

ALTERNATIVE VEGETATION MANAGEMENT TRIAL  
FINAL REPORT

PROJECT #96-3-04

**ALTERNATIVE VEGETATION  
MANAGEMENT TRIAL**

**PROJECT 95-3-04**

**MAY, 1996**

**ALTERNATIVE VEGETATION  
MANAGEMENT TRIAL**

**PROJECT 95-3-04**

**submitted to:**

**MANITOBA MODEL FOREST**

**by:**

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**PINE FALLS, MANITOBA**

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## 1.0 INTRODUCTION

Competition from undesirable vegetation in plantations is a problem continually faced by forest managers within the Model Forest. The impacts of competition on crop trees can result in a reduction of growth and survival. In some cases severe competition can destroy an entire plantation. Fortunately managers have a variety of tools for controlling undesirable vegetation. For the last 15 years herbicides have been used within the Model Forest area by Manitoba Natural Resources and Pine Falls Paper Company Limited for the control of competing vegetation and the subsequent enhancement in survival and growth of softwood plantations on softwood and mixedwood sites. Even though the total area treated in any one year comprises only a small component of the area harvested, the continuous use of herbicides (particularly aerial application) within the Model Forest area has been questioned. Concerns have arisen on the impacts that herbicides have on wildlife, water resources and public safety. Since ecological sustainable forest management is a primary objective of the Model Forest, a need was identified to carry out a study of alternative methods of vegetation control.

The alternative vegetation management project was first initiated in the Model Forest in 1993. The overall objective of the project was to evaluate alternative techniques for vegetation management in softwood plantations and subsequently reducing the dependency on broadcast aerial herbicide applications. Initially the Model Forest project partners decided to set up a trial evaluating four different techniques. A trial was set up and post treatment measurements were completed in the fall of 1993 and 1994. The techniques chosen for the study were the Seppi Forestry Mower, hand snapping, brush saws followed by a stump treatment of herbicide, and a ground application of herbicide.

The Seppi Forestry Mower uses a mechanical means of controlling vegetation. The Seppi, normally mounted on a tractor, consists of a series of "hammers" which are attached to a drum which spins when engaged. These "hammers" shred the vegetation at a particular height (ranges from ground level to approximately 1 metre in height) and

leaves a rough and jagged cut to the stem. The treatment is usually carried out after leaf flush (early June). Hand snapping which is not commonly used, is done manually. It consists of snapping the stem at approximately 45 centimetres with a hinge remaining. Previous research has shown this method as being effective in controlling aspen competition. For greatest effectiveness the treatment is carried out following leaf flush (early June). The brush saw and stump treatment is also carried out manually. The brush saw consists of a circular saw powered by a small gas powered engine. Attached to the brush saw is a spray apparatus which is used to apply the herbicide onto the stem after it has been cut off by the brush saw. Unlike the Seppi, the brush saw makes a clean cut. The herbicide used was glyphosate (trade name Vision), a popular herbicide used in controlling aspen. This treatment is done in mid-August. The final treatment which is the ground application of Vision herbicide is carried out using a motorized spray apparatus with a cluster nozzle mounted on a skidder. This ground application is the method commonly used by Pine Falls Paper Company in controlling aspen and is normally carried during late August.

In the spring of 1995, following a review of alternative vegetation management options under evaluation and/or being used in other provinces, two additional techniques were recommended for evaluation in this study. These included a basal treatment of the herbicide triclopyr (trade name Release) and a brush saw treatment. Release is a relatively new systemic herbicide which is applied directly to the bark of competing vegetation. Using a backpack sprayer each stem is treated using a herbicide-oil mixture which is applied to the basal portions of the stem. Although the treatment can be carried out throughout the year it is recommended that treatment be done while the vegetation is still dormant. Manual brush saw treatments have been used before as a means of vegetation control. The results have been extremely variable, with a second treatment often required within one or two years. In recent studies however, this technique has proven to be successful and viable if completed during the active summer growing season (Mid-June to the end of July) and if the stems are cut at approximately 30 cm or just below the lowest live lateral branch.

