

Extract from the Prospectus for Seventh Forest Partnership

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What about the outlook for wood?

We are often asked :

- ?? Will the world need wood in 25 to 35 years' time?
- ?? Why is so much radiata pine grown in New Zealand?
- ?? 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 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

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 thousands of tree species we now use globally, we may eventually get most of our wood from only four or five species.

One of these will be radiata pine. Another will be Douglas-fir. The New Zealand plantation technology, especially that for radiata pine is probably the most advanced of any plantation tree species.

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.

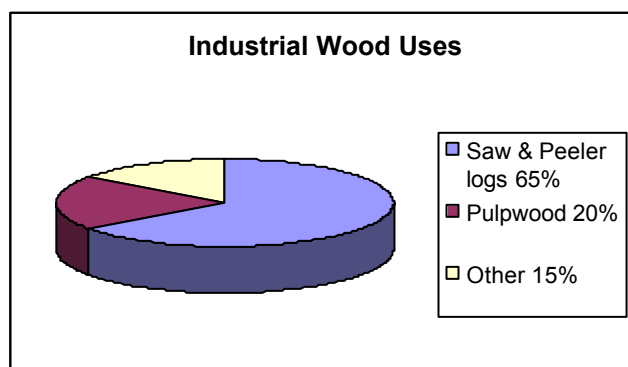
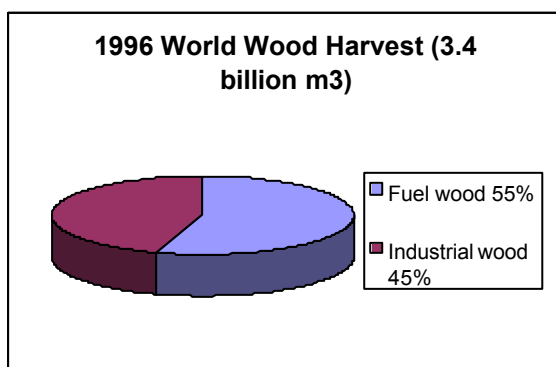
Although the opportunity for NZ that offers the most promise and poses the least risk is radiata pine intensively managed for clearwood production, there is a definite place for Douglas-fir on some sites. Because it is a construction timber, Douglas-fir requires no pruning and therefore less capital for growing.

When the wood becomes available for harvest, plantation owners may have to be far more proactive 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. (Over 50% of the world's wood harvest).

The other wood uses are all industrial. (Just under 50% of the world's wood harvest). Of these wood uses the sawlog for the production of sawn timber (and plywood) is the most important. The world's pulp and paper industry uses about 40% of the world's industrial wood but the industry is less important than this usage suggests. More than half of the wood used in making pulp comes not from logs but from the chipping of residues from the sawmill and plywood industries. Less than half the wood used for making pulp is supplied as logs. Logs that are often small and/or of a quality that makes them less desirable or unacceptable for sawing or peeling. Some wood is still used in the round for poles, posts and pit props. My interpretation of wood use is below:



1996 WORLD'S WOOD HARVEST

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MAJOR INDUSTRIAL WOOD USES

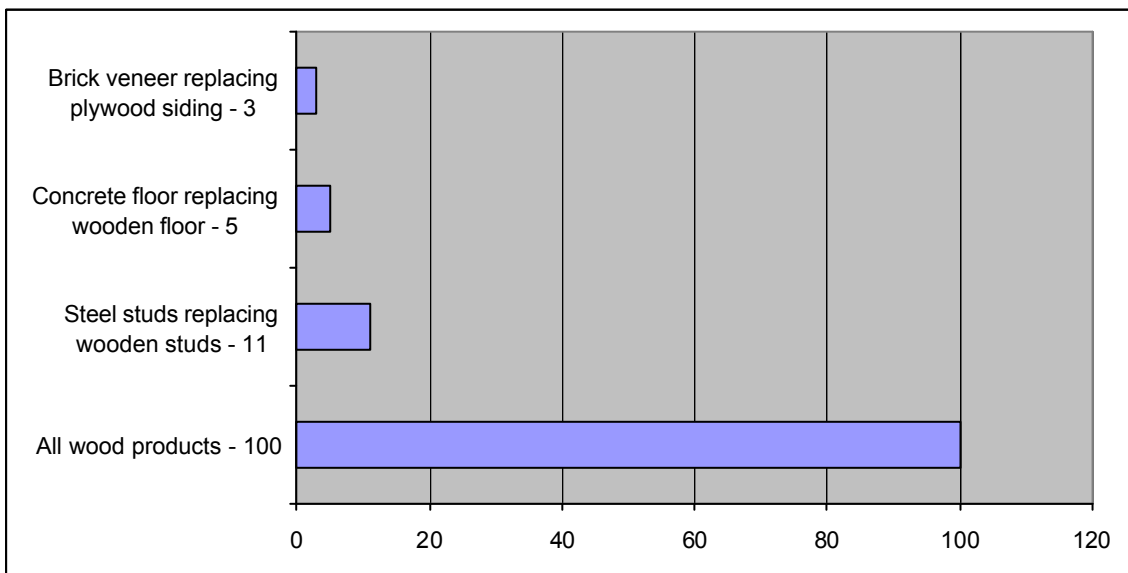
The enormous reserves of natural forests has meant that at the global level, human civilisation has not yet been constrained by an overall wood shortage. Earlier wood shortages have all been either economic or local. But we are approaching the limits of wood harvest from natural forests. The use of them 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 - *Environmental*

