Some observations on the economics of commercial forestry in New Zealand

David Evison

Introduction

The 1913 Royal Commission on Forestry recommended the development of the planted forestry sector in New Zealand. The Commission clearly saw forestry as an investment activity which should be evaluated on commercial terms when it recommended the use of discounted cash flow analysis and the inclusion of land costs and management costs in the calculation of net present value in evaluating forestry investments. Economics is also a key tool for analysing forestry markets and processing options, as well as export competitiveness and land use change to and from forestry. These topics, and a discussion of the development and implementation of forestry sector strategies, are the subject of this paper.

The New Zealand forestry sector is currently examining processing options. The Wood Council of New Zealand is leading the process, and has provided a scenario of the 'size of the prize' in terms of increase in export revenue (Wood Council of NZ, 2012). Analysis by Scion with the help of FP Innovations of Canada, to estimate the profitability of different processing options has been completed – the 'Woodscape' project. Along with that work we need strategic thinking, market analysis, government and policy support, and the involvement of the existing major players in the sector. If we choose to process a larger volume of harvest, we will need investors. If significant new investment results, there will be a major expansion in the sector in the next 10 years.

The Woodscape research indicates there are profitable processing opportunities, and increasing scale increases profitability in almost all cases. These findings highlight the importance of markets – increasing your scale only works if you can sell the entire output – and of investment in processing to fulfil the potential of the forestry sector.

A challenge for any resource-based industry of scale is identifying the commodity area of focus. In forestry there seem to be three main choices –

- Pulp or paper
- Sawn timber
- Logs.

For example, western Canada has chosen sawn timber, New Zealand export logs, and Chile, as we will examine in more detail later, pulp and paper. Before taking a more in depth look at the New Zealand and Chilean strategies, we will first review the resource situation in New Zealand.

The resource

Figure 1 shows the total harvest from plantation forests, the New Zealand domestic consumption, in roundwood equivalent for all products, from these forests, and the forecast of future harvests assuming a non-declining yield (MAF, 2010). It demonstrates why the focus of the forestry sector is necessarily on exports, and also shows that the difference between the resource capability and supply is now fairly small, so the term 'wall of wood' can be discarded.

Anyone unconvinced by this should recall that investment returns from forestry are fairly constant for a few years each side of the optimal rotation so there is flexibility concerning the age of harvest. In addition, Park et al. (2012) have shown that some of the forests established in the 1990s may not be harvested on schedule because harvesting, roading and transport costs may exceed log revenues. Some of the forests may have to wait for high log prices, and some may not be replanted.

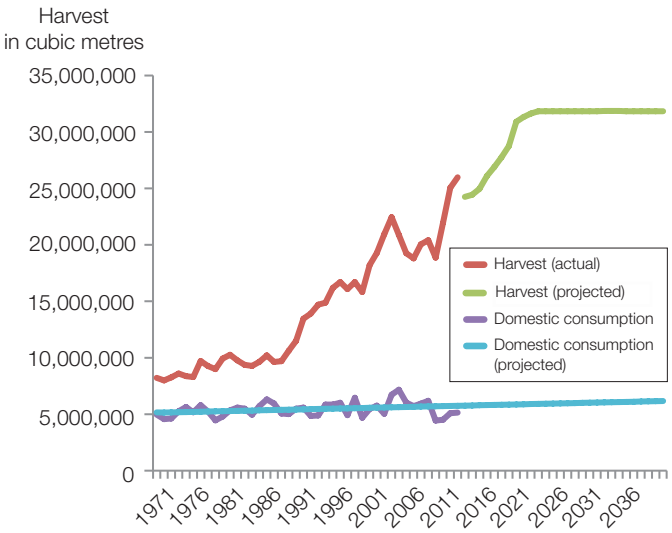

Figure 1: Harvest and consumption of New Zealand planted forest roundwood – historical and predicted Source: Ministry of Forestry, 2010

The Royal Commission on Forestry in 1913 identified radiata pine as the best option for a plantation programme in New Zealand:

> It is now well known that *Pinus radiata* will yield a really good second-class timber when from thirty to thirty-five years old (Haszard, 1913).

Radiata pine was described as being good enough for building and excellent for packaging. We now know that radiata has excellent machining, nailing, screwing, painting and sanding properties, and the sawn timber

is very amenable to treatment by preservative or other chemicals. Berg (2013) noted that the pulp-making properties of radiata pine were already being researched by the 1920s, and it turns out to be excellent for packaging papers and fluff pulp. We know the quality of our resource, and how to improve it. Our efforts should therefore be directed towards which markets, both product and country, we should be targeting.

Strategy revisited

Plantation forestry in New Zealand has been blessed with a large number of strategic analyses, far too many to summarise in this article, since the report of the Royal Commission in 1913. For example, Jack Westoby, at an Institute of Forestry address at University of Canterbury in 1969 noted –

> … As I see it, New Zealand's problem is a very simple one. You have versatile, cheap raw material. And you can easily create more of it. But so can some others, better placed for world markets. How can you beat geography? By moving towards high value lines and by getting ahead and keeping ahead in the whole field of product research, design and development … (Westoby, 1970).

In 1992 the New Zealand Forest Industries Strategy was published (Edgar et al., 1992) and concluded –

1. The industry should "fly in formation" with an "industry wide strategic direction" that did not "compromise the rights of individuals to pursue their own path of endeavour". This was recommended as the principal immediate goal of the industry.
2. The sawmilling sector had a pivotal role "… the greatest impediment to collective industry growth common to all the development courses is the lack of a strong, vibrant, innovative and internationally focused sawmilling sector …".
3. Bleached softwood kraft pulp was an excellent opportunity for both Chile and New Zealand, based on financial modelling.
4. The cost of capital was high in New Zealand and the availability of capital was low.
5. There was a lack of resource concentration.

The views of the authors on log exports are also worth repeating –

> … Ultimately, the increase in New Zealand's log harvest could be placed in the Pacific Asian region in log form. Provided the market development is on an orderly coordinated basis, current attractive pricing levels should be able to be maintained. But such a development outcome would result in 47% of the New Zealand industry's total harvest being marketed internationally as logs/chips … Is this position consistent with the nation's aspirations? Certainly it is difficult to argue that it represents a sound export product mix strategy … (Edgar et al., 1992).

Log exports as a strategic choice

New Zealand is the largest exporter of coniferous logs by volume (Table 1). The log export strategy is very much market-driven. We have introduced radiata pine to a number of significant markets and the species is now quite well known. In some cases log markets have become markets for processed products. Our first log export customer, Japan, now processes radiata pine in New Zealand into a range of solid wood, panel and pulp products.

