MINISTRY OF AGRICULTURE AND FORESTRY

A FORESTRY SECTOR STUDY

APRIL 2009

Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

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The inputs of all these people are gratefully acknowledged.

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DISCLAIMER

FOREWORD

Forestry is an important sector for New Zealand – providing economic returns (of over three percent of GDP), employment, and environmental benefits. Thirty percent of New Zealand is tree covered (7 percent plantation forests and 23 percent indigenous).

Forestry is an industry with long-run time frames (at least 25 years from planting to harvesting), significant capital investment requirements, and infrastructure issues (ranging from roading to energy). Hence this report does not focus on the current economic situation, but rather the longer-term issues.

It is also an industry that will have a lot more wood available from 2010, potentially almost doubling by 2024. This new wood is likely to be held in smaller lots, and further away from key infrastructure than current wood supply, bringing with it new challenges.

The Ministry of Agriculture and Forestry (MAF) is the Government's principal adviser on forestry issues. We also have a role in working with the sectors to look at strategic issues – identifying where there are industry-wide risks or opportunities, especially in situations where it is difficult to "see the wood for the trees". This report is one of the ways in which we are delivering on this role.

The Forestry Sector Study is the most recent comprehensive review of the state of the forestry industries, the drivers for change, and the nature of the challenges ahead that government (central, regional and local) and industries face. It is intended to foster debate on the future direction of the sector, and to gain a better understanding of the issues that influence the contribution and performance of the sector. At a practical level, the findings will be used to shape the future work and priorities of MAF.

This report was compiled by MAF staff and reviewed externally by forestry sector representatives. It is however, MAF's perspective. Not everyone will agree with the content and conclusions. We look forward to discussion with, and between, industry players on the issues arising from the study, and on potential actions that will enhance the sustainable development of New Zealand's forestry sector.

Paul Stocks
Deputy Director-General
MAF Policy

FOREWORD

The comprehensive review associated with this sector study document provides ongoing stimulus to our industry with the challenge to further enhance and grow the sustainable resources we manage.

The industry has links to the origin of New Zealand as we know it and has provided employment and wealth along with shelter and capability for the nation.

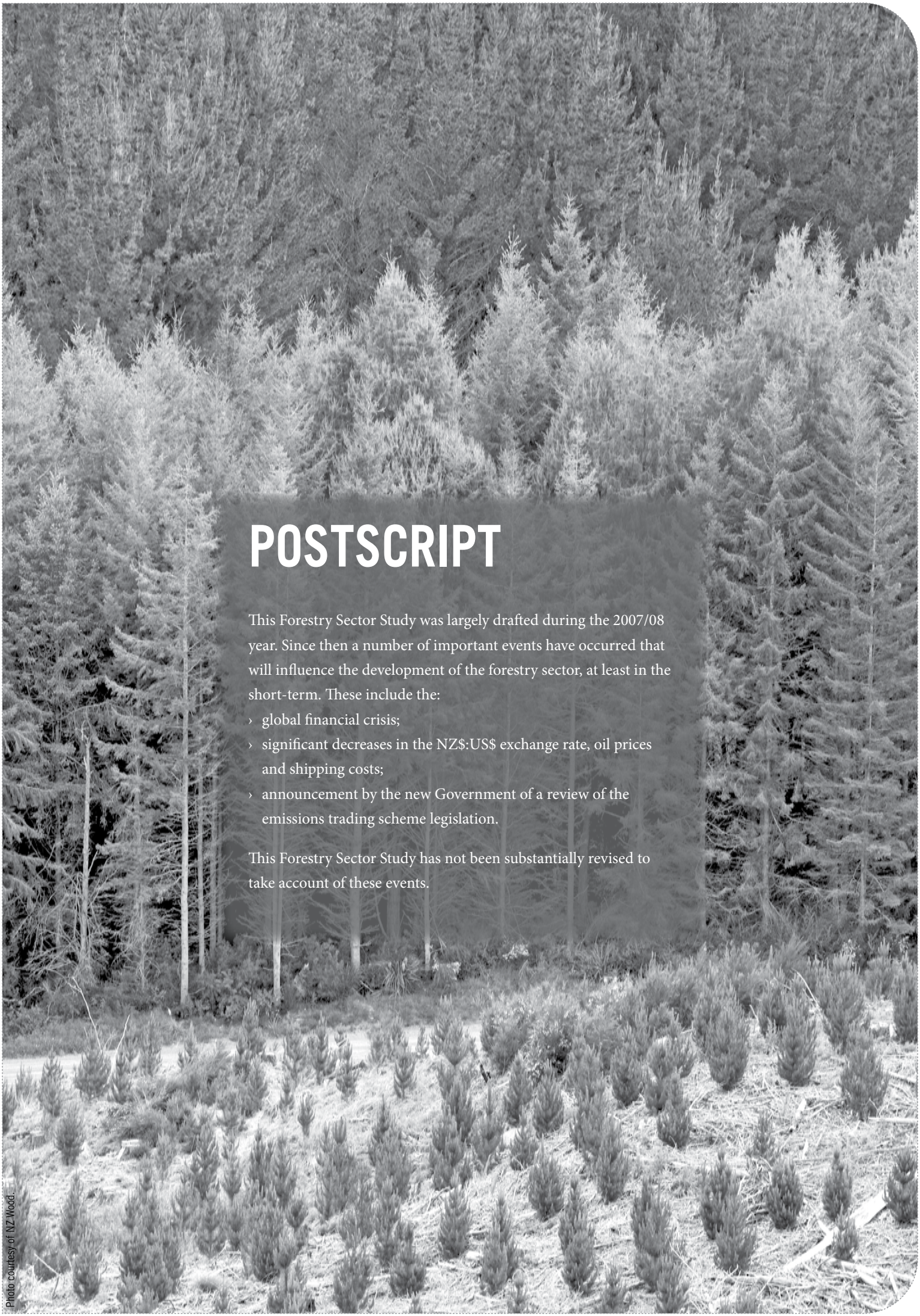
Forestry products provide today the means to continue to support the environmental needs of both our country and the greater global community and, with healthy debate involving collective policy and planning, our contribution will grow.

Trees are grown with commitment for the future due to harvest cycles that are generally between 25 and 40 years. With this comes the need for significant capital investment coupled with skill development and, given our remoteness from and dependence upon export markets, the need to thoroughly coordinate effort and product development to add to the value opportunity for New Zealand and New Zealanders.

In my capacity as Chairman of the Wood Council of New Zealand, representing both the growing and processing interests of the industry, I look forward to the continued commitment of all involved, Government, officials, local bodies, educational institutions and the greater industry participants, as we develop our future together.

The Forestry Sector Study will assist in this.

Doug Ducker
Chairman
Wood Council of New Zealand



POSTSCRIPT

This Forestry Sector Study was largely drafted during the 2007/08 year. Since then a number of important events have occurred that will influence the development of the forestry sector, at least in the short-term. These include the:

- global financial crisis;
- significant decreases in the NZ$:US$ exchange rate, oil prices and shipping costs;
- announcement by the new Government of a review of the emissions trading scheme legislation.

This Forestry Sector Study has not been substantially revised to take account of these events.

Photo courtesy of NZ Wood.

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1 INTRODUCTION

Forests, forest management, and forest products and services tend to encourage debate and strong emotion. In New Zealand, this is because indigenous and plantation forests are important to most sectors of society for a range of sometimes competing values and uses: aesthetic, economic, ecological, for recreation or employment.

There has been much debate over the decades and many achievements, but, arguably, the forestry sector has yet to fully deliver on its potential to help New Zealand sustainably manage land and water resources, to contribute to the economy, to conserve and manage biodiversity, and to mitigate carbon dioxide emissions.

THE PURPOSE OF THE STUDY

The objectives for the Forestry Sector Study are to deliver a report that provides:

- in-depth and future-focused evaluations of the economic, environmental and social dimensions of the forestry sector in New Zealand;
- future directions for the sector and for the use of trees in integrated land management;
- an analysis of the forestry sector that will be credible, but innovative and challenging;
- an understanding that will lead to informed decisions on the opportunities and issues where government can take actions to support sustainable development through forestry;
- a Ministry of Agriculture and Forestry (MAF) vision for the future direction of forestry in New Zealand.

