

WE ARE OFTEN ASKED ABOUT THE OUTLOOK FOR WOOD:

- Will the world need wood in 25 to 35 years' time?
- Why do we put most of our investment into radiata pine?
- Will there be too much for the market with so much being planted?

Rather than give our, probably partial answers to these questions, we would ask you to read the following paper by Dr W.R.J. (Wink) Sutton, an international forestry consultant and a recognised authority on plantation forestry.

Dr Sutton worked for 20 years as a scientist at the NZ Forest Research Institute, concentrating on the silviculture of radiata pine, and then for Fletcher Challenge Forests as Director of Research and Strategy. He has presented papers and given lectures on the world's need for wood at many international forums and universities. This paper is based on several of his recent publications, especially one he presented to a symposium in the United States in 1995 and another given to a forest investment conference in New Zealand in 1998.

THE FUTURE FOR WOOD - WILL THERE BE DEMAND FOR WOOD IN THE FUTURE?

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

"There are no energy efficient or environmentally acceptable substitutes that could replace wood"

Summary

Although we use as least as much wood as we do food, wood supply (which still comes mostly from natural forests) is only now becoming limiting. There are no energy efficient or environmentally acceptable substitutes that could replace wood. The most likely means we have of satisfying the increasing global demand for wood is to obtain more of our wood from plantations. Management of plantations will increasingly parallel intensive agriculture. One consequence is that of the 1,000 tree species we now use globally, we may eventually get most of our wood from four or five species. One of these will be radiata pine. Radiata grows fast on a wide range of sites, has desirable wood properties and responds well to both genetic improvement and stand management. The plantation technology for radiata pine is probably the most advanced of any tree species.

The evolution and success of radiata pine in NZ has major implications and lessons for the rest of the world.

The major advantages of wood are its renewability, sustainability and environmental friendliness. NZ's five rotations (140 years) of sawlog plantation experience give it a unique insight into the future of forestry:

- the emergence of only one dominant plantation tree species, radiata pine;
- the importance of early management decisions in determining final tree marketability and profitability;
- that global wood supplies will increasingly come from plantations.

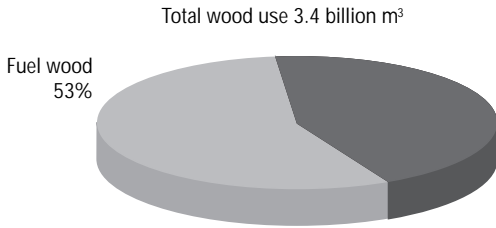
In our changing world, projections of future wood demand will be increasingly difficult. Wood supply projections will also be difficult. The only aspect of the future that can be predicted with any confidence is the population growth. There are also likely to be constraints on energy. Both of these trends will enhance the future of wood.

The opportunity for NZ that offers the most promise and poses the least risk is radiata pine intensively managed for clearwood production.

When the wood becomes available for harvest, plantation owners may have to be far more pro-active in the development of new wood markets.

The Current Importance of Wood

Everyone recognises our need for food, and hence the need for agriculture. In contrast, very few recognise the importance of wood in the global economy. FAO statistics for 1996 have the world using 3.4 billion m³ (or tonnes) of wood. Wood is still the major energy source for the majority of the world's people, and burning of wood for fuel is still the major use of wood.