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).



RELATIVE ENERGY EFFICIENCY OF WOOD AND WOOD SUBSTITUTES

Assuming wood energy efficiency equals 100

(Interpretation from Koch 1992)

All wood substitutes are far less environmentally friendly than wood. Wood substitutes often involve mining, pollution, the 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? :

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.

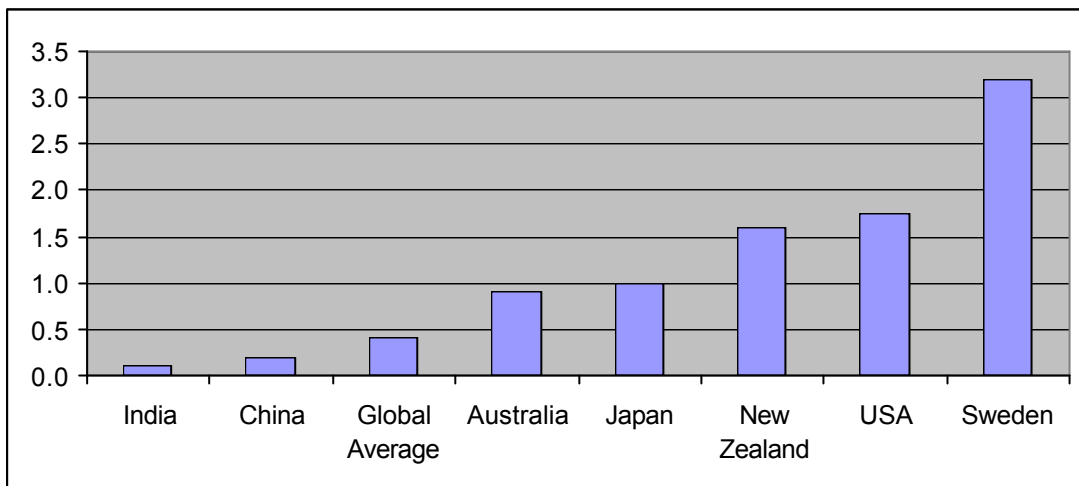
First is the global population. In late 1999 it has reached six billion. Although the rate of growth is slowing, the average rate of growth is still high and there are large differences between countries. Those with high average incomes (either the wealthy countries or the wealthy classes in poor countries) 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.

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.

Region	Population (millions)	Total industrial wood consumption (million m³)	Per capita consumption (m³)
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

**1994 INDUSTRIAL WOOD CONSUMPTION - WORLD TOTAL
INDUSTRIAL ROUNDWOOD BY REGION**

Source: DANA Limited interpretation of FAO data



Industrial Roundwood (m³)/capita
PER CAPITA CONSUMPTION - COUNTRY COMPARISON

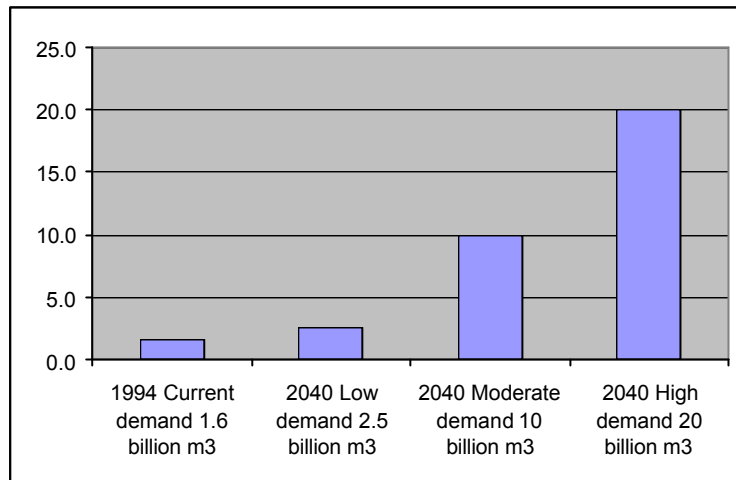
Source: DANA Limited interpretation of 1994 FAO data

Assume the world's population continues to increase from the current six billion and stabilises at about ten billion by 2040/50. A global population of ten 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. (High demand in the chart below).

