



What age should you harvest?

By Piers Maclaren – source New Zealand Tree Grower, August 2003

People often ask about rotation age. How long does it take a given species to mature? Unlike pumpkins – 6 weeks, or people – 53 years, a tree is mature at any age you want it to be which is whenever you need the cash. You can produce Douglas-fir Christmas trees at age three or temple-columns at age 100. Of course, it is inefficient to fell trees too early or too late – assuming prevailing prices at the time are favourable, you maximise your profits at a certain, predictable rotation age. Let us analyse this in detail.

Peak annual production

When does annual volume production in a stand of radiata pine peak? It is somewhere between 20 and 30 years. Young trees are not very productive – they are too busy filling up the empty spaces between trees, and building up their green crowns. The more greenery on a tree, the more sunlight it can capture and therefore the more carbon dioxide, water and nutrients it can acquire. Eventually, all the ground-space is occupied, weeds are suppressed, and maximum crown is achieved as foliage starts to die from the bottom upwards at the same rate as it is added to the top. The stand is performing at peak capacity.

But having reached a peak, annual production immediately starts a slow decline, because water has to be pumped higher and higher with each successive year. Also, trees that fail to compete for sunlight die, reducing the amount of recoverable wood grown. If you want to average the maximum wood production over the whole rotation, you harvest when annual production starts to fall below the average up to that time. The maximum average annual wood production in thinned and pruned radiata pine usually occurs at about age 35 to 40. In practice, the average rotation age for radiata pine in New Zealand is around 27 years.

Improvement with Age

Another factor deeply concerns farm foresters and that is wood quality. They are keen to produce a top-of-the-market product, because experience has taught them that quality is always well rewarded. Small, isolated woodlots are viable only if they are superior, so that buyers seek out growers rather than vice versa. Processors complain about the poor quality of juvenile wood, and reminisce nostalgically about the advantages of 50-year old trees from the depression plantings. Most attributes of wood – including strength, stiffness, hardness, distortion, and clearwood content – improve with age, like wine. Exceptions are uses that favour lower wood density, or do not favour dark-coloured and harder-to-treat heartwood, which starts to appear in radiata pine at about age 12. These include certain types of pulpwood.

Establishing a premium

The whingeing of wood processors, however, fails to impress me. A 14-year-old tree in Northland has the same density as a 40-year-old tree in Southland, and the same trend occurs with altitude, with a higher density at sea level. And I do not hear especially loud moaning

about wood from the deep south or from the hill country. Also, every old tree contains a young tree within it – wood from the centre or top of a tree is always inferior, but processors have always been able to handle a certain proportion of this stuff.

It is in the interests of the processor to establish a premium – more money per cubic metre from older trees. Currently, the only price signal the grower may receive is 'Yup, we'll take your woodlot. Or, no, not interested'. Furthermore, specifications for all grades of wood are astonishingly crude. Logs are either within spec or outside spec, with ill-defined boundaries, whereas a rational approach would require a sliding scale of price and quality. Pruned Log Index is a good first step on such a continuous spectrum, and replaces the primitive P1/P2 categories for pruned logs.

For as long as there continues to be a huge price difference for discrete categories of log, the woodlot grower is tempted to defer harvest until soon after a specification is achieved. For example, a grower may choose to fell when the majority of pruned butts meet the P1 specification – 40 cm small end diameter. This can occur almost before the arboreal age of consent – if the stand is on fertile farm sites at low stocking. At high stocking or on less fertile sites, large diameters may never be attained, whatever the rotation. Once a critical threshold of log specifications is reached however, there is no longer the same incentive to delay harvest.

Age brings more risks

So far, all the arguments are in favour of increasing rotation age from the current 27 years. But what are the downsides of longer rotations? The first one is risk. As the stand matures, it becomes increasingly expensive to insure the standing against fire. Furthermore, it is no longer possible to insure against wind. Tall, skinny trees are increasingly at risk from catastrophic wind throw. And there is a certain probability that, if you hang in there for a few extra years, log prices may not improve. They may collapse totally. It is a question of the devil you know, versus the devil you do not.

Many small-scale growers will fell their woodlots when they are offered a half-reasonable price. This is the opportunity to pay off their mortgage, give an inheritance to the child who does not inherit the farm, or to go on that world holiday. They want the money now, rather than wait a few years for a potentially larger payout.

But what if a small company, partnership or family trust owns the forest? In this case, the cash flow requirements of individual investors may differ, and the decision on rotation age must be made on a more objective basis.

MARVL

The first step is to value the forest. This must be done by assessing the trees, using software such as MARVL. Atlas Cruiser and YGen are possible alternatives. Like any tool, the skill of the operator is important and many stories can be provided of poor MARVL inventories, but there is no better system. The MARVL analysis provides the current valuation, and for every year for the next ten years or so. Results after ten years are less reliable.

The owners must then decide whether the increment in wood value from another year's physical growth, together with the likelihood of an increase in wood prices, is worth more or less than prevailing market interest rates. Of course, interest gets taxed every year whereas tree growth gets taxed only once – when the trees are sold. There may also be all sorts of

other accounting strategies, such as deductibility or tax spreading, that come into it. The owners will need to liaise carefully with their accountant.

A significant value

When the MARVL inventory has been done, the owners typically discover that their 27-year-old stand of trees is worth a significant sum of money. At current prices, provided it has been pruned and thinned and is 30 hectares or more in area, it may easily be worth a million dollars. The stand is also accumulating at an impressive rate. Perhaps it is growing by wood equivalent to a value of \$60,000 per year, which at current valuation would be around 6%.

So the next year the stand will be worth even more at \$1,060,000. But the stand has to work harder and harder to produce the same rate of return. If the value-increment on the 28-year-old stand is also \$60,000, then this represents only 5.66% rate of return. Then if it is allowed to grow until age 29, the stand will be worth \$1,120,000, at which point a further \$60,000 improvement equates only to 5.44%. The time will come soon when the owners decide they cannot afford to let the stand grow any older. They may be missing out on the money they could be making from alternative investments, including replanting the crop.

The best rate of return

So now we know why some people fell trees when they are still producing high volumes of wood, and long before they have reached their maximum production averaged over the whole rotation – the main reasons for the short rotations in New Zealand.

The trees are felled at the height of their productivity, well before their maximum average growth is reached. They are also felled at an age where wood quality characteristics are less than ideal. But they are felled at an age that gives the best rate of return. On good sites, calculations indicate that the maximum internal rate of return is achieved well before 25, and in extreme cases before age 20. On such sites, we can anticipate that – unless processors start paying more for older trees – rotation ages will keep coming down.