Table 1: The world's top five coniferous log exporters in 2012

	Quantity cubic metres	Value US dollars thousand free on board
New Zealand	13,744,513	$1,275,097
Russian Federation	12,902,311	$1,189,838
United States of America	9,483,495	$1,322,415
Canada	5,673,155	$581,907
Czech Republic	4,311,108	$351,064

Source: http://faostat.fao.org accessed 24 August 2013

There are some potential strategic issues with the log export strategy –

- We are exporting the saw-log fraction and the pulp and fibre fraction
- Logging and transport costs are a large component of total revenue and they can increase sufficiently to erase all profit for some growers. We are exporting a lot of water
- We have low control over the quality of the end product – degrade in transit and port processing
- Log markets have always been subject to government intervention, and the effect of natural disasters in other parts of the world and the Russian log export ban, the spotted owl, and major windstorms in Europe are examples of this
- Biosecurity risks are greater with log exports than with processed forestry products, and treatments such as methyl bromide are controversial.

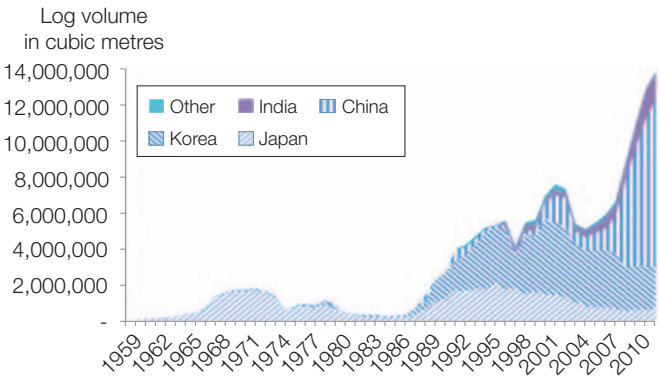

Figure 2: Volume of log exports from New Zealand – 1959 to 2012

Source: www.stats.govt.nz

Figure 2 shows the development of New Zealand's export log trade since the 1950s. Increasing demand from Japan to provide packaging material for its growing export industries provided the impetus, and marketing was coordinated by the major forest growers, including the government.

We now have four significant markets, with some in decline and others increasing. They have something in common – all are big economies, and growth in demand for logs is associated with high rates of economic growth. Figure 3 shows the history of growth in real GDP as a 10-year moving average for our four major log markets. It seems that if the GDP growth rate is at or above about five per cent we have a growing market for our logs. The Japanese log market declined in the 1990s and the Korean market declined in the mid-2000s when economic growth dropped below this level. A main strategic question for New Zealand is whether there will be more markets with these characteristics in the future.

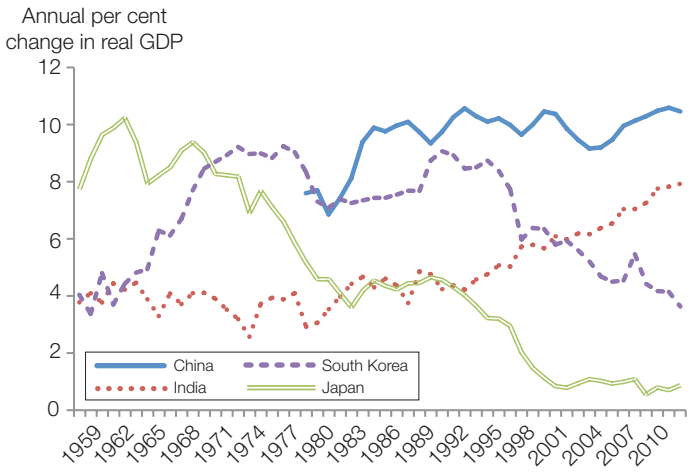

Figure 3: Change in real GDP as a five-year moving average for New Zealands's major log markets Source: www.imf.org

Figure 4 shows long-term trends in export log prices. The graph shows real log prices, adjusted to remove inflation using the New Zealand producer price index. With the 'noise' of inflation removed, we can see the effect of shifts in supply and demand on prices. The most obvious trend is the decline in log prices since the price spike of the early 1990s. Even ignoring the spikiest part of the spike, there has been a long-term and severe downward trend. Real prices of pruned and A-grade logs halved from 1997 to 2007. Log prices for higher grade logs have now stabilised and possibly recovered marginally at a time when export volumes have more than doubled, which is positive. Over the period shown, the trend in pulp log prices has been steady or slowly increasing.

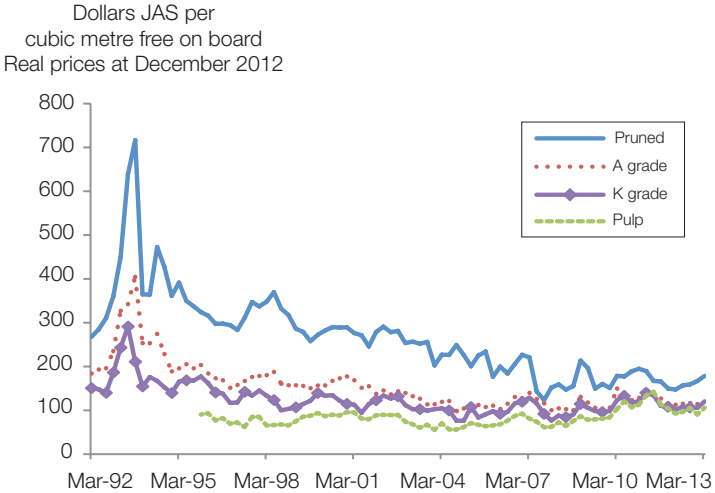

Figure 4: Radiata pine export log prices by grade 1992 to 2013
Sources: www.mpi.govt.nz/news-resources/statistics-forecasting/forestry/indicative-new-zealand-radiata-pine-log-prices.aspx; www.stats.govt.nz/infoshare

To understand price trends before 1992 we can look at unit values, calculated by dividing the total volume of export logs by the total value. The detailed price data for A and K grade is also shown in Figure 5, for the period that they are available, demonstrating the unit value is probably a good proxy for actual market price trends. In this view the price spike looks rather more like business as usual when compared with earlier price data – the average real log unit value from 1972 to 1993 was around $200 a cubic metre in 2013 New Zealand dollars. In summary, we have a period from 1972 to around 1993 when prices averaged about $200 a cubic metre. After the price spike, and as we increased our exports to about six million cubic metres, prices declined fairly rapidly to around $110 a cubic metres in the mid-2000s and have increased to about $125 a cubic metre since then.

There are a number of plausible economic explanations for this decline in prices. The increase in volumes might itself cause prices to decline, the competitive behaviour of New Zealand log sellers discussed in both Edgar et al., 1992 and Wood Council of NZ, 2012, and a general decline of export competitiveness in New Zealand. We will look at the third possibility later, but the conditions under which Edgar et al. (1992) indicated log exports would be a viable if unexciting option, maintaining the prices of the period before 1990, no longer apply.