To supply the extra 18.4 billion m³ of wood (our current industrial harvest is 1.6 billion m³) we would need an additional new productive plantation resource larger than the area of Brazil (900 million hectares). And 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, or an extra 8.4 billion m³ of industrial wood by 2040. (Moderate demand in the chart below).

Even if we assume no increase in the per capita industrial wood use the world will still need 2.5 billion m³ of industrial wood (or if fuelwood is included, just under 6 billion m³) to satisfy the global demand of 10 billion people. (Low demand in the chart below). Just to supply the required extra 0.9 billion m³ of industrial wood we would need an additional productive plantation area of 45 million hectares (or an area nearly twice that of New Zealand).



GLOBAL DEMAND FOR INDUSTRIAL WOOD - PRESENT & FUTURE

Based on population expectations and per capita consumption levels

A Greater & Wealthier Population Requires More Energy

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 photosynthesis 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?

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 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.

Although New Zealand is now almost totally reliant on plantations for its wood this is an exception. Only South Africa is as dependent on plantations as we are. There are some estimates of plantation production that are in my opinion too high. My own analysis suggests that plantations, as New Zealanders understand them account for no more than 20% of the world's current industrial wood supply (there are no estimates of the importance of plantations to the supply of fuelwood),

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. Almost all of the rest is our other most acceptable species – Douglas-fir.

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 (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 (especially as a clearwood) and its ability to grow well on a wide range of sites. It also has the 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 most of it from as few as four or five species (Sutton, 1995). Radiata pine and Douglas-fir will be two 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. It is not surprising therefore that for most NZ investors no other species is considered worthy of investment. However, Douglas-fir is an exception, but then only on suitable sites, especially in the South Island.

Given the inherent uncertainty of the future, what wood quality/end-use should we target?

Growing For a Market Thirty (or More) 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, 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. No-one in the world is considering growing Douglas-fir plantations specifically for pulpwood.

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.

I recommend Radiata plantation investors consider only the management option of clearwood. The recent Asian financial crises confirmed our faith in clearwood as only pruned logs were able to largely maintain their prices.

New Zealand's concentration on one species (radiata pine) 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.

Douglas-fir (on suitable sites) is an alternative to radiata pine. Douglas-fir is not a clearwood species. Douglas-fir's markets are those for structural timbers. As a structural timber Douglas-fir is superior to radiata pine.

Although construction timber is unlikely to be as valuable in the market place as clearwood, Douglas-fir grown for construction timber has an advantage over radiata pine grown for clearwood. Provided stands are well stocked and tree stockings kept high (to restrict branch size) there is generally no need for pruning. This means Douglas-fir plantations can require less capital for establishment than radiata pine.

The ‘Wall of Wood’

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 reasons 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’s wood volume that NZ supplies, (currently NZ plantations only supply a little more than 1% of the world’s industrial wood).

This resource provides the wood processing industry with a huge market opportunity. If NZ entrepreneurs do not take up the challenge then the risk is that someone from overseas soon will.

We don’t Know the Future.....

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 our high yielding plantations. Those reasons 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 that 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 our radiata pine and Douglas-fir because most wood 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. Even at the lower price levels, plantation investment returns may still be acceptable.

Concluding Comments

Considering the market potential NZ’s plantations have, and will have as new plantings approach harvest, I am 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 (of Douglas-fir).

In his 1992 remarks at the celebration of "25 years of high yield forestry" Staebler said:

"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.)

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 and Douglas-fir plantations. Furthermore, those opportunities can be enhanced by plantation owners themselves being more proactive.

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Dr Sutton confirms that he has given, and has not withdrawn before delivery of a copy of the above Prospectus for registration, his written consent to the distribution of the Prospectus with his paper included in the form and context in which it is included there.

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Dr Sutton has not provided professional advice to the issuer of the Prospectus and he is not presently nor intending to be, a director, officer, or employee of the issuer of the Prospectus.

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