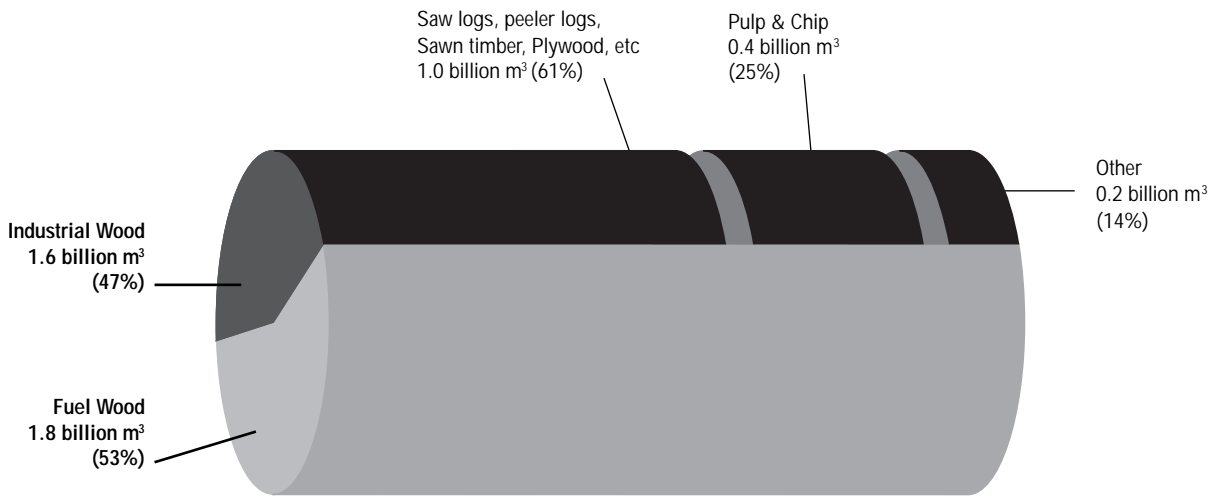


1996 GLOBAL WOOD USE



GLOBAL INDUSTRIAL WOOD HARVEST BY FOREST SOURCE

The other wood uses are all industrial. Of these the sawlog for the production of sawn timber (and plywood) is the most important. Some wood is still used in the round for poles, posts and pit props. The pulp and paper industry attracts a great deal of interest but it is not directly the major user of wood (since wood residues are a major source of its supply). It uses less than 20% of the global industrial wood harvest and most of this is less desirable or unacceptable for other uses. My interpretation of FAO statistics is as below:



1996 WOOD HARVEST AND USE

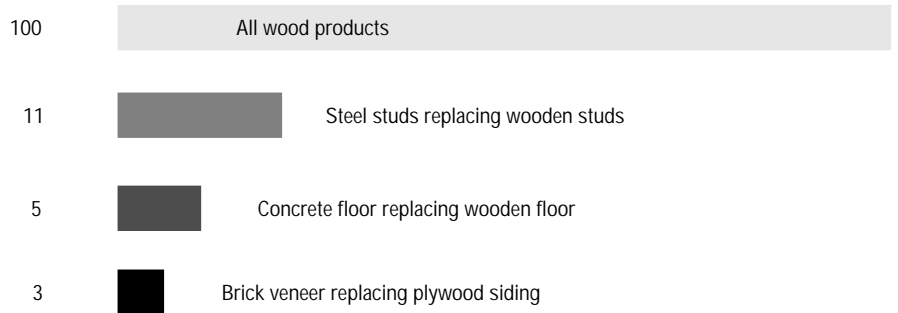
The enormous reserves of natural forests has meant that at the global level, human civilisation has not yet been constrained by an overall wood shortage. Earlier wood shortages have all been either economic or local. But we are approaching the limits of wood harvest from natural forests. The use of them for wood production is being increasingly opposed by environmentalist / preservationist groups: the pressure is to retain the remaining natural forests of the world in their natural state.

The greatest pressures are to stop the harvest of old growth forests. The public perception now is that the remaining natural forests are under serious and increasing threat.

An Increasing Need For Wood - Environmentally

We are very likely to need increasing volumes of wood. The need for wood for energy in the developing world is well recognised. The energy needs of the developed world could also be partially satisfied by using wood as the source. Most of the wood used in the developed countries is, however, for industrial purposes (sawn timber, plywood, roundwood, reconstituted boards and paper). The world demand for wood products can be expected to increase significantly if developed countries are sincere about their commitment under the 1992 Climate Change Convention to hold atmospheric emissions of fossil carbon. All wood-substitutes (steel, cement, plastics, aluminium) are major energy users and require a great deal more energy than equivalent wood products (Koch 1992, Sutton 1993).

"..all wood substitutes are far less environmentally friendly than wood.."



RELATIVE PRODUCTION FOR A GIVEN QUANTITY OF ENERGY
Interpretation from Koch 1992

Also, all wood substitutes are far less environmentally friendly than wood involving mining, pollution, atmospheric release of fossil carbon from fossil fuels, etc.

