SX 83701 V

EFFECT OF TIMING ON THE SUCCESS OF MECHANICAL CONTROL OF RED ALDER-OPERATIONAL TRIAL

ESTABLISHMENT REPORT

BY

FRANK PENDL
AND
BRIAN D'ANJOU

MINISTRY OF FORESTS
RESEARCH SECTION
VANCOUVER REGION

APRIL, 1984

TABLE OF CONTENTS

1. INTRODUCTION

Red alder (Alnus rubra Bong.), a common deciduous tree species found throughout the coastal area of B.C., has been one of the major impediments to the successful survival and growth of conifers on some of the best forest sites within the Vancouver Forest Region. Because of its rapid juvenile growth and ability to form dense stands, red alder is capable of dominating recently logged sites, and out competing conifers for growing space and moisture. Although there are several herbicides that are effective control agents against red alder, many areas in the region are environmentally sensitive (near population centres, close to important water bodies) making the use of herbicides unpopular with some of the public. One possible alternative for red alder control is manual brushing, employing chainsaws or circular brush saws to cut back young alder, temporarily releasing the conifers from alder competition.

The effectiveness of manual brush control as a practical silvicultural tool against red alder has not been studied extensively. The rapid resprouting and growth of red alder and other brush species after cutting has led most researchers to the study of herbicides for such brush problems. However, recently a cooperative brush control study began in Western Washington and Oregon, employing chainsaws for the control of several common species of brush, including red alder (Roberts, 1980). The benefit of the manual treatment in this study has

so far been negligible, based on conifer height growth. Harrington (1983) studied the effects of tree age, period of cut and height, angle and aspect of cut on the early resprouting of red alder. Both the Harrington and Roberts studies supported the theory that alder's (as well as other brush species) ability to resprout is minimized if cut immediately after leaf development in the spring. Harrington also suggested stump mortality could be maximized by cutting the alder as low to the ground and as level as possible.

An opportunity to study further the sprouting habits of red alder and the practicality of manual control arose in 1983 when local concerns negated the use of herbicides on an immature conifer-red alder stand near Powell River, B.C. The site, gently sloping and relatively clear of debris was ideal for establishing an operational trial employing circular saws for the control of red alder.

The primary objectives of the trial are;

1. Examine the effects of timing of cut on the resprouting of red alder. Five treatment periods between June 7 and Sept. 1 will be compared. The most effective treatment period (minimum alder regrowth) will be determined.
2. Determine the effect of alder removal on conifer growth and health. The most effective treatment period based on subsequent conifer growth will be determined.

Secondary objectives of the study are;

3. Determine the effects of stump height and angle of cut on the survival and resprouting of red alder.
4. Report any damage to conifers directly attributable to the brushing operation.

This establishment report will summarize work completed in this trial to date. Damage to conifers resulting from the brushing operation will be discussed.