SCOPE AND FOCUS

The "forestry sector" is interpreted as that part of New Zealand's economy based on the growing and management of trees and forests, and the associated production of wood-based goods and delivery of services. The only component of the forestry sector specifically excluded from the study is the management of the conservation forest estate[1]. Within this scope, the study focuses on the component commercial industries, reflecting MAF's policy and regulatory interests. This mandate extends to sustainable catchment management and the use of trees and forests to provide a mix of benefits from wood products and environmental services.

Issues are often considered in the context of 15 to 20 years from now, but no single time horizon has been applied. For some issues, it is not realistic to look beyond 5 to 10 years, while other issues may accommodate a 30-year perspective.

STUDY APPROACH

The Forestry Sector Study report has been compiled by MAF Policy staff, with assistance from the MAF Biosecurity New Zealand Policy team. It is a blend of personal knowledge and extensive literature reviews, and was reviewed by five external forestry professionals.

To commence the analysis "themes" were identified under which forestry sector issues could be grouped. The themes were then discussed in workshops, evaluated and reported on in terms of their importance to the development of the forestry sector. These themes now constitute chapters of this report.

Within each chapter, a maximum of six drivers, threats and opportunities have been identified. Drivers are major issues that will determine the

1 This is a statutory responsibility of the Department of Conservation.

future direction of the forestry sector, but over which the sector has limited or no influence. In contrast, actions from within the forestry sector will determine the extent to which opportunities are grasped and threats are avoided or mitigated.

REPORT PRESENTATION

CHAPTER 2: FUTURE DRIVERS FOR NEW ZEALAND FORESTRY

Chapter 2 draws together the key drivers, strengths, threats and opportunities that will influence the development of the New Zealand forestry sector over the next 20 years. These issues are looked at in more detail in Chapters 3–14.

PART 1: THE SETTING

CHAPTER 3: DESCRIPTION OF THE EXISTING SECTOR

Chapter 3 describes what the various industries of New Zealand's forestry sector look like at the time of publication. It looks at the structure of the industries and topics such as wood availability and trade, as well as describing the exotic forest resource.

CHAPTER 4: INSTITUTIONAL FRAMEWORKS

Following on from the description of the forestry sector, Chapter 4 looks at the frameworks that support it: forest ownership, industry associations and regulatory issues.

CHAPTER 5: THE ROLES OF GOVERNMENT

The final chapter dealing with the setting within which the forestry sector operates concerns the roles of government. Historically, central government did not just have a major influence on the operating environment, but was directly involved in the development of the commercial forest industries. That has changed dramatically over the last 20 years, but other roles that support or indirectly influence the development of the forestry sector are enduring.

PART 2: FORESTRY SECTOR INPUTS AND OUTPUTS

CHAPTER 6: FORESTRY SECTOR INPUTS

Chapter 6 considers what the forestry sector needs to make it work, such as people, finance, energy and transport.

CHAPTER 7: NEW ZEALAND FORESTRY'S COMPETITIVENESS AND COMPARATIVE ADVANTAGE

Because New Zealand's forest industries operate in a global marketplace, their success largely depends on how competitive they are. A part of competitiveness is being able to use any advantages that New Zealand's forest industries might have compared with other countries. Chapter 7 looks at both of these aspects.

CHAPTER 8: FORESTRY SECTOR OUTPUTS – NOW AND INTO THE FUTURE

Chapter 8 examines how the forestry sector contributes to New Zealand's economic, social and environmental development. It builds on the analysis in Chapter 3 ("Description of the existing sector") and looks at future opportunities, including complementary crops, wood residues for energy production and new products from woody biomass. The discussion covers:

- the environmental benefits of developing forests (for example, erosion mitigation and carbon storage);
- forestry's contribution to local communities;
- the sector's contribution to tourism and energy production.

PART 3: CURRENT AND FUTURE INFLUENCES

CHAPTER 9: RESEARCH AND INNOVATION

The future outputs from the forestry sector discussed in Chapter 8 will, in part, be determined by the research direction and innovation activity of the sector over the next few years. Chapter 9 highlights future research priorities, opportunities for gains from research and innovation, and the

challenges of turning innovation into profits.

CHAPTER 10: CLIMATE CHANGE AND FORESTRY

The roles forests can play in responding to climate change offer many opportunities and challenges for New Zealand forestry and may generate major changes to forest management. These are discussed in Chapter 10.

CHAPTER 11: INTERNATIONAL INFLUENCES

Chapter 11 describes the international influences on New Zealand forestry, how these will shape the sector and how the sector needs to respond. International timber trade and the globalisation of forest-related environmental, social and cultural issues will continue to shape New Zealand's forestry sector. As a largely export-dependent industry, New Zealand has well-recognised advantages. On the other hand, there are also considerable risks if we fail to take advantage of global trends.

CHAPTER 12: BIOLOGICAL RISKS AND THEIR MANAGEMENT

New Zealand's isolation has meant that indigenous flora and fauna and the plantation forest estate are free from many of the pests and diseases that affect other countries. However, increasing trade and travel, and climate change, are elevating the risk of pests and diseases entering New Zealand and becoming established. Chapter 12 examines the nature of the risks and how forest health and biosecurity are managed in New Zealand.

CHAPTER 13: PHYSICAL RISKS TO NEW ZEALAND'S FORESTS

Chapter 13 continues with the theme of risks to the forestry sector by looking at the physical environment within which New Zealand's forests grow. Fire is the physical risk that we hear most about, but is it the most important? The influences of climate change on physical risks are also examined.

CHAPTER 14: FORESTRY IN THE EYES OF SOCIETY

Chapter 14 completes the consideration of matters that influence both the setting within which the forestry sector operates and what it delivers to society. Ultimately, the management of any resource and the production of goods and services from that resource serve the well-being of the local, regional, national and/or international communities. It is critical that forest managers and producers of goods and services understand the values, perceptions and attitudes of the societies they serve, and that societies understand the true nature of the forestry sector. Failure to establish this mutual understanding invariably leads to conflict.

FUTURE DRIVERS FOR NEW ZEALAND FORESTRY

2

OVERVIEW

This chapter draws together the key drivers, strengths, threats and opportunities that will influence the development of the New Zealand forestry sector over the next 20 years. These issues are looked at in more detail in Chapters 3–14.

Before looking to the future, however, the chapter briefly reflects on New Zealand's forests and forestry sector, changes over the previous 20 years and what characterised the New Zealand forestry sector in 2008.

FORESTS AND THE FORESTRY SECTOR IN NEW ZEALAND

New Zealand is a forested country by nature. Before Māori settlement about 800 years ago, few areas below the natural treeline were unforested.

Between the 14th and 16th centuries in particular, large areas of forest were burnt as the Māori population expanded. In around 1840, when European settlement commenced in earnest, indigenous forests covered 53 percent of the land area. Forests were seen as both an obstacle to agriculture and an inexhaustible source of timber. Pasture increased from 70 000 hectares in 1861 to 4.5 million hectares in 1901 (Ministry for the Environment, 1997). By 1920, most of the current 11.7 million hectares of agricultural land had been cleared. Indigenous forest cover is now 6.3 million hectares or 23 percent of New Zealand's land area.

With European settlement came the development of an expanding local timber market. In 1913, a Royal Commission on Forestry forecast that demand for timber would exhaust the supply from indigenous forests in about 50 years. A state forest service was established in 1919 and a large-scale afforestation programme using exotic tree species started from the mid-1920s to provide a long-term domestic timber supply. Through the late 1930s to the 1950s, the focus turned to utilisation of the plantation forest resource, with the commissioning of (then) large-scale sawmills, the establishment of a research organisation and the development of a pulp and paper mill. A second planting "boom" occurred during the 1970s and 1980s, seeking to build on the domestic success and create export-oriented forest industries.