A major shift away from wood, and an increased use of wood-substitutes, would increase overall energy requirements. That would almost certainly increase the use of fossil fuels (and therefore increase the release of fossil carbon into the atmosphere). Unless there is a major breakthrough in the development of a cheap, environmentally friendly and renewable energy source, large scale substitution of wood will not be possible.

What can we predict about the future?

Population growth

An Increasing Population and Standard of Living

Given the inherent difficulty in confidently predicting the future, is there anything we can predict with confidence? Yes there are at least two things.

First is the global population. In late 1999 it has reached six billion. Although the rate of growth is slowing, the average rate of growth is still high and there are large differences between countries. Those with high average incomes (either the wealthy countries or the wealthy classes in poor countries) have, on average, fewer children than those on low incomes. A democratic solution that reduces population growth, is to increase the average wealth. The problem is that increased wealth increases consumption. Increased consumption increases energy use.

Economic growth

The rising expectations and improving living standards of the developing countries, especially in Asia, seems certain to increase wood use (Sutton 1993). Global industrial wood consumption averages 0.29 m³ per person per year. There are huge differences between countries. In the USA, for example, per capita consumption exceeds 2.0 m³ per person per year. Consumption in Australia is about half this level, whereas in China and India per capita use is less than 0.1 m³.

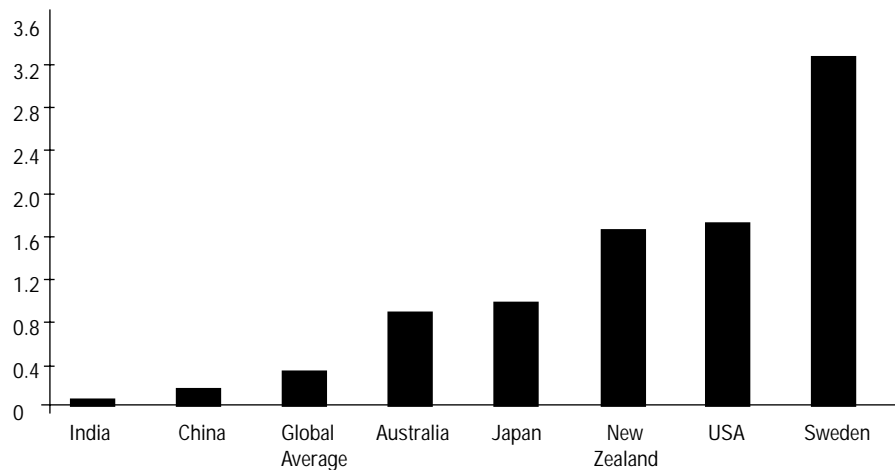
1994 TIMBER CONSUMPTION - WORLD TOTAL
INDUSTRIAL ROUNDWOOD BY REGION

Region	Population (millions)	Total timber consumption (million m ³)	Per capita consumption (m ³)
Oceania	27	21	0.80
South America	309	101	0.33
North & Central America	449	526	1.17
Europe	498	345	0.69
Asia	3,113	381	0.12
Russia & former Soviet States	289	111	0.38
Africa	642	64	0.10
World Total	5,327	1,549	0.29