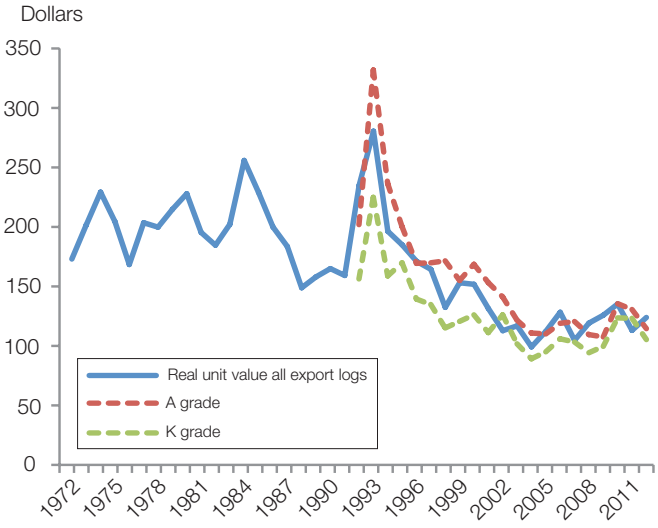

Figure 5: Real unit values of New Zealand export logs 1972 to 2013
Sources: www.mpi.govt.nz/news-resources/statistics-forecasting/forestry/indicative-new-zealand-radiata-pine-log-prices.aspx; www.stats.govt.nz/infoshare

Export log price also provides insights into premiums for quality. Figure 6 shows the ratio of pruned to A grade, A grade to K grade and K grade to pulp. A ratio of one means there is no premium between the two grades in question.

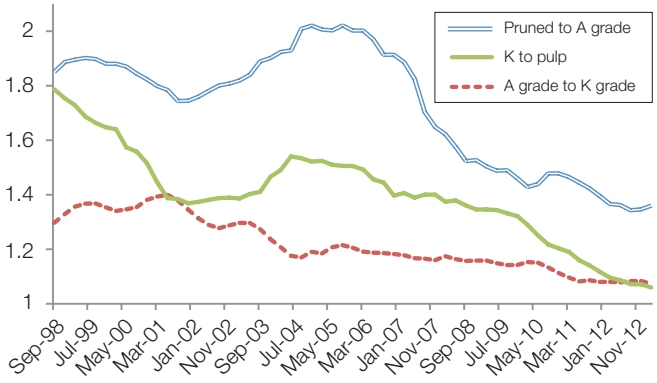

Figure 6: Price premiums for quality New Zealand export logs 1998 to 2013, five-year moving average

Although there have been some significant fluctuations, the overall trend for all ratios is down. The margin for size A/K has almost disappeared, whereas there is still a margin for pruning P/A. The arguments for and against pruning were traversed by a number of authors in the February 1999 issue of the *New Zealand Journal of Forestry*. Given that pruning is an investment decision based on a view of markets 25 years in the future, it should not be a surprise or a concern that different investors would come to different conclusions.

However, many published studies have concluded that pruning is more profitable. For example, Croskery, 1999 and Maclaren et al., 2008. Croskery (1999) stated that if the differential between pruned and unpruned was at least $32 a cubic metre, then pruning would earn the required rate of return, eight per cent at that time. It appears the margin is currently at around the break-even point.

Strategically there appear to be some advantages in the clearwood strategy. First, it shows the attributes of sustainable competitive advantage '… an advantage that allows a business to be more successful than its competitors over a long period of time …' (Online Cambridge Dictionary, 2013.) Secondly, it is consistent with some of the best wood quality properties of radiata pine. Thirdly, it provides a consumer product in the United States, a major wood-using market. A number of New Zealand companies are serving this market as suppliers of the major home improvement chains in the United States, such as Home Depot and Lowes, see Figure 7.

Appearance grades sawn timber and related products will always be a niche market strategy – New Zealand cannot build its entire industry expansion on this opportunity. Commodity market sawmilling specialists require a uniform resource producing high proportions of structural grade timber, and that is not our resource.

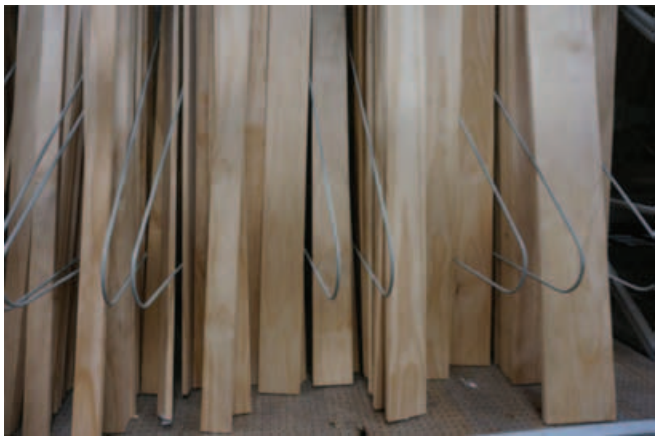

Figure 7: Radiata pine long clears at Lowe's Home Improvement Warehouse, Seattle, June 2013

Development of Chilean forestry sector

Chile has a similar-sized economy, population, growing conditions and major plantation species as New Zealand. However, it is clear the Chilean forestry sector has been following a radically different strategy from New Zealand if we look at trends in log and chemical pulp exports for the two countries since 1990, see Figures 8 and 9.

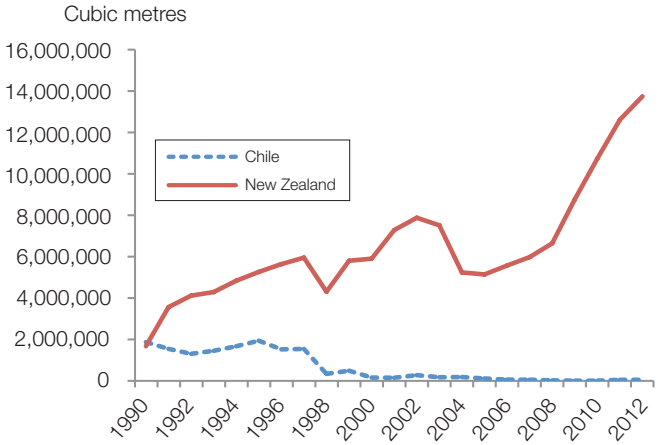

Figure 8: Log exports by volume, 1990 to 2012, New Zealand and Chile Source: http://faostat.fao.org accessed 24 August 2013

