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TITLE: ESTABLISHMENT OF A REPLICATED PRUNING TRIAL IN DOUGLAS-FIR AT
KAINGAROA FOREST

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AUTHOR(S): I.P. McINNES

DATE: 30.7.93

KEYWORDS: *PSEUDOTSUGA MENZIESII*, PRUNING, FOLLOWERS, CROWN,
DOS

ABSTRACT*

A replicated pruning trial was established in a 10-year-old stand of Douglas-fir at Kaingaroa Forest to determine the effects of pruning.

The trial is based on a final crop stocking of 250 stems/ha. The trial consists of 2 replications of a 3 x 3 x 2 factorial design containing the following factor levels:

Followers (stems/ha)	0, 250, 500
Crown length at pruning (m)	4, 6, 8
Final pruned height (m)	0, 6, 12

Trial installation was started in November 1992. Due to the size of the trial (52 plots in total) it has taken several months to complete. The first winter measurement (the standard time for measurement) is due in August 1993. Further measurements will be taken annually. Further pruning lifts will be carried out approximately every second year, although this will be dependent on the actual growth experienced.

Note: This material is unpublished and must not be cited as a literature reference

ESTABLISHMENT OF A REPLICATED PRUNING TRIAL IN DOUGLAS-FIR AT KAINGAROA FOREST

Objective

To predict the effect of pruning on Douglas-fir, conditional on followers, level of pruning, and pruning severity.

Principal Target

The extension of the 'EARLY' growth model to predict the effects of silviculture at young ages for Douglas-fir.

Introduction

Douglas-fir currently makes up approximately 5% of New Zealand's exotic plantation forest of 1.2 million hectares. It is the second most common plantation species after radiata pine. It is an important species but has tended to be overlooked in silvicultural research in favour of radiata pine..

In the past, it has been expected that the most common use of Douglas-fir will be for framing and structural timber due to the timber being on average stronger than radiata pine. This meant that Douglas-fir was managed on a low intensity silvicultural regime which included thinnings but usually no pruning. There are no pruning trials in Douglas-fir in New Zealand and hence there is a lack of knowledge on the effects of pruning as a silvicultural option.

This trial will aim to provide a range of information on how Douglas-fir is affected by pruning, in particular, pruning to different levels, different severity of pruning, and the effect of followers. The data will then be used to adapt 'EARLY' for Douglas-fir.

Trial Location

The trial is in Compartment 96 of Kaingaroa forest (Forestry Corporation of NZ Ltd). Figure 1 in the Appendix shows the location of the trial within compartment 96. This stand was planted in 1982 at a stocking of 1666 stems/ha. Part of the compartment failed and was replanted in radiata pine. No silviculture was carried out on the Douglas-fir in which the trial is located. Site index (for radiata pine at age 20 years) is 33 m. Predicted site index for Douglas-fir is 38m (at age 40 years).

Treatments

The trial consists of 2 replications of a $3^2 \times 2$ factorial design containing the following factor levels :

followers (stems/ha)	0, 250, 500
crown length at pruning (m)	4, 6, 8
prune height (m)	0, 6, 12.

Crop tree stocking was kept constant at 250 stems/ha.

Additional replications of unpruned trees at 250, 500, and 750 stems/ha (matching the stocking of the crop and follower trees in the $3^2 \times 2$ factorial) were included so as to provide enough control plots.

The $3^2 \times 2$ factorial arrangement of the pruning treatments can be analysed using a quadratic response surface. This will give predictions of similar precision to the unpruned treatments despite the latter having twice as many replications.

The trial will be blocked on the basis of average current plot dbh, using the arrangement of three blocks per replication given in plan 6.11 in Cochrane and Cox (1957).

A summary of the treatments is in Figure 1. There are 21 treatments in total but an additional unpruned control for each stocking was included. This led to 24 treatments. There are two replications so in total, 48 plots are involved.

An additional 4 plots were installed which have had 500 stems/ha (40 trees per plot) pruned to leave 6m of crown with a maximum pruned height of 6m. These plots have no followers. This will give an indication of the effect of higher numbers of pruned trees, and whether further work may have to be done on this in the future.