Source: DANA Limited interpretation of FAO data

PER CAPITA CONSUMPTION - COUNTRY COMPARISON

Industrial roundwood - m³/capita



Source: DANA Limited interpretation of 1994 FAO data

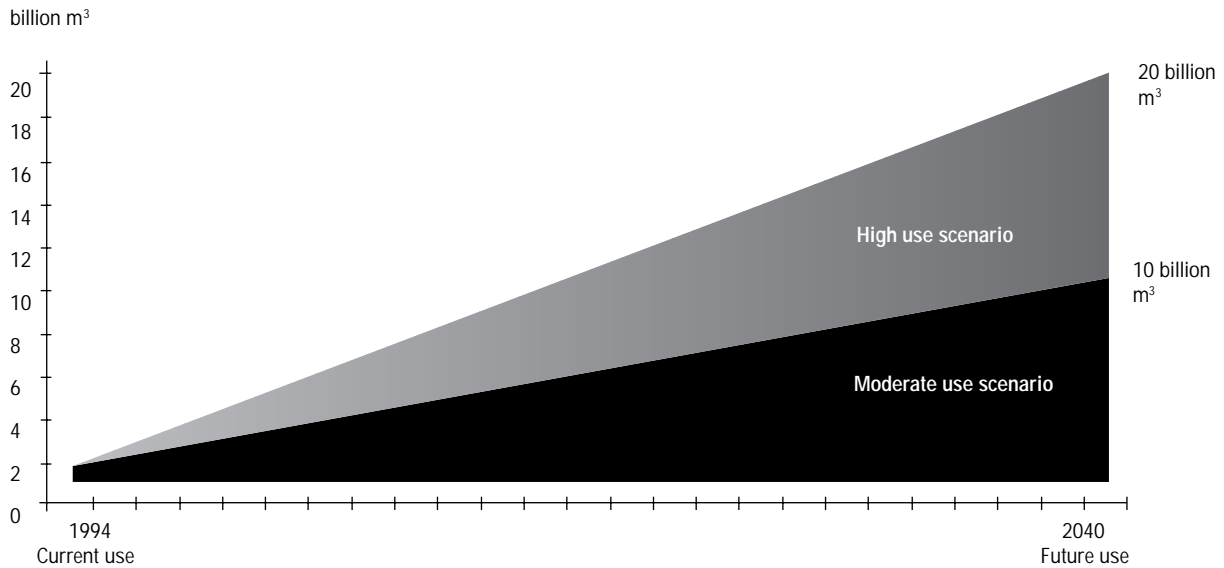
"...we would need a new highly productive plantation resource the size of Brazil..."

Assume the world's population continues to increase from the current 6 billion and stabilises at about 10 billion by 2040. A global population of 10 billion requiring 2m³ per person per year (about the same as the current USA/NZ consumption) would require 20 billion m³ per year - 13 times as much wood for industry as we currently use.

To supply that wood we would need a new highly productive plantation resource the size of Brazil (900 million hectares). We would need to start planting that plantation now.

Even if we assume a lower increase in per capita consumption, say 1m³ per person per year we would still need 10 billion m³ of industrial wood by 2040 - or about seven times as much wood as we use now.

POTENTIAL FUTURE GLOBAL INDUSTRIAL WOOD REQUIREMENTS *



**Based on increased population and per capita consumption*

More & Wealthier People Require Energy

“Wood used in its solid state ... requires far less additional energy than substitutes like steel, concrete or plastic.”

Without a huge increase in the supply of wood, where might the world find an additional energy source of the size required to provide the energy needs of a world where the average income level was high enough to greatly reduce the growth in population? Possible global energy demand, even with major energy conservation efforts, could by the year 2040 be around eight times the current global use (Sutton, 1996). An increased energy supply of that size cannot come from increased fossil fuel use. The continuing global commitment to actually reduce the release of fossil carbon into the atmosphere will alone ensure that. Where can the world quickly find an energy source that could even double the energy supply let alone allow an eight-fold increase? A partial answer is a greatly increased use of solar energy. Usually this is by direct conversion to a fuel or electricity. But an indirect route may be just as realistic. We might consider using solar energy through the photosynthetic process to make very energy efficient material(s). Such a material is wood. Wood used in its solid state (sawn timber, plywood, etc.,) requires far less additional energy than substitutes like steel, concrete or plastic.

A far greater use of solid wood in the global economy reduces not only the need for energy but also reduces the amount of fossil carbon released - fossil carbon comes not only from burning fossil fuel but also from the manufacture of cement from limestone.

Because wood is a low energy use alternative to steel, concrete and plastic, there is, contrary to the views expressed by urban and affluent environmentalists determined to lock up natural forests, a strong environmental case for a far greater use of wood in the future. Only the development of a new massive energy supply that is cheap, renewable, sustainable, and environmentally friendly would change that. But currently there are few in prospect.

So the world population trend and the questions about the world's ability to greatly increase the amount of cheap energy should provide some optimism for investors in plantations.

Even if a cheap energy source was developed, a good case can be made that a

large wealthy global population will have a preference for a natural and variable product such as wood, rather than mass-manufactured synthetics.

Where Will All This Wood Come From?

"Natural forests, ..will have greater and greater difficulty in providing the volumes of wood that will be required for the global population."

"New Zealand has been practising plantation forestry for over 140 years."

