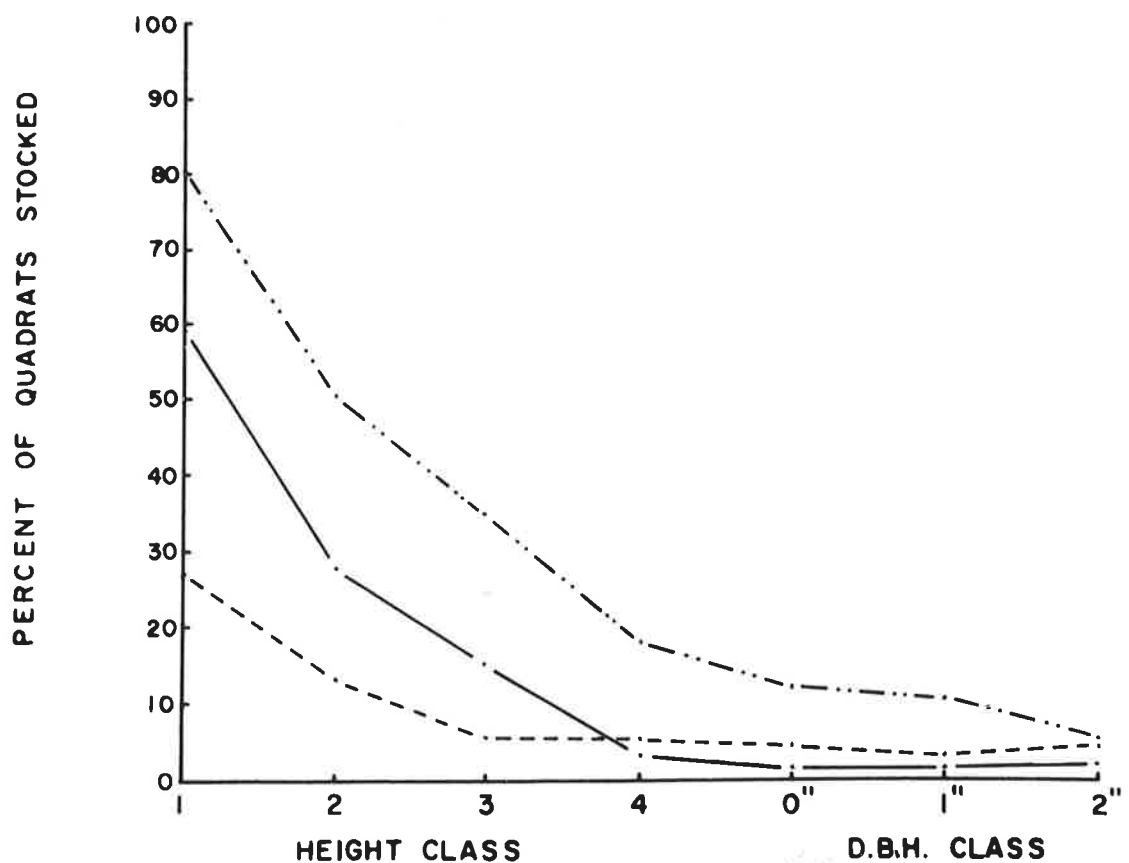
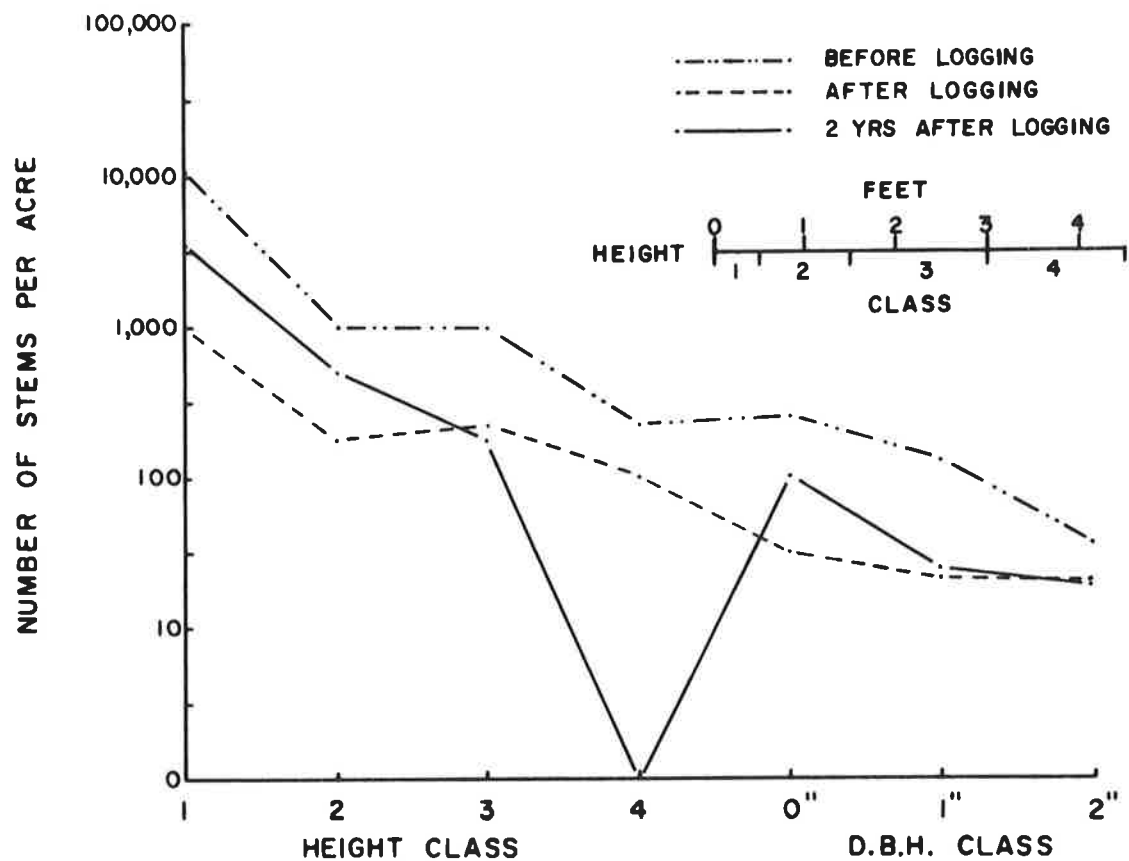


FIGURE 9. ADVANCE GROWTH ON AREA 7 ; STEM NUMBER AND