Today, there are 1.8 million hectares of plantation forests, which cover 7 percent of New Zealand's land area; 93 percent are privately owned. Plantation forests are dominated by radiata pine (89 percent by area), with Douglas-fir accounting for 6 percent by area. In the year ended March 2008, 20.6 million cubic metres of roundwood[2] were harvested in New Zealand, of which 99.9 percent came from plantation forests. With the maturing of the plantations established in the 1970s and 1980s, there is capacity to increase the sustainable annual harvest by up to 50 percent over the next 12 years.

This resource is now the foundation for New Zealand's wood processing industries, which include around 370 sawmills, seven pulp and paper mills, three medium-density fibreboard (MDF) mills, three particleboard mills, six plywood and laminated veneer lumber plants and about 80 remanufacturing plants. Their levels of production are identified in Table 2.1.

About 70 percent of the harvested volume (roundwood equivalent) is exported, earning

2 Wood in its natural state as removed from forests.

TABLE 2.1: PRODUCTION OF WOOD PRODUCTS FOR THE YEAR ENDED MARCH 2008

PRODUCT	QUANTITY (000)
Sawn timber (m^3)	4 341
Wood pulp (t)	1 546
Paper and paperboard (t)	871
Fibreboard (m^3)	765
Veneer (m^3)	513
Plywood (m^3)	416
Particleboard (m^3)	245

Source
MAF, 2007b.

In the year ended March 2008, 20.6 million cubic metres of roundwood[2] were harvested in New Zealand, of which 99.9 percent came from plantation forests.

$3.5 billion in the year ended March 2008, or approximately $2000 for every hectare of plantation forest existing in that year. In the same year, the forestry sector accounted for about 10 percent of the total value of New Zealand's export trade.

The forestry sector also directly contributed 3.2 percent to gross domestic product (GDP) for the year ended March 2007.

Growing global and domestic concerns about environmental sustainability mean that attention is increasingly focusing on the "environmental services" provided by New Zealand's forests. These are wide ranging and largely unvalued, but probably far exceed the commercial values. They include the maintenance of biodiversity, the mitigation of soil erosion, the maintenance of water quality, the sequestration and storage of carbon, landscape values and the provision of recreational opportunities.

One such environmental service or "externality" (where the actions of individuals or firms affect others, but the costs or benefits are not reflected in the values of their transactions) that is now being commercialised is carbon sequestration. This could have profound implications for the forestry sector over the coming decades because it is likely to affect the risk profile, expected returns, types of products and wood availability.

Forests' mitigation of soil erosion is a critical environmental service in New Zealand. Nearly 10 percent of New Zealand's land area has severe to extreme soil erosion, and over half the country is affected by moderate to slight soil erosion (Ministry for the Environment, 1997). Soil erosion affects not just onsite environmental and commercial values, but can have major impacts on downstream properties, infrastructure and community services. In 1988, Cyclone Bola caused soil erosion of unprecedented scale on the East Coast. Property damage was estimated at nearly $120 million, and 1500 landowners received relief payments totalling $60 million. Land that had been under forest for eight years or more had only one-tenth of the soil loss rate of pasture land (Ministry for the Environment, 1997).

Water quality is of increasing concern in New Zealand. About 30 percent of the country's lakes are considered likely to have poor water quality due to excessive nutrient levels. One-third of the monitored groundwater has elevated nitrogen levels and 20 percent shows signs of contamination with faecal matter (Mallard, 2007). However, streams draining indigenous forests and maturing plantation forests generally have high water quality and low concentrations of nutrients and suspended solids (O'Loughlin, 2005b). Many domestic water supplies are sourced from forested catchments, underscoring the importance of forestry in maintaining high quality drinking water.

THE NEXT 20 YEARS

The Forestry Sector Study does not try to predict what the forestry sector will look like in the future or how it will get there. Instead, it aims to identify the sector's key drivers for the next 20 years and the opportunities that arise for forest management, wood processing and exporting forest products.

Population and economic growth will be the major influences on demand for wood products. The global population is expected to increase from 6.6 billion to 8.3 billion by 2030. The trend of urbanisation is expected to continue so that, by 2030, around 60 percent of the global population will be living in cities, compared with about 50 percent in 2003. Economic development in the key emerging markets of China and India is expected to continue to be strong, with average annual GDP growth rates of around 5.5 percent for China and 5.1 percent for India from 2010 to 2030 (Maplesden and Turner, 2006). All this provides opportunities to increase the use of wood. It will also increase the focus on natural resource management and sustainability issues globally.

On top of these there will always be change and this can create uncertainty. For example, in New Zealand, a 20-year time period will span at least seven general elections, 20 government budgets and, almost certainly, further ownership changes within the wood processing and forest growing industries. Also, fluctuations in international market demand and the supply of wood and wood products, the development of new products, increasing demands globally for non-wood environmental services, pressure for renewable energy sources and any international crises will all have profound impacts on the sector's future.

Climate change will generate major changes for New Zealand forestry. These will not only relate to the impacts of climate change on growing conditions and forest management through enhanced risks from fire, wind and pests, but also to the various mechanisms being put in place globally to enhance forestry's contribution to climate change mitigation.

LOOKING BACK 20 YEARS – TO HELP LOOK FORWARD

The late 1980s saw rapid change in the forestry sector, with many opportunities and hurdles. The economy moved quickly from being highly regulated to being market-led with a floating New Zealand dollar. The move to a state-owned enterprise structure clearly separated commercial and conservation forests. Fletcher Challenge Limited was New Zealand's largest publicly listed company by market capitalisation, New Zealand Forest Products was fourth and Carter Holt Harvey was seventh; Brierley Investments Limited, also a major player in the forestry sector, was second. A national forestry planning model was being prepared and the industries were moving overseas for both markets and investment opportunities.

There were still many uncertainties, with heightened public debate over the future of indigenous forests and sustainability. Catchment boards were still an important feature of the landscape, but an ad hoc ministerial committee had ordered a review of the Town and Country Planning Act 1977 and associated legislation. The intention was to develop a planning system that would slash red tape and better respond to economic changes.

The key legacies of the last 20 years are possibly the constantly changing ownership of the plantation forest estate and uncertainty regarding the outcomes of Treaty of Waitangi settlements affecting Crown forest land. There has never been a more complicated mix of forest ownership and strategies, with:

- some large companies clearing forest for cash flow;
- small-scale owners unsure about what to do and

lacking any form of collective view or power;
› overseas-owned Timber Industry Management Organisations (TIMOs) possibly focused primarily on forest re-sale value in the medium-term, with perhaps limited incentives to engage in long-term initiatives for the benefit of the sector.

Other legacies are the recent disappearance of the publicly listed forestry companies that dominated the forestry sector in the 1990s, and the existence of few integrated forestry companies.

