Dream Merchants: Why Forestry Practices Will Change
John Walker

Abstract

Plantations are overcapitalised and need creative solutions to break the mould with their heritage as an industrial commodity. Globalisation has and will continue to drive production costs lower. Two examples are considered where new technologies in communications and logistics (the Invader system and acoustics) allow for superior log differentiation to tailor wood supply to more specific market requirements and, it is argued, reduce the rotation age further. Biotechnology offers the greatest prospects in the medium term.

Nurturing an Innovative Environment

In an institution or company there is the danger of kindred spirits, of people all sharing the same ethos and intellectual framework which endangers open-minded analysis of alternative ideas, and a refusal or inability to take account of other peoples' perspectives.

Among managers, it is the paralysis of prospective failure or the fear of revealing one's technical ignorance and inadequacies that hinders development and slows technology transfer. Avoiding all mistakes inhibits learning and having to be right first time stifles progress. Rather the doors of perception should be open to the possibility of new ideas: "Science is a debate in progress, not a body of knowledge" (Francis Bacon). Further, companies and Government CRIs in particular must put in place genuine incentives for their most creative staff with stock options or a share of royalties.

New knowledge-based companies value ideas and innovation - they exist because of them - whereas some large corporations have a command-and-control style of management, which many young people will no longer tolerate.

The owner of a pruned forest will be reluctant to sell that forest cheaply because there has been a considerable emotional, financial and physical commitment. The "endowment effect" ensures that we set a higher price on what we own (our endowment, whether our pruned forest, research programme or elegantly simple idea) than we would pay for the identical item if we did not own it. Hence the righteous anger when someone should actually advocate not pruning: "that's what foresters do best".

Some believe passionately that one ought to be rewarded for delivering maturing trees or well-pruned logs, yet Fenton never argued that pruning produced a more profitable crop. More recently Bilek and Horgan (1992) came to the same general conclusion. New Zealand is over-endowed with pruned forests.

Furthermore foresters are wedded to the ideology of Malthusian scarcity, heedless of the long decline in commodity prices. I understand that the first transatlantic cable required 175 000 tons of copper. Compare that to modern satellite communication and fibre-optic cables. The problem today is not scarcity but abundance. Asian businesses in particular have produced better products with less materials and at a lower cost.

Coping With Global Competition (broad issues)

Of the key material resources land, timber and finance, only the latter is in short supply in New Zealand - but, paradoxically, New Zealand forests may be overcapitalised! The nation's inability to accumulate capital is cultural, reflecting the failure of success. The dream of the average Kiwi is to own a large house, a well-branded car, a boat and a bach at the beach and, if one is inclined to be a real capitalist, it is as a landlord. What more should one aspire to in a land of plenty?

Great New Zealand Role Models are ordinary blokes and would include the likes of Sir Edmond Hillary, Fred Hollows, Rewi Alley, Colin Meads and Rachel Hunter. Among the commercial wizards that have earned the greatest respect are Stephen Tindale, Dick Hubbard and, locally, Denis Chapman: and they are heroes precisely because they have retained their communitarian streak despite their wealth.

Contrast that with the success of failure. Housing costs for the disadvantaged must not exceed 25 per cent of income; the belief that retirement should be the Government's responsibility. All the while, gambling took $7.6 billion in 1999; perhaps because this is the best or only hope for many New Zealanders to make it big.

The current revolution at work today is increased global competition but this has been under way since 1984. At the national level in the 1970s NZ Forest Products mill at Kinleith was configured to be the paper supplier for New Zealand, with six paper machines producing numerous bleached and unbleached grades - broadly bonds, corrugating medium for cartons, linerboards, release papers and glassine, sack-kraft, writing.

With small production runs, the inevitable set-up times and the struggle to meet basic quality specifications, it is no surprise that the mill was viable only within a closed, centrally regulated economy. Such government-sponsored protectionism was an attempt to control local markets and ironically it created an artificial scarcity. Therefore NZFP Kinleith could afford to employ some 2,500 workers whereas today the CHH Kinleith mill has one paper machine producing the same amount of paper as in the 1970s, but of a relatively narrow range of linerboard and corrugating medium products, with 750
employees.