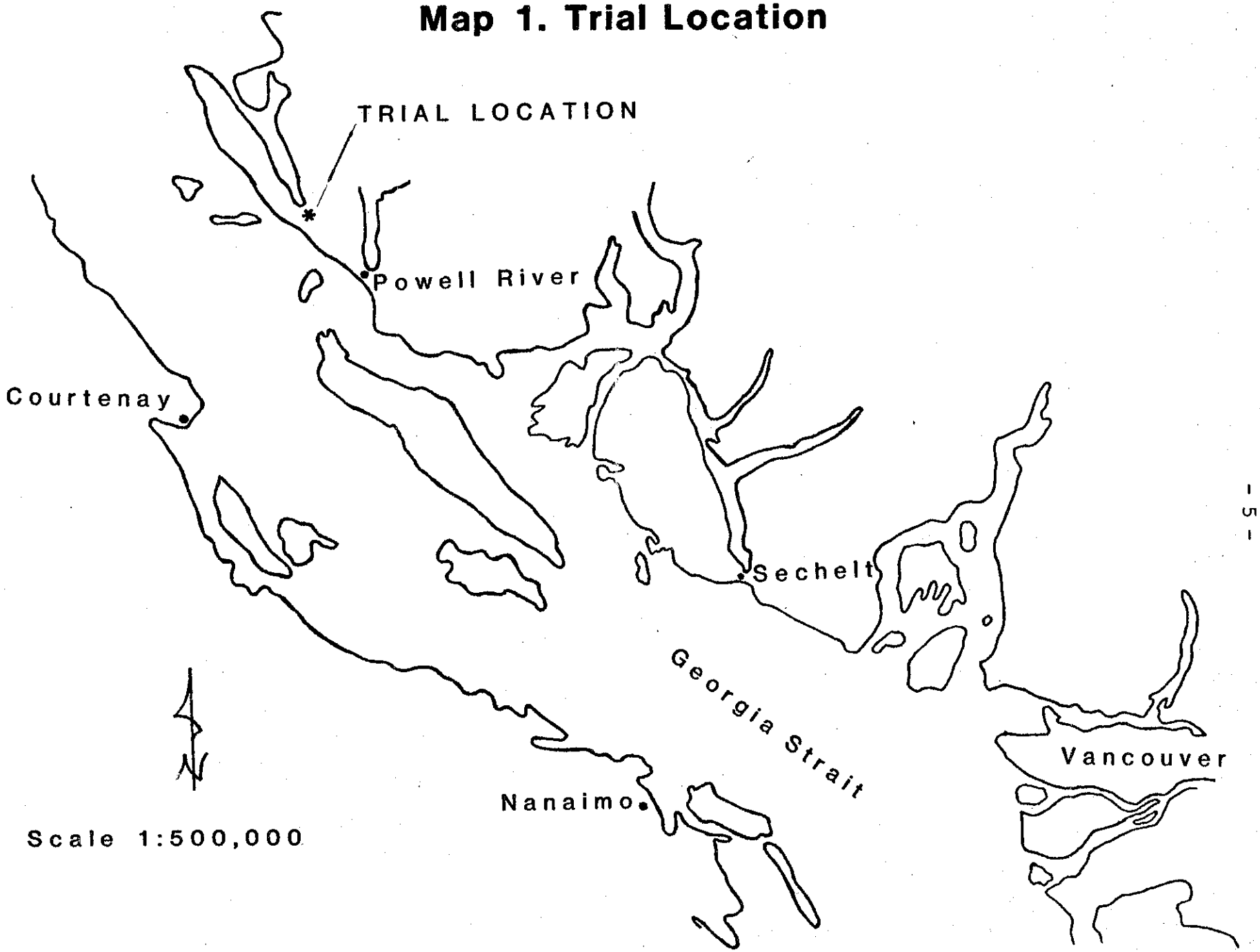
2. SITE HISTORY

The trial was established on a site about 16 km northwest of Powell River, B.C. (Map 1). The site is located within the Wetter Coastal Douglas-fir Biogeoclimatic Subzone at an elevation between 80 and 120 meters above sea level. Prior to logging, an immature stand of Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) between 41 and 60 years of age occupied the site with a minor component of western hemlock (Tsuga heterophylla (Raf.) Sarg.). The Douglas-fir was infected with Phellinus weirii, a root rot destructive to immature Douglas-fir, so to control the spread of the root rot, the stand was logged between 1976 and 1978.

In 1978, a caterpiller tractor pulled out stumps on 20.7 ha of the site in an attempt to isolate root rot infections. The resulting debris was collected into piles but was not burned. This stump pulling operation created a disturbed soil layer between 6 and 12 cm in depth, much deeper in some areas. Despite the disturbance, soils in the study area were identified as a Gleyed Humo-Ferric Podzol in the lower portion of the study area and a Duric Humo-Ferric Podzol, with mottled horizons near the cemented layer, in the upper portion (Nuszdorfer, 1983).

Based on soil characteristics, the lower portion of the study area was judged to have a soil moisture regime ranging from subhygric to hygric while the moisture regime ranged from

Map 1. Trial Location



submesic to mesic in the upper portion. The nutrient regime for the entire study area was poor to medium, due to low organic matter content of the soil combined with coarse soil texture.

In the spring of 1979, the site was planted with a 70%/30% mix of Douglas-fir and Grand fir (Abies grandis (Dougl. ex D. Don)) (stock description in Appendix 1). Survival studies in the spring of 1980 indicated high survival of both species (Douglas-fir: 90%, Grand fir: 100%).

A survey of the site in the fall of 1980 revealed a stand of red alder had regenerated from seed. The disturbed mineral soil on the site proved ideal for the regeneration of alder and rapid early growth allowed it to dominate and overtop the newly established conifer regeneration. In November and December of that year, 9.5 ha of alder was manually treated with chainsaws. Seven months later, all the alder cut had coppiced, with sprouts averaging one meter in height. The alder continued to grow unabated when a pre-treatment survey within the trial area was taken in the spring of 1983 (Table 1).

Table 1. Pre-treatment Survey of the Operational Trial Site - Spring 1983

	Area not manually brushed	Area manually brushed in 1980
Stems per ha		
(i) Alder (1.3m ht)	4,300	51,500
(ii) Conifers (planted and naturals)	1,800	2,250
Conifer Height (m) planted only		
(i) Douglas-fir	1.24	1.20
(ii) Grand fir	.94	.99
Alder height (m)	4.5	3.3
Average diameter of alder (cm)	3.5	1.2

The manual brushing treatment increased the number of alder stems per hectare by more than 12 times. The average diameter and height of the alder however decreased due to the brushing. The pre-treatment survey also indicated good stocking of conifers, consisting mainly of the planted Douglas-fir and Grand fir (1650 SPH). About 160 SPH of Western Hemlock (Tsuga heterophylla) seedlings were counted, seeding in from the stand above the trial location. Scattered stems of Western red cedar (Thuja plicata), Sitka spruce (Picea sitchensis) and Lodgepole pine were found in small numbers (< 50 SPH) beneath the alder canopy.