We have a dilemma. The use of the world's remaining natural forest for wood harvest is being increasingly opposed, yet wood is the most environmentally friendly product we have. Our global economy will require increasing volumes of wood. The only solution to this dilemma is to shift increasingly the wood harvest from the remaining natural forests to plantations.

This solution will require a major rethink of the objectives of forest management. In most countries (and certainly those countries harvesting most of their wood from natural forests) the prevailing forest management objective is multiple use. Wood harvest is only one of many objectives. Environmental protection, biodiversity enhancement, endangered species protection and recreation are often given equal consideration with that of the need for wood. There are additional pressures to use only local indigenous species, achieve age diversity, and even to avoid clearfelling as a harvest system. The management objectives are multiple.

Unfortunately such management objectives are not only expensive but also increasingly difficult to administer. How do we determine the balance between the competing objectives, some of which are almost incompatible? One outcome seems inevitable. Natural forests, under multiple use management objectives, will have greater and greater difficulty in providing the volumes of wood that will be required for the global population. Wood from such a system will be increasingly expensive.

The solution of moving increasingly to plantations for our wood has many attractions. It leaves the remaining natural forest to be managed for its non-wood producing objectives. These demands will be easier to satisfy because there will be no conflict with the need to harvest wood. The plantations, although managed primarily for wood production, will still be responsibly managed with respect to the environment. However, management will not have to meet the pressures and satisfy the demands of the other users.

What can we learn of relevance from the New Zealand plantation experience?

New Zealand has been practising plantation forestry for over 140 years. In that time it has gone from 100% indigenous and imported supply, to almost 100% plantation supply, as well as exporting about half of its harvest. Chile is the only other country to have done this. It is my conclusion that this switch from natural (even if it is managed) forest to almost a total reliance on plantations will one day be the norm for almost all of the world's industrial wood supply.

Some other countries have been growing plantations for longer than NZ, but none have had as much experience in growing sawlogs for lumber end-use markets.

To date about 400 promising tree species have been trialed in NZ. Despite this we have over 90% of our plantation estate, as well as over 90% of new plantings, in one tree species - radiata pine.

It is my interpretation that this is not because of any narrow-mindedness on the part of NZ plantation owners. Rather it is an inevitable consequence of intensive plantation forestry.

There is a parallel in agriculture which started with a multitude of plants, animals and birds. As practices became more intensive and markets more price competitive, the number of food types, species and varieties declined greatly. Today most of the world's agricultural food comes from less than eight plants (wheat, potatoes, corn, rice etc.) two animals (the pig and cow), and one bird

"Radiata pine will be one of those few favoured trees."

(the chicken). This is because a preferred agricultural food must have more than desirable attributes (pleasant taste, ease of preparation, ease of genetic manipulation etc.). Winners must also have ease of domestication, including the ability to respond to management.

The NZ plantation dominance of radiata pine comes both from the desirable attributes of the wood and its ability to grow well on a wide range of sites, with the additional ability to respond predictably to stand management treatments, especially pruning and thinning.

It is my prediction, that by the end of the 21st century most of the world's wood will not just come from plantations but from as few as four or five species (Sutton, 1995). Radiata pine will be one of those few favoured trees.

New Zealand's Competitive Advantage

New Zealand has no competitive advantage in access to cheap land, cheap labour or cheap capital. But NZ has major advantages in plantation experience and research, and in radiata pine. For most NZ investors no other species is considered worthy of investment.

As well as 140 years of experience, a considerable amount of research has been carried out on radiata pine in NZ. One of the key insights from that research is, even though the rotation may be as long as 25 to 30 years, most aspects of both tree size and tree quality at harvest are pre-determined by the decisions at the time of planting and in the first several years. This poses a problem for the forest grower and investor with so much capital at stake. The early decisions on site, seed source, initial spacing, the timing and intensity of pruning and thinning, and final crop stocking require an appreciation of the wood values and markets 20 to 30 years hence. Given the inherent uncertainty of the future what wood quality/end-use should we target?

Growing For a Market Thirty Years Hence

Experience shows we are not very good at predicting either total wood usage or the demand for various wood products. This is because of technological developments, substitution, wood reconstitution, changing fashions etc.

Future wood supply projections are more reliable, but can still be wrong. Forest conservationists at the beginning of this century were convinced that there would be a major wood shortage from the 1930s and beyond. Despite now using at least twice and maybe three times as much wood as we did 100 years ago, the confidently predicted timber famine never eventuated, although regional shortages did.

