Session 1
Paper (c)

The effect Production Thinning has had on the N.Z.Forest Products Limited New Crop

P.J.THODE
Acting Forest Manager
N.Z.Forest Products Ltd
Kinleith

INTRODUCTION

Production thinning of the "new crop" began in the early 1960's when the oldest stands were approaching 20 years of age. The No. 1 pulpmill was well established and thinnings were seen as both essential to forest management and as a source of increased volume of pulpwood. In 1972 the production of pulp was doubled when the No.2 pulpmill was opened with a consequential heavier demand on the forest. Volumes required annually for the complex at Kinleith exceeded the sustainable cut. This had been forseen and as the average age of the forest was relatively high the forest could be sustained through an increase in area ,the thinning programme and a decline in the age of clearfell.(1) The production thinning programme assumed even greater importance at this stage as a means of maintaining the age of clearfell at the highest possible level. The forest then has had a certain market for pulpwood thinnings such that the thinnings have never been too far removed from that considered silviculturally desirable.

Outside commentators have often pointed out that early thinning to waste and concentration on quality log production would be a more profitable option for the forest grower than the type of forest management practised at Kinleith. This ignores the single ownership and principal need for the Kinleith forest to supply the existing mills which have been constructed under a corporate philosophy dedicated to the supply of plywood, sawn timber and pulp and paper products. The minimisation of the cost of raw materials to produce these products is of prime importance so a concentrated forest area with estate management and maximum volume production consistent with logs needed is an obvious route to follow.

KINLEITH FOREST - NO PRODUCTION THINNING

To gauge the effect that a thinning to waste philosophy might have had on the forest a series of simulations were run starting with the state of the forest in 1966 and ending in 1985. On the one hand production thinning at the historic level was maintained while on the other the

entire Kinleith forest supply was taken from clearfelling. Because the reality of 20 years of forest management was so complex it was not possible to recreate the actual course of events. However, the level of new planting was included, the same yield table was used (an average) and clearfelling was by oldest age class. The differences in the end results of the simulations are tabled below to illustrate the gains that have been made by pursuing production thinning.

Table 1	Difference
ENF Rotation (years)	5.0
ENF Age Class Area (ha)	-560.0
ENF Annual Yield (m m3)	.098
Growing Stock (m m3)	6.055
Oldest Age Class (years)	13
Average Age (years)	2.6

These differences which are all positively influenced by the production thinning programme are substantial in a forest the size of Kinleith. The total volume production thinned from the forest between 1.4.66 and 31.3.85 was 5.084 m m3.

The low point of clearfell age which will be reached in the middle of the 1990's and is expected to be approximately 28 years of age on average would unquestionably have been unacceptably low. Perhaps as low as 20 - 22 years or lower.

SILVICULTURAL REGIMES

Silvicultural schedules for new crop Radiata pine at Kinleith were derived by J.E.Henry and S.Spurr in the early 1960's.(2) They envisaged production thinning beginning at age 12 and being repeated at 6 yearly intervals until age 42. Clearfelling was to be at age 50. The original schedule was as follows.

Table 2	Stocking per Ha		Volume Removed	
Age	Before	After	m3 / ha	
12	1235	617	49	
18	617	370	161	
24	370	247	140	
30	247	173	154	
36	173	124	161	
42	124	99	126	
50	Clearfell		896	1687

These intermediate yields were to provide fencing material, pulpwood and sawlogs. This regime with a planting stocking of 1667 s/ha, a

spacing thinning to waste to 1235 s/ha at age 5, and two production thinnings at age 12 and 18 years of age has largely been followed at Kinleith, until recently. This regime has produced the "new crop" at Kinleith that will be clerfelled over the next 10-15 years.

Changes to this regime have been introduced gradually for a variety of reasons to meet the demands of the day.

1. The 3rd to 6th production thinnings were dispensed with very early because of the difficulties of acheiving even two thinnings in practise, the inevitable reduction in stocking below that specified during the thinning, and most importantly the decision to build the No.2 pulpmill which meant that very few stands would get older than 30 years of age before clearfelling.

2. The lowering of the after 2nd thinning prescribed stocking to 300 s/ha to allow bigger machines to be used and reduce the incidence of bark damage.

3. The production thinning of steep country with small haulers demanded that a lower stocking of 280 s/ha and a single thinning approach because of the cost be adopted.

4. The decision to allow pruned stands to be thinned at age 11-12 years to a final prescribed stocking of 375 s/ha to concentrate volume on the pruned stems.

5. The dropping of 2nd thinning in all stands and the adoption of a universal final crop stocking of 375 s/ha after production thinning because

   a. The large areas planted in the 1970's were being thinned. There is currently a very large thinning programme (over 6000 ha / year). Not all of it can be production thinned because of the adverse effect it would have on the wood mix to the mill both in terms of fibre quality and cost. In the meantime an upper limit of 600,000 tonnes per year has been fixed.(1)

   b. It had been found that the response in extra growth to thinning at this age was negligible and the operation consisted largely of an early expensive partial clearfelling.