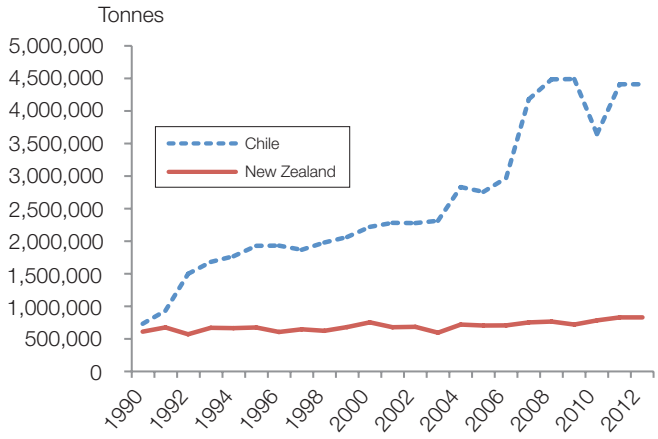

Figure 9: Chemical pulp exports by volume, 1990 to 2012, New Zealand and Chile Source: http://faostat.fao.org accessed 24 August 2013

Figure 10 shows that in 2012 the value of New Zealand's forestry exports is two-thirds that of Chile. There is around a quarter of a billion dollars of newsprint exports missing from the data because of confidentiality restrictions, therefore New Zealand's export data may underestimate actual exports by about five per cent. However, even if this data was included, the conclusions would still be the same. Chile started to pull ahead in about 2004.

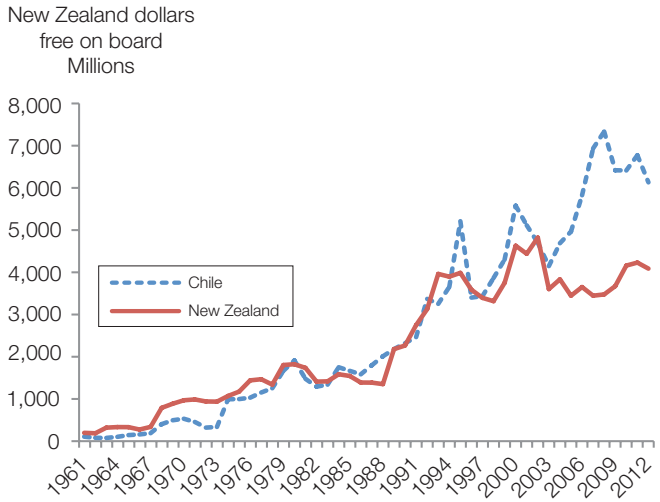

Figure 10: Total value of exports by volume, 1961 to 2012, New Zealand and Chile. Source: http://faostat.fao.org accessed 24 August 2013

Chile has two large vertically integrated forestry companies Arauco and CPMC, as well as a number of smaller companies involved in processing. These two are big enough to be in the top five New Zealand companies as reported in *NZ Management*. These companies have been responsible for implementing the Chilean pulp strategy, and Table 2 shows these companies are profitable.

New Zealand forestry markets

New Zealand sells a diverse range of products in overseas markets as shown in Figure 11, and as might be expected this data also shows the increasing importance of log exports. Over this period our harvest has gone from 16 to 28 million cubic metres, but we have had no increase in export value. So the forest growing industry is pedalling harder but total export revenue is not growing.

Figure 12 shows that New Zealand's important markets are reasonably stable. All markets in the top

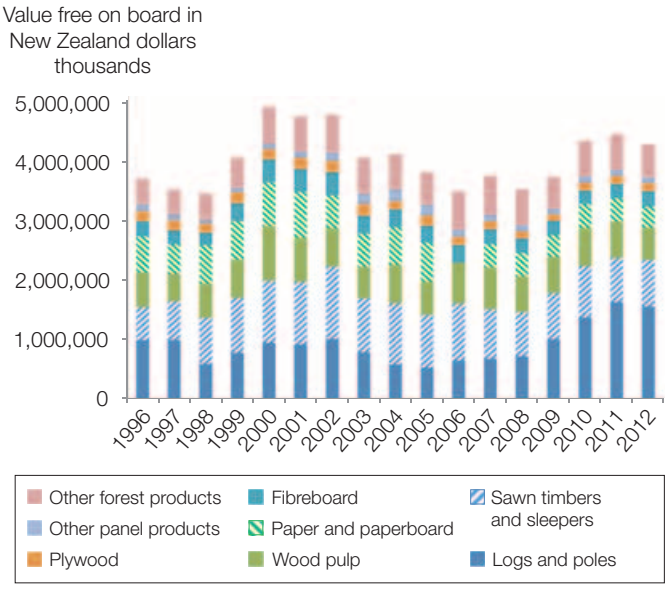

Figure 11: New Zealand forestry exports by product 1995 to 2012
Source: MPI

10 now have been in the top 15 since 1996. Taiwan, the USA and Japan are becoming less important. For example, Japan has gone from the most important market to third most important, USA has gone from fourth to sixth, and Taiwan from sixth to ninth. These are all developed market economies, and are mainly

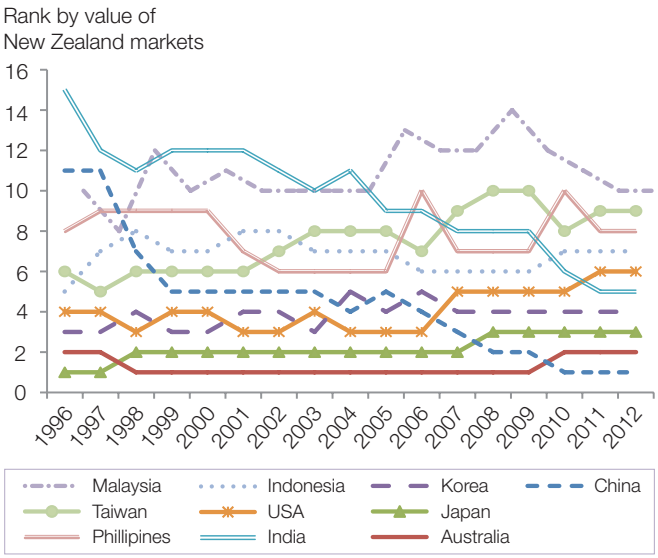

Figure 12: New Zealand forestry markets, ranked 1996 to 2012
Source: MPI

Table 2: Assets, revenue and profit for Chile's two largest forestry companies 2011 and 2012

	Arauco		CMPC	
	2012	2011	2012	2011
Assets in New Zealand dollars, thousands	$16,717,304	$15,865,904	$17,327,822	$16,871,504
Revenue in New Zealand dollars, thousands	$5,280,365	$5,529,345	$5,871,294	$6,050,010
Profit (NPAT) in New Zealand dollars, thousands	$173,291	$784,671	$249,701	$497,094

Converted from US dollars using the average of monthly exchange rates from 2011 and 2012 from the Reserve Bank of New Zealand
Source: Arauco, 2012 and CMPC, 2012

Table 3: Characterisation of New Zealand's 10 largest forestry markets in 2012

Ranking	Country	Per cent of value in logs	Change in ranking
1	China	72%	up
2	Australia	0%	stable
3	Japan	17%	down
4	Korea	64%	stable
5	India	86%	up
6	USA	0%	down
7	Indonesia	0%	stable
8	Philippines	0%	stable
9	Taiwan	12%	down
10	Malaysia	0%	stable

markets for processed products. China and India are becoming more important, from fifteenth to fifth and eleventh to first, and they are mainly log markets.