Figure 1. Silvicultural Treatments Within The Trial.

Final Crop (stems/ha)	Followers (stems/ha)	Pruned Height (m)	Crown Length (m)
250	0	0	0
			0
		6	4
			6
			8
		12	4
			6
			8
	250	0	0
			0
		6	4
			6
			8
		12	4
			6
			8
	500	0	0
			0
		6	4
			6
			8
		12	4
			6
			8
500	0	6	6

Trial Layout

The measurement plots are rectangular in shape and measure 27m by 29.6m to give an area of 0.08 ha. Figure 2 in the Appendix shows the dimensions of the individual plots. Given a final crop stocking of 250 stems/ha, this size will allow a minimum of

20 trees to be included in the plot. There is a 9m wide buffer zone around the measurement plot. Total area of measurement plot and buffer zone is therefore 0.21 ha.

In total, 52 plots have been installed. The layout of the trial is shown in Figure 3 in the Appendix together with the treatments. Figure 4 lists each plot and the treatment that has been applied to it.

Measurements

All plots will have the final crop element measured for :

- dbhob (cm)
- height (m)
- crown height or pruned height (m).

In addition, followers will be measured for dbhob and a sample measured for height and crown height.

A sample of pruned plots will be measured for :

- DOS (cm)
- pruned height (m)
- maximum branch (mm)
- caliper diameter at base of remaining green crown (cm).

Measurements will be carried out at :

- time of treatment,
- winter of each year.

All data will be recorded on the relevant PSP forms, and entered on the FRI PSP system.

Timing of Operations

Pruning	Time	Stand Age
1st lift	Jan/Feb 1993	10.6
2nd lift	May-Sept 1994	12
Further lifts at 2 year intervals.		

Thinning

This was done at the time of establishment of the trial to reduce numbers to the trial stockings. The followers will be removed in a production thinning at approximately age 28.

Trial Duration

Trial installation began in November of 1992. Preparation of the site, layout of plots and selection and tagging of trees took several months due to the large size of the trial. The first winter measurement is scheduled for August of 1993.

It is expected that this trial will continue until it is production thinned at approximately age 28.

Staff Responsible

Mr R.L. Knowles (NZ FRI) was responsible for the trial design, site selection, and overall supervision of the trial installation.

Mr I.P. McInnes (NZ FRI) was responsible for the daily supervision of staff in the field for the installation and measurement.

Mr D. Lowry (Forestry Corporation of NZ) is the liason for Forestry Corporation in whose forest the trial is located.

Acknowledgements

Forestry Corporation provided much support for this project by allowing it to be installed in their forest. They also provided staff to help with site preparation, pruning and thinning.

References

Cochrane, W.G., and Cox, G.M., 1957. *Experimental Designs*, Wiley New York, 2nd Edition.

Appendix

Figure 1. Trial Location within Compartment 96, Kaingaroa Forest.