3. EXPERIMENTAL DESIGN

The operational trial was established in the southern end of the opening (Appendix 2). The plots were located between a road which transects the opening and a stand of Douglas-fir and Western hemlock. The site had a south westerly aspect, with slope averaging between 30 and 40%.

The study area was divided into four blocks (Map 2). Blocks C and D contained alder that had been manually treated in the fall of 1980. Blocks A and B contained alder left untreated. Each block (.68 ha in size) contained six treatment plots, one plot for each of the five treatment periods plus a control with the alder left uncut. Each treatment plot was randomly assigned within each block.

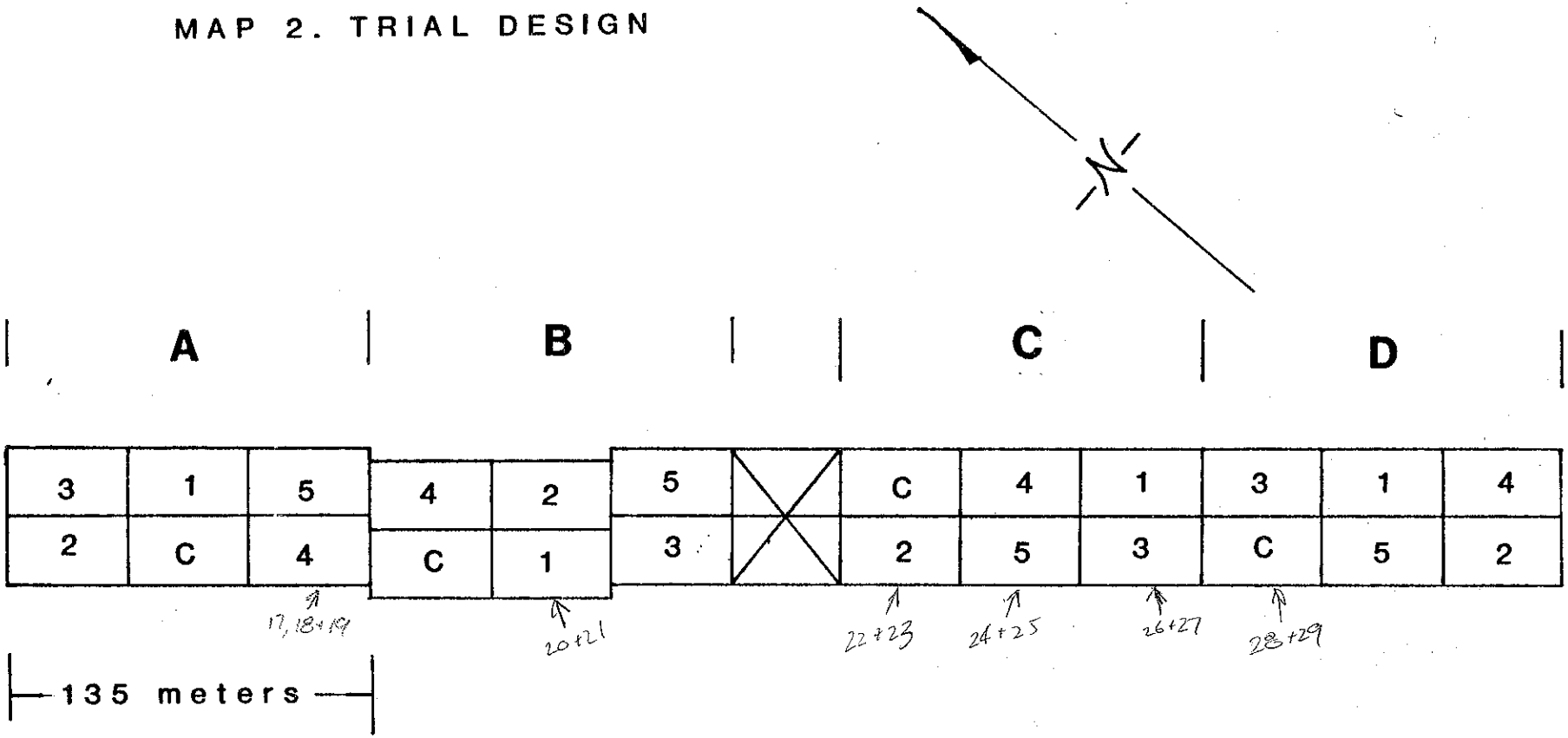
The five treatment periods for this trial are indicated in Table 2.