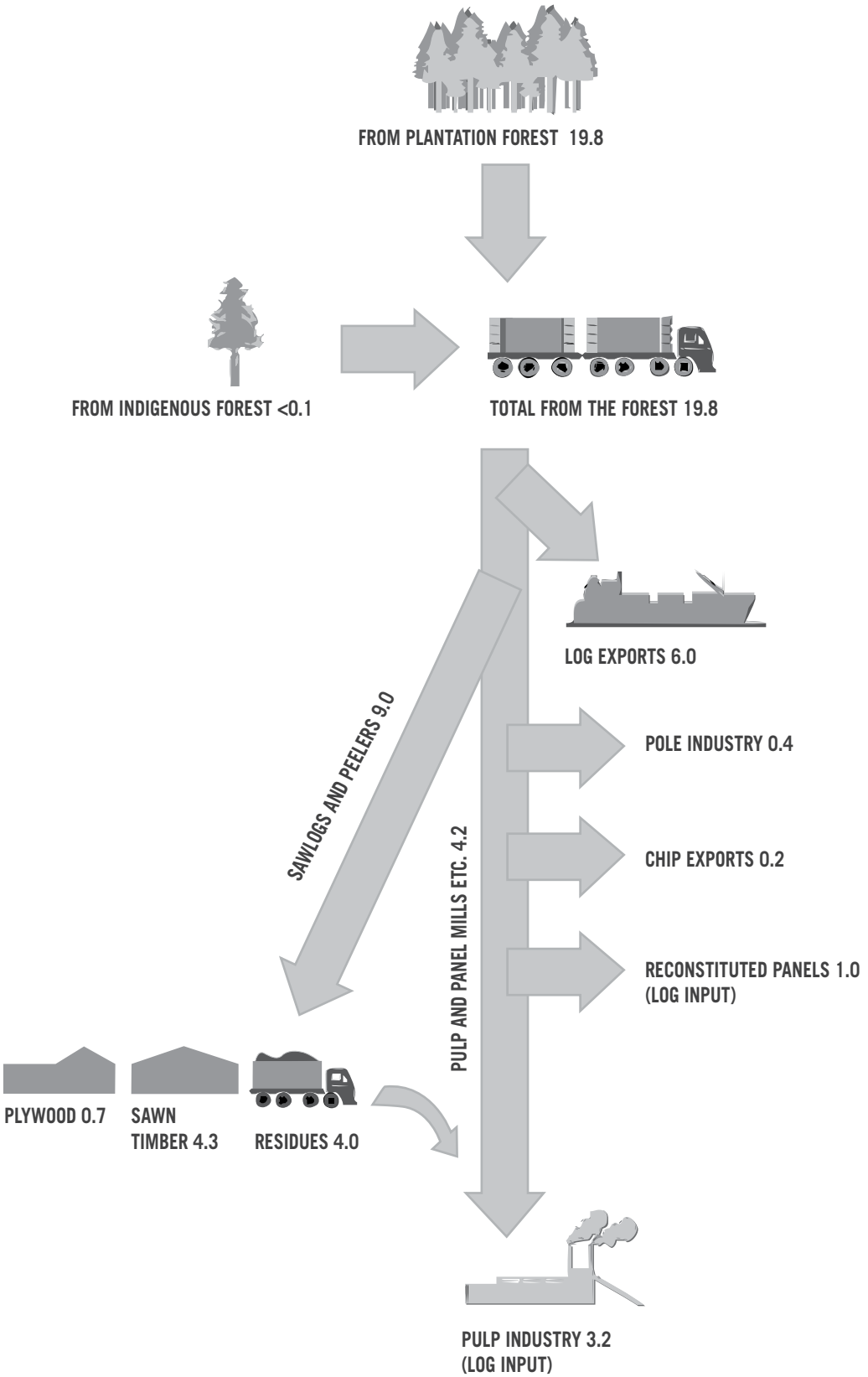
A number of other messages emerge:
› Short-term market signals have had a surprisingly strong influence on long-term investment in forests.
› Predicting investment patterns beyond the short-term is problematic.
› Radiata pine remains the utility species of choice, and few beyond the innovative small-scale growers consider alternative species other than Douglas-fir.
› New Zealand forest products have struggled to compete on either price or non-price attributes on the international market.

Photo courtesy of NZ Wood.

Growing global and domestic concerns about environmental sustainability mean that attention is increasingly focusing on the "environmental services" provided by New Zealand's forests.

› Market dynamics can change quite dramatically over the short and medium-terms. For example, changes in India's domestic regulatory regime opened a log market opportunity virtually overnight, while certified sustainable forest management has become inexorably important in many affluent markets.
› Sustainable indigenous forest management may be possible on a small scale, but it is expensive and unlikely to significantly contribute to the forestry sector.
› The publicly listed corporate ownership model seems incompatible with long-term forestry investment, particularly in difficult trading environments when management and shareholders still expect strong cash flows, high share prices and dividends.
› Resource management legislation is by nature interventional, with uncertain outcomes sometimes based on subjective values (for example, natural character, landscape and cultural values) that are often not easily understood or predicted.
› The 1992 forest industries' strategic vision of "flying in formation" is difficult to achieve (see Chapter 4 section entitled "National Forest Policy").

FIGURE 2.1: LOG FLOW IN THE NEW ZEALAND FORESTRY SECTOR FOR THE YEAR ENDED MARCH 2007 (VOLUMES IN MILLIONS OF CUBIC METRES ROUNDWOOD EQUIVALENT)



THE STATE OF THE NEW ZEALAND FORESTRY SECTOR TODAY

In 2008, the New Zealand forestry sector was characterised by:

- the continued dominance of radiata pine;
- a low level of new planting that was exceeded by deforestation of exotic forests, although the vast majority of harvested forests is still being replanted;
- plantation forest ownership dominated by TIMOs and small-scale investors;
- the harvesting of less than the expanding "available" plantation wood supply;
- a negligible harvest from indigenous forests;
- the export as logs and processed products of around 70 percent (roundwood equivalent) of the wood harvested;
- the processing in New Zealand of about 60 percent (roundwood equivalent) of the annually exported wood products;
- significant growth since 2000 in veneer, plywood (including laminated veneer lumber), fibreboard and lumber production;
- a renewed focus on the use of engineered radiata pine timber products;
- difficulty in attracting skilled labour and new recruits for training;
- few products that compete on price or non-price attributes such as product differentiation;
- the increasing importance of environmental management and social responsibility to consumers and the public, and hence to the sector;
- a range of industry associations and consortiums representing forest owners and wood processors;
- an apparently low level of commitment by the sector to a long-term strategy, including research and development;
- few large-scale integrated forestry companies, and none with historical ties to New Zealand to "champion" forestry;
- significant policy challenges arising from climate change;

... an innovative and profitable forestry sector that takes full advantage of increasing demands for timber and wood products.

- a significant engagement between the Government and the private sector through the Forest Industry Development Agenda (FIDA).

MAF'S VISION FOR THE FORESTRY SECTOR

MAF's vision for the forestry sector in New Zealand for the next 20 years sees:

- an innovative and profitable forestry sector that takes full advantage of increasing demands for timber and wood products;
- an extended and sustainably managed forest resource providing valued "environmental services".

The original expectations of a vibrant, export-oriented forestry sector have yet to be fulfilled; it is currently unable to fully utilise the available wood resource. New Zealand's wood processing mills are generally small by international standards and there was no significant productivity growth[3] in the wood processing and forest growing and harvesting industries between 1996 and 2006.

The forestry sector has mainly relied on market growth in a relatively small number of markets to sell its products, rather than increasing market share and market diversification. Maplesden and Turner (2006) identified exceptions, with strong growth in recent years (albeit off small bases) in areas such as:

- sawn timber, mouldings, builders' joinery and carpentry exports to the United States (US);
- laminated veneer lumber exports to Japan;
- veneer to the Philippines;
- MDF to China;
- logs to India.

3 As measured by Total Factor Productivity.

Forests have always provided environmental services, but they have received little financial recognition because they are generally externalities and non-exclusive products (that is, they can be consumed by everyone and no one can be excluded, and so owners cannot charge for them). A growing global environmental awareness, particularly around issues related to sustainability and climate change, is changing this situation. Reducing greenhouse gas emissions is a major global issue, and carbon trading is now a reality. More financial assistance is becoming available to use trees and forests to support sustainable catchment management. These opportunities can be combined with timber production and the demonstration of sustainable forest management to expand a highly valuable forest estate.

The vision is expanded in the following sections. These sections list the key drivers that emerge from the theme-based discussions in Chapter 3–14, and set out the associated opportunities and the strengths of, and threats to, the sector. How the sector takes advantage of the strengths and mitigates the threats will determine if the opportunities are taken up, and the degree to which the vision becomes reality.

Photo courtesy of Red Stag Photography.

KEY DRIVER 1 – A FOREST IS MORE THAN WOOD

GLOBALLY, COMMUNITIES WILL DEMAND MORE FROM FORESTS, SUCH AS CARBON SEQUESTRATION AND STORAGE, MAINTENANCE OF BIODIVERSITY AND WATER QUALITY, AND DEMONSTRATION OF SUSTAINABLE MANAGEMENT

STRENGTHS

- Increasing public understanding of the contributions of trees and forests
- Large areas of land requiring trees for sustainable management
- Market mechanisms developing for environmental services
- Implementation of sustainable management verification processes at national and forest levels

THREATS

- Uncertainty about how demands will be transmitted through the policies of domestic and international regulators
- Environmental pressures putting more restrictions and costs on forestry businesses
- International criticisms of plantation forestry affecting recognition, roles and trade
- Pressure on water yields leading to restrictions on afforestation
- Investors discouraged through poor returns for traditional wood-based products

OPPORTUNITIES

- Elevating forestry's economic (wood and non-wood forest products) and environmental contributions to New Zealand's sustainable development by increasing rates of return to forest investors
- Spreading risk through multiple income streams and creating opportunities for forest investors
- Global changes in wood supply through reducing unsustainably and illegally produced timber products in global markets

DISCUSSION OF KEY DRIVER 1

INCREASING RECOGNITION OF FORESTRY'S ECONOMIC VALUE

Many of the environmental services provided by forests are non-exclusive (that is, people cannot be excluded from enjoying the services) and therefore not recognised financially, despite their substantial economic value. MAF considers that these market failures have led to a global underinvestment in forestry and sustainable forest management.