CHH Kinleith still likes to supply the local market as it offers the best returns (minimal freight costs), but must do so at import parity prices against worldwide competition. Hence, the focus on a small range of products that can be manufactured competitively.

Globalisation, together with greater transparency, undermines monopoly power. Consequently, continual reinvestment in technology is simply the pre-requisite to participate in the global market.

With tight margins even the best companies will struggle and the return on capital may fall. Any incremental gain in productivity should flow through first to the consumer in the form of lower prices and hence higher real wages.

Dividends in New Zealand are amongst the highest in the world. Companies, which struggle to maintain the dividend, are at risk of under-investing. Do companies have no better use for their profits that they are willing to return them to their shareholders? A company that is growing rapidly pays little by way of dividends as it can put them to better use ploughing them back into the business. Foresters claim to think in the long term and scorn the accountant's mentality. Yet those same bean counters and patient investors have been prepared to fund over many years biotech start-up companies with, at best, current price to earnings ratios of over 100, or more often with a negative cash flow.

Sponsors of these companies are the ultimate Dream Merchants. In fact many such companies have real embedded value, founded on years of research, clinical trials and patents, that provide high entry barriers to competitors. They have an array of products at varying stages along the development pipeline that address specific market needs in agriculture, human and veterinary medicine, environmental improvement and chemical/drug delivery systems.

Financial markets are emphasising that capital entombed in old industries can be better deployed elsewhere. This applies even to the finest companies such as BP Amoco with a widely respected management team, despite record results driven by rigorous cost cutting, the sale of non-core assets, and an intense focus on its strategic advantages. This is despite increased sales and crude-oil prices high enough to justify increased oil exploration and development.

Reluctantly, BP Amoco has announced a rolling 10 per cent buy-back scheme of its shares so that its shareholders may apply those funds elsewhere. This trend is reflected in the collapse in the price of "real" companies while the money-destroying "dot.coms" soar.

The companies of the old economy have real assets that enable them to reduce their equity and leverage themselves with loans (although they do not welcome the idea), whereas dot.coms and other venture start-ups are risky and have such differential returns that preclude bank loans.

If an equity manager invests in 10 exciting technology companies, the odds are reasonable that the one or two that succeed will more than compensate for the total losses on the others. In contrast a banker cannot earn an adequate incremental return on those that succeed to compensate for the losses on loans to companies that fail.

The current view of the market is that the near-certainty of moderate success in the future is no match for the less certain prospects of spectacular success.

As of 11th February the P/E for the NZ market was 12-13, the Dow was 24, and the NASDAQ was 345. This suggests a misallocation of resources as overvalued companies pull away from lower rated ones that could use the funds more productively. However, the contrast is not simply between old and new economies, but within the latter there are real companies growing profits at 30-40 per cent a year and others only at the conceptual stage promising jam tomorrow (or in 2005, or sometime, if ever). There is huge concern over the crowding out by Government deficits, but not a word about the effects of inflated stock values. Further, savers are heavily penalised paying a 50 per cent bubble-tax on further investment in overvalued stock - so the low US savings rate is entirely rational. How much more satisfying that people should lose money in the market than in taxes! With the dot.coms it all ends in conspicuous consumption by entrepreneurs who managed to find suckers for their stock.

With Belgrade and Rhodes - the land and sea bulwarks of the West - falling to the Ottomans in successive years (1521/2); with the stability of Italy shattered by invasion, partition and subjugation; at a time when Christendom had contracted to its smallest since the fall of the Roman Empire; few could foresee a new dynamic Europe. Thus Busbequius, an ambassador at the court of the Sultan lamented, "We set out to conquer worthless new empires beyond the seas and we are losing the heart of Europe".

