THE INFLUENCE OF SILVICULTURE AND THE ROLE OF THINNING ON A REGION'S WOOD SUPPLY

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ABSTRACT

The Bay of Plenty region in central North Island is well endowed with plantations of radiata pine which, however, are grossly uneven in age class distribution.

The older stands are needed until 1990 to sustain supplies until the much younger stands can take over. Instability in the older stands and susceptibility of other pines to disease has induced a high level of cutting now and a critical supply situation about 1990 even after rotations have been shortened to the point where utilisation of thinnings is no longer viable. Relatively short rotations for radiata pine for post-1990 wood supply are proposed for State forests. These rotations are primarily to produce sawlogs, some of high quality resulting from intensive silviculture, the rest to be of lesser quality from minimal silviculture.

The end result will be sawlogs from the butts producing about 40% of the yield with the untended tops destined for chips and pulpwood.

INTRODUCTION

Description of Region

The area under discussion is known as "Bay of Plenty Exotic Production Region" and is located within approximately one million hectares of central North Island. The region is topographically distinct being surrounded by the coast on one side and by steep and broken hill country on the other sides. Internally, transport systems are by road and rail with the former quite intensive. External connections also include a deepwater port which is served by both road and rail from the centre of a major State forest some 120 km distant.

The country is generally rolling (probably steep by Australian standards) and frequently dissected by steep-sided dry gullies. Soils are derived from free-draining volcanic ash of moderate fertility. Rainfall is an evenly spread 1500 mm/year and winters range from mild at the coast to severe inland (where much of present exotic forest is located at around 600 m above sea level).

Sites therefore allow good if somewhat coarse growth of radiata pine with indices ranging from 25 to 40 m and a mean annual increment approaching 25 m^3/ha.

Forest Resources

The Bay of Plenty region was well endowed with relatively mature untended radiata pine forests when utilisation of exotic timber began on a large scale in the

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1950s. It will always be a net exporter of forest products which have so far come mainly from State forests planted in the 1920s and early 1930s. However, a dearth of planting between 1936 and 1960 has placed a limit on the availability of wood from the region until the 1990s. From 1960 private planting began to expand rapidly so that in the 1990s wood will be coming from both State and private sector with the State eventually providing less than half of the region's wood supply.

Predictions of log quality requirements on State forests indicate that small wood, as would be obtained from thinnings, is needed at least until the mid-1980s but thereafter much depends on the silviculture adopted in private forests. It is predicted that commercial thinning of State radiata pine will continue until then but is not essential from then onwards. This implies that changes in silvicultural regimes are now imminent and two regimes are proposed. One to produce large sawlogs as quickly as possible and the other to produce smaller dimension multiple use wood with a minimum of silvicultural attention. It is considered that initially short rotations are essential in order to provide for continuity in supply from the badly unbalanced age class distribution.

REGIONAL WOOD SUPPLY PATTERNS

Effect of Forest Ownership

Approximately 20 percent of the region is covered by exotic forests. The distribution of ownership, both present and that projected for 20 years ahead, is as follows (areas in hectares):

Ownership	Radiata pine	Other species	Total
Present —			
private	70 000	10 000	80 000
State	70 000	50 000	120 000
total	140 000	60 000	200 000
Potential — (c. 1995)			
private	150 000	—	150 000
State	110 000	20 000	130 000
total	260 000	20 000	280 000

There is thus room for further expansion up to an optimistic maximum of 280 000 ha and most of the expansion would probably be privately owned. Approximately 50% of "other species" under State ownership are of unthrifty or disease-prone species such as Corsican and ponderosa pines and these are expected to be logged and converted, mainly to radiata, over the next 20 years.

The current age class distribution of radiata has a significant effect on the wood supply pattern and is summarised as follows (areas in hectares):

Ownership	Pre-1936	1936-60	Post 1960	Total
Private	5 000	10 000	55 000	70 000
State	30 000	10 000	30 000	70 000
Total	35 000	20 000	85 000	140 000

It is therefore not surprising that most of the exotic cut is currently coming from State forests and a marked change in the pattern can be expected within 20 years. The pattern of current production and potential productive capacity for the region's exotic forests may be estimated as follows (in m^3/year × 1000):

	Current Production			Future Capacity		
Ownership	Radiata	Other	Total	Radiata	Other	Total
Private	400	100	500	3 800		3 800
State	2 300	1 200	3 500	2 700	300	3 000
Total	2 700	1 300	4 000	6 500	300	6 800

Current production of 4M m^3/year is equivalent to 85% of the national exotic demand and with a population of only 170,000 (5% of national total) and a *per capita* consumption of say 2 m^3 the region will obviously be a major net exporter to other regions and overseas for a very long time. The future productive capacity of 6.8M m^3 is equivalent to 75% of the national exotic demand in the year 2000.