DISTRIBUTION BEFORE , IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING

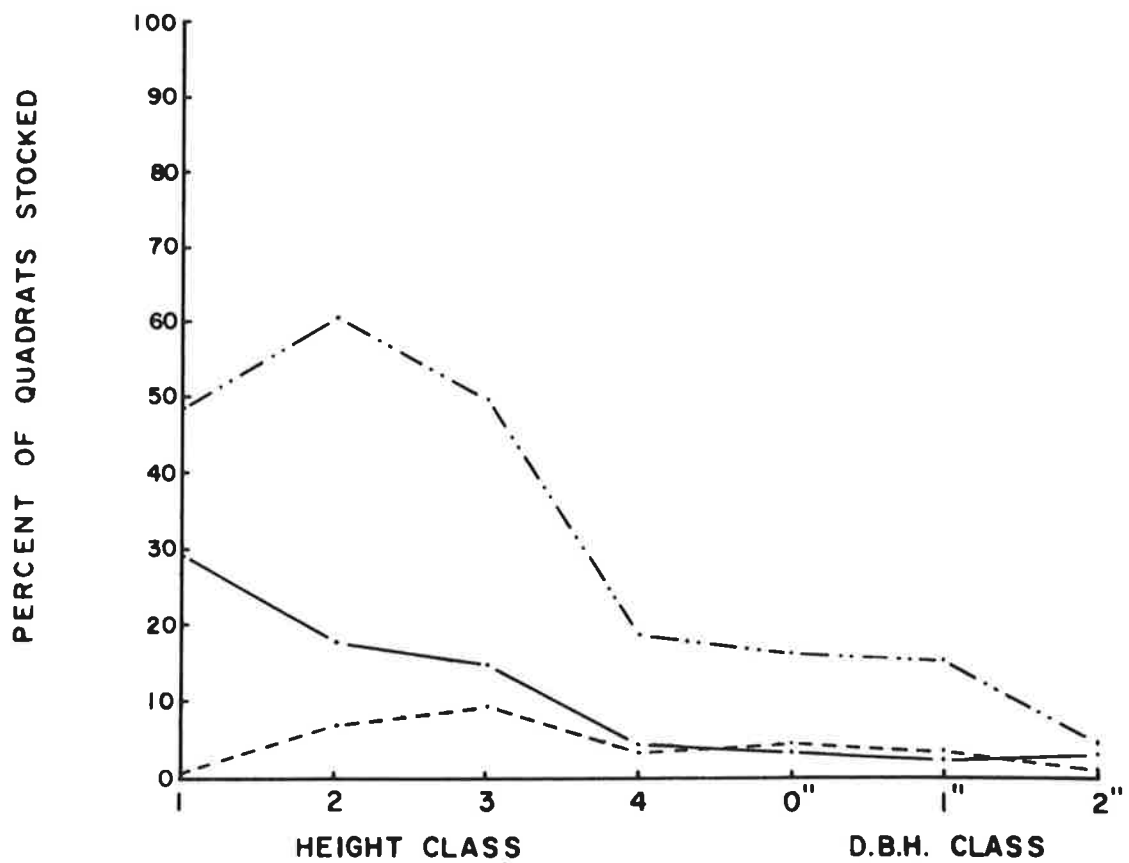