The irrelevance of those Portuguese voyages on the Atlantic in the search of new opportunities may parallel our response to the gutting of real industries, like agriculture and forestry in New Zealand. Even the Art and extravagance of the Renaissance might be interpreted as much a reflection of an inward-looking Christian Europe consuming its capital - as opportunities for trade with the East were being progressively shut-down. At that time the entire world was widely thought to be in terminal decline, figuratively illustrated by Pope Clement VII commissioning Michelangelo to paint The Last Judgement in the Sistine Chapel. Today, New Zealanders merely buy used Japanese 4-wheel drive cars.

Such discontinuities are not breaks with the past but the logical consequences of preceding events, eg the French Revolution or the fall of the Berlin Wall. Of the French Revolution, Alexis de Tocqueville could say, "Never was any such event so inevitable yet so completely unforeseen".

Today we see the weakening of government by the intoxication of ideologies - of Globalisation, Rogernomics...
and paradigm shifts – and by dissent social groups railing against a society in which they feel themselves to be marginalised or misfits. Conflict and change are vital for progress but harmony and stability are essential for our happiness.

**Dream Merchants**

All the redundancies, all the efficiencies, the sale of non-core assets and the switch to contracting out many forest operations are not going to achieve greater profits: tough on the CEOs. Such moves simply justify staying in business and ensure corporate survival. Industries are operating in a deflationary environment in which devaluation has become the way of international trade. The hi-tech fads may morph, but still the pressure on traditional companies will be excruciating as every company rethinks its core business and as the best managers drive through transforming waves of creative destruction.

There is no Houdini-like escape but, also, there need be no Mephistopheles - the Spirit of Negation. If forest companies are to obtain a better return on capital - or achieve some return of capital - one route to curtail expenditure is by less thinning and pruning and a further drop in rotation age.

In Britain a few have contemplated reducing the rotation age for some oak from 120 years, to 80 years, to even 40 years; while with pine in New Zealand we have seen the rotation age fall from 45-50 years to 25-30 years, and so why not to 15-20 years? Quality need not suffer.

First, remember the resource is New Zealand pine, not French oak, Italian walnut or Appalachian cherry. Internationally, the best-known New Zealand brand in forest products would be Customwood that nearly became the generic name for medium density fibreboard in Asia and Europe.

Secondly, farmers, small woodlot owners and lawyers will continue to prune for clearwood as in the former cases they are turning their cheap labour into capital and in the latter case they are seeking tax-efficiency – or they are just having a sophisticated punt.

Thirdly, clearwood can be produced without resorting to pruning: one would anticipate the planting of some uninodeal clones in less windy areas and a considerable step-up in the production of short-length blanks (shook) for furniture or fingerjointing.

While owners of pruned trees have time to dream, our integrated forest companies should be positioning themselves as Dream Merchants (Table 1). The current strategy in New Zealand is to make a fast growing, poorly performing species into adequately performing products. Where then does our market advantage lie? Whatever the answer, it will lie in the value-adding chain. A product only ceases to be a commodity when the purchaser has imposed unique specifications and the wood is part of a wider vision of consumer needs and desires.

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### Table 1. Traditional perspectives of wood quality and forest products do not identify with the pull of the market. Industry is switching from production-driven to consumer-led marketing in which individual preferences matter. Broader issues would include sustainability and eco-labelling (adapted from Walker & Nakada, 1999).

<table>
<thead>
<tr>
<th>Market</th>
<th>Attributes sought:</th>
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<tbody>
<tr>
<td></td>
<td>key underlying properties</td>
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<table>
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<tr>
<th>Housing</th>
<th>Quality, reliability and financial security:</th>
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<td></td>
<td>stiffness, straightness, strength</td>
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<tr>
<th>Furniture</th>
<th>Selling a dream; furniture is a statement of your personality:</th>
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<tr>
<td></td>
<td>warmth colour</td>
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<tr>
<th>Newsprint Advertising, sport, sex and politics:</th>
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</thead>
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<tr>
<td>paper of reasonable brightness, showing good print and sharp, revealing pictures</td>
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</tbody>
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### 1. Drawing the threads together: modern communications