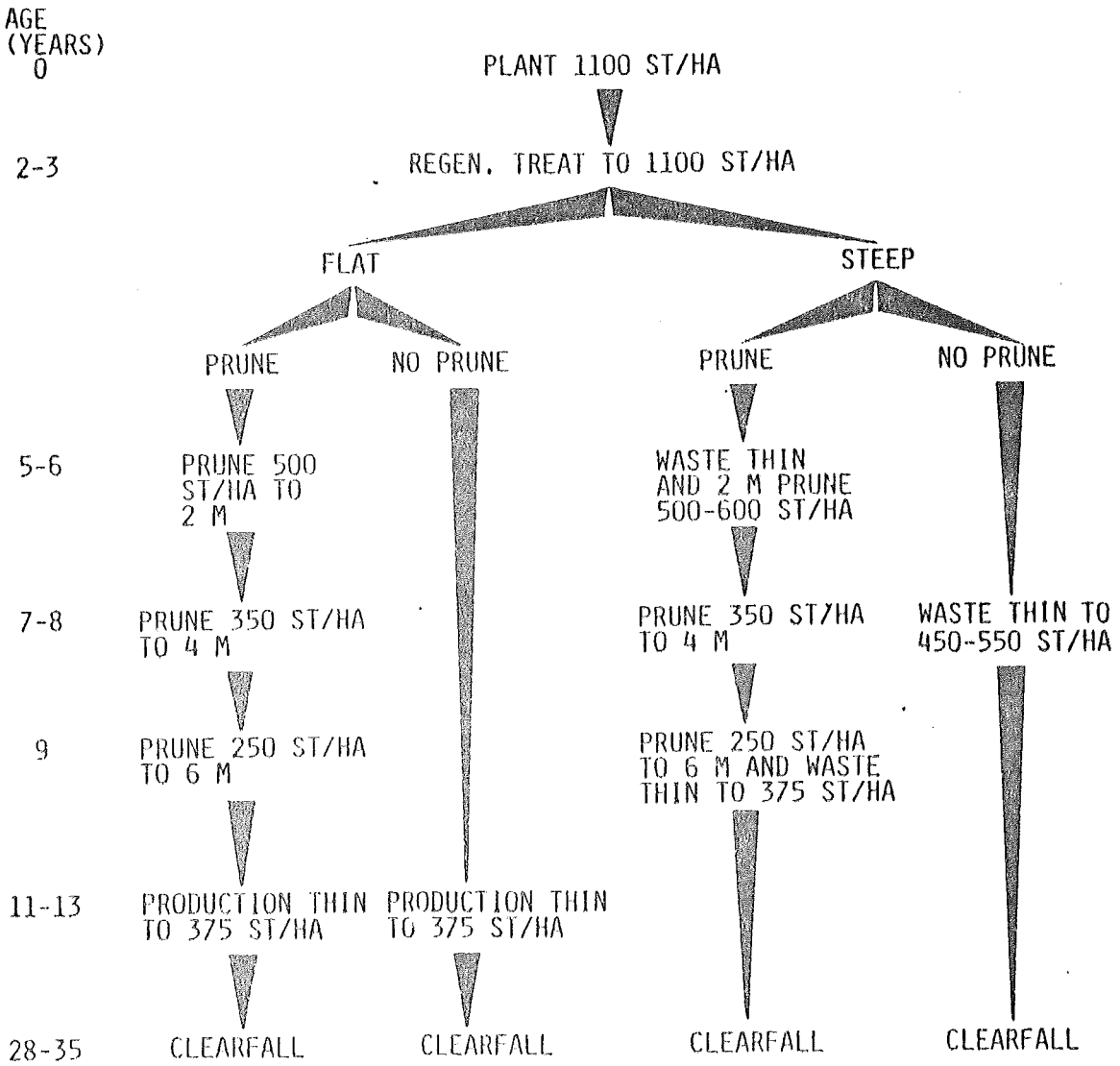
6. The age of the single prescribed thinning to 375 s/ha (actual 315 s/ha) now varies between 11 and 18 years of age depending on the quality of the stand in question. Yields average 100 tonnes/ha realisable.

7. In future it is likely that there will be a heavier early thinning to waste with a delayed single production thinning at age 14-15 in all stands possibly even those pruned. There will be short term excursions into 2nd thinning however to meet mill demand when Cental North Island wood supplies are at a nadir in the 1990's.

Regimes currently employed in the forest are set out in Figure 1.