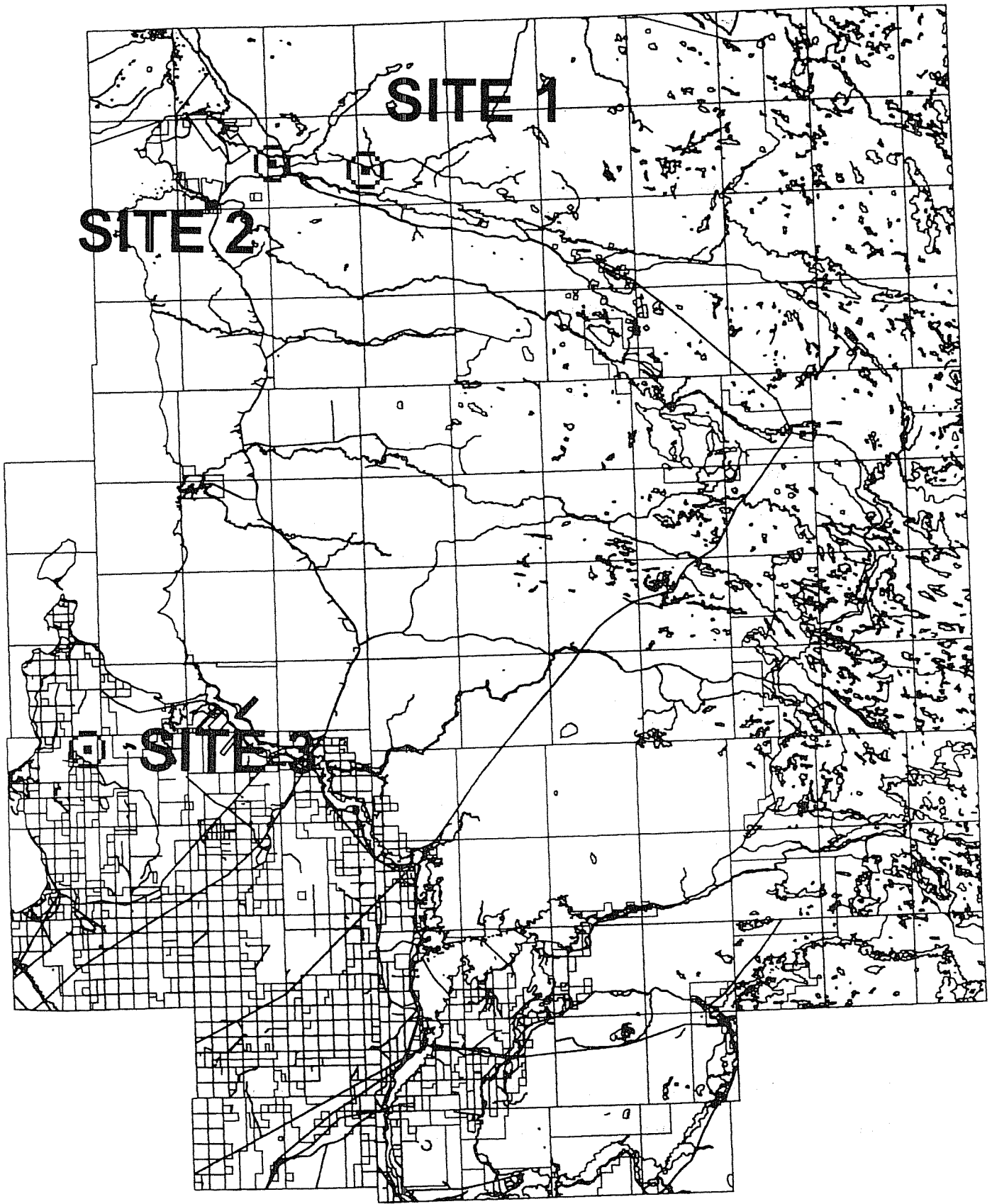
A separate trial was set up to evaluate these additional treatments. Due to the different trial locations and start-up periods, the initial 1993 and 1995 trials were treated as two separate studies. This report deals with the findings of the 1993 trial to date and describes the initial establishment of the 1995 trial.

## 2.0 STUDY AREA DESCRIPTION

The initial 1993 trial was carried out on two different sites within the Model Forest area. Site 1, which is located on the south side of the Beaver Creek Road at kilometre 7, was burned in 1989, and disc trenched and planted with black spruce in 1991. The topography is sloping, with rock outcroppings throughout the area. The site is well drained and the soils are deep clay loams. The competition is very high with the major competitive species being aspen, willow, cherry and raspberry. Site 2, which is located at the junction of PR 304 and the Rice River Road, was also burned in 1989, and disc trenched and planted in 1991. The area is flat, well drained and the soils are deep sandy loams. Competition is high, consisting mainly of aspen and willow.

A site was located in the Belair Forest for the 1995 trial (Site 3). The site which is located off the North Star Trail, was logged in 1990 and was predominantly an aspen - white spruce covertime. The area was disc trenched and planted with white spruce in 1991. The area can be described as being flat, very moist, and consisting of sandy-loam soils overtopped by organic. Competition is high, consisting mainly of aspen and willow.

All three sites are ideal for the study since they represent a typical mixedwood spruce plantation with severe competition. Figure 1 shows the general location of both study sites.



MANITOBA MODEL FOREST

STUDY SITES

FIGURE 1

### 3.0 STUDY DESIGN AND METHODOLOGY

As mentioned earlier in the introduction, the initial trial and the 1995 trial will be treated as two separate studies. Although the methodology used in each of the trials is similar there are differences in the block design and sample size. The following section gives a brief overview of the design and methodology used in both trials.