The new of the two revolutions is in communications and the sharing of information by internet and intranet. A significant reason why industry needs excess capital and performs sub-optimally is because it lacks complete information that links demand to supply. The Invader system, which provides control of harvesting operations and optimal log making, demonstrates this effect as powerfully as any new innovation in forestry (Riddle et al., 1999). The physical operation is the electronic measurement and description of the whole stem noting dimensions, branch size, sweep which are then matched against current log grades, log prices and market requirements. Invader then considers all possible combinations of logs that the stem could be cut into and offers an optimal solution. Armed with this information, the logger works back down the stem marking where it should be cut.

However, this technical description relates to the TimberTech Logger. The concept is much larger. The future of the Invader system lies in the integration in real time of log optimisation with wood flow and stock control, access to the daily requirements of customers and managing the log yards of client companies. In effect this turns the forest and mill yard into a huge modern warehouse, greatly adding value (maximisation of better grades in strong current demand and efficient log allocation) and perhaps reducing costs (less wood in the forest). Barcoding individual logs at the skids would provide a downstream flow of information that would
be a significant help in determining processing options.

2. Globalisation and its impact on wood allocation

Globalisation is the maturer of the two revolutions. It has been powerfully at work within New Zealand for some 15 years and is largely responsible for current improved competitiveness. However there are always further opportunities.

Sawmills, to be flexible and to have a variety cutting patterns and end-products, need more capital. They require more log storage space, more bins to sort lumber for length, thickness and grade, kilns must use a variety of schedules etc. For example, traditionally in Australia and New Zealand 40-60 bin sorts for lumber are common, because milling is less specialised and mills supply diverse markets, whereas a specialist mill would require at most 20 bin sorts. In theory, different markets allow the miller to cut the appropriate sizes and grades for each log from a diverse log supply tailoring the optimum pattern of each log for the appropriate market. In reality optimisation is rarely achieved and flexibility comes at a high cost. Mills need to become specialised Dream Machines – producing only structural, only laminated mouldings,..., according to the specifications of valued clients....These mills will achieve acceptable profitability only by procuring the right logs and cutting the right lumber with particular customers in mind.

Getting the right logs to the right mill is the first step in realising the dream. Here, another technology comes to the fore. The new acoustic devices, of Carter Holt Harvey (Hitman®) and Fletcher Challenge Forests (SWAT®), can sort stems and logs into differing intrinsic wood quality categories (Harris & Andrews, 1999; Parker, 1999). This allows the forest owner to further segregate "identical logs" into different piles on the skid site or at the merchandising yard.

There would be advantages in integration with the Invader system®. There would be even greater benefits if individual logs were barcoded at the site. In the ideal world barcoding would provide stand-averaged information (site, age, silviculture, risk of resin pockets etc) together with real data pertinent to that particular log - log type (butt, second, third etc.), grade, diameter, length, together with predictive acoustic information.

At one level, stand data allows judgement as to the overall value of a stand. The buyer is able to compare stand data with previous experience in milling similar stands to arrive at an appropriate price for the grade or mix of log grades. The stand history will give the sawmiller an idea of the appropriate products to cut from the wood and possible cutting strategies. It may be possible to deduce the likely incidence of resin pockets or of drying checks.

However, there is an enormous amount of intrinsic variation in wood properties within a stand and it is at this level that sorting of logs with acoustics proves helpful. It allows the least stiff logs to be identified. With this information on the barcode of the log as it enters the headrig the sawmiller is forewarned of the potential or otherwise of that log. If the acoustic velocity is high then the log has a high stiffness modulus and the chances are that the wood cut from near the pith will also be stiff. On the other hand if the velocity is low then the log will be marginal for the production of structural lumber; with the chances being high that much of the wood will fail to make structural lumber, the corewood should be processed with a limited range of non-structural products in mind.

