

2. We have systems in place to monitor performance and intervene when necessary. Indicator Plots comparing best possible practice with operational practice have been used to achieve significant increases in survival and initial growth. Age 5 acceptability and survival studies help us to monitor the overall success of the establishment phase and determine appropriate establishment practice.
3. We have done it in the past. We first planted 555 stems per hectare on selected sites in 1991. Eight years on, growth and form in these stands is very good.

On some of our more problematic sites, where for example the soils are seasonally very wet and slopes are too steep to cultivate, we will plant slightly higher numbers of lower value material with the expectation of higher than usual mortality in the first year. Exceptional sites will require exceptional silvicultural practice.

While not all trees planted will be ideal, growth, form and survival levels are now so consistently good that selection thinning is being phased out.

For several years Carter Holt Harvey has limited pruning to the best performing sites in its forests. Typically 25 - 30% of the available age classes have met our standards for pruning. This level of pruning activity was similar to many New Zealand forestry companies.

The product of pruning is a butt-log with an outer sheath of knot-free wood where the branches have been removed. Stiffness, an important property for structural timber, is greatest in the butt-log of the tree. Turning this portion of the tree into long-length clearwood, commonly used for appearance grade and requiring little stiffness, does not make best use of the inherent properties of radiata.

Branch cluster frequency is greatest at the base of the tree. Whorl spacing increases from 0.1-0.5 metres between whorls at the base, to an average of 0.6 metres at 8 - 12m up the stem. Recovering clearwood by sourcing it where it naturally occurs further up the tree is clearly an option worth considering, particularly as new developments in engineered wood products come on stream.

Pruning reduces the growth of the trees since it removes part of the growing crown. Pruning regimes also target fewer trees per hectare in the final crop in order to maximise individual tree size. These latter two factors together result in some 15 % reduction in wood volume yield per hectare from a pruned stand. This volume reduction can be tolerated if the final value of the pruned wood compensates adequately. Projections indicate that it will not. We believe that in combination these factors mean that we will not receive an acceptable return in the future for the pruning investment.

It is easy to look at forest management requiring several pruning and thinning operations and call this "intensive forestry management." Carter Holt Harvey views intensive forestry management as identifying our view of the future, and developing and implementing programmes that will realise the vision. Intensive forest management requires developing and planting the best trees, understanding and improving the crop and the site, increasing productivity, creating value in the right place and time with appropriate technology. It's about providing innovative processing partners with the specific resource they will need to produce the products their customers want so that competitive returns are earned for our investors.

Adding Value at the End of the Rotation

The annual harvest of logs from our own land is greater than 5 million m³. Implementing technology to maximise the value of the trees at the end of the rotation is extremely important, as there is a huge multiplier effect of any technology improvement. We have recently introduced the TimberTech tool to our log-making operations. This technology was developed by the LIRO/Interpine Joint Venture and is revolutionising the way we manufacture our trees into logs. While increasing the labour required to process stems at the landings, the additional revenue gained by using the tool to optimise cutting patterns more than compensates for the additional expense. Not only are we better able to match the existing resource to customer requirements, but we also gain a much more accurate understanding of the resource that we are harvesting.

Where to next?

Millennium Forestry will see several new technologies introduced prior to the start of the 21st Century. One of the more exciting technologies that we are in the process of commercialising in conjunction with a third party, is a log segregation tool. This technology will enable us to not only sort and allocate logs by structural and appearance grades, but also offers a tremendous opportunity to segregate according to fibre characteristics.

Millennium Forestry is a strategy to be more profitable and involves the application of knowledge through technology. There are many other technologies in the pipeline that promise to keep New Zealand at the front of world forestry well into the new millennium.

Wink Sutton

Dr. W. R. J. (Wink) Sutton

The announcement

On Wednesday 9 December 1998 Carter Holt Harvey Forests (CHHF) announced the launch of 'Millennium Forestry' regime for its 330,000 hectares of radiata pine plantations in New Zealand. The objective is clearwood (knot-free wood) but requires neither thinning nor pruning. Trees will be established at the final crop stocking (around 500 stems per hectare) and left until felling. The rotation age will be about 20 years (an age confirmed by Devon McLean (Chief Executive, CHHF) in a radio interview on the day of the announcement). The company will source clearwood by the use of "sophisticated new log scanning equipment and other devices", and, by post-harvest re-engineering wood processes (both will replace labour intensive forest management).

General opinion

For the current investor in Carter Holt Harvey (CHH) the shift to a low cost forest management regime is attractive. For the next 20 years CHH investors will continue to receive revenue from past silvicultural investments (especially thinning, but also pruning) while only making minimal investments back into current management.

Although the CHHF Millennium Forestry proposals may be a justifiable investment decision, the consequences for employment (and the economy) will be significant. By reducing plantation forestry to the absolute minimum, silvicultural employment will be limited to just a few tree planters in winter. Because Millennium Forestry will require very few management decisions there will be little need for managers and professional foresters. Because of the reduced need for staff at all levels there will be significant implications for all training institutions - private providers, polytechnics and universities.