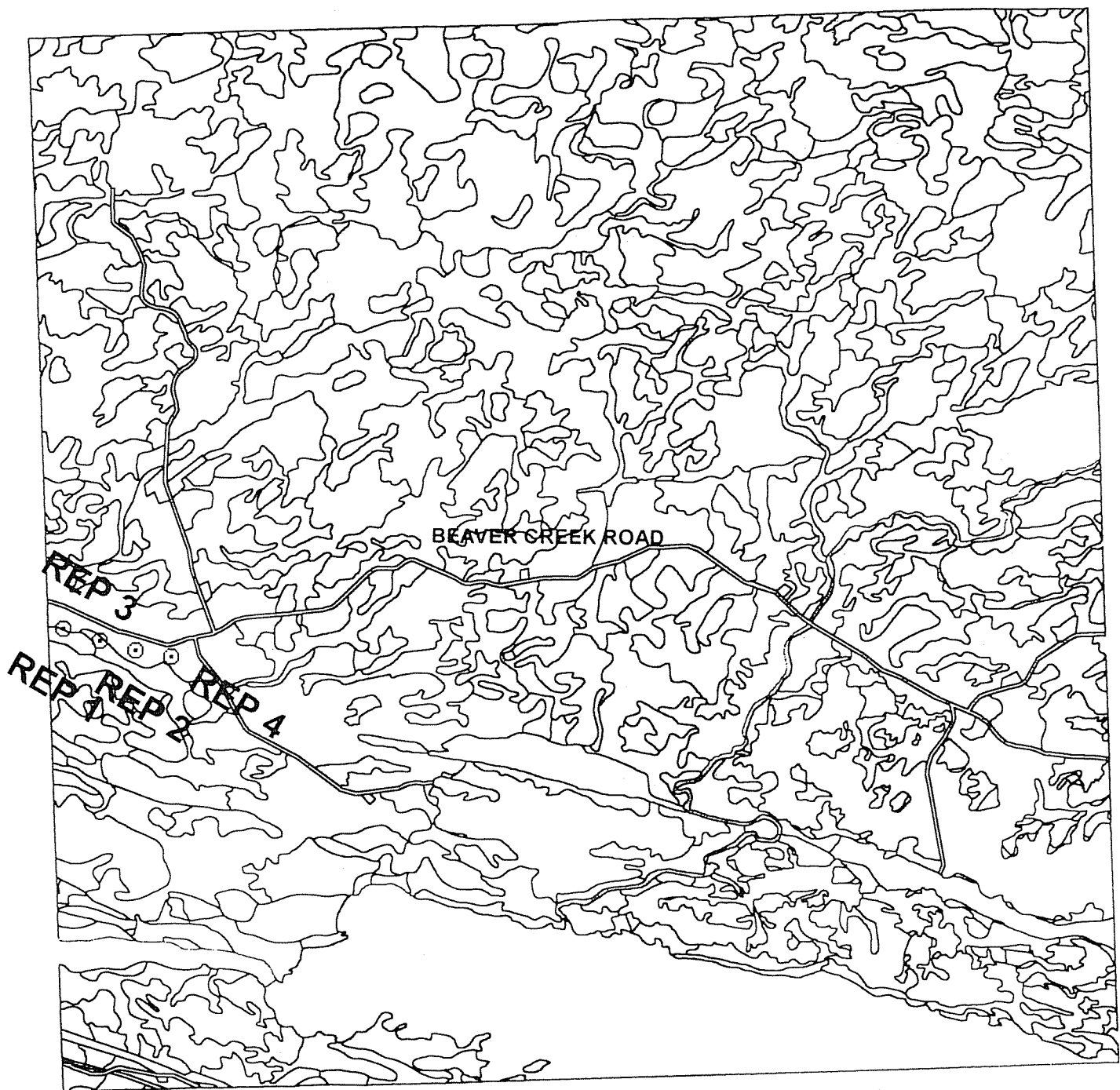
#### Initial 1993 Trial

On each site, a series of four replicates were laid out, staked and labeled with its appropriate site and replicate number. The location of the replicates is presented in Figures 2 and 3. Each replicate consisted of five 10 x 30 m treatment blocks, laid out adjacent to each other. The treatment blocks were labeled as follows:

T1	-	Seppi Forestry Mower
T2	-	Hand snapping
T3	-	Brush saw with stump application of Vision
T4	-	Control, no treatment
T5	-	Ground application of Vision herbicide

A minimum 5 metre buffer was established between each of the treatments, with the exception of treatment five (T5) which had a minimum ten metre buffer. Buffers were necessary to ensure that treatment results were not affected by adjacent treatments.