Between-tree variations within a stand are enormous (Table 2), far greater than any between-stand variations. However, currently within each sort all logs are deemed to be identical - a discrete population with no obvious means of further differentiation. The problem the log buyer faces is that one does not know which individual logs will meet the quality specifications for the mill's outturn. The unidentified poorest logs will be processed at a loss as identification of poor quality is perceived only subsequently.

### Table 2. Between-log variations in stiffness, strength, density and spiral grain for all kiln-dried lumber from the worst and best 10% of logs within each log type sorted according to stiffness (data from a stand on the Canterbury Plains). The modulus of elasticity (MOE) represents value because machine stress grading is based entirely on flexural stiffness of the boards. There is little or no difference between the MOE in tension and bending, and tensile MOE was preferred in these experiments for technical reasons.

<table>
<thead>
<tr>
<th>Log Type</th>
<th>Stiffness group</th>
<th>Tensile MOE (GPa)</th>
<th>UTS (MPa)</th>
<th>Density Kg/m³</th>
<th>Spiral grain (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>Low</td>
<td>5.1</td>
<td>8.3</td>
<td>477</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>7.2</td>
<td>15.3</td>
<td>487</td>
<td>2.5</td>
</tr>
<tr>
<td>Middle</td>
<td>Low</td>
<td>5.5</td>
<td>10.1</td>
<td>458</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>8.1</td>
<td>21.4</td>
<td>479</td>
<td>2.3</td>
</tr>
<tr>
<td>Butt</td>
<td>Low</td>
<td>4.7</td>
<td>11.5</td>
<td>489</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>8.4</td>
<td>25.5</td>
<td>527</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Consider the proposition that 90 per cent of all the problems in manufacturing good product can be attributed to 10 per cent of the logs being milled. The unidentified poorest logs will be processed at a loss as
identification of poor quality is perceived only subsequently. Boards will be dried, only to warp unacceptable; lumber will be dressed with a rough, woolly or chipped surface; structural lumber will be graded only to find that it fails to meet specifications. This low quality tail in a population is a feature of all processing whether machining screws, mixing concrete, or casting metal. The reason why it is so important to the timber industry is that trees are amongst the most variable of all living organisms. The range of strength in a batch of steel is insignificant compared to the range of property values found in lumber. This is why many see the future of the industry in engineered wood panels where wood may be chipped or fiberised before being blended and glued together again. The average property values may not change much but the range - the variability - is greatly reduced.

It is the low quality tail of the population distribution that causes the difficulties with processing and product performance not the average wood quality properties of the stand or the particular log sort. The processor is not primarily interested in obtaining superwood, but rather that as much of the wood supply as possible should meet some minimum threshold values. This distinction is crucial. It switches interest from the superior qualities of the outerwood to the problematic issues of corewood. It switches interest from identifying the best trees in a stand to knowing as much as possible about the poorest trees in a stand. Any suggestion that some 10 per cent (perhaps) of all current sawlogs might be chipped probably upsets foresters. The risk is even greater if, knowing that there is poor wood, foresters remain indifferent to the rightful, until now unresolved, concerns of their customers.

Acoustics is the only robust skid-based tool capable of differentiating between logs that have already been sorted visually. Acoustic sorting merely ranks logs according to [speed of sound]² along the stem, which in turn is related to the volume-averaged stiffness of the wood. There are two striking features (Figure 1): there is little difference in the mean volume-averaged log stiffness between the butt and upper logs; and the range of values within each log type is large. The similarity in the average velocities in the four log types (Figure 1) is curious as the proportion of corewood increases dramatically on moving up the stem from 35 per cent in the butt logs to 75 per cent in the upper logs. Traditionally corewood has been taken to be indicative of “poor quality” so one might have expected the upper logs to have much lower average velocities and lower stiffnesses.