FIG. 1

SILVICULTURAL MANAGEMENT REGIMES



BARK DAMAGE

Another problem advanced which suggests that thinning to waste would be preferable to ensure the quality of the final crop trees is that of bark damage. This is recognised in that the Forestry Department has a policy of requiring no bark damage. Recognising that this is practically inoperable there are two parts to the bark damage standards.

1. All damage is recorded which occurs greater than 50 cm from ground level on the bottom side of the tree.

2. Damage is recorded as severe where bark removed exceeds 30% of the circumference in a continuous strip or greater than 50% of the circumference in total below 50 cm from the ground.

A level of 4% of crop trees being damaged has been set by the Forestry Division at Kinleith. Operational reports over the last two years show that this level occurs on 34-40% of recorded inspections. However, levels of 10% or greater are rarely if ever recorded. It is reasonable to assume that this level of bark damage,at least, has prevailed within the forest in the past so if it were of economic significance this would be reflected in product yields and log mixes acheived. These yields and mixes are explored below. From personal observation the problem is of manageable proportions although there have been few definitive studies within N.Z. on the subject. I have observed one pruned butt log being peeled to oblivion in the plywood mill because of rot caused through thinning damage. It is also possible to find short lengths of wood left in the cutover containing the damage or pulp logs being taken from the butt first. It remains of such concern that pruning is being progressively moved to steep country where thinning to waste will be practised and such damage to pruned logs can be minimised or eliminated.

It has been suggested that the value of the pruned butt logs will be so high in the future that even damage caused during logging and transporting will be of economic significance. There does not appear to be any readily available information on this perceived problem. It seems most likely that any such logs would end up in the sawmill and be cut to boards or the damaged surface would be lost in the roundup in the plymill.

Johnston (3) reports on extensive research overseas on bark damage as well as giving some data on Radiata pine in the A.C.T. He concluded that Radiata was resistant to fungal degrade compared to other species. Provided that trees were felled before 40 years of age (in Australia) serious decay is unlikely because the spread of fungal infection from the wound is so slow. He was not prepared to say that it was of no significance and that it should be kept to a minimum.

VOLUMES PER HECTARE

Until the late 1970's, early 1980's clearfelling at Kinleith was largely concentrated in the first crop planted between 1924 and 1930. The age of clearfelling was therefore increasing, loggers found that the trees on the average hectare were increasing in piece size and that the volume was increasing, albeit slowly. Variations existed of course depending on the thinning practise and most hauler stands were never thinned.

Ist crop volumes realised at clearfelling today are in the order of 650 cubic metres per hectare as is also found in our Tahorakuri forest. In the former case the age is 55-60 years and in the latter 38 years. Obviously there is a difference in stocking and piece size. 2nd crop stands entered the clearfelling phase during the early 1980's and by the end of the decade will constitute nearly all of the clearfelling at Kinleith.

Spurr's (2) thinning schedule predicted that stands at 30 years of age (after 2 thinnings only) would contain a volume to a 10 cm top of 840 cubic metres per hectare with 370 live stems. Allowing for a realisation factor of 0.78 this would produce a yield of 655 cubic metres per hectare. Not in fact significantly different to that found on average in the other two recognised sub forest types at the time of clearfelling. Resource studies (4) undertaken at Kinleith on 30 year old 2nd crop stands have provided the following information.

Table 3	Study 1	Study 2	Study 3
Stocking (s/ha)	206	365	219
Mean DBH (cm)	53.7	41.5	51.9
Mean top Height (m)	43.4	38.6	43.7
Total Volume (m3/ha)	682	745	712
Recovered Volume (m3/ha)	593	655	602
Assumed Thin Volume (m3/ha)	200	150	200
Total Recovered Vol (m3/ha)	793	805	802
% Quality Logs	84	61	88

The stand in Study 1 and Study 3 was pruned and thinned in it's entirety and is considered representative of the better type of 2nd crop stands in the forest. The stand used in Study 2 was only partially thinned and pruned and was considered to represent the poorer type of 2nd crop stnad in the forest. Despite the fact that the stand in studies 1 and 3 is lower stocked there is interesting agreement with the predictions made by Spurr (49 & 161 & 655 = 865) cubic metres per hectare. The predicted result is approx. 8% greater than the reality.

PRODUCT MIXES

Consumption of logs at the Kinleith mill is relatively standard in it's mix from year to year. The log requirements of the mills are increasing with time as improvements are made to existing plant or

replacements are constructed. In the year 1986/87 mill consumption is budgetted as follows.

Table 4	m m3	% all sources	% C/F Kinleith
Sawlogs,Plylogs	.988	38	66
Pulplogs (C/F)	.520	20	34
Thinnings	.650	25	
Purchased logs,chips (all pulp)	.442	17	
	2.600	100	100

The Resource studies gave the following results in terms of product types. Note that the log specifications were those in everyday use at the mill. Figures given are percentages.