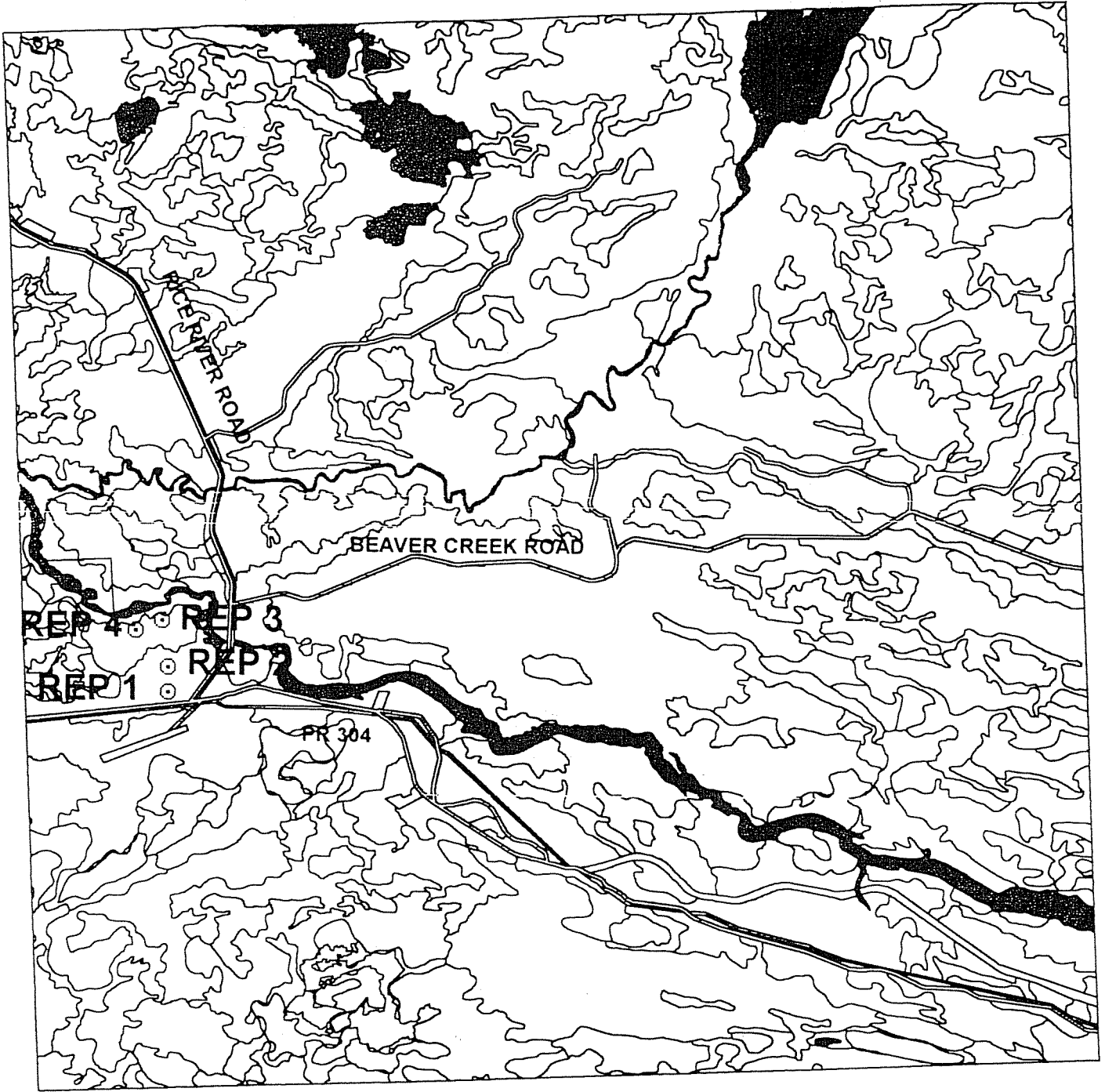
Prior to treatment, two milli-hectare circular permanent plots were established in each of the treatment blocks. The first plots were located five metres in from the sides of the blocks and ten metres from the front of the blocks. The second plots were also located five metres from the sides but were located 10 metres from the back of the blocks. In each of the plots, density and average heights for aspen and balsam poplar were recorded. An estimate of percent cover for aspen, shrubs (greater than 0.5 metres tall)



SITE 1

TOWNSHIP 25 RANGE 11

FIGURE 2



SITE 2

TOWNSHIP 25 RANGE 10

FIGURE 3

and ground cover was also recorded. Once the measurements were completed, treatments were carried out in each of the blocks.

Following treatment, ten crop trees were selected, measured, pinned and labeled in each of the treatment blocks. Crop trees which fell within 1.5 metres from the edge of the block were not selected. Root collar diameters and heights of each crop tree were measured.

The crop trees were also assigned a code which represented damage caused by the treatment. The classifications for the damage codes are:

0. Dead
1. No damage
2. Top broken or damaged
3. Leaning greater than 45°, but minor damage
4. Leaning greater than 45°, with severe damage

In order not to bias the study, crop trees were selected in a consistent systematic fashion. Using the first milli-hectare plot as a starting point, the immediate five crop trees on either side of the plot pin were selected. This survey design worked for most treatments, however the design was altered slightly in blocks with inconsistent planting.

Plot layout, initial measurements and treatments were all carried out in 1993. Since it would take several years to obtain any conclusive results, additional measurements and evaluations were scheduled in each of the remaining years of the current Model Forest program. To date re-measurements have been carried out in 1994 and 1995 with one more scheduled for the fall of 1996.