The reason for the similarity in average velocities between log types is probably a consequence of differing radial stiffness gradients within each log type (Table 3). In the butt log the very low corewood stiffness is compensated for by the very high stiffness of the outerwood, whereas in the top log the corewood stiffness is low and what little outerwood there is is of modest stiffness. The material in first few rings adjacent to the pith deserves particular attention because it is the poorest quality wood in the tree (low density, low stiffness, modest strength, liable to warp, full of knot clusters). However, one should be cautious of sweeping generalisations regarding this wood.

Table 3. Mean within-tree variation of modulus of elasticity. The MOE values (GPa) are for dried lumber sawn from these approximate locations within the stem (data from a stand on the Canterbury Plains).

<table>
<thead>
<tr>
<th></th>
<th>Rings 1-5</th>
<th>Rings 6-10</th>
<th>Rings 11-15</th>
<th>Rings 16-20</th>
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<tbody>
<tr>
<td>Top Log</td>
<td>5.3</td>
<td>6.7</td>
<td>8.2</td>
<td>-</td>
</tr>
<tr>
<td>Middle Log</td>
<td>5.2</td>
<td>6.5</td>
<td>8.6</td>
<td>8.5</td>
</tr>
<tr>
<td>Butt Log</td>
<td>4.5</td>
<td>6.5</td>
<td>8.5</td>
<td>9.6</td>
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</table>

In the butt log there can be some extremely low stiffness wood next to the pith and some very high stiffness wood near the cambium. Whereas in the upper log the wood next to the pith is of modest-to-low stiffness and that near the cambium the wood is of modest-to-high stiffness. Consequently, the velocity of sound by volume averaging the corewood and outerwood stiffnesses may, coincidently, be coming to the same value whether for the butt or upper log. The butt log has a steep stiffness gradient from pith to cambium while the upper log has a gentler gradient. It is important to recognise that the logs with the very slowest velocities are butt logs and
the centres of these butt logs have exceptionally poor intrinsic wood qualities. With acoustic sorting these particular butt logs can be segregated out and should be processed differently.

Enough is known about radiata pine to draw viable wood quality maps for the stem (Figure 2) and from these it is possible to give some indication as to how best to process the stem. The wood quality maps for crook or bow and for twist may be less familiar than that for basic density. The hard-to-process wood is still in the corewood, but the problem is different in the butt log (very low stiffness and liability to bow or crook) to that in the upper logs (twist). Those logs with the lowest acoustic velocities will feature enlarged low quality zones: the low density corewood zone will extend further from the pith, while the low stiffness and warp-prone cone will be both wider at the base of the tree and rise higher up the stem of the poorest butt logs.

Pruning and long rotations offer no new opportunities for the corewood which remains unchanged, as good or bad as it ever was. The predominance of corewood in very young trees is of concern to foresters: to which of the grower who saw benefits in straight, fast-growing, healthy trees. The processor was slow to offer convincing alternatives that could be achieved economically, while the consumer had no voice and no technical appreciation.

Today tree breeders have started to offer nursery stock of families and clones that have superior wood properties (high or low density, superior stiffness, less spiral grain). However, this wood will not be milled in the next 20 years.

Forestry can learn from work with fruit and vegetables that are the last bastion of commodity trading in the supermarket. No one has successfully grown and supplied national, branded fresh produce, eg. Dole and others behave more like year-round bulk commodity providers of bananas. Yet there are some wonderfully evocative brand names: Nature’s Bounty, The Master’s Touch, Endless Summer, Flavr Savr*. In the US consumers are more dissatisfied with fresh tomatoes than any other item of fresh produce but, significantly, research indicates that people are willing to pay a huge premium for improved, flavoursome fruit, ranging from 50 per cent to 250 per cent over the price of the generic product (Harvard Business School, 1994).

There is the potential for newly-configured genetically engineered trees (Jurassic Pine) with modified structure and chemistry, and for health foods and supplements. Contrast the consumer focus in the breeding of fruit and vegetables with classical tree improvement. This is unfair because in the former case the consumer is obvious, the breeding cycle is faster and there have been many decades of slow, tentative selection of desired traits. Classical tree breeding has addressed only the priorities of the grower who saw benefits in straight, fast-growing, healthy trees. The processor was slow to offer convincing alternatives that could be achieved economically, while the consumer had no voice and no technical appreciation.