Because China is now our largest market, and is a market for our processed products as well as logs, it deserves a little more attention. Figure 13 shows fibre for paper manufacture in chips, recovered paper and pulp has gone from 12 per cent of total imports by value to 48 per cent of total imports, ignoring any fibre contribution from logs. At the same time the volumes of all these products have increased nearly 10-fold. There has been a dramatic change in the composition of exports since around 2000, as well as a significant increase in the volume of products imported.

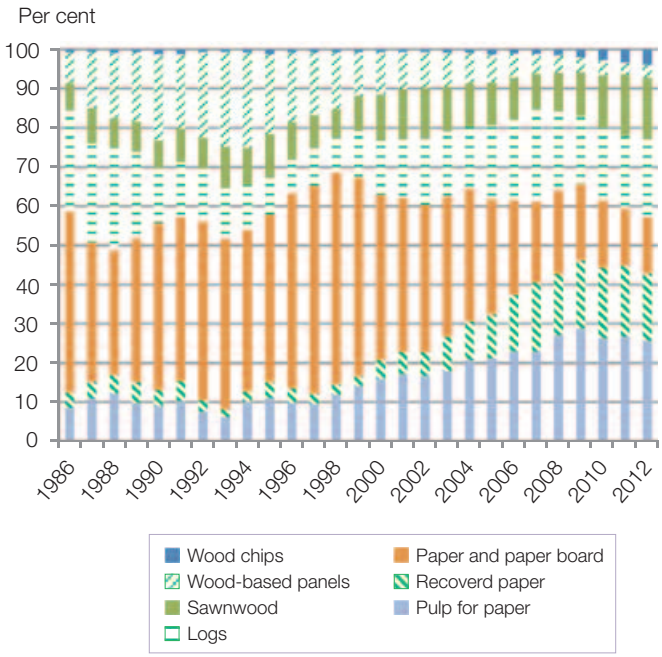

Figure 13: Chinese imports of forestry products from all countries, by product 1986 to 2012, per cent of total value

Source: www.faostat.fao.org

Macro-economics and government

A country's competitiveness can be measured by the real exchange rate (Evison, 2010). The real exchange rate is calculated using the nominal exchange rate for a particular currency, adjusted by the relative level of inflation in the two economies in question. As calculated in this article, as the real exchange rate declines, competitiveness also declines. Figure 14 shows a marked decline in competitiveness for all of New Zealand's major markets over the past 15 years. Manufacturing and exporter lobby groups have been widely critical of the government's monetary policy and its effect on interest rates and exchange rates for a number of years.

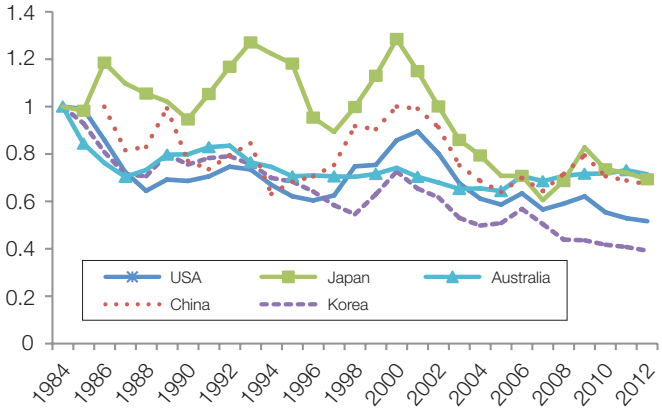

Figure 14: Export competitiveness of the NZ economy

Figure 14 above shows that while real exchange rates do show some cyclicality, there is also a strong negative trend. Table 4 shows that other small countries dependent on trade, including Chile, have been able to maintain competitiveness in these markets much more successfully than New Zealand. It seems likely that differences in government policy will explain at least part of this difference.

Table 4: Change in competitiveness, real exchange rate, 1984 to 2012

	USA	China	Japan	Korea	Australia
New Zealand	-48%	-33%	-31%	-61%	-29%
Singapore	5%	-2%	40%	-21%	45%
Chile	-24%	-22%	3%	-42%	6%

Source: Evison, 2010 updated

We can use the real exchange rate to convert the real price in New Zealand dollars, to a real price in the customer's currency. Figure 15 shows the price trend for the A grade log in both real New Zealand dollars and Japanese yen, and Figure 16 the real Korean won price for the K grade log. We can see that, over the period 2000 to 2012, the price paid by Japanese customers has been relatively constant and the price paid by Korean customers has increased, while returns to New Zealand exporters have declined. This indicates that declining New Zealand competitiveness is contributing to declining returns from log exports.

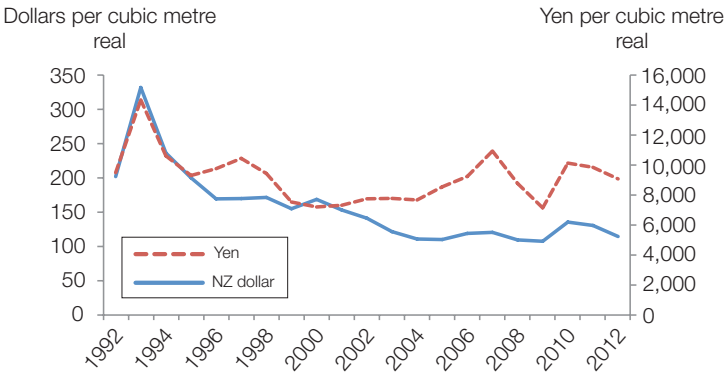

Figure 15: Real (inflation adjusted) A-grade log price in New Zealand dollars and Japanese yen