Re-measurements were carried out during the month of August. It was critical that re-measuring be completed during late summer to ensure that the crop trees were fully

flushed and had set bud. The milli-hectare plots as well as the selected crop trees were located and re-measured. Crop trees were also re-assigned a damage code. Damaged and missing pins and labels were also replaced if needed. Data was entered on a computer and analyzed using the MS-Excel spreadsheet program. Analysis and result calculations two years after initial treatment are presented in the results section of this report.

### 1995 Trial

A few modifications and improvements in the design and methodology of the initial study were implemented in the 1995 trial. Again a series of four replicates were laid out for each of the treatments. However the size of the treatment blocks were increased to 50 x 50 metres. The treatment blocks were labeled as follows:

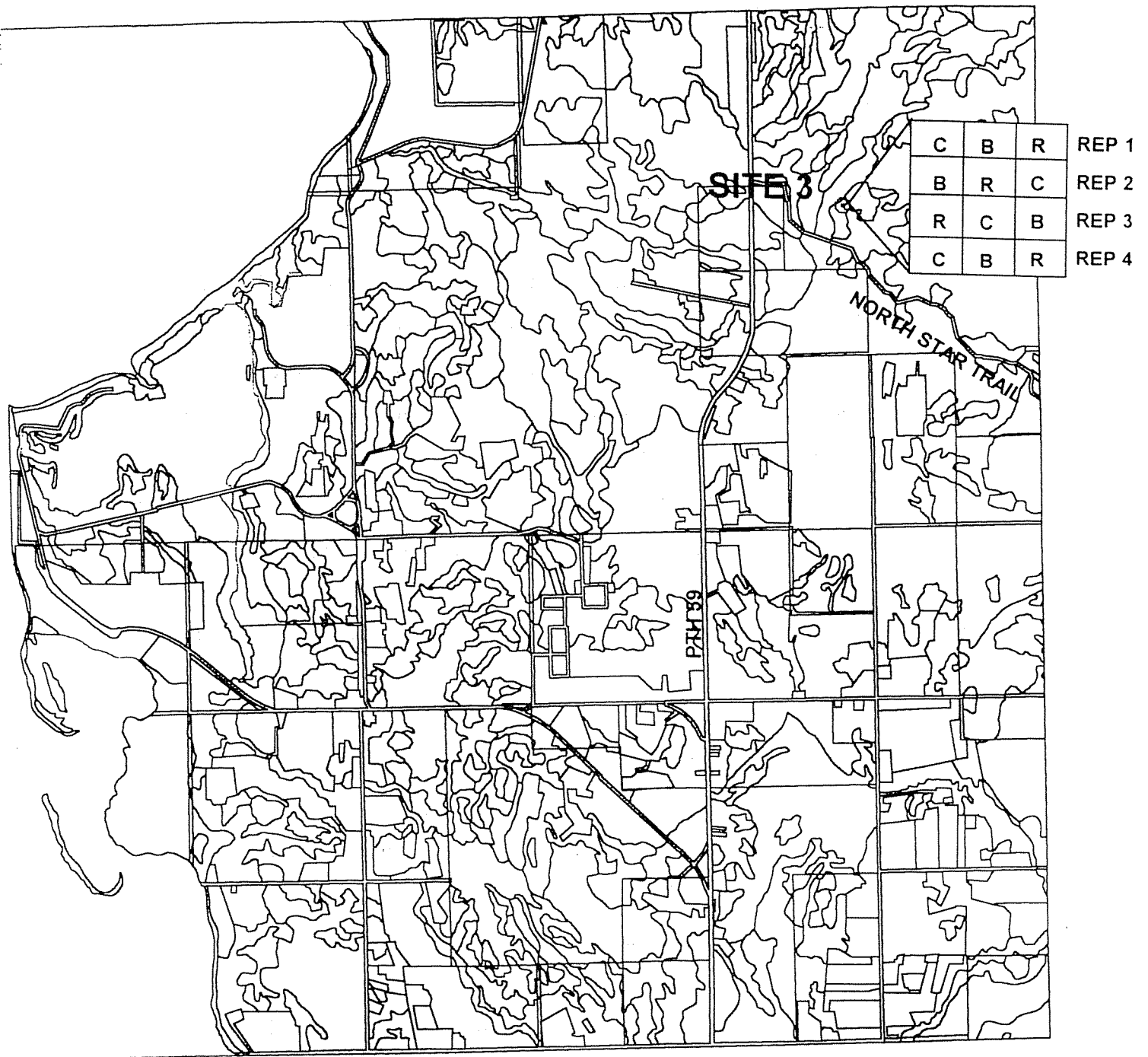
T1	-	Control, no treatment
T2	-	Manual Brush Saw
T3	-	Basal Application of Release

Due to the size of the treatment blocks there was no need to establish a buffer. Figure 4 shows the block design used for this trial.

Competition and crop tree monitoring was carried out in the same fashion as in the initial study. The only difference was in the number of measurements taken. Instead of having two milli-hectare plots in each block for monitoring competition, four plots were established. The number of crop trees sampled was also increased from ten to twenty. All other aspects of the methodology, including assigning damage codes, pinning and labeling, measurements, and analysis are the same as in the initial study.