Table 2. Treatment Periods for the Manual Control of Red Alder

Treatment Plot #	Treatment Period
1	June 7 - 8
2	July 5 - 7
3	July 19 - 21
4	Aug. 2 - 4
5	Aug. 30 - Sept. 1
C	Control-Untreated

An area approximately 1 km northwest of the initial trial location was treated with chainsaws between December 27th and January 1st, 1984. The area was almost identical in vegetation and soil condition to the initial trial, with red alder dominating a recently established stand of Douglas-fir and grand fir. Four plots were established in this "dormant treatment", with 50 conifers and 50 alder stumps sampled in each plot by previously discussed methods.

MAP 2. TRIAL DESIGN



SCALE 1:2500

4. METHOD OF BRUSHING

Light weight, rotary shaft brushcutters were used throughout this trial to cut the alder (Photo 1). The workers were instructed to cut the alder as low to the ground as possible and as level as possible. The number of workers actually cutting in a day varied between 3 and 5. No more than two workers would cut on one plot at a time. No formal production figures for the cutting operation were kept but a group of four cutters would complete the four plots in 1.5 to 2 days. This translates roughly to a production figure of .1 to .08 ha per day per person. However machine breakdowns were common, reducing considerably the productivity of the workers in this trial.

No serious accidents occurred during the cutting operation. Problems did arise when hornets and wasps were in the active state, for the area had large populations of nests both in the alder canopy as well as on the ground. Temperature and humidity readings were taken on site during most days the cutting was taking place.

5. SAMPLING AND MEASUREMENTS

After brushing was completed on a plot, 50 alder stumps and 50 planted conifers were randomly selected using computer generated random point maps (Appendix 3). Each selected stump and conifer was staked with a 4 foot cedar stake to which a plastic number tag was attached.

At time of sampling, the following information for each conifer was recorded;

(i) species

(ii) pathological remarks

(iii) interference from alder brush, if any.

Since the alder in blocks C and D had been treated once before (and coppiced) and blocks A and B had not, information collected at time of sampling was different.

(a) Blocks A and B

(i) stump diameter

(ii) stump height

(iii) angle of cut

(b) Blocks C and D

(i) Number of cut coppices

(ii) Height of coppices (put into height classes)

In all blocks, the number of live branches coming from each sampled alder was recorded.

Fall assessment was done in the first week of October after conifer growth had ceased. Conifer height, diameter, and health as well as coppice growth on the alder stumps were measured. Appendix 4 and 5 indicate data collected in these preliminary measurements for sampled conifers and alder respectively. The codes used to assess conifer health are indicated in Appendix 6.

6. DISCUSSION

No statistical comparison will be made at this time between the treatment dates relative to coppicing or conifer growth. Since the alder stumps in each treatment period had a different length of growing season to coppice, the comparison at this time would be meaningless. This comparison will be done at the end of next growing season.

In terms of the direct impact of brushing on the conifers, assessment after brushing revealed about 6% of the trees were covered by debris, seriously interfering with leader growth or creating a prominent lean in the conifer. A slightly larger percentage of Grand fir were covered by debris compared to Douglas-fir, mainly due to Grand firs smaller average height. A percentage of these disturbed trees will eventually be able to develop normally after alder brush begins to decay. Future assessments will determine this percentage. About 1% of the conifer were completely severed at or near ground level, almost eliminating any possiblity of developing into crop trees, and 1.5% of the trees had scars on the stem or branches resulting from the saw blades, but most of the injuries were not considered serious. Since the site was well stocked with conifers ($\geq$ 1800 SPH) previous to brushing, any damage to conifers directly attributable to the brushing operation cannot be considered serious.

Grand fir was affected the greatest by the removal of the alder canopy, with 20% of the stems displaying symptoms of sunscald. Only 3% of the Douglas-fir displayed similar symptoms. Douglas-fir leaders and laterals did tend to droop for a few days after alder removal but returned to normal several days later.

In spite of the stump pulling operation which took place in this area to eliminate infection centers of the root rot Phellinus weirii, some Douglas-fir seedlings in the trial area had early symptoms of the disease. Any sampled conifers having symptoms of root rot will be recorded in future assessments, allowing us an idea of spread patterns and rates.

Alder coppicing occured for all treatment periods, Appendix 7 is a summary of coppicing that occurred as of early October. Total sprout growth is an arithemetic summation of all coppice growth that occurred on an alder stump

7. REFERENCES

Harrington, C.A. 1983. Factors influencing initial sprouting of red alder. Draft Report. Forestry Sciences Laboratory, Olympia, Washington.