There is now growing recognition of these market failures globally. Communities are increasingly demanding the environmental and economic services associated with trees and forests, such as:

- biodiversity and habitat;
- mitigation of soil erosion;
- reduction in water run-off;
- improvement in water quality;
- protection of riparian zones;
- sequestration and storage of carbon;
- public recreation;
- landscape values;
- sustainable production of wood and non-wood forest products. (Chapters 5, 6, 8, 9, 11 and 14).

OFFSETTING GREENHOUSE GASES

New Zealand's agricultural sector produces 40 million tonnes of carbon dioxide-equivalent greenhouse gases annually. These gases could be offset for the next 40 to 50 years if about 1.3 million hectares were planted with exotic forest.

There is enough land potentially available to plant such an area. New Zealand's agricultural sector currently uses 11.7 million hectares (MAF, 2005), but about 3.0 million hectares require some form of erosion control. Tree planting will continue to be one of the best ways to use some of New Zealand's eroding pastoral hill country.

The sustainable and integrated management of this land (Chapter 8) can enable planting at different levels of intensity. Some of these plantings may be purely for land protection. The majority can probably combine protection with production and enhance economic, ecological and social resilience at property, district, regional and national levels.

ECONOMIC MECHANISMS NEEDED FOR FORESTRY

There are barriers to realising these opportunities. The major barrier has been the lack of mechanisms that economically recognise forestry's environmental services and how those services support sustainable land management (Chapter 14). Climate change issues are starting to create market mechanisms, with the carbon market growing to an estimated US$30 billion in 2005/06 (Capoor and Ambrosi, 2007).

In New Zealand, legislation that established an emissions trading scheme (ETS), with forestry the first sector to be involved, is being reviewed. The likely level of activity under an ETS cannot be gauged at this early stage. Economic analysis suggests that even at relatively low carbon prices, participation in an ETS would have a positive affect on internal rates of return for forestry. At high carbon prices the effects would be significant. There are risks for investors, however, particularly about uncertainty related to the future price of carbon and the nature of future international climate change agreements (Chapter 10).

Government grants are available under the East Coast Forestry Project for afforestation to mitigate severe soil erosion in the Gisborne District. Targeted support for communities that need to protect erosion-prone land is also provided through the Sustainable Land Management Hill Country Erosion Fund. Further funding is available under the Afforestation Grant Scheme to plant forests on previously unforested ("Kyoto compliant") land. Nutrient trading is also being developed in the Lake Taupo catchment, which is designed to encourage

low nutrient land uses, such as forestry.

Looking ahead these mechanisms may provide regular and/or alternative income streams, potentially coupled with income from the production of non-wood forest products. These new income streams would transform the economics of forestry and the way people view it as a land use and investment opportunity. However, those who pay for environmental services may also expect to be involved in the management of the forests that provide the services (Chapter 8). This situation will provide both challenges and trade-offs for private forest owners when working with parties who may be seeking different mixes of wood products and environmental services.

POSSIBLE BARRIERS TO INVESTMENT

Investment in trees and forests will inevitably be affected by uncertainty about how demands for environmental services will be transmitted through regulators' policies at the international, central and local government levels.

Other domestic barriers include:

- a general lack of integration between farming and forestry, with the exception of farm-foresters;
- the potential for poor returns that would discourage investors;
- land-use controls in parts of many districts that require consents for tree planting;
- difficulties with obtaining consents under the Resource Management Act 1991 (RMA) for developing supporting wood processing facilities;
- issues and/or perceptions about the stability and cost of the electricity supply;
- shortages of skilled labour.

SUSTAINABLE FOREST MANAGEMENT

The demands for sustainable forest management and sustainable forest products have resulted in internationally recognised criteria and indicators for monitoring and reporting trends in national (and, for some countries, regional and local) forest management. The principles supporting third-party certification focus on the individual business level (Chapters 7, 11 and 14).

New Zealand is well placed to respond to these pressures and to monitoring, reporting and certification processes. Such processes are yet to deliver any consistent financial premiums to exporters. However, they are likely to become increasingly important for market access in developed countries, and in demonstrating forestry's environmental credentials when competing against steel, concrete, aluminium and plastic-based products.

Internationally, the continued and often poorly informed generic opposition to plantation forestry in some parts of the world has potential to constrain the acceptability of its products and services (Chapter 14). These international positions can spill over to affect domestic initiatives. An example is the complications the New Zealand Forest Owners Association has experienced getting its national standards for sustainable forest management endorsed by the Forest Stewardship Council.

KEY DRIVER 2 – CHANGING LIFESTYLES

LIFESTYLES AND WAYS OF WORKING WILL BE TRANSFORMED BY ISSUES RELATING TO CLIMATE CHANGE AND PRODUCTION SYSTEMS, ENERGY PRICES, AND A GREATER FOCUS ON RENEWABLE RESOURCES AND ENERGY-EFFICIENT AND SUSTAINABLE ENVIRONMENTS

STRENGTHS

- Low carbon footprint of most wood products

THREATS

- Competition from alternative (non-wood) building products
- Lack of mechanisms to demonstrate environmental credentials of wood-based products compared with other (often competing) products

OPPORTUNITIES

- Focus on sustainable buildings favouring wood-based construction products over more energy-intensive products
- International and domestic demand for multi-storey, urban residential buildings using new structural systems providing opportunities for engineered wood products
- Climate change, a focus on sustainability, higher energy costs, and energy security concerns encouraging further research and development of biomaterials and bioenergy from wood fibre

DISCUSSION OF KEY DRIVER 2

CHANGING LIFESTYLES AND WAYS OF WORKING

Increasing concern for the environment, coupled with higher energy prices (Chapters 6, 9 and 14), are expected to drive changes to lifestyles and ways of working. People will demand sustainable products and more energy-efficient built environments with effective infrastructure so they can live closer to services and their places of employment (Chapter 11).

Climate change-induced environmental concerns are already leading people to consider the environmental credentials of building products (Chapter 9), although ways to evaluate these products are still being developed. Objective evaluations of embodied energy and life cycle analysis are likely to result in favourable outcomes for wood-based building products over products that usually have more energy-intensive manufacturing processes. Higher energy costs may also make wood-based products more cost competitive.

There will be greater opportunities for more use of wood in higher-intensity urban living and the development of multi-storey residential buildings. While this sort of construction has historically seen limited use of structural wood-based products, advances in engineered wood products mean these products could be used in the construction of three to four-storey buildings (Chapter 9).

WOOD AS A RENEWABLE RESOURCE

Image and perceptions will be important. Wood has a great story to tell as a renewable resource with relatively low embodied energy. In New Zealand, the NZ Wood programme (jointly funded by industry and government) has begun to tell this story, though to firmly secure wood's place in the national psyche, a sustained multi-year campaign is required.

PLANT-BASED BIOMATERIALS AND BIOENERGY

The transition from products derived from fossil fuels to the energy derived from sustainable resources provides exciting opportunities for plant-based biomaterials and bioenergy.

Biomaterials currently being investigated in New Zealand include bioplastics, biofoams, moulded structures and packaging, and composites (wood-plastics and wood-steel) (Chapter 9). However, the biomaterials industry is still in its infancy with substantial research and evaluation to complete on processes and economics. It may be 20 or 30 years before biomaterials add significantly to forestry returns.