To date trial establishment and initial measurements have been carried out on all treatment blocks as well as the implementation of the brush saw application. The basal

application of Release which was scheduled to be carried out in late October of 1995 was not done due to an early winter. Plans are underway to carry out this treatment in May of 1996. The trial location is presented in Figure 4.



SITE 3

TOWNSHIP 18 RANGE 07

FIGURE 4

## 4.0 RESULTS

### Competing Vegetation (1993 Trial)

Competition data collected from the initial study is summarized in Tables 1 and 2. The results show that the effectiveness of each treatment in controlling competing vegetation and ground cover varied. The ground application of Vision has been by far the most effective control of aspen and shrubs to date. Two years following treatment, the aspen stem density had been reduced to under 1500 stems per hectare and the canopy cover had been reduced to about 1.5 percent for the aspen and 10 percent for the shrubs. However this dramatic decrease in canopy cover resulted in a large increase in ground vegetation consisting mostly of herbaceous plants and grasses. Although much smaller than the aspen, this ground vegetation is still a threat to the crop trees since it competes for moisture and nutrients.

The brush saw and subsequent stump application of Vision yielded good results in controlling aspen competition. There was no sign of suckering, which typically tends to be a problem when only a brushsaw is used. The impact on shrub competition varied from each site. Shrub cover nearly doubled on Site 1 but had decreased by 8 percent on Site 2. Like the herbicide application, ground vegetation cover increased after treatment.

The Seppi yielded fair results. Aspen density was reduced to approximately 9500 stems per hectare on both sites. A significant decrease from the original 24000 and 32600 stems per hectare, but not nearly as effective as the herbicide application. Shrub cover and ground cover increased following treatment.

The hand snapping had varying results on each site. In terms of controlling aspen, density and canopy cover had been reduced to 6750 stems per hectare on Site 1 and 14500 stems per hectare on Site 2. Again shrub cover and ground cover increased.

Table 1 : Competition Summary for Site 1

TREATMENT	AVERAGE STEM DENSITY	AVERAGE STEM HEIGHT	PERCENT COVER		
			TREE	SHRUB	GROUND
SEPPI					
1993	24250	2.9	29	38	38
1994	10500	1.5	15	70	92
1995	9625	2.0	27	45	55
HAND SNAPPING					
1993	16375	2.4	29	56	33
1994	6625	1.3	9	87	55
1995	6750	1.8	10	68	36
BRUSH SAW					
1993	25875	3.4	48	24	43
1994	6875	0.8	4	43	52
1995	6875	1.4	14	41	48
CONTROL					
1993	23500	3.3	40	51	34
1994	15750	4.1	50	80	49
1995	14875	4.2	62	72	21
GROUND APPLICATION					
1993	33250	3.3	49	23	51
1994	625	0.7	1	33	75
1995	1250	1	1	14	93

Table 2 : Competition Summary for Site 2

TREATMENT	AVERAGE STEM DENSITY	AVERAGE STEM HEIGHT	PERCENT COVER		
			TREE	SHRUB	GROUND
SEPPI					
1993	32625	2.5	39	26	48
1994	13000	1.3	25	46	86
1995	9875	1.5	26	33	70
HAND SNAPPING					
1993	34500	3.4	60	29	38
1994	16500	1.4	35	49	86
1995	14500	1.9	34	38	58
BRUSH SAW					
1993	18375	1.9	28	29	26
1994	3500	0.7	1	34	65
1995	4000	1.1	5	21	71
CONTROL					
1993	18875	2.2	29	26	53
1994	17875	3.9	54	58	78
1995	17250	4.2	66	29	42
GROUND APPLICATION					
1993	24250	2.3	34	27	45
1994	625	0.5	0	18	83
1995	1250	1	2	6	93

In the control block, stem density had decreased slightly and canopy cover had increased significantly. The decrease in density is probably the result of self thinning. The increase in canopy cover is probably due to the fact that the trees are getting taller and producing larger crowns. Shrub cover had increased and ground cover had decreased on both sites.

#### Crop Tree Response (1993 Trial)

To determine the effects of the different release treatments on crop tree response, a statistical (2 x 5) factorial test was used for the analysis. This test was selected since it could be used to determine if any significant differences existed in growth response between each of the treatment blocks on the different sites. Growth response was measured in terms of basal area growth and height growth beginning from time of treatment to time of re-measurement (two growing seasons). Growth increments for basal area and height are summarized in Tables 3 and 4 respectively.

Results of the factorial test are summarized in a two-way anova table (Tables 5 and 6). The test was conducted at two confidence levels, 95 percent and 99 percent as indicated in the last two columns of the table. An asterisk indicates that there is a significant difference in the factors where as a "NS" signifies that there is no significant difference.

According to the anova tables, there was a significant difference in basal area and height when comparing the treated blocks to the control at a confidence level of 95 percent. There was however no significant difference when using a 99 percent confidence level. There was also no significant differences in basal area and height when comparing the treatments to each other.