Table 5	Study 2	Study 3
Sawlogs,Plylogs	61	88
Pulplogs	39	12
	100	100

Comments

1. In Study 2 the stand was of the lower quality expected from the 2nd crop because silviculture had not been up to standard.

2. In Study 3 the skiddies had upgraded a substantial percentage of logs beyond the specification

Given therefore, that the silvicultural system had been designed for generality, flexibility and to meet the kinds of products demanded by the mill it can be said to have been successful. Certainly the use of production thinnings has not only provided intermediate yields of pulpwood but has still allowed the production of logs capable of meeting the specifications at Kinleith.

LOG QUALITY

Log quality from the forest is considered to have peaked with the clearfelling of the last of the thinned first crop. This may be not be the case in the long run with the use of genetically superior trees, but, in the meantime we are facing a decline in log quality. This comes about mainly because

1. Logs to the sawmill and plymill, in particular, while still the best of the butt logs will be smaller in diameter even though they meet the specifications.

2. The quality and extent of pruning cannot completely reproduce the log quality size gave to the first crop logs given that we are constrained by the need to clearfell earlier.

3. The 2nd crop was thinned earlier than the 1st crop was which means that not only are upper tree branches larger on average but that more of them are alive at the time of clearfell. This should cause log quality to be lower in the upper tree and produce an increase in the need for trimming on the logging skids.

The extent to which better log making practises can alleviate this decline has yet to be seen. The history of silvicultural practise has produced sub forests so oldest age cutting cannot provide a uniform log product mix to the mill through the cutting of the future crop, especially in the next 10-15 years. Recent simulations have suggested a need to consider overcutting unpruned areas and undercutting pruned areas to maintain an even but increasing supply of pruned logs to the mills. There will therefore be a greater drop in log quality in the short run than originally anticipated. However, it will surely rise again. The other and most important method of increasing log quality to the sawmills and plymills is to increase the percentage of the clearefelled crop moving to the pulpmill. Note from Table 4 that only 66% of clearfell goes to quality demand centres in the 1986/87 year.

TREE CROP CHANGES - EFFECT ON LOGGING PRACTISES.

It seems logical to me even though I'm not a Logger that some or all of the following changes will be required. There may even be more.

1. For ground skidding, tractors will need to be smaller ie D6 or less. At Kinleith the age of clearfelling will range from as low as 25 years to as high as 35 years. Piece sizes will be in the range of 2 to 3 m3 rather than the 5 to 6 m3 found now. Realisations are presumably high because the trees break higher up and utilisation is better.

2. The extent of hauler in the new crop is such that the number of cable machines involved in logging will need to double to approx. 11. The proportion of such country will however be similar to that found in the 1st crop.ie approx. 30% of clearfell volume. Simulations show that the maintenance of clearfelling age in the 25-35 year age range will require maximum production on all topographic land types. This was not the case originally with the 1st crop because supply exceeded demand in the beginning. There will have to be a substantial increase in investment in cable machines as well as the training of people to operate them. The stricter requirements of the soil and water people will restrict the techniques that can be used.

3. The increased number of live branches require a greater trimming effort. Dependence on the chainsaw for all log types may become impossible because of the cost involved. Innovative techniques should be neede in the case of pulplogs in particular, perhaps with a lower quality being accepted. Past thinning has reduced the extent of badly malformed trees in 2nd crop areas so that log

making should be easier and wastage less. Although the resource studies done at Kinleith showed that skiddies, admittedly with little training, did not recognise log quality characteristics well. Veneer logs in particular were produced when logs were of sawlog quality. Considerably more training appears to be required.

4. Seperation of pruned butt logs on the skids may br a requirement of the end user. This has not yet been insisted on at Kinleith but will present increased costs somewhere in the fieldshould it prove necessary. An increase in skid size to unacceptable levels may also be required. On the other hand the resource studies showed that pruned butts are easily recognisable.

5. Early 1st crop logging practise at Kinleith produced a patchwork quilt of small stands where adjacent stands often have quite different ages (5-10 years apart). While this was for a short period until the first SJ4 hauler was purchased in 1959 and annual demand increased substantially it is causing some problems at present. Amalgamation of these stands into timbersheds where logging within 1-2 years is required may cause problems with equipment size and rigging. The ability to respond quickly to piece size changes seems necassary in these situations.

CONCLUSION

Despite observations that the need to produce pulpwood from production thinnings will compromise the quality of the 2nd crop, it has been found that this is not necessarily the case at Kinleith. The thinnings have allowed the 2nd crop to be clearfelled later than would be the case with waste thinning thus the silvicultural work has been capitalised on. The extent of bark damage does not appear to be of serious economic significance. Generally speaking the regimes practised provide the kind of log products required by the mill at Kinleith so the silvicultural systems employed have been successful.

Smaller trees, smaller machin
becaus of cost structure.

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