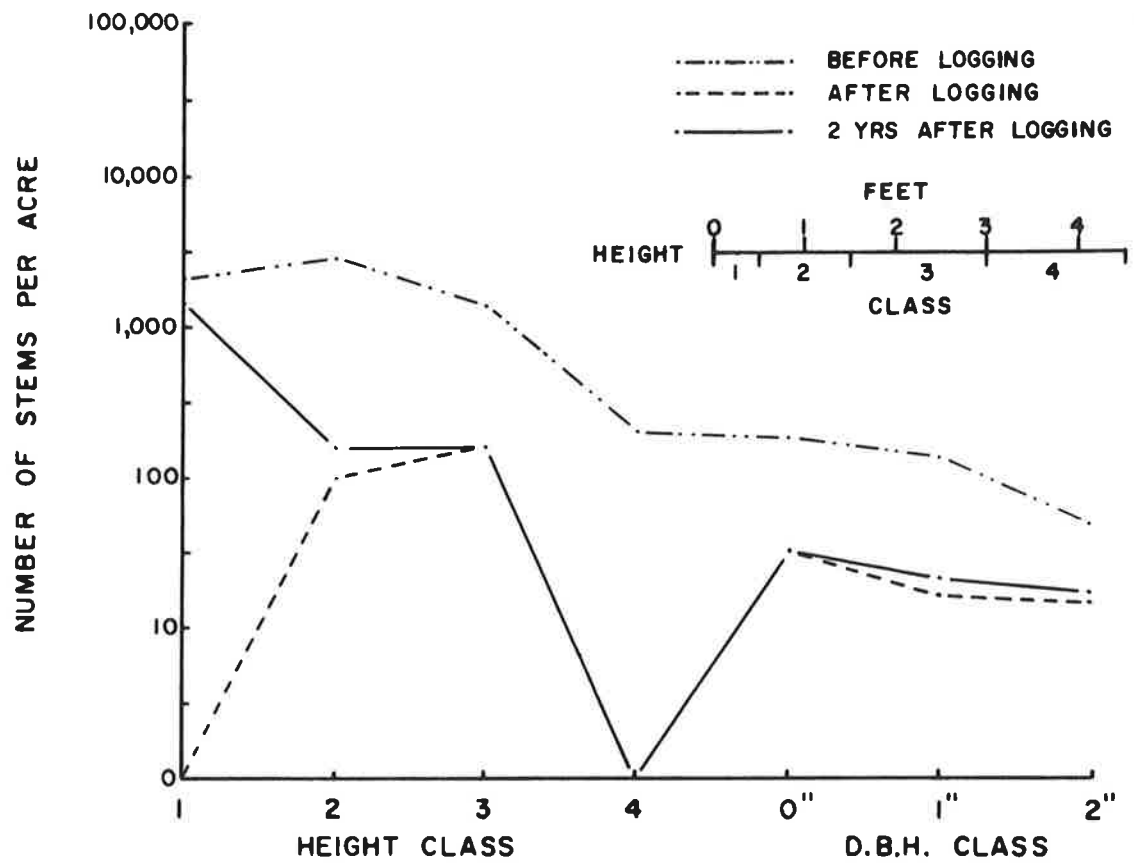
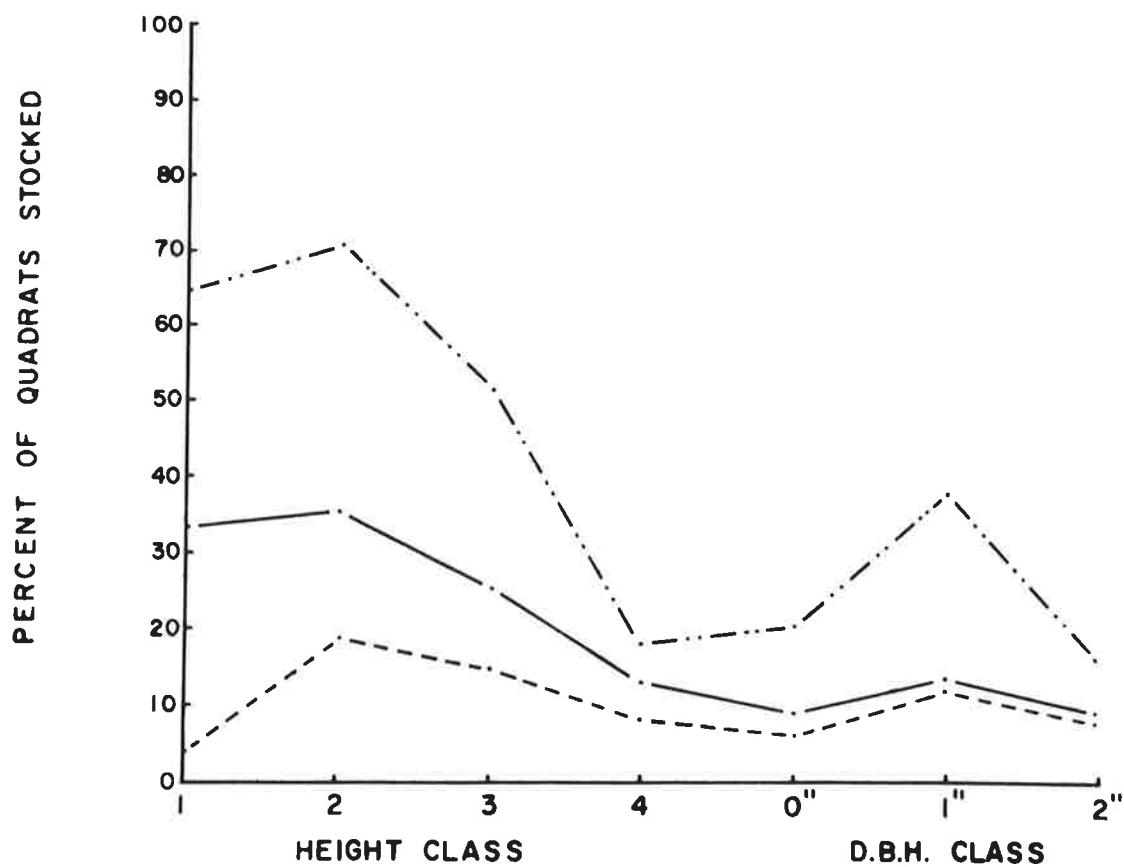
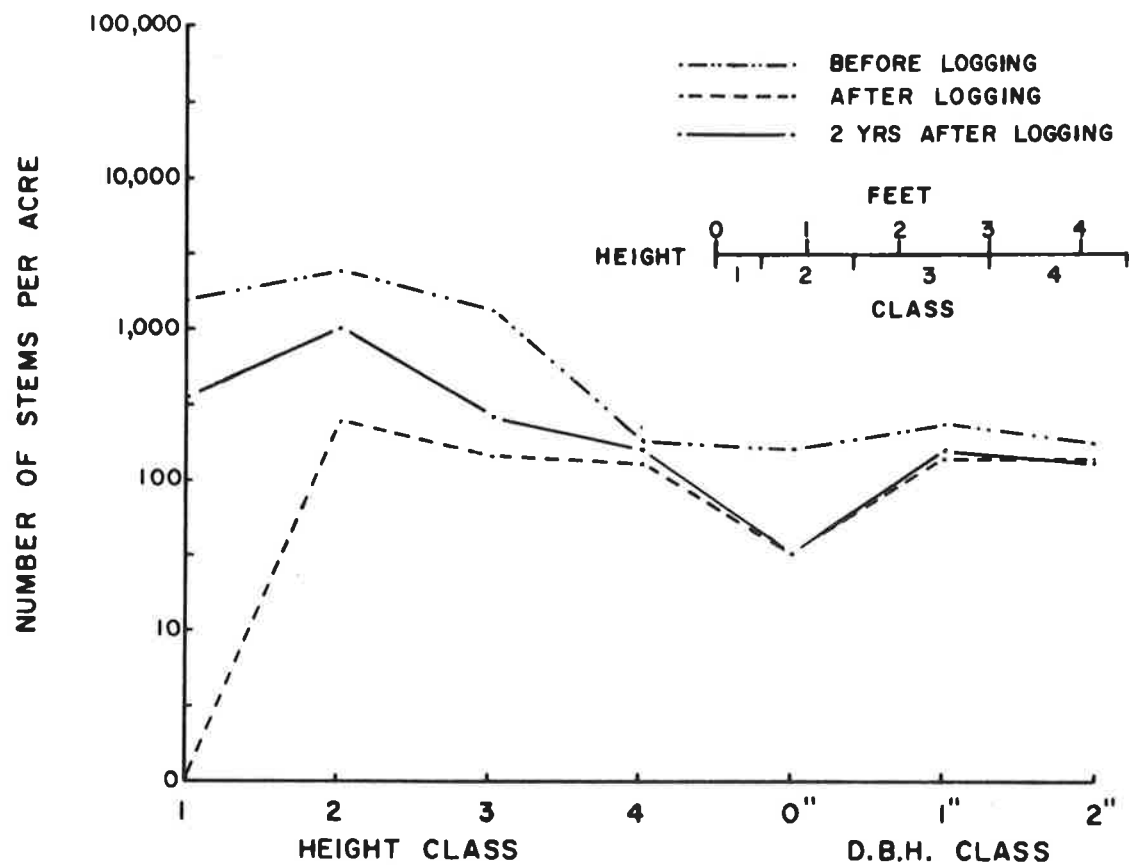


FIGURE 10. ADVANCE GROWTH