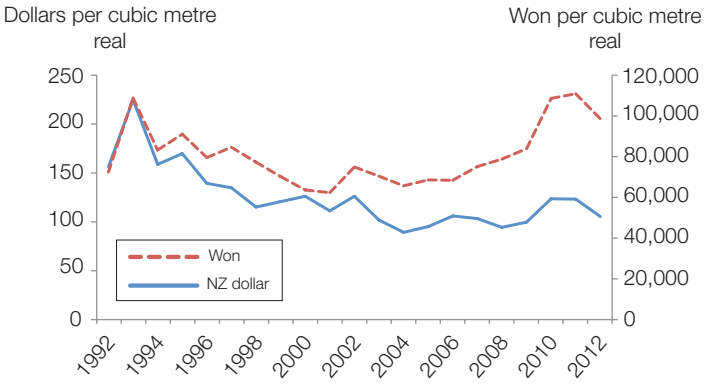

Figure 16: Real (inflation adjusted) K-grade log price in New Zealand dollars and Korean won

Table 5: Produced energy from wood by user

Sector	Energy terajoules
Wood processing and wood products	20,139.13
Paper and paper products, printing and publishing	8,631.91
Household	7,841.02
Other	689.64
Total	37,301.71

Source: http://enduse.eeca.govt.nz/default.aspx accessed 6 September 2013

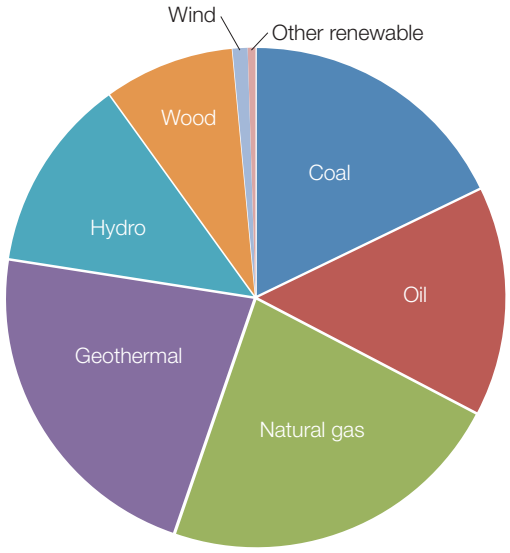

Figure 17: New Zealand domestic energy production in 2011

Source: www.med.govt.nz/sectors-industries/energy/energy-modelling/data/energy-balances

Bioenergy

The existing significant role of wood as an energy source in the New Zealand economy seems poorly understood, while its future potential runs the risk of being over-stated. Figure 17 shows that wood contributes eight per cent of our energy production and, it produces 19 per cent of all energy from renewables. Table 5 shows the majority is used in the wood processing and pulp and paper industries for process heat and steam, and by households for space heating.

Hall and Gifford (2007) point out that wood is the predominant source of energy in the forestry processing sectors because it is derived from residual wood which would have a cost of disposal if it was not burned. They show that the forestry processing industries are using about 75 per cent of the residual wood. Forestry processing industries are consequently more than 60 per cent energy self-sufficient, and their reliance on fossil fuels is much lower than other industries as shown in Tables 6 and 7.

Wood is generally the cheapest source of energy for residential space heating, according to a recent study by the New Zealand Consumers Institute. If more efficient

Table 6: Sources of energy in the pulp and paper industry 2007

	Black liquor	Wood	Electricity	Geothermal	Natural gas	Other	Total
Energy use petajoules	21.7	8.6	5.7	5.8	5.4	0.3	47.4
Per cent of total	46%	18%	12%	12%	11%	1%	

Source: http://enduse.eeca.govt.nz/default.aspx accessed 6 September 2013

Table 7: Sources of energy New Zealand wood processing industry 2007

	Wood	Electricity	Natural gas	Other	Total
Energy use petajoules	20.1	7.5	3.3	1.7	32.6
Per cent of total	62%	23%	10%	5%	

Source: http://enduse.eeca.govt.nz/default.aspx accessed 6 September 2013

technologies with lower emissions were available, it is possible that there would be even greater use of wood for residential heating, and for heating of institutional buildings.

There has been a considerable amount of work analysing the use of wood for energy from other sources, such as logging cut-over waste and purpose-grown plantations, see for example, Hall, 2009, and for other uses such as liquid fuels, for example, PCE, 2010. Currently the economics of delivered wood cost, the price of competitor fuels and the state of development of the processing technologies, are all unfavourable. Sufficient work has been done to know what change in fuel price would be required for woody biomass to be a viable alternative in these applications. Until then, the increasing use of woody biomass as fuel is likely to depend on increasing demand from an expanded forestry processing sector, or increased demand for residential and institutional heating.

Carbon forestry

The current situation with carbon forestry is highly paradoxical. At a strategic level, establishment of new forests is the only viable large-scale technology for removing greenhouse gases from the atmosphere. The only reason that New Zealand has met its international commitments under the Kyoto Protocol for the period 2008 to 2012 is because of the sequestration of carbon by new forest investments made by land owners since 1990 (Ministry for the Environment, 2013).

The government is currently free-riding on the services provided by those investors, as many do not participate in the New Zealand Emissions Trading Scheme (ETS). This needs to be documented so that when these forest owners wish to harvest and make decisions about land use, their decision is not proscribed in the same way as for pre-1990 forest owners. The infringement of their property rights to meet New Zealand's international commitment to climate change was always wrong. Now that New Zealand is no longer a signatory to Kyoto, the pre-1990 forest requirement to surrender credits after land use change should be removed.

The contribution that participation in the ETS can have on the profitability of commercial forestry in this country is mainly dependent on three factors –

1. The structure of the area of forest participating in the ETS
2. The price of carbon
3. The risk appetite of the forest owner.

To understand the importance of structure we will look at two extremes. First, the normal forest, which has an equal area in each age class, from newly-planted to harvest age. For example, a 900-hectare forest harvested at 30 years might have 30 hectares in each age class. While this may seem an artificial example, it is the type of forest that would provide a continuous supply of timber to markets, in the same way as any other industrial process would. If we could enter such a forest into the New Zealand ETS, the returns from sale of carbon credits would follow the pattern shown in Figure 18.

Because the afforestation reforestation debit credit rule has been retained in the ETS, for the first year of participation the forest owner earns New Zealand Units (NZUs) on all forest growth, and there are no liabilities associated with the first harvest. Carbon cash flows decline as carbon liabilities increase each year. Eventually, liabilities equal annual earnings, and there is no further benefit to participation in the ETS. Compliance costs actually provide a small dis-benefit.