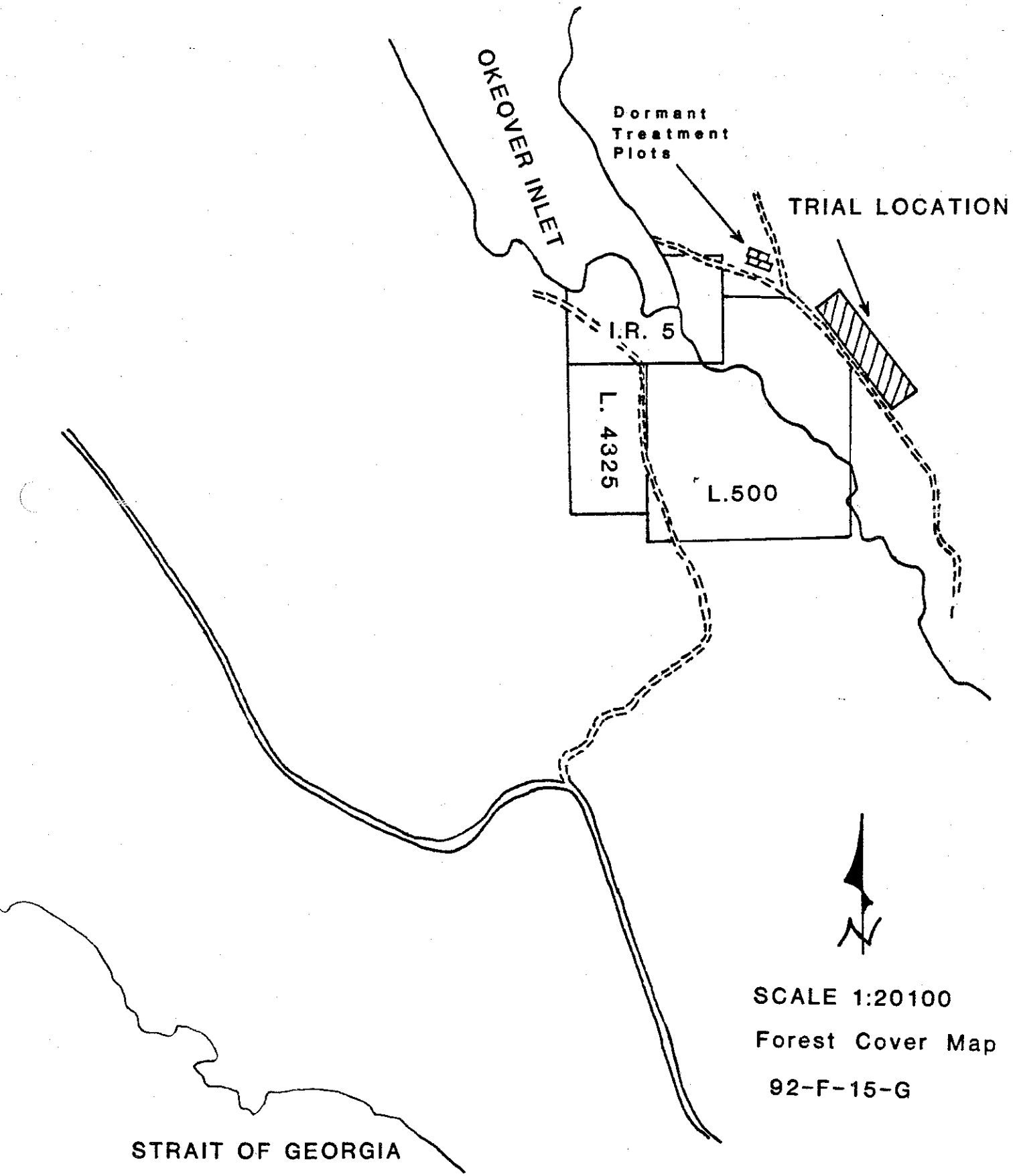
Nuszdorfer, F. 1983. Ecosystem Survey of Study Area Near Okeover Arm. Pers. Comm.

Roberts, C. 1980. Cooperative brush control study-second year report. Reforestation consultant, Corvallis, Oregon.