The public image of plantation forestry could also suffer. Driving though kilometre after kilometre of untended and widely spaced trees will confirm for some of the public that plantation forestry is nothing more than wood fibre farming. The public perception could be that plantation forestry is an unsophisticated, low cost, and low quality industry.

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Reviews CHH's Millennium Forestry

A silviculturist's view

The company in its press release stated that it plans to 'make' clearwood. I assume that this means re-engineered by the end and edge gluing of short clears of solid wood. If this, or something similar, is to be the process then tree quality will be most important. A uniform clearwood product could be made from a product such as MDF (medium density fibreboard) which will require no solid wood at all. If the final product is to be MDF, or a similar reconstituted product, then tree quality is not important. For the rest of this discussion I have assumed that clearwood is a solid wood product and tree quality will remain important.

It is difficult to find a silvicultural regime that is simpler, or lower cost, than CHHF's Millennium Forestry viz. plant at the final crop stocking of about 500 stems per hectare and clearfell at age about 20 years. The sheer simplicity of the regime implies that little could go wrong and that risks should be minimised.

My experience in silviculture is that most new regimes rarely achieve all their initial expectations. This regime will probably be no exception:

- 1) The basic concept of the regime has been tried before. Several Forest Research trials with improved tree stock have examples of very wide initial spacings (around 500 stems per hectare) with no subsequent thinning or pruning. I no longer have access to the results of these trials but from memory these stands had large diameter branches and poor stem form. These observations are very similar to at least one other management trial in New Zealand. These trials are now at, or older, than normal plantation rotations. I presume the CHHF research foresters must have accessed the results from these trials and have satisfied themselves why they consider the Company will now be successful when the earlier attempts at very wide initial spacing were generally unsuccessful.
- 2) A major wood quality issue is juvenile wood (the wood laid down in the first 10 to 12 annual rings). This is a quality concern for most sawmillers who process New Zealand radiata pine. The CHHF Millennium Forestry regime will encourage rapid initial diameter growth (when the trees are young and producing juvenile wood) while diameter growth will be slower at the end of the rotation (when the tree produces mature wood). Solid wood from the 20 year old trees of Millennium Forestry will be mostly juvenile wood (probably in excess of 70%).
- 3) For maximum efficiency in the recovery of clearcuttings (for the making of clearwood) the Millennium Forestry trees should have long internodes. This will ensure not only the maximum recovery of clears but also both the minimum of effort and the minimum of waste (knots). To have trees with a long internodes implies a reversal of most of the tree breeding efforts of the last 30 years (which, by aiming for multinodals, has *reduced* internode lengths).

The company must be aware of these three potential disadvantages. Unless they are overcome then Millennium Forestry probably represents nothing more than a cost cutting exercise. Developments such as sophisticated log scanning, re-engineering innovations, etc are of little use if the trees being harvested contain very little wood of the desired quality. When established at very wide initial spacings, even the best trees of the current tree breeding programme will have branches of a large diameter and a high percentage of

juvenile wood. Unless the planting stock comes from the long internode parents the mature Millennium Forestry trees will have the short internodes (and hence short lengths of clears).

Over the last decade CHH has made a major investment in tree genetics and biotechnology. Is it possible that the company has made a biotechnology breakthrough? A breakthrough in clonal plantation forestry that will now ensure that ALL trees:

- will have uniformly good form and light branching (no matter how wide the initial spacing),
- begin producing mature (and not juvenile) wood at a very early age (say, between ages two and five), and,
- have long internodes.

Even if the company has made such a breakthrough it could not yet have grown the trees for more than a few years and nor could it have tested the trees in any conversion studies. If Millennium Forestry depends on a biotechnology breakthrough then there are still risks. There can be no proof yet that the regime will work even on one site, let alone all sites. Can the company be sure that the trees at harvest will have desirable wood quality attributes?

In its press statement the Company quoted Devon McLean as saying *"we have also been influenced by the narrowing price differential between clearwood and unpruned radiata pine. The economic return on pruning is not expected to improve in the longer term"*. Arguments over the future price for all wood qualities has been going on for decades. I have come to the conclusion that the future price of almost everything can not be accurately predicted. This is because almost all future prices are unpredictable.

The debate about whether to produce clearwood by silviculture or by wood engineering processes has been going on for decades. The following prediction was made in an editorial in New Zealand Forest Industries Review of 1974 (page 1 of volume 5 number 6) *"..... in ten years most timber will be reconstituted and faced with veneer."* Those plantation owners who have continued to thin and prune for the last 25 years must now be grateful that they ignored this prediction.

Plantation owners, however, should never be complacent. There will be developments that will challenge conventional thinking. Until we know more, plantation owners would be unwise to follow the CHHF move to Millennium Forestry.

Summary

Short to medium term investors in CHH may benefit from the change to Millennium Forestry. Long term however there are risks. The overall economics of the proposed silvicultural regime and the engineering solutions are uncertain. There is no certainty that the Millennium Forestry will prove to be either practicable or economically superior.

In the short term (viz the next two decades) employment, the educational institutions, the forestry profession and probably plantation forestry's public image will all suffer because of the Carter Holt Harvey Forests change to Millennium Forestry.