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**Biotechnology: the Next Frontier**

Conventional breeding and the application of innovative process technology should be the preferred starting points for transforming future forest operations.

In tree breeding the logic is to improve the properties of corewood as corewood is the part of the tree most in need of improvement. There is far less financial benefit in improving outerwood properties that are adequate already. For radiata pine the challenge is to locate clones and families with high initial density (>400 kg/m$^3$), small microfibril angle (<30°), long fibres (>2.2 mm), modest compression wood etc. in year one and modest spiral grain (<2.5°) by around year 4. In such eventualities the first formed wood could hardly be described as corewood as currently perceived.

There is an opportunity to update Egon Glesinger’s *The coming age of wood* (1950), with its vision for timber, not only as a structural material but as a source of food for man and animals, and as a chemical feedstock for liquid and gaseous fuels, for textiles and plastics.

![Figure 2. Schematic wood quality profiles in Radiata pine: (a) for density where a cylinder of low density wood extends up the entire stem; (b) for stiffness and crook or bow where a variable-sized cone of high microfibril angle is located predominantly in the butt log; and (c) for twist represented by an inverted cone in the upper logs where spiral grain can be significant (>6 degrees).](image-url)
Taking the tomato as an example of a consumer focus, developments in genetic engineering to improve quality moved largely from the input side of breeding - for disease resistance, herbicide resistance, lower production and harvesting costs - to the output side, to the benefit of the consumer and the food processor. Even here emphasis focused on features the consumer desires - appearance, taste, texture and retention of freshness - and less directly on shelf life and firmness which are sought-after attributes for the packer and retailer. The trick has been to get the tomato to ripen but not soften. This allows harvesting in the open field to be delayed until the tomatoes have developed full flavour and texture, before passing firm fruit down the distribution chain with minimal rates of spoilage. This contrasts with the current practice of prematurely picking hard, tasteless, green tomatoes, trucking them in cooled containers before finally ripening them artificially with ethylene gas. The market for purees, pastes and ketchup - the equivalent of the pulp and paper industry - also benefits from a firmer and less watery vine-ripened sauce tomato. There is less pectin breakdown and thickened sauces are achieved with less evaporation that otherwise drives off some of the volatile esters - part of the flavour complex that traditionally is replaced. But, by extending the time tomatoes are left in the field to ripen, the risks of unfavourable weather and disease are increased, forcing the grower to take account of these dangers in their strategies. So the search for flavour takes the breeder back to reconsider disease resistance again!

Biotechnology offers many opportunities to improve wood quality. These include the obvious ones of less lignin and less cross-linking of lignin (hardwoods have less lignin, 20 per cent vs 28 per cent in softwoods, and the lignin is of lower molecular weight) resulting in less pollution and more economic pulping and bleaching of chemical pulps. Unconventional ideas to consider should include colour (white or honied), odour (by modifying the extractives), and interlocked grain so making a virtue of one of Radiata pine’s vices.

Conclusions

New Zealand forest companies are probably over-capitalised, and need to achieve a better balance in allocation of resources between growing trees and processing wood.

New technologies will reduce the risks for sawmillers and other processors of buying logs with uncertain qualities. They will enable them to specialise and produce higher quality products with less variation. They will enable the forest grower to reduce their rotations and achieve a reasonable return on investment. New technologies provide an essential step in turning New Zealand’s forest products industry from commodity producers into Dream Merchants.

Agricultural biotechnology companies are deeply out of favour with potential customers in stark contrast to the medical biotechs, the current darlings of financial markets. Fletcher Challenge Forests, a local forest biotech stock with a strong cash flow, must be a good speculative play with the shares at 53c (15/3/2000).

Acknowledgments

This work is partly funded by the Public Good Science Fund.

References