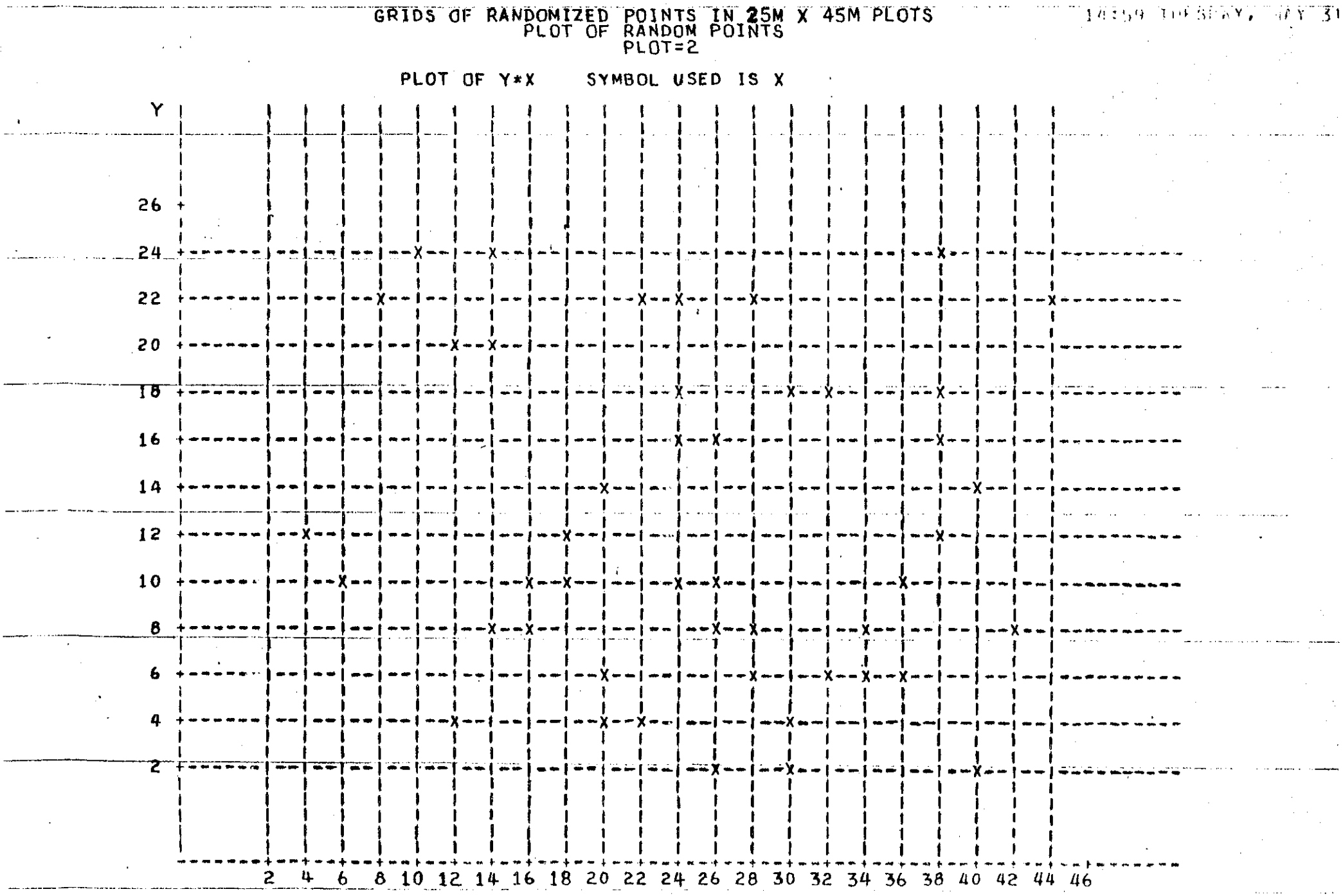
APPENDIX 1. DESCRIPTION OF PLANTING STOCK

SPECIES	Bg	F
SEEDLOT	854	3208
STOCK TYPE	2+0 Br	2+0 Br
PRODUCING NURSERY	Campbell River Nursery	Surrey
DATE LIFTED	Mar. 14/79	Feb. 27/79
CONDITION OF STOCK		
(i) GOOD	90%	90%
(ii) MULTIPLE LEADED	5%	5%
(iii) SPINDLY	5%	5%

APPENDIX 2. TRIAL LOCATION



APPENDIX 3. RANDOM POINT MAP



APPENDIX 4. CODING SHEET FOR CONIFERS

BLOCK	PLOT	TREE NUMBER	SPECIES	1983 HEIGHT '82 (cm)	1983 HEIGHT (CM) '83	1983 CONDITION CODE	1983 CONDITION CODE	1983 TREE CLASS	1983 PATHOLOGICAL CODE AND LOCATION	1983 DIAMETER AT 20cm (mm)	1983 SUBSEQUENT CONDITION	1984 DBH (MM) at 1.3m	1984 HEIGHT (cm)	1984 TREE CLASS	1984 SUBSEQUENT CONDITION	1984 PATHOLOGICAL CODE AND LOCATION
A	1	101	B	86	105	4		1			1					
A	1	102	B	100	135	4		1			0					
A	1	103	F	111	167	4		1		22	1					
A	1	104	B	98	135	4		1			1					
A	1	105	F	105	139	4		1		28	0					
A	1	106	F	201	268	4		1			1					
A	1	107	B	110	136	4		1		19	3					
A	1	108	F	108	150	4		1		23	1					
A	1	109	F	119	167	4		1		32	0					
A	1	110	B	136	167	4		1			1					
A	1	111	F	116	159	4		1		27	0					
A	1	112	F	159	211	4		1		35	0					
A	1	113	F	113	149	4		1			0					
A	1	114	B	120	146	4		1			3					
A	1	115	B	129	154	4		1		19	1					
A	1	116	F	94	151	4		1		22	3					
A	1	117	F	139	195	4		2	F1		3					
A	1	118	B	124	148	4		1			3					
A	1	119	F	115	144	4		1		24	1					
A	1	120	F	163	216	4		2	F1		0					
A	1	121	B	75	90	4		1		14	3					
A	1	122	F	163	213	4		1		30	0					
A	1	123	B	83	107	4		1			1					