So what should we aim to grow mostly, pulp, structural timber or clearwood?

Radiata is a very good pulping species. However, growing it in NZ for pulp may not be a viable investment. Pulp gets most of its wood from non-sawlog quality logs or wood residues. Some species, such as Eucalyptus in South America and Asia can be grown as high yielding, short rotation crops for pulpwood. For radiata investors seeking high returns, sawlog regimes offer better opportunities than the growing of pulpwood crops.

A more contentious issue is radiata grown for structural lumber. Some disagree, but I have never favoured growing radiata for structural grades only, especially for export markets, because:

- most of the world's forests will only produce small trees with small branches, more suited for production of structural lumber than radiata;
- even with conservative silviculture, radiata will always have larger branches and hence larger knots than most of the world's traditional structural timber species;

"The Asian financial crises confirmed our faith in clearwood as only pruned logs were able to largely maintain their prices."

- radiata is not a stiff wood and stiffness (modulus of elasticity) is the prime requirement of high quality structural timber. Australasian domestic markets have learnt to deal with radiata's lack of stiffness but further abroad it compares unfavourably with preferred structural timbers such as Douglas-fir and South-em pine;
- the prices for even the best structural grades of lumber or plywood are never relatively high. This could be because most trees currently being used produce large portions of good structural grade wood and I suspect, although this has yet to be proven, it is the grade most vulnerable to substitution.
- a major reason for not growing structural lumber is because doing so restricts radiata's ability to grow a large volume of its most valuable product, - clearwood. Growing good structural timber requires close initial spacing, delayed thinning, high final crop stockings and, consequently a small final tree size. This is the opposite of the ideal regime for clearwood and so it is not possible to have a silvicultural regime that maximises production of both grades.

A life-time experience has done nothing to diminish my conviction that clearwood is radiata pine's and NZ's most competitive and comparative advantage. My reasons are:

- As a clearwood, radiata is one of the world's best. Its even texture ensures the clearwood is easy to process, to finish, to stain, to glue, etc.
- Radiata's growth attributes greatly favour clearwood. It is not the world's fastest volume producer but few other species can achieve, even with appropriate management, a large diameter, say 60 cms, sooner than radiata. And for the production of clearwood, a large tree diameter is essential.
- Radiata has the potential, not yet fully exploited, to produce long internodes in the second and third logs which could produce clear lengths of 1.2m to 1.8m.

I recommend plantation investors consider only the management option of clearwood. The Asian financial crises confirmed our faith in clearwood as pruned logs were the product that best maintained prices.

New Zealand's concentration on one species has been criticised, but for a small country that has meant a concentration of research and the establishment of a large resource with a predictable supply of trees of consistent size and quality.

The 'Wall of Wood'

"If NZ entrepreneurs do not take up the challenge then someone from overseas soon will."

There is much recent comment about the coming 'wall of wood' - the increasing volume of wood to be harvested as a result of the second planting boom in the 1970s and 1980s.

I helped create that wave of opportunity and it frustrates me to hear some in the wood processing industry describe it as a threat, not the opportunity that it is. As explained earlier there are logical and rational reason why that resource had to be created before a proven market existed.

I find it hard to accept now that given:

- (a) the uniqueness of some of that resource (especially clearwood), and
- (b) the small proportion of the world wood volume that NZ supplies, (currently NZ plantations only supply 1% of the world's industrial wood),

so few in the wood processing industry see the huge market opportunity that has been created. If NZ entrepreneurs do not take up the challenge then someone from overseas soon will.

Discussion

Imagine a Wood-less World

"...the plantation grower of a versatile fast growing species like radiata is very likely to be making a sound investment."

We don't Know the Future.....

"A price fall would not make plantation forest investment unprofitable, it would merely reduce the profit."

Wood is very versatile. We use it in up to 100,000 ways. But let us assume for a moment that we have a world that uses no wood at all, (which is in fact conceptually possible). And then imagine we have just discovered wood for the first time. It would be promoted everywhere as a new miracle raw material. Advocates would stress its renewability, its sustainability, its environmental friendliness, its low energy requirements, etc. Every day new and exiting wood uses would be found. Talented bright people as well as investors, would be eager to get into the wood sector. Wood would be seen as the new wonder raw material with so much going for it.