Significant differences existed between the two sites when comparing diameter and height. Not surprisingly this would suggest that site has a great influence on growth response.

Table 3 : Mean Basal Area (cm<sup>2</sup>) Incremental Growth

SITE 1	RELEASE TREATMENT	REPLICATES				RELEASE TREATMENT SUBTOTALS	SITE TOTALS
		1	2	3	4		
	SEMPI	5.41	3.70	3.92	4.34	37.59	
	SNAPPING	7.27	9.16	7.45	4.82	28.69	
	BRUSH SAW	4.85	11.70	5.97	2.35	24.87	
	CONTROL	2.52	4.89	1.45	2.53	11.39	
	GROUND	6.56	10.75	3.04	6.61	26.96	
<b>BLOCK SUBTOTALS</b>		<b>26.61</b>	<b>40.19</b>	<b>21.83</b>	<b>20.65</b>		<b>109.28</b>
SITE 2	RELEASE TREATMENT	REPLICATES				RELEASE TREATMENT SUBTOTALS	SITE TOTALS
		1	2	3	4		
	SEMPI	3.26	4.71	2.35	2.9	13.23	
	SNAPPING	2.64	2.56	2.54	2.36	10.10	
	BRUSH SAW	8.08	5.17	3.45	3.92	20.62	
	CONTROL	2.57	2.89	0.52	0.68	6.65	
	GROUND	5.57	3.92	5.1	2.51	17.11	
<b>BLOCK SUBTOTALS</b>		<b>22.13</b>	<b>19.25</b>	<b>13.96</b>	<b>12.38</b>		<b>67.72</b>

Table 4 : Mean Height (m) Incremental Growth

SITE 1	RELEASE TREATMENT	REPLICATES				RELEASE TREATMENT SUBTOTALS	SITE TOTALS
		1	2	3	4		
	SEMPI	0.50	0.52	0.51	0.54	2.08	
	SNAPPING	0.68	0.75	0.72	0.50	2.65	
	BRUSH SAW	0.34	0.71	0.49	0.32	1.86	
	CONTROL	0.46	0.62	0.22	0.34	1.64	
	GROUND	0.56	0.66	0.43	0.62	2.27	
<b>BLOCK SUBTOTALS</b>		<b>2.54</b>	<b>3.26</b>	<b>2.38</b>	<b>2.32</b>		<b>10.49</b>
SITE 1	RELEASE TREATMENT	REPLICATES				RELEASE TREATMENT SUBTOTALS	SITE TOTALS
		1	2	3	4		
	SEMPI	0.50	0.61	0.45	0.43	2.00	
	SNAPPING	0.39	0.36	0.47	0.39	1.61	
	BRUSH SAW	0.60	0.45	0.36	0.40	1.81	
	CONTROL	0.42	0.40	0.13	0.20	1.14	
	GROUND	0.49	0.44	0.55	0.28	1.76	
<b>BLOCK SUBTOTALS</b>		<b>2.40</b>	<b>2.26</b>	<b>1.97</b>	<b>1.70</b>		<b>8.33</b>

**Table 5**  
**Two-Way Anova Table - Basal Area**

SOURCE	DF	SS	MS	F	0.01	0.05
Replicates	3	44 8463	14 9488	5.32400	**	**
Site	1	43 1926	43 1926	15.3831	**	**
<b>Treatments</b>						
Treatments vs Control	3	37 6375	12.5459	4.46821	ns	**
Seppi vs Snapping	1	3 35289	3.35289	1.19413	ns	ns
Seppi vs Brush Saw	1	11.0904	11.0904	3.94986	ns	ns
Seppi vs Ground	1	9 08368	9.08368	3.23516	ns	ns
Snapping vs Brush Saw	1	2 24741	2.24742	0.80042	ns	ns
Snapping vs Ground	1	1 39907	1.39907	0.49828	ns	ns
Brush Saw vs Ground	1	0 10006	0.10006	0.03563	ns	ns
Site/Treatment	4	19 3397	4.83492	1.72196	ns	ns
Error	27	75 8107	2.80780			
<b>TOTAL</b>	<b>39</b>	<b>247.282</b>				

**Table 6**  
**Two-Way Anova Table - Height**

SOURCE	DF	SS	MS	F	0.01	0.05
Replicates	3	0.13238	0.04413	4.2821	**	**
Site	1	0.11703	0.11703	11.3568	**	**
<b>Treatments</b>						
Treatments vs Control	3	0.12087	0.04029	3.90993	ns	**
Seppi vs Snapping	1	0.00169	0.00169	0.16328	ns	ns
Seppi vs Brush Saw	1	0.00821	0.00821	0.79630	ns	ns
Seppi vs Ground	1	0.00011	0.00011	0.01087	ns	ns
Snapping vs Brush Saw	1	0.01732	0.01732	1.68074	ns	ns
Snapping vs Ground	1	0.00266	0.00266	0.25841	ns	ns
Brush Saw vs Ground	1	0.00640	0.00640	0.62109	ns	ns
Site/Release	4	0.08051	0.02013	1.95325	ns	ns
Error	27	0.27823	0.01030			
<b>TOTAL</b>	<b>39</b>	<b>0.78199</b>				

The site-release interaction remained non-significant for both diameter and height, suggesting that the release treatments did not react differently on each site. In other words the effectiveness of the Seppi for example was not significantly different on Site 1 than it was on Site 2. This type of interaction is known as a independent interaction.