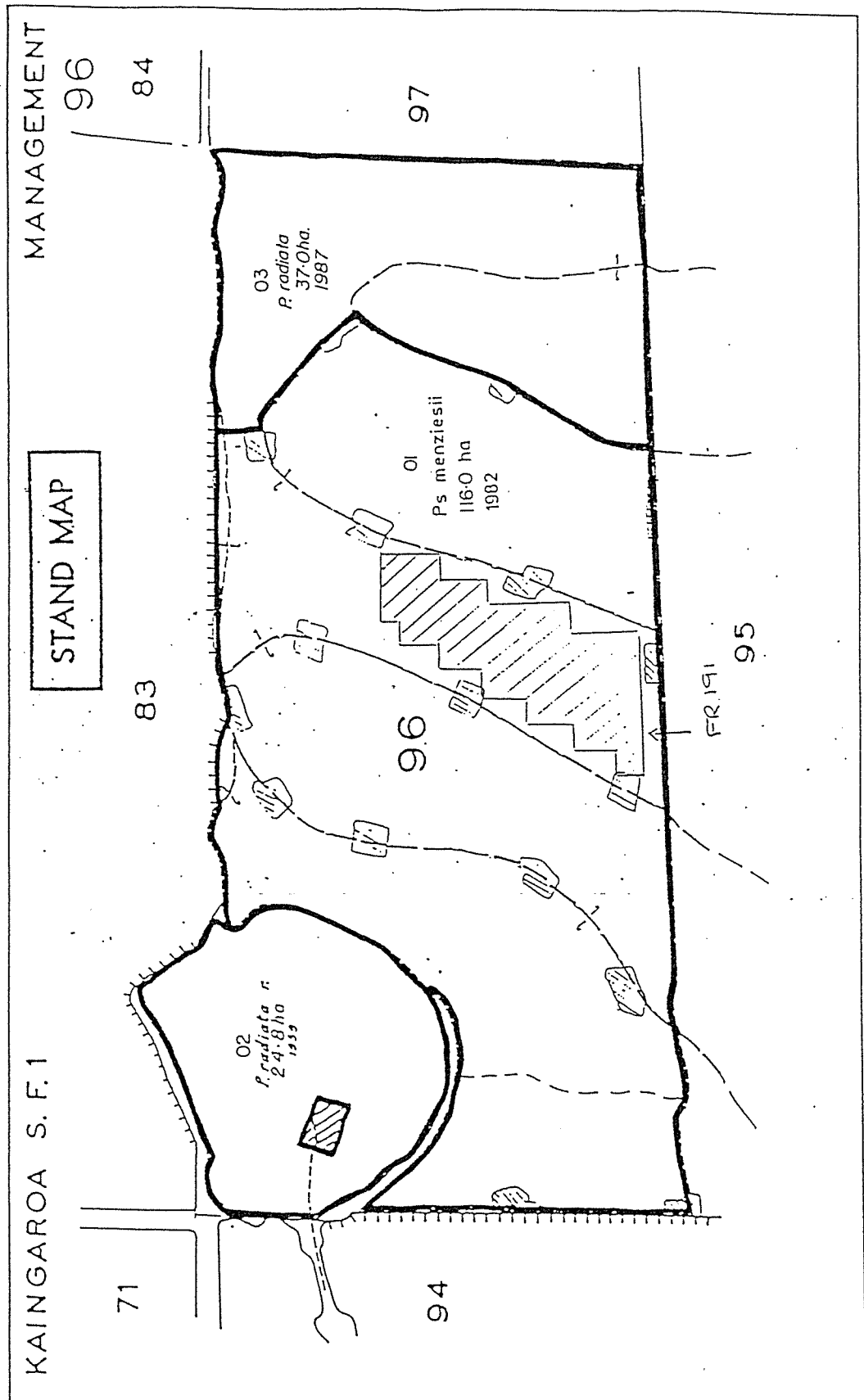