But it isn't promoted or seen in that way, yet. Wood producing, manufacturing and using industries have not been aggressive in their marketing of the virtues of wood over its substitutes. However that huge potential remains untapped and must provide NZ plantation growers with an excellent opportunity. Environmental concerns are increasing all the time so the plantation grower of a versatile fast growing species like radiata is very likely to be making a sound investment. Just as those growers who started pruning and thinning in the 1960s and 1970s when the market for their clearwood would not exist until the 1990s, today's growers should rightly have confidence that there will be a market for their wood. It is my interpretation that radiata clearwood is NZ's competitive advantage, and will remain so.

No-one has any special insight into the future. There are few trends in which we can have any confidence. However, we have good reasons for optimism about the future of plantation wood, especially radiata pine. They include:

- (a) the sustainability, the renewability and the environmental friendliness of wood;
- (b) that future wood supply will increasingly come from plantations.

Intensive plantation management, instead of being a global exception, will increasingly become the global norm.

Future wood prices are just as unpredictable as the size of the wood market. Some anticipate a fall because of possible over-supply and substitution by steel, concrete, plastic and other materials. For the simple reasons of population and economic growth as well as the environmental advantages of wood, I think that is unlikely and I agree with many others that wood will at least maintain its competitive position.

Another little understood factor is the true economic cost of wood is yet to be felt. The true cost of growing most of the world's wood is higher than that of radiata pine because most comes from slower growing tree species. As more countries adopt realistic costing and valuation methods, and, as subsidies to forestry seem likely to be reduced, the favourable position of NZ will be enhanced. This factor alone should at least maintain or even increase wood prices. Despite this justifiable optimism we should also consider the consequences of a price fall. A price fall would not make plantation forest investment unprofitable, it would merely reduce the profit. A halving of wood prices might only reduce radiata plantation investment returns from say a 9% real return to a 6% real return on invested capital. Even at these lower price levels, radiata plantation investment returns may still be acceptable.

Concluding Comments

"We had a period when Timberlands thought that every decision should be made on the basis of return on investment, so many practices were accordingly rejected. My comment is that if Frederick Weyerhaeuser had surrounded himself with a bunch of economists and MBAs in 1900, he would never have bought 900,000 acres of North Pacific land. He just wouldn't do it. Lousy investment. This company has always succeeded because of visionaries, and that still is the case, always will be."

(Rex McCullough, pers comm.)

Considering the market potential NZ's plantations have, and will have as new plantings approach harvest, I am reminded of a recent visit by a wood buyer concerned about NZ's ability to sustain supplies of clearwood. The sight of all our pruned trees quickly dispelled any fears. This, of course, led to a discussion of the evolution of our silviculture. He was most impressed by our vision. "You mean you were pruning trees in the 1970s for us in the 1990s!" Then he added the comment that really surprised me "But you never told us about it!"

Clearly plantation owners need to do far more promotion to maximise their investment.

I am also reminded of a statement by the late Dr George Staebler. George was for many years Weyerhaeuser's Chief Forest Researcher. He was one, if not the originator, of proposals for Weyerhaeuser's high yield forestry which, in a global context, equates to intensive plantation management.

In his 1992 remarks at the celebration of "25 years of high yield forestry" Staebler said: *(quote in margin)*

The importance of vision cannot be over-stressed.

There are risks in everything we do. Some see risks in everything about plantation forestry: some see little but optimism.

To answer the question that is posed by the title of this paper, I am confident that even though there are risks there are good reasons for confidence that there will be a future market for our radiata pine plantations. Furthermore, those opportunities can be enhanced by plantation owners themselves being more proactive.

Dr W.R.J. Sutton has given, and has not withdrawn before delivery of a copy of the Prospectus for registration, his consent to the distribution of the Prospectus with this paper included in the form and context in which it is included in this prospectus.

Dr W.R.J. Sutton is not and does not intend to become a director, officer or employee of, or professional advisor to the issuer of the Prospectus.

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While Dr. Sutton is willing to have his published work reprinted in this prospectus, his general advocacy of wood and radiata pine should not automatically be taken as his personal endorsement of this or any other investment.