Also under investigation are further opportunities for converting wood fibre into energy and biofuels. As costs are imposed on greenhouse gas emissions from the use of fossil fuels, economic drivers will increasingly favour bioenergy, including solid wood energy such as wood pellets, biomass gasification, and ligno-cellulosic ethanol. Oil prices, energy security, and climate change concerns are already driving innovations such as torrefaction, bioenergy and biochar co-production, and potentially cellulignin (Chapter 9).

The use of wood fibre for production of biofuels and speciality chemicals is being seriously researched in New Zealand and elsewhere. However, the recent conversions overseas of arable land from producing food to producing biofuels have generated global controversy and some uncertainty about biofuels.

RESEARCH AND DEVELOPMENT

The ability to meet these changes lies in fostering appropriate research, planning, and commercialisation over the next 20 years. This will require sustained investment and industry-wide collaboration in support of the "innovation system" to ensure the necessary capability is developed and retained.

KEY DRIVER 3 – ENERGY SUPPLY AND COST

ENERGY IS A KEY COST FOR PROCESSING AND DELIVERING WOOD PRODUCTS, AND MAY ALSO BE A KEY OUTPUT OF THE FORESTRY SECTOR

STRENGTHS

- Science system capable of developing and adapting energy-related technologies
- Availability and use of biomass as an energy source
- Use of wood processing residues reduces waste disposal
- Adoption of energy conservation management
- A renewable forest resource that already provides a significant proportion of the sector's energy needs

THREATS

- High and/or uncertain New Zealand energy prices increasing costs and impeding investment
- Rising costs of transport for exporting goods
- Competition for forest and wood residue supplies possibly stranding residue-processing capital

OPPORTUNITIES

- Higher transport costs favouring the production and export of engineered and other more highly processed wood products
- Increasing the use of biomass, particularly forest residues, to reduce costs of energy used in wood processing and lowering the industry's carbon footprint
- Improving logistics and log truck configurations to reduce freight costs
- Reducing freight tonnages by developing small-scale, high-tech sawmills close to scattered forest resources
- Biofuels

DISCUSSION OF KEY DRIVER 3

ENERGY CONSUMPTION AND COSTS

The forestry sector accounts for about 13 percent of New Zealand's energy consumption, and the wood processing industries are some of New Zealand's largest energy consumers (Chapter 6). The transportation of logs to processing facilities or ports, and the delivery of wood products to overseas markets, can also be major production costs (Chapters 6 and 9).

New Zealand price indices for electricity, gas and petroleum all show significant upward trends since 2003 (Statistics New Zealand, 2007b). Natural gas prices have risen sharply and may rise further in New Zealand as the Maui gas field nears the end of its economic life and if further gas deposits are not found. Gas-generation costs often determine the price of electricity, so rising gas prices are likely to cause rises in electricity prices (Ministry of Economic Development, 2006).

USING BIOMASS TO REDUCE CARBON FOOTPRINT

The wood processing industries are able to reduce their carbon footprint by using biomass to generate energy in addition to electricity and gas. Biomass accounts for over 80 percent of the energy used by sawmills and is used extensively to produce heat and electricity (co-generation). To be viable, a large demand for heat is required, but, as energy costs increase, this dynamic will change. Biomass is currently sourced mainly from processing residues, but forest residues could be further exploited (Chapter 6). The potential increase in harvested volumes will provide additional volumes of biomass for use as an energy source.

EFFICIENT TRANSPORT OPTIONS

Transporting logs from the forest to the point of processing can account for 20 to 25 percent of the final production costs. For export products, sea freight costs are a critical component of the overall costs of supply – 50 percent or more of the final price for export logs, 20 to 25 percent for lumber, and 15 to 20 percent for pulp and paper (Chapter 6). Fuel is a major component of all those costs resulting in the price of oil driving a significant proportion of production costs.

Improving logistics and logging truck configurations (increased weights and dimensions) provide opportunities to reduce domestic transport costs (Chapter 9). The possibility of developing small-scale, high-tech sawmills close to the more scattered forest resource would reduce the actual tonnage and kilometres of transported wood products.

Sea freight costs could be addressed by (for example) co-ordinating freight movements when supplying a common market.

KEY DRIVER 4 – THE MARKETS ARE OVERSEAS

AN INCREASING NEW ZEALAND WOOD SUPPLY THAT ALREADY GREATLY EXCEEDS DOMESTIC DEMAND WILL DICTATE AN EVEN STRONGER FOCUS ON EXPORT MARKETS

STRENGTHS

- Ability to build on existing exporting experience
- Expected growth in demand from key Asian countries, most with existing trade links
- Adoption of recognised verification processes for sustainable management
- Focus on international trade issues
- Moves internationally to put more of the global wood supply on a legal and sustainable basis
- A "developed world" investment environment
- International linkages of many large-scale forest owners

THREATS

- Limited existing markets providing acceptable returns
- Failure to fund research and development for new and innovative products or to build innovation into business strategies
- Shipping costs/availability
- Failure of radiata pine products to perform adequately due to poor handling, processing, storage or utilisation in export markets
- Retreat from a globalised market resulting in new trade barriers, including tariff escalation
- Exchange rate volatility and exposure to external forces unrelated to market conditions for wood products

OPPORTUNITIES

- Exploiting increasing demands from Asian and new Middle Eastern markets
- Developing new high value-added and profit-added products that make the affluent but more distant European markets realistic additional destinations
- Reducing sea freight costs through innovative back loading, co-ordinated freight movements and low carbon footprint shipping
- Shipping more highly-valued finished products and fewer logs and semi-processed products
- Building world-scale and internationally cost-competitive wood processing plants where forest resources are more concentrated

DISCUSSION OF KEY DRIVER 4

NEW ZEALAND AND OVERSEAS MARKETS

Most of New Zealand's wood products are destined for overseas markets. Regardless of the development of new products and new uses, the extent of the commercial forest resource and the size of New Zealand's population mean domestic demand will account for a small proportion of the total production.

New Zealand's geographic location in the lower reaches of the Pacific Ocean and the cost of shipping ensures that the markets of the Asia-Pacific region will remain the focus for New Zealand's exported wood products for the foreseeable future. Development of new profitable and high-value products may also enable affluent European markets to be accessed. (Chapters 3 and 6). As the value of products increases, freight costs as a proportion of total costs decrease and make shipping to more distant markets viable.

Consumption of forest products is forecast to grow strongly in developing Asian countries such as China, India, Vietnam and the Republic of Korea. However, New Zealand exports must be competitive on the basis of price and/or other attributes to survive the challenges from other exporting countries, such as Chile, Russia and Brazil, which have extensive forest resources and low production costs (Chapters 7 and 11).

LIMITED EXISTING MARKETS FOR FOREST PRODUCTS

New Zealand is also exposed to economic downturns through the currently limited number of significant export markets for forest products. In 2007/08, six countries (Australia, Japan, China, Korea, the United States and Indonesia) imported more than NZ$100 million of forest products from New Zealand (Chapter 3). Exports of products such as paper and paperboard, fibreboard and other panel products are each heavily focused on one country, with one other "significant" destination and a number of very small importing countries. The more affluent Middle Eastern countries, which are going through major demographic changes, may provide important opportunities for market diversification.

Any move away from market globalisation and tariff reductions for processed products could significantly impede New Zealand's ability to compete against domestic processing in those markets, forcing the export of more logs (Chapter 11). However, addressing international trade issues is a high priority for the Government and the private sector.

REDUCING SHIPPING COSTS

Reducing shipping costs could be as important as productivity gains in making New Zealand wood products more cost competitive on international markets (Chapter 6). High shipping costs will continue to place countries that are far from the major markets at an extra disadvantage, particularly for low-value commodity products.

Sea freight costs may be reduced through innovative back-loading and co-ordinated freight movements among exporters. There is also the option of using container services to convey small volumes of logs to destinations where the economics of scheduling a break-bulk visit would be marginal. As noted under driver 3, one of the principal ways of reducing the freight burden is to move along the production chain and produce more highly processed timber products.

To date little attention has been given to the potential for low carbon footprint shipping using a combination of conventional power plants with sail and/or solar power.