ON AREA 8 ; STEM NUMBER AND DISTRIBUTION BEFORE , IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING



**FIGURE 11. ADVANCE GROWTH ON AREA 9 ; STEM NUMBER AND DISTRIBUTION BEFORE , IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**

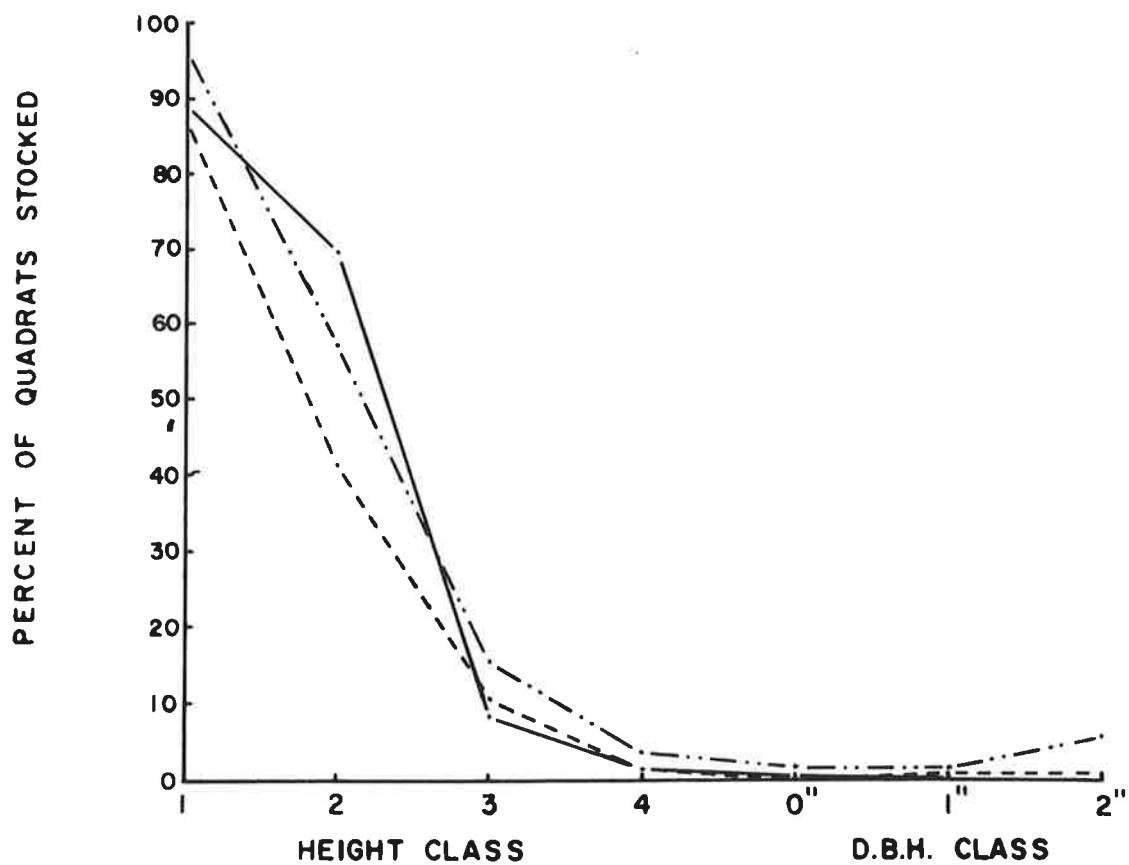