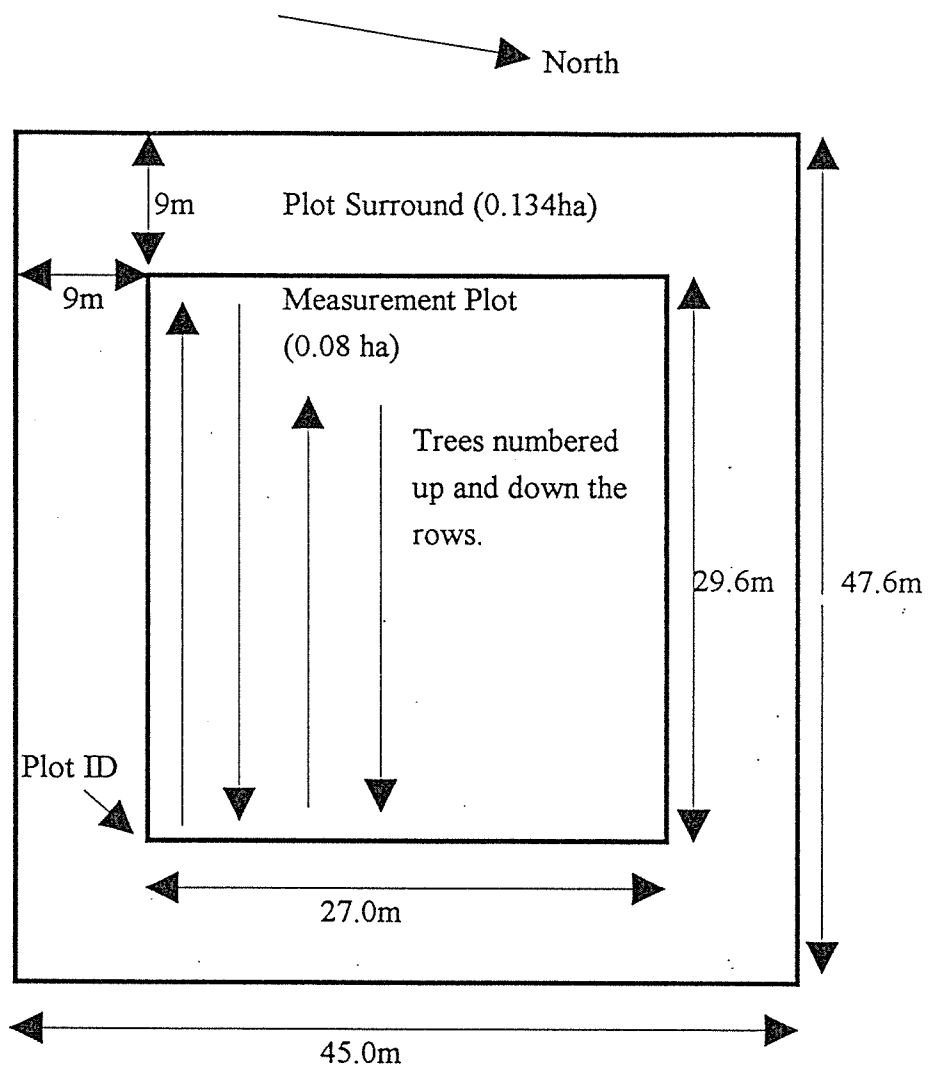