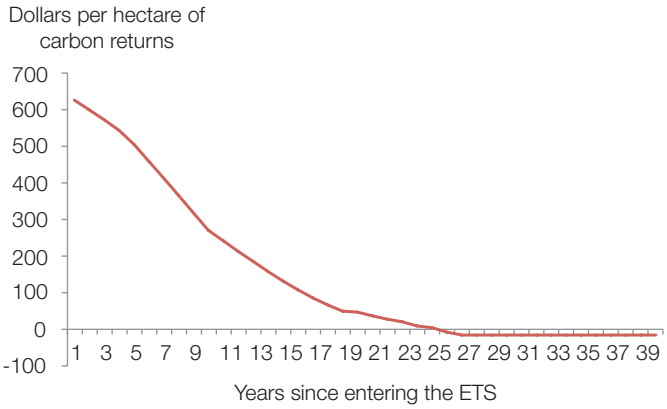

Figure 18: Carbon cash flow from a normal forest

At the other extreme is the single-age class forest. With this forest structure, the risk appetite of the forest owner will determine the contribution of carbon to forest profitability. If this forest is maintained in perpetuity there is a part of the carbon stock which is established in the first rotation and never removed. This has been identified as 'safer carbon' in Figure 19, because it is the lowest risk carbon to sell. However, it is only a one-off payment. If any NZUs from later years are sold, an equivalent number will need to be surrendered after harvest. Therefore forest owners are only getting the time value of money on these credits, and they are identified as such in Figure 19. Forest owners are taking on the risk of price changes, which is mainly a cash-flow risk, but will also affect investment returns.

A forest owner with the single-age class and a low-risk appetite may only sell the 'safer' carbon. This is a short-term series of payments, approximately the first 10 years of the first rotation, which is not repeated. A single-age class forest owner might alternatively wish to generate as much cash as possible from carbon credits, in which case the timber harvest is more likely to be seen as the means to discharge the carbon liability, rather than the focus of the enterprise.

With any other forest structure, the closer to a normal forest it is, the lower the effect of participation in the ETS on forest profitability. Of course, under all circumstances where a forest participates in the ETS,

the land owner has a contingent liability equal to the number of NZUs claimed. Should the carbon stock decrease, this liability will need to be discharged, and only then will the liability be quantified in a financial sense, using the price of NZUs purchased for surrender. This liability is naturally seen as an additional risk by forest owners, and reduces the liquidity of forests as an asset class.

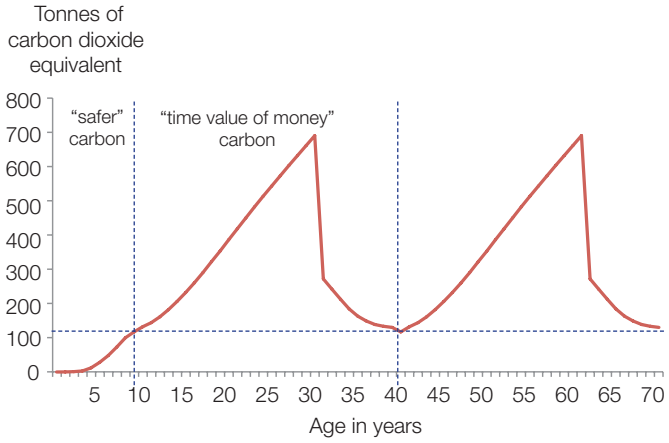

Figure 19: Carbon returns from a single age class forest

The third effect on profitability is the price of NZUs. The government has determined that the maximum price that emitters should pay is $25 a tonne, through its transition measures for the ETS. At the time of writing, in September 2013, the price is around four dollars a tonne and some participating forest owners are exiting the ETS (MfE, 2012). We know that, in any industry, willingness to supply is closely related to costs of production, so it seems appropriate to ask – what NZU price might be required to encourage forest owners to provide this important environmental service?

The Afforestation Grant Scheme provided funds to establish new forest, and a means for the government to acquire the rights to the carbon from the first 10 years of growth of that forest. The average price paid by the government for these grants was $1,700 per hectare (MAF, 2011). If we assume that the carbon increment from the ETS look-up tables (MAF, 2009) for Bay of Plenty represents the average carbon flow as shown in Table 8, we can calculate what the implied carbon price was for this carbon, on a willing buyer, willing seller basis. At an eight per cent discount rate, a payment of $1,700 per hectare values that carbon at about $16.50 per tonne carbon dioxide equivalent. This gives some indication why forest owners would withdraw at a carbon price of four dollars, and may provide an indication of a suitable price floor for the New Zealand carbon market.

Profitability of commercial forestry and other land uses

It has been shown (Horgan, 2007) that new land planting is quite sensitive to the current internal rate of return of forestry (Figure 20). The lack of recent new land planting would indicate that returns from forestry are currently inadequate to encourage this investment.

Table 8: Carbon increment – Bay of Plenty forest look-up table

Age	Carbon increment Tonnes of carbon dioxide equivalent
1	0.4
2	1.6
3	4
4	18
5	27
6	33
7	34
8	25
9	12
10	14

Source: MAF

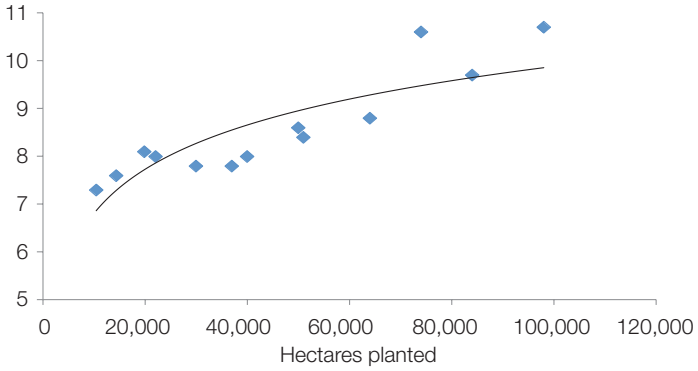

Figure 20: Relationship between forestry rate of return and new land planting Source: Horgan, 2007

There are currently no publicly-available and regularly-produced estimates of the profitability of forestry (Evison, 2008). Two recent surveys of commercial forestry costs in Nelson/Marlborough and Otago/Southland carried out by the School of Forestry at the University of Canterbury, combined with prices and yields published by the Ministry for Primary Industries, indicated commercial forestry was providing rates of return of 5.8 per cent and 5.6 per cent respectively. These rates would be consistent with a very low rate of new land planting in forestry, as predicted in Figure 20.

Land use change can be partly explained by differences in rates of return for competing land uses. Data from the *Farm Monitoring Reports* of the Ministry for Primary Industries indicate that the average return for hill country sheep and beef farming from 2000 to 2012 was 4.5 per cent and for dairy from 2001 to 2012 was 7.1 per cent. Returns from capital appreciation were an average of 6.5 per cent for hill country sheep and beef and 5.2 per cent for dairy.

Land price appreciation on suitable land, that which is currently occupied by hill country sheep and beef farms, has made further expansion of forestry unprofitable. At the other end, opportunities for intensification from irrigation are leading to land use change away from forestry.