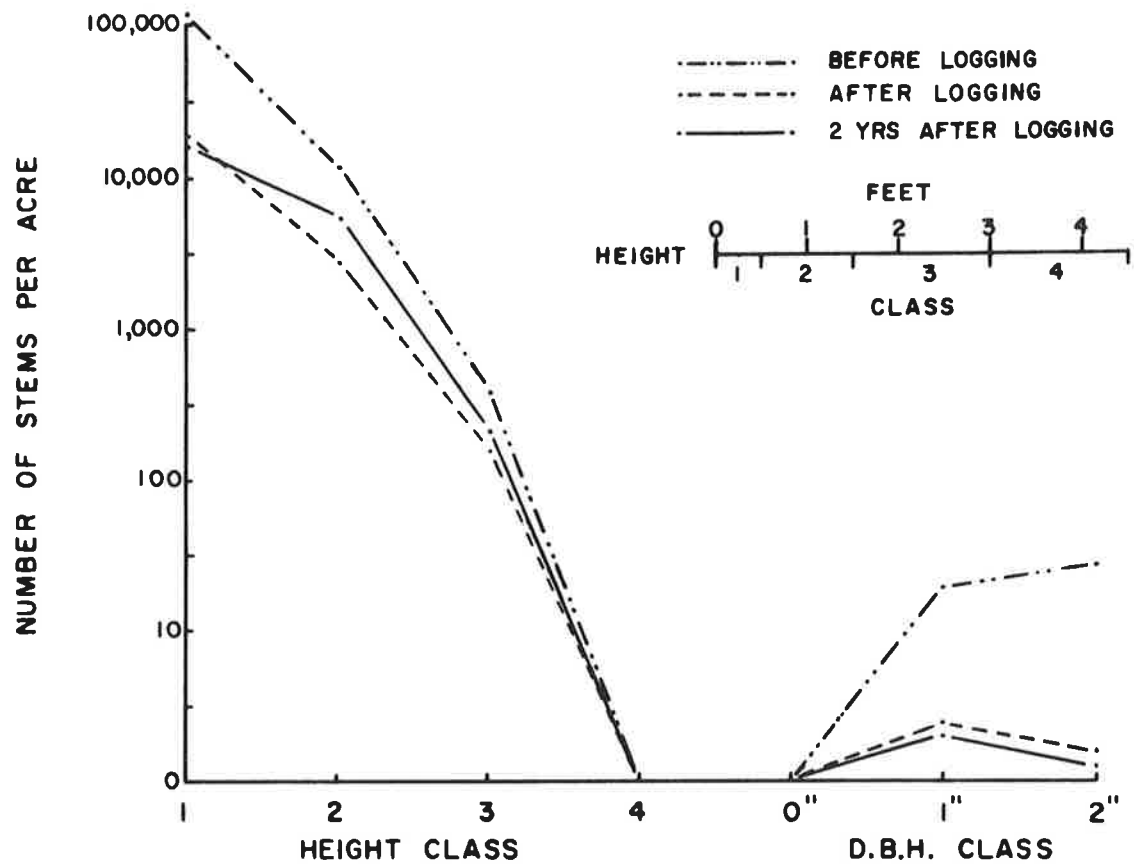
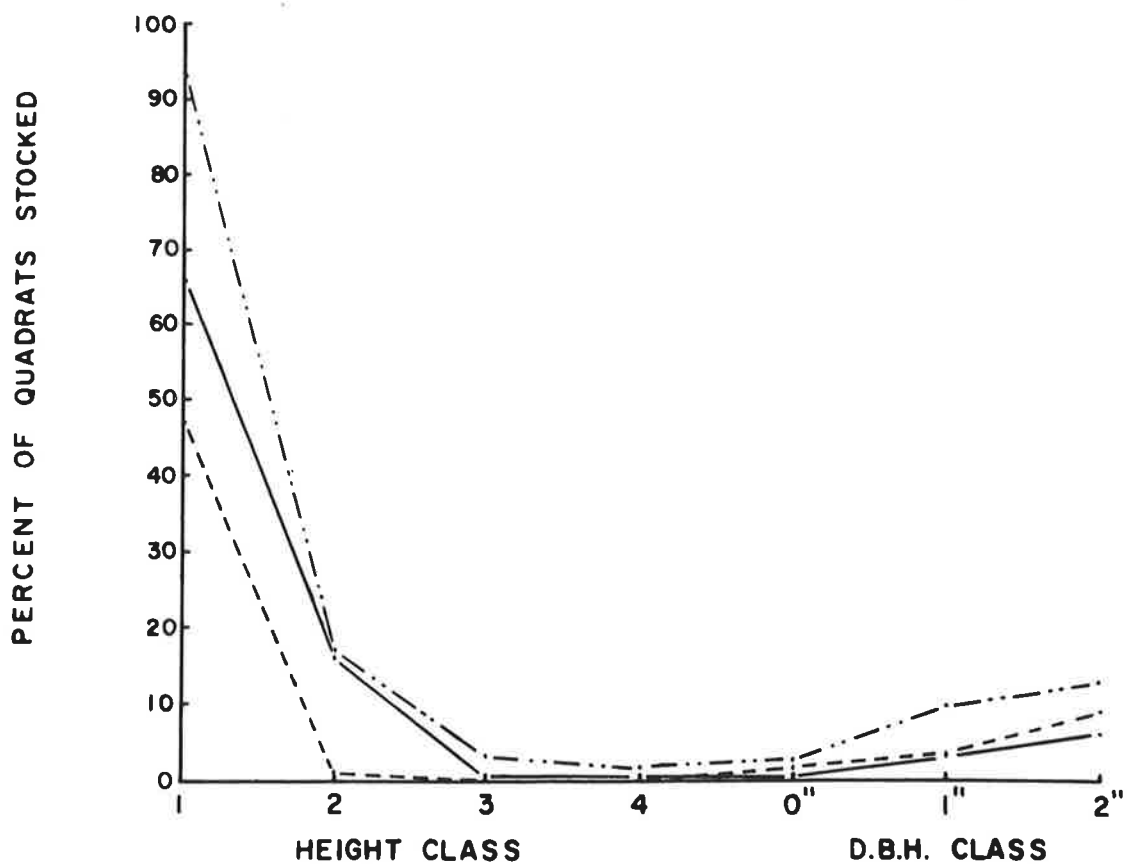
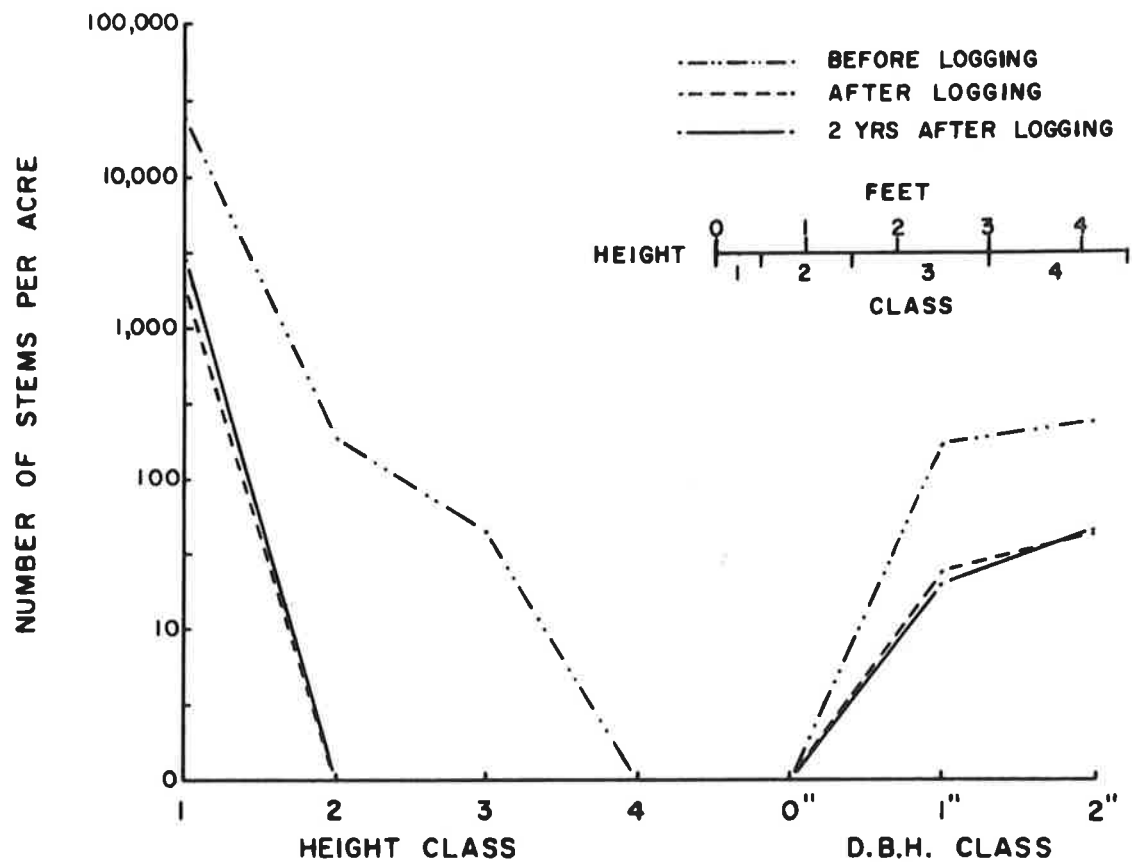


FIGURE 12. ADVANCE GROWTH ON AREA 10 ; STEM NUMBER AND DISTRIBUTION BEFORE , IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING



**FIGURE 13. ADVANCE GROWTH ON AREA 11 ; STEM NUMBER AND DISTRIBUTION BEFORE, IMMEDIATELY FOLLOWING AND 2 YEARS AFTER LOGGING**