APPENDIX 5. CODING SHEET FOR ALDER

BLOCK PLOT	STUMP NUMBER	SPECIES	BLOCKS A+B: STUMP D.O.B. (CM)	STUMP HEIGHT (CM)	ANGLE OF CUT °	# OF BRANCHES LEFT AFTER CUT	# BRANCHES WITH LEAVES	HINGE 1=YES 0=NO	BLOCKS C+D: # OF SPROUTS BEFORE CUT	# OF SPROUTS IN EACH DIAMETER CLASS (CM) 0-2	2-4	4-6	6-8	# OF SPROUTS IN EACH HEIGHT CLASS AFTER CUT 0-5	5-10	10-15	>15	# BRANCHES WITH LEAVES	HINGES? HOW MANY	FALL '83 ASSESS.: # OF SPROUTS	# OF SPROUTS IN EACH HEIGHTCLASS 0-.25m	.25-.5m	.5-.75m	.75-1.0m
A1	151	D	07	08	10	00	000													8	3	4	1	0
A1	152	D	09	08	12	01	010													10	6	4	0	0
A1	153	D	09	08	05	03	000													60	41	13	3	3
A1	154	D	03	13	18	00	000													11	5	5	1	0
A1	155	D	07	13	10	00	000													7	7	0	0	0
A1	156	D	05	13	20	00	000													10	8	1	1	0
A1	157	D	09	08	10	00	000													191	2	7	0	0
A1	158	D	05	13	20	04	040													16	1	7	6	2
A1	159	D	05	08	05	02	000													19	4	9	6	0
A1	160	D	07	08	00	02	010													12	4	6	2	0
A1	161	D	07	08	15	00	000													21	6	10	4	1
A1	162	D	09	08	15	00	000													12	8	3	1	0
A1	163	D	07	08	10	03	000													48	24	12	8	4
A1	164	D	05	13	10	01	000													6	1	3	2	0
A1	165	D	07	13	15	03	030													9	3	6	0	0
A1	166	D	07	13	00	00	000													151	1	3	1	0
A1	167	D	07	13	10	02	010													26	13	8	3	2
A1	168	D	09	08	05	01	010													4	0	4	0	0
A1	169	D	05	08	10	00	000													7	3	4	0	0
A1	170	D	05	08	05	00	000													22	8	10	3	1
A1	171	D	03	13	10	02	020													13	5	4	4	0
A1	172	D	07	08	05	08	010													25	9	5	7	4
A1	173	D	05	08	15	00	000													13	9	4	0	0

APPENDIX 6. CODES USED FOR ASSESSING CONIFERS

(i) SPECIES

B - Grand fir
F - Doulgas-fir

(ii) CONDITION CODE
-after cutting

1 = Severed
2 = Damaged
3 = Covered by Debris
4 = Free Growing

(iii) TREE CLASS

1 = Residual
2 = Suspect
3 = Dead

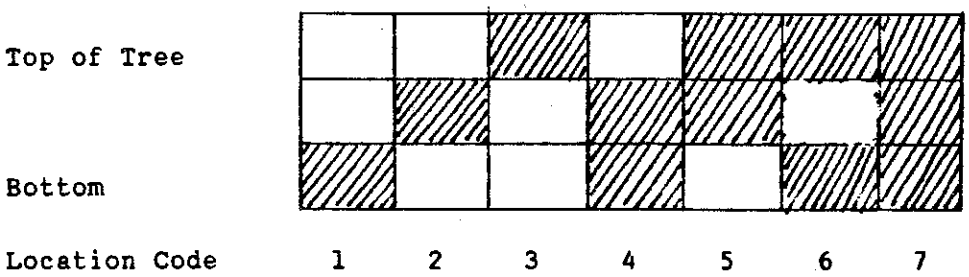
(iv) PATHOLOGICAL CODE

S = Scar
F = Fork or Crook
D = Dead or Broken

(v) SUBSEQUENT CONDITION
-fall assessment

1 = Chloritic
2 = Seedling Toppled
3 = Sun Scald
4 = Insect Damage
5 = Disease Damage
6 = Animal Damage
7 = Covered by Debris
8 = Dieback of Terminal or Lateral Growth

(vi) LOCATION CODE



APPENDIX 7. COPPICING FOR EACH TREATMENT PERIOD MEASURED DURING FIRST SEASON

TREATMENT PERIOD	SAMPLE SIZE	AVERAGE NUMBER OF SPROUTS	STANDARD DEVIATION	AVERAGE TOTAL SPROUT GROWTH (m)	STANDARD DEVIATION
1	200	15.6	10.6	6.2	4.4
2	197*	12.3	8.6	2.5	2.1
3	200	11.3	9.5	1.7	1.5
4	200	3.8	3.8	0.5	0.5
5	200	1.3	2.3	0.2	0.3

* Three stumps sampled turned out not to be red alder.