With most of the cut coming from State Forest there are very few current problems in allocating the cut within the region. The magnitude of the State's cut is not expected to change very much in the future but the share of the cut will drop markedly as private forests become productive. There is therefore a growing need for co-ordination of State and private production both within the region and between regions. Not a great deal has yet been done, yet the results of collaboration could have quite marked effects on selection of silvicultural regimes for production of future wood supplies, timing of supplies, and on regional industrial development. Some of the predictions made in this paper are therefore clouded by this problem.

Effect on Silviculture

The success of timber preservation, the post war building boom and the development of Tasman Pulp and Paper Company in the centre of the region combined harmoniously with the large areas and relative maturity of the exotic species growing in the region. We were able to embark directly into a clearfelling programme which became large scale in the late 1950s. At that time the silvicultural aim was to spread the age class distribution by thinning some of the mature stands. After the demise of unthinned stands the supply was to be sustained by clearfelling the thinned stands and by thinning new and second generation crops at 18 and 30 years and by clearfelling at 40 years.

Unfortunately the "old crop" proved to be unstable after thinning thus making us uncertain as to just how long the old crop could be expected to remain standing anyway. The rate of cutting was therefore increased and the deficit induced in the early 1990s was to be filled by shortening rotations of young stands to 30 years with only one production thinning at 18 years (current practice).

The recent arrival of *Dothistroma pini* on the scene and its effects on Corsican and ponderosa pines meant a further increase in the exotic cut was needed and another deficit in wood supply was induced in the early 1990s. Further shortening of radiata pine rotations will be required to fill the gap but just how short could depend on the

contribution made by private forests at that time. A number of simulations of the growth of State resources and likely demands on them have and are still being run to try and determine just how short rotations will need to be and what types of wood are likely to be produced. Current indications are that rotations will drop below 25 years for a time thus giving us very little room for manoeuvre in manipulating yields over the next 20 years.

This revolution in silvicultural philosophy has therefore been forced upon management in this region regardless of any economic advantages that may accrue.

Regional Log Quality Considerations

The preceding section indicates the need for shorter rotations for continuity of supply but this is only half the picture. Log quality and size requirements also need attention before any conclusions on the type of silviculture to be adopted can be reached.

In Bay of Plenty, wood supplies currently support 25 sawmills of capacities ranging from 3 000 to 450 000 m^3/year and a total uptake of 1.6M m^3/year. A number of the smaller capacity mills depend on indigenous logs from the fringes of the region but supplies are limited (6%) and are expected to decline fairly quickly. The region also supports industries producing pulp, paper, paper board, tissues, particle and liner boards, and peeled products from exotic logs. Most of the private forests are owned by those industries and some also have long term supply agreements with the State. One organisation has the right to a very large slice of State supply until well past the turn of the century.

An analysis of State supply agreements shows that the quality and annual quantities of log types currently needed from exotic State forests are as follows (in $m^3 \times 1000$):

Sawlogs and Peelers Small end diameter (s.e.d.) 15 cm to large end diameter (l.e.d.) 95 cm. (Peeler s.e.d.s 35 cm) Round, straight, with small or no knots - -	1780
Stone Groundwood S.e.d. 15 cm, l.e.d. 35 cm. Required in the round, relatively straight, less than 20 years old, small knots. In direct competition with small log frame mills - - - - - - - - - - - - - - - -	420
Refiner Groundwood S.e.d. 10 cm, l.e.d. 50 cm, not needed in the round but must be less than 20 years old. Can be from sawmill slabs, sawdust, top logs and reject stone groundwood, sawlogs and poles - - - - - - - -	220
Chipwood S.e.d. 10 cm, l.e.d. 95 cm, no restrictions of any significance - - -	1020
Poles and Posts Similar dimensions and quality to stone groundwood with accent on straightness, roundness, and minimal knot sizes - - - - - -	60
	3500

Some of the quality specifications are satisfied by species other than radiata pine, e.g., Douglas fir for framing, posts, and poles. Also, some of the unthrifty species are partly able to replace radiata, e.g., ponderosa pine as stone groundwood and refiner groundwood, Corsican pine as sawlogs, posts and poles. After adjusting for these, the

supply pattern for State-grown radiata pine now and about 20 years hence is likely to be as follows (in $m^3 \times 1000$):