EFFECT OF EXCHANGE RATE MOVEMENTS

Exports are also exposed to what has been, and continues to be, a volatile New Zealand dollar/United States dollar exchange rate, with the New Zealand dollar varying between 39 to 80 US cents since the year 2000. Exchange rate movement will continue to be strongly influenced by external factors, such as the strength or weakness of the US dollar and global economic growth patterns. Other forces, such as a significant oil discovery in New Zealand, could strengthen the New Zealand dollar further and impact significantly on exports.

ENSURING SUSTAINABLE FORESTRY

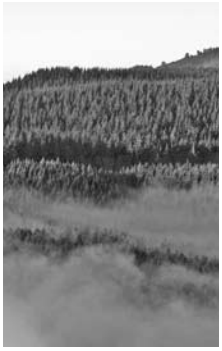
The international focus on ensuring that wood is sourced from sustainably managed and legally harvested forests may favourably change the supply dynamics in the Asia-Pacific region (Chapter 3). Illegal logging has been estimated to depress average log prices for New Zealand growers by 10.6 percent, and to have cost the New Zealand forestry sector up to $266 million per year in lost revenue (Chapter 11).

INTERNATIONAL LINKS

Changes in plantation forest ownership over the last two decades have resulted in a substantial proportion of the forest area coming under the control of companies with overseas headquarters (Chapter 3). These international links mean the companies can access their "home" markets and distribute products through established overseas networks.

UNDERSTANDING THE PRODUCT

The New Zealand wood exporting sector must also ensure that importers understand how to correctly store and use radiata pine logs and processed products. Incorrect storage and use will lead to product failure, loss of consumer confidence and the loss of markets. This requires a sustained commitment to servicing markets.



KEY DRIVER 5 – THE FOREST RESOURCE

THE EXISTING PLANTATION FOREST RESOURCE PREDETERMINES POTENTIAL WOOD AVAILABILITY AND QUALITY, BUT SUPPLY DYNAMICS WILL CHANGE

STRENGTHS

- Highly researched tree species and understanding of wood properties
- Established domestic processing industries with potential to expand
- Effective biosecurity
- Versatile species allowing complete tree/log utilisation on a single site
- Ability to co-ordinate in-market support and product development based on a single versatile species
- Good resource statistics and ability to forecast wood availability

THREATS

- Radiata pine seen as a low-quality species in some markets
- Pest, diseases, wind, climate change
- Wood supply fluctuations as harvesting decisions become exposed to carbon pricing
- Small-scale owner resource quality and quantity less well understood
- Reluctance of small-scale owners to adopt collective models
- Lack of connection between processors and small-scale owners
- Poor infrastructure where the proportion of small-scale ownership is high
- Scattered resource increasing costs throughout the value chain

OPPORTUNITIES

- Ability to develop markets based on an increasing, sustainable and assured wood supply
- Wood processors taking advantage of an uncommitted resource and responding to market surges
- Small-scale forest owners in aggregate assuming a level of strategic importance in the development of the forest industry
- Enhancing the economics throughout the value chain by collectively managing small-scale forest resources and creating economies of scale

DISCUSSION OF KEY DRIVER 5

HARVESTING OVER THE NEXT 20 YEARS

For the next 20 years, both the quantity and the quality of the wood that will be harvested have been set by the forests already established and by their management (Chapter 3). However, development of some very short-rotation crops for bioenergy production may be possible.

Barring physical (wind) or biological (establishment of a major pest or disease) disasters, New Zealand can expect that the annual quantity of wood available for harvesting will increase by around 10 to 11 million cubic metres by 2020, or 50 percent more than the current annual harvest (Chapter 3). This increase does not mean all the additional wood will actually be harvested. The amount harvested will be determined by the availability of markets that provide acceptable returns to producers, and possibly by carbon prices, which may encourage "carbon farming" rather than tree harvesting. Also impacting on markets will be competition from overseas producers and from alternative (non-wood) products (Chapters 3 and 11).

RADIATA PINE RESOURCE

The large majority of this additional wood available to harvest will be radiata pine, a well-researched species that is regarded as a utility softwood readily processed for sawn timber, finger-jointed and glue-laminated lumber, turnery, posts and poles, panel, and pulp and paper products (Chapter 14). Its limited stiffness constrains some structural uses (Burdon and Miller, 1992). About 60 percent (by area) of the radiata pine resource has been pruned to be used for solid wood products, although only about 15 percent (by volume) will be clearwood (wood free of branch knots or other defects).

DOUGLAS-FIR

By the late 2020s, the sector will start to see increasing volumes of Douglas-fir, a higher-value timber species, coming on stream.

PROMOTING RESEARCH AND DEVELOPMENT

Research and development will be critical to New Zealand's international competitiveness, as it can identify ways to lower production costs and differentiate products. This cannot happen, however, unless innovation and productivity are valued and substantial industry support and funding are provided for a strong research capability (Chapter 9).

SMALL-SCALE FOREST OWNERS

There are approximately 15 123 forest owners in New Zealand. About 15 000 hold less than 1000 hectares each but in aggregate own 30 percent of the plantation forest estate. Some 13 000 of these owners have less than 40 hectares each (MAF, 2007a) (Chapters 3 and 4).

As most of this small-scale resource was established in the 1990s, there could be a "spike" in the wood available over the 10-year period from the early 2020s. However, these forest owners are not necessarily motivated purely by commercial objectives, and harvesting could be spread over a range of rotation lengths or, in some instances, not carried out. The resource is often in quite small, remote blocks (many of which are not supported by good infrastructure) and widely spread geographically, with volumes and log qualities that are less well understood than the resource currently being harvested (Chapter 3).

To take advantage of this opportunity, small-scale forest owners will need to be aware of commercial issues and understand how the industry operates. Industry bodies will have a key role in ensuring this happens. Small-scale owners may need to establish some form of collective business enterprise that can

provide ongoing or medium-term log supplies and capture the full economic value of their resource, rather than undertaking one-off harvests. The few attempts to develop collective models suggest this may be difficult to achieve: owners place a high value on independence and managing their own options. Models from the agricultural sector do not readily fit the forestry sector (Chapter 4).

Small-scale forest owners also face difficulties in demonstrating sustainable forest management, largely because of the costs of accessing recognised certification processes.

Recent processing plant ownership changes and potential increases in the volumes of wood available from independent small-scale growers suggest a weaker relationship between growers of the raw material and processors of that material, and consequently less understanding of each other's requirements and objectives. It may also make it more difficult for processors to secure ongoing supplies of wood of the desired quality from a range of forest owners. If these challenges are significant, then domestic processors may be reluctant to pursue this source of log supply if other options exist – unless the price is lower (Chapters 3 and 4). An option that may assist small-scale growers is the development of small-scale, high-tech mills nearer the resource.

› WOOD SUPPLY TO THE PROCESSING INDUSTRIES

The operation of new and existing wood processing ventures will increasingly require suitable log supply agreements to be negotiated with a much greater diversity of (often small-scale) forest owners. For potential offshore investors in wood processing, the prospect of securing a large and ongoing wood supply from a diversified ownership may seem insurmountable, unless growers are willing to enter into some form of resource aggregation.

Average harvesting costs are likely to increase if a higher percentage of the volume is taken from steeper, more remote country, where satisfying environmental standards will require extra attention. In addition, the forestry sector is likely to have to offer higher wages and better-defined career pathways to attract and retain a high-quality workforce in the future (Chapters 3 and 7). There may also be an issue about the availability of skilled logging contractors to undertake this work. In many situations, the roading infrastructure will require upgrading (Chapter 6).

The solid wood processing industry is a key link in the wood processing value chain because it consumes about 48 percent of the current harvest; it also on-supplies a large quantity of residues for the production of other wood products (Chapter 3). If transport costs remain high, wood processing is the logical way to intensify the value of product per unit of shipping.

› EFFECT OF AN EMISSIONS TRADING SCHEME ON FORESTRY

An emissions trading scheme (ETS) could significantly change the forest-growing industry. Participants in an ETS may shift investment to long-lived, high-volume species such as Douglas-fir, redwoods and eucalypts. Rotation ages may vary more as carbon balance and the carbon price of a forest become significant factors in harvesting decisions (Chapter 10). Some forests may be managed purely for carbon farming.