PHOTO 1 - Rotary shaft brushcutters used throughout the trial

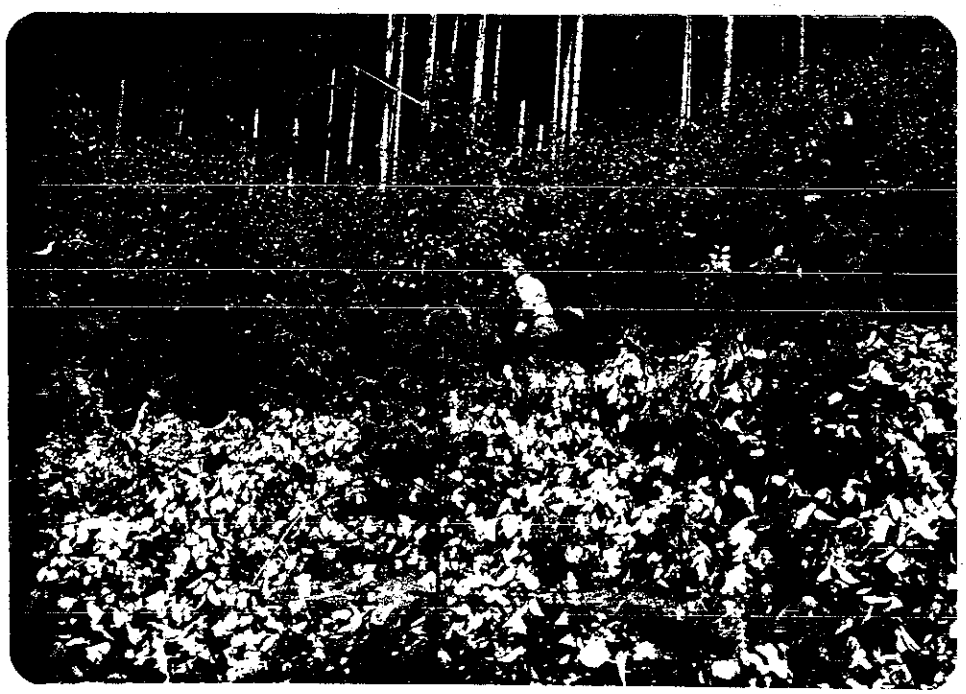


PHOTO 2 - Brushing taking place on site with 50,000 stems of alder per hectare

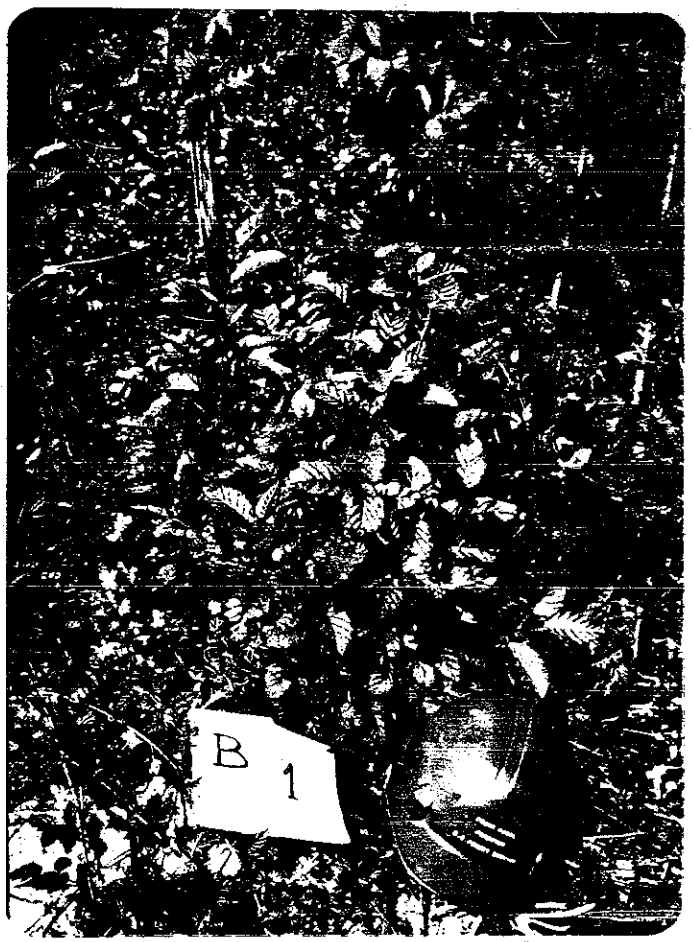


PHOTO 3 - Example of coppicing as of October on a site treated in first week of July

PHOTO 4 - Treated alder dries out under the summer sun but new coppicing is already evident