### Tree Mortality and Damage

The treatment with the highest incidence of crop tree mortality was the Seppi. Twelve out of a possible 80 crop trees were dead and 2 were damaged. Most of the deaths were a result of the tractor running over the trees or the Seppi accidentally shredding them. The ground application of herbicide also had a high incidence of mortality. Again most of the deaths were caused by the skidder running over the trees. It is unlikely that any of the trees died from the herbicide itself. The number of dead trees found in the brush saw/ stump application treatment increased from four last year to seven. Most of the deaths were caused by the brush saw. The hand snapping yielded excellent results. All of the crop trees were living and none were damaged. The possibility of this treatment harming the crop trees is rare since no machinery is used. The control block had a total of five dead trees which was the same as in the previous year. Heavy competition and a lack of light was probably a contributing factor leading to the death of the trees. A summary of the mortality rates and damage sustained by the crop trees for all five treatments is listed in Table 7.

### 1995 Trial

Aspen competition was high throughout most of the treatment blocks. Densities averaged approximately 25,500 stems per hectare. The height of the aspen averaged 3.3 metres and canopy cover was around 50 to 70 percent in most blocks. Other competing vegetation included willow, ash and grasses in the wetter areas. Average crop tree height was 0.43 metres and average root collar diameter was 5.1 cm. Planting densities varied considerably throughout the block. This variation did cause some problems in the

sampling design since it was not always possible to locate twenty crop trees in each of the treatment blocks. In the second replicate of the brushsaw treatment only two crop trees were located for measuring, and in the third replicate of the Release treatment only ten trees were located. This slight modification however is not expected to seriously bias the results of this study.

**Table 7**  
**Crop Tree Mortality and Damage Summary for both Sites**  
 (percentages are in brackets)

TREATMENT	TOTAL NUMBER						TOTAL DAMAGED & DEAD
	UNDAMAGED TREES	TREES WITH DAMAGED TOPS	TREES LEANING GREATER THAN 45° WITH MINOR DAMAGE	TREES LEANING GREATER THAN 45° WITH SEVERE DAMAGE	DEAD TREES		
Seppi	66 (82)	0	2 (3)	0	12 (15)	14 (18)	
Hand Snapping	80 (100)	0	0	0	0	0	
Brush Saw / Stump Applicator	70 (87)	0	1 (1)	2 (3)	7 (9)	10 (13)	
Control	73 (91)	0	2 (3)	0	5 (6)	7 (9)	
Ground Herbicide	66 (82)	0	3 (4)	0	11 (14)	14 (18)	

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The findings of this study so far have not shown one particular treatment to be superior over the other. Each of the treatments have their merits and could be applied within the Model Forest in certain situations. Preliminary results up to date have shown that the treatments using herbicides have been more effective in controlling aspen than the non-chemical treatments. The chemical treatments had much lower stem counts and lower canopy cover percentages. Also there was no evidence of suckering where as suckering was present in the Seppi and hand snapping treatments. However, these lower aspen densities have not resulted in better crop tree response. In fact height response was slightly greater in the non-chemical treatments. One thing is for certain, all of the treatments have improved growth response among the crop trees when compared to the control. Figures in Tables 4 and 5 show that the trees in the treated blocks are outperforming the trees in the control block.

As mentioned previously each of the treatments have their unique advantages and could be used in particular situations. The ground application of Vision using a skidder mounted applicator is the most cost effective alternative available. This system is very effective in controlling aspen and can treat a large area at a relatively small cost. This system however does have its disadvantages. It could not be used in advanced plantations where the larger crop trees are prone to damage from the skidder running over them. It is better suited as a pre planting preparation treatment. This system is also susceptible to non controllable factors such as the weather.

The Seppi, although not as cost effective is another viable options where the use of herbicides is not practical or not permitted such as near water bodies. However like the ground application, the Seppi is restricted to only treating young plantation.

The brush saw and stump treatment could be used in both young and advanced plantations where the competition is moderate and the treatment area is small and

selective (i.e. around the crop tree). Due to its high operating cost this treatment would not be feasible in treating large areas where the competition is severe.

The hand snapping is unlikely to be used as a means of vegetation control on a operational basis mainly due to its low productivity rates. The treatment however could be used in situations such as seed orchards and Christmas tree plantations where the risks of damaging the crop trees should be minimized.

As far as the 1995 trial, it is still in the establishment stage so no conclusive results on the brush saw and Release treatments are available. Re-measurements are scheduled for the fall of 1996.