Log Type	1975	%	1995	%
Sawlogs and Peelers	1360	59	1100	41
Stone Groundwood	370	16	420	16
Refiner Groundwood	230	10	230	9
Chipwood	340	15	880	33
Posts, poles, etc.	10	—	30	1
Totals	2310	100	2660	100

The sawlog and stone groundwood percentages are very much dependent on what our major customer grows in its own forests and it may be expected that the 1995 stone groundwood component will drop considerably. The drop in sawlog and increase in chipwood are respectively due to termination of a major log sale and disappearance of several chipwood species prior to 1995. The national domestic demand percentages for sawlogs and peelers in 1975 and 1995 are 68% and 55% respectively and the lower figures for Bay of Plenty are considered reasonable due to the weighting effect of a major pulp and paper mill in the region.

Log quality specifications seem unlikely to change except that the sawlog size range might be expected to narrow to something like s.e.d. 25 cm to l.e.d. 60 cm and smaller. There is plenty of speculation and little in the way of conclusions as to the importance of knots and knot size in the future other than one customer who was heard to say that "no knots are better than small knots are better than big knots . . . all at the big knot price." At any rate the type of wood available from the State forests between now and 1995 is of course already largely determined by age class distribution and past silviculture. Predictions are that:

(1) In the 1970s there is a surplus of stone groundwood from thinning young stands and from old crop top logs from overstocked old crop stands not thinned by sirex, and from ponderosa pine. There is also a surplus of sawlogs from the untended old crop. The surplus is being chipped; very little can be despatched to additional markets, e.g., export without aggravating the wood deficit in the early 1990s.

(2) In the early 1980s we still have the old crop which will be older and bigger with the stone groundwood supply being reduced by these factors and by the disappearance of ponderosa pine. Thinning of young stands is expected to make up any deficit which is unlikely to total more than 170 000 m^3/year (only 7% of the radiata pine cut). Surplus sawlogs continue to be chipped.

(3) In the late 1980s the old crop disappears and supplies from second generation stands come on stream. The results will be a marked drop in piece size, an increase in the stone groundwood component, and some sawlogs still disappearing into the chipper. Small material from private forests may supply all stone groundwood requirements.

(4) In the 1990s piece size will continue to drop for several years and then steady at whatever size is created by silvicultural regimes adopted from now on.

Overall, there is no surplus of State wood until the turn of the century and until then the mixture of log quality types is somewhat unbalanced. In the last decade the quality balance could be influenced greatly by silviculture adopted in the private sector. In the meantime planning for State forests in the Bay of Plenty region is proceeding in a partial vacuum under the following tenets:

(1) Honour long term sale agreement in quantitative terms.
(2) Provide sawlogs as needed by local industry.
(3) Provide any surplus in a universally acceptable form—generally held to be of sawlog dimension and quality—they can always be chipped.

THE ROLE OF THINNINGS

Our first concern must therefore be to make our old crop last until younger stands can take over. We must also make some of the wood to be cut in the 1990s available sooner if possible without losing too much in the way of increment or piece size. On the face of it these requirements would seem best achieved by adoption of two separate silvicultural regimes for radiata pine. One for growing larger high quality sawlogs and peelers and the other for small dimension sawlogs, poles and, if needed, stone groundwood. Refiner groundwood and chipwood would come from slabwood, top logs and rejects from both regimes. It is considered that regardless of proportions of the resource allocated to each regime at least 40% of the wood produced could be classified as sawlogs nearly all of which would come from butt logs.

It is considered that the two regimes likely to be adopted for State forests in the Bay of Plenty are as follows:

(1) *On steeper slopes and some flat country*
Relatively unrestricted growth from an early age (say 575 stems/ha at 7 m reducing to 300 stems/ha ex high quality stock at 12 m) to produce the larger sawlogs at the earliest possible time. As a consequence of free growth, pruning of butt logs will be mandatory. Mean d.b.h. at 21 years could be around 45 cm.

(2) *On remaining flat country*
Some control of branch size on butt logs by maintaining a higher stocking (say 575 stems/ha from 7 m onwards), no pruning or thinning to waste. It would be possible to thin or clearfell for small sawlogs from 16 years (mean d.b.h. 33 cm) onwards. This regime would provide a measure of flexibility in manipulating the log quality balance. It is also needed as a supplement to the first which is labour intensive.

If so, there is no role for thinning, in the long term, in the Bay of Plenty region.

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