Figure 2. Individual Plot Dimensions



Yellow pegs are located at the 4 corners of the measurement plot and red pegs at the 4 outer corners of the plot surround.

Total area of the measurement plot and surround is 0.214 ha.

Figure 3. Trial Layout

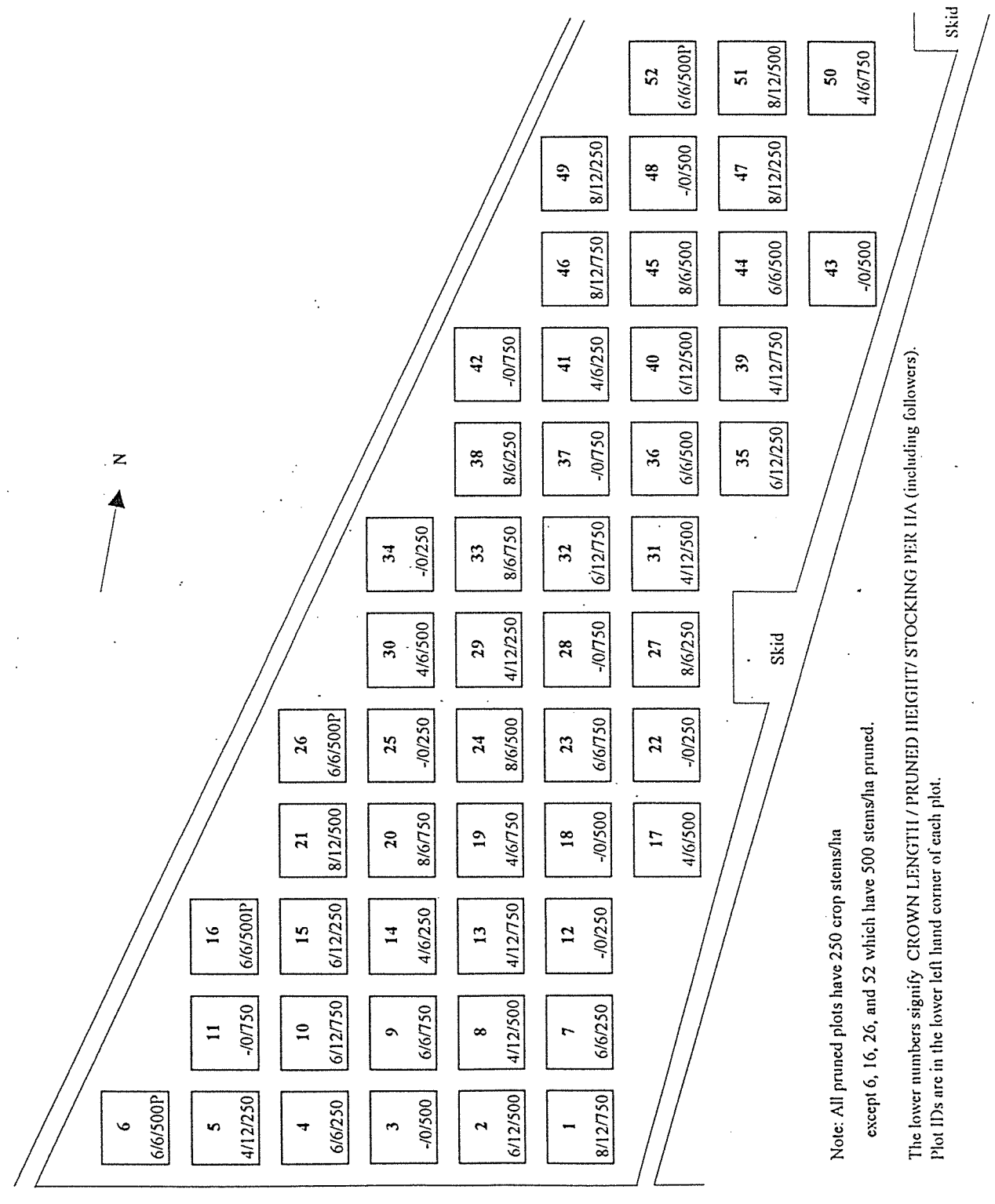


Figure 4. Individual Plot Treatments

Plot	Replication	Pruned Height (m)	Crown Length (m)	Final Crop (stems/ha)	Followers (stems/ha)
1	1	12	8	250	500
2	1	12	6	250	250
3	1	0	-	250	250
4	1	6	6	250	0
5	1	12	4	250	0
6	1	6	6	500	0
7	2	6	6	250	0
8	2	12	4	250	250
9	2	6	6	250	500
10	2	12	6	250	500
11	1	0	-	250	500
12	1	0	-	250	0
13	1	12	4	250	500
14	1	6	4	250	0
15	2	12	6	250	0
16	2	6	6	500	0
17	1	6	4	250	250
18	2	0	-	250	250
19	2	6	4	250	500
20	2	6	8	250	500
21	2	12	8	250	250
22	2	0	-	250	0
23	1	6	6	250	500
24	2	6	8	250	250
25	1	0	-	250	0
26	3	6	6	500	0
27	1	6	8	250	0
28	2	0	-	250	500
29	2	12	4	250	0
30	2	6	4	250	250
31	2	12	4	250	250
32	2	12	6	250	500
33	1	6	8	250	500
34	2	0	-	250	0

35	1	12	6	250	0
36	1	6	6	250	250
37	1	0	-	250	500
38	2	6	8	250	0
39	2	12	4	250	500
40	2	12	6	250	250
41	2	6	4	250	0
42	2	0	-	250	500
43	2	0	-	250	250
44	2	6	6	250	250
45	1	6	8	250	250
46	2	12	8	250	500
47	1	12	8	250	0
48	1	0	-	250	250
49	2	12	8	250	0
50	1	6	4	250	500
51	1	12	8	250	250
52	4	6	6	500	0