Above all, the prices generated by the log export market are not sufficient to encourage new investment in forestry, at the expected rate of return which is somewhere between seven per cent and eight per cent real, based on discount rates forestry companies currently use for valuation of their forest estates. Prices are not sufficient to encourage replanting in some cases.

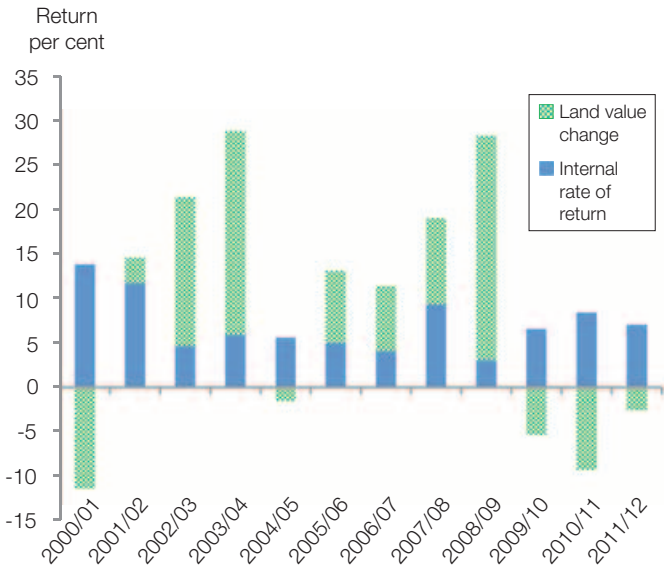

Figure 21: Real rate of return from dairy farming and farm capital appreciation – New Zealand average Source: Evison, 2008 updated

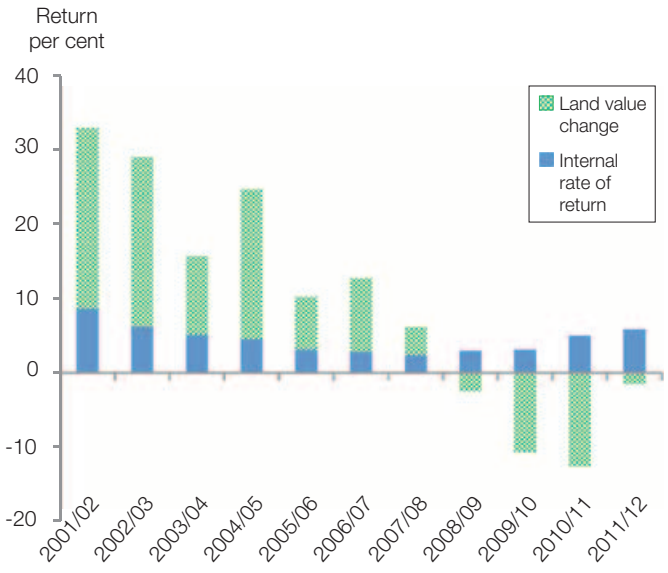

Figure 22: Real rate of return from hill country sheep and beef farming and farm capital appreciation – New Zealand average Source: Evison, 2008 updated

Discussion and conclusion

New Zealand has established a valuable and well-managed resource, and we can grow more if the economics are favourable. Incremental improvements in the resource are in the pipeline, and we should have the confidence that we either have, or can develop, technologies in this area. We have markets – the fastest growing markets are in our region, and capital to process wood has been moving from the western hemisphere to the east, and the northern hemisphere to the south. We can identify profitable processing options. It seems that New Zealand's problem is a lack of commitment to implementing a strategic direction at a large enough scale, and lack of willingness to commit capital to this industry.

Pulp and paper is the commodity focus selected by Chile, and there is no clear reason why our focus should be different, based on resource, technology and markets. As noted earlier, radiata pine has excellent properties for these products. Investment in this area does not preclude, in fact it encourages, the development of solid wood processing, both niche and smaller commodity options. It offers an expansion path through to further processing when the time is right. It is primary processing on a large scale that we need now, and there is evidence our major markets require these products. Pulp is the only product category which opens up considerable scope for new product development. Biochemical production and greater use of wood for energy are adjuncts to that strategy, not replacements for it. We should not be distracted by minor revenue sources or small-scale processing – this has a role to play, but determining our commodity focus is the main task.

There is no evidence that any forest output other than timber is going to contribute significantly or reliably to the long-term profitability of commercial forestry. It has been shown above that, while there may be significant returns from carbon credit sales for part of the first rotation, the longer term financial impact is likely to be insignificant. Wood is already a significant source of energy for residential space heating, and for process heat and steam in forestry processing. Without a major change in the economics of competitor fuels, increased use of wood for energy will occur only if we process more wood or develop improved technologies for space heating.

The export of logs has been presented in this paper as a strategic choice, but it could also have been presented as the default option, the option you take when you have not made an active choice. However, the main question is – is this a viable option for the future? Our commodity focus on logs is not producing a sufficient financial return to either plant new forests, or replant all of the forests that are harvested. A log export strategy is the minimum capital investment option, but is it also low risk?

A number of the barriers identified in the 1992 Forest Industries Strategy should no longer be a concern. The resource concentration problem may have been solved to some extent by the planting boom of the 1990s. Data on log exports by port shows that we are capable of concentrating our resource if there is a market. While it is agreed that the solid wood and fibre processing industries are closely linked, it should be clear that a high performing sawmilling sector is not a precursor to other development – the Chilean

experience should provide ample evidence of that. It is surprising that 'flying in formation' would be identified as a major strategic goal, and that it would continue to be an issue for the sector. Indeed, flying in formation is probably more the consequence of adopting a strategic direction than the cause of it.

Profitability of forestry has declined, and now is less than the productive returns from dairy farming, and greater than the productive returns from hill country sheep and beef farming. The contribution of off-farm income is not included in these calculations, and it is very likely this adds to the viability of hill country farming. The difference with dairy farming is there is a clear path and support for intensification – increased herd and farm sizes and higher production. There has historically been a strong capital gain on the land and property generally for both sheep and beef and dairy farming.

A further critical point not discussed in this paper is whether we can build a stronger culture of processing in the forestry sector, and stronger support from the general public. We need to learn lessons from the recent failures to build new processing plants because of regulatory restrictions. The fact that a green industry such as sawmilling – weight losing products, high energy self-sufficiency and a positive carbon footprint – could be rejected on the Coromandel Peninsula on environmental grounds, was a travesty.

What we need is either investment of new capital by incumbents, or new investors. If we want to grow the forestry sector in New Zealand the most important question to answer is – how are we going to make investment in new processing capacity a reality? The industry now needs a blueprint of what to do to achieve that goal, and tangible support from government, not a list of reasons for delaying critical investment decisions.

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