Other new uses for forests may emerge such as providing carbon offsets to mitigate landowners' carbon liabilities from other activities, and coppicing crops for bioenergy. The effects of climate change may have regional implications for species selection and forest management.

OVER THE HORIZON

The Forestry Sector Study has a 20-year horizon. However, it could be worthwhile from a policy perspective to postulate some over-the-horizon situations, and what the New Zealand forestry sector might look like in 50 years time.

CONTEXT

Firstly, it might be useful to look at what the universal situation might be in 50 years time; the context in which New Zealand forestry, and indeed the country's whole social, environmental and economic framework, might be operating[4].

It is widely accepted that global population will have increased from around 6 billion in 2007 to over 9 billion in 2050, assuming there are no international catastrophes or/and major wars. This increase in itself will create major challenges and may dictate radical changes in the way we consume and make the things we will need to live.

But if we keep using resources the way we do today we could be heading for disaster. For example, if that proportion of the 9 billion living in the current developing world increased their nutritional intake to that of the current developed world then the 9 billion would be equivalent to 13 billion eating at current nutrition levels. Without paradigm shifts in nearly all production systems there simply won't be enough resources, especially land and water.

With international shortages of land and water likely to be the major issues of 2050, greater even than, but connected to climate change, as the backdrop, what might the New Zealand forest sector of the 2050s look like?

4 The sources for this section are (a) a talk given to a MAF Policy meeting in May 2008 by Dr Ron McDowall (Civil & Environmental Engineering Department, University of Auckland); and (b) an article by Julian Cribb, adjunct Professor in Science Communication at the University of Technology, Sydney, in *Cosmos* Magazine, issue 20, page 96.

FORESTRY IN 2058

It is not possible to comprehensively address such a radical question in the confines of a New Zealand Forestry Sector Study, but a few ideas, some of which are extrapolations from things we already have an inkling of, are outlined below. They are MAF's ideas, are possibly controversial (and are meant to be) and have not been reality-checked outside of MAF, though MAF welcomes comment. They relate only to forestry and do not speculate on economic or political circumstances (except for one "extreme scenario"), or on climate change impacts. Biological and physical risks from climate change are discussed in Chapters 12 and 13.

It could be that in the year 2058:

1. Extensive fast-growing, easily-coppiced tree crops of low-lignin (easy break-down) trees for bioenergy are growing on land that does not compete with food crops.

2. All parts of trees, including in-forest residues, are utilised for a range of products and uses, with crops sown to supplement for nutrients not returned to the soil due to all-tree utilisation.

3. Equipment is available to mechanically and economically harvest bioenergy and timber-crop trees and residues on steep topography; for example, remote control technology for tree cutting and extraction.

4. Engineered and reconstituted wood products are far more common as construction materials than solid wood and many non-wood products. Wood-panel/wood-foam sandwiches are as common as concrete tilt-slabs were in the early 2000s. Wood-foam has replaced polystyrene. Wood and wood-based products are the main construction materials of choice for all but the largest/tallest buildings.

5. Research on wood (cellulose) chemistry has resulted in a number of niche products based around this chemistry, which has gone beyond the understanding of biomaterials prevalent in the first decade of the century. "Plastics" are made from cellulose, and these plastics are the most commonly used packaging material, which is both smart (with imbedded chips) and biodegradable. ("Smart packaging" gives information about the perishable product, for example, whether the product has been stored at the correct temperature.)

6. Desirable traits of trees (identified by gene mapping) are rapidly assimilated into new tree-breeding stock through vegetative (non-GE) methods, leading to speedy production of "designer trees". The non-GE aspect is a major clean green marketing advantage.

7. The plantation estate is well over 3 million hectares, with "only" half of that being radiata pine; there is a lot of long-rotation "carbon forestry" (for example, Douglas-fir, cypresses) with single-tree/coup harvesting of large and valuable trees; energy cropping is common.

8. No pulp and/or paper industries exist in New Zealand; material previously used by them is used in reconstituted products, biomaterials, and energy production.

9. Wood processing industries are supplying all their own energy needs; forestry equipment is self sufficient in wood-based biofuels.

10. Log exports are non-existent due to shipping issues; containerised primary breakdown has replaced log exports and all exports of other wood-based products are containerised. Specialised (and readily available) containers allow in-container fumigation/treatment (if/where necessary). Even domestic logs are transported in containers, which has eliminated fungal attack and prolonged the time available for delivery to processing mills.

11. Issues concerning resource consenting of forest industry activities have been mitigated; the RMA has been replaced by "better" legislation (better for all stakeholders) and there are fewer (but better resourced) councils.

12. Non-toxic methods of wood preservation are common and are producing highly durable and price-competitive wood-based products that have replaced aluminium as a building/fit-out material. Widespread use of mobile pyrolysis plants that are used in local/distributed energy generation are safely disposing of old treated wood (for example, CCA).

13. Only a few large wood processing plants (not necessarily sawmills) exist in New Zealand, located in areas were forests are concentrated. Efficient transport moves material in and out of these few plants and they are co-located with associated processing plants. There are few, if any, small or medium sawmills. In areas with scattered forests, highly efficient, hi-tech, portable processing plants are working close to small-scale forests; and residues are used for local energy generation.

14. Forest owners and managers are being recompensed for most environmental services provided by forests, beyond carbon sequestration. That in turn has led to a much greater say in the way those forests are managed by those paying for the services. One result is an upsurge in private-public partnership "community forests". These forests are based on multi-use concepts, including production of non-wood forest products.

15. Climate change issues that dominated the first decade of the century are now part of mainstream forestry. New forests are being planted; the trading of carbon credits is commonplace, as is the planting of offsets; the successors to the Kyoto Protocol have provided certainty and forests are playing a significant part in lowering greenhouse gas levels.

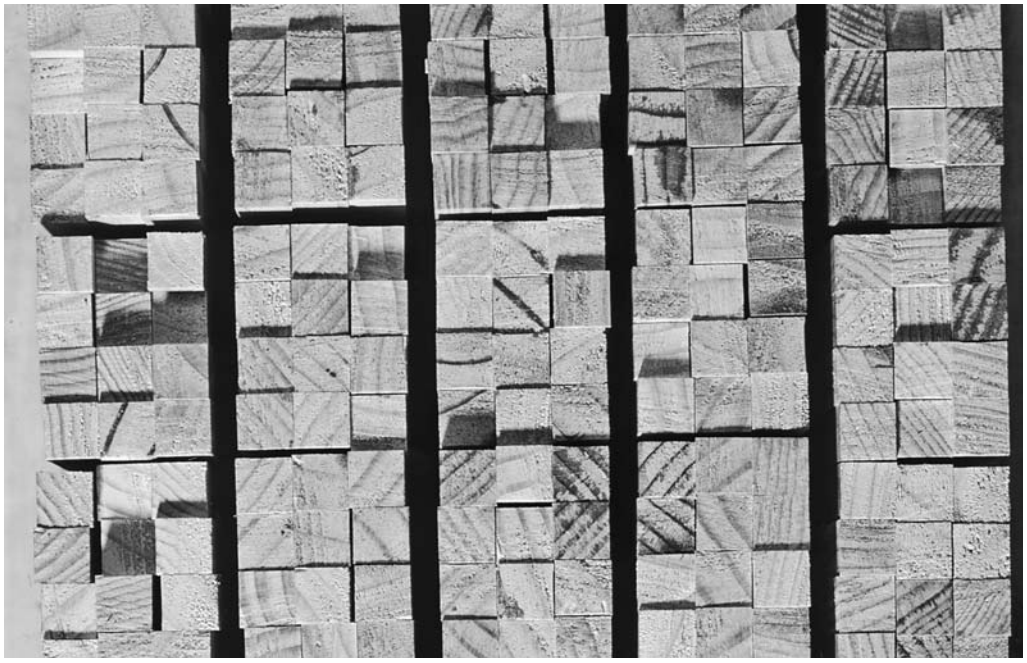
16. Timber, wood cutting and wood processing technology (including reconstituted wood products) do not use any water; wood products preservation does not require pressure/vacuum equipment; what little solid wood that is in use is dried by radio frequency and the water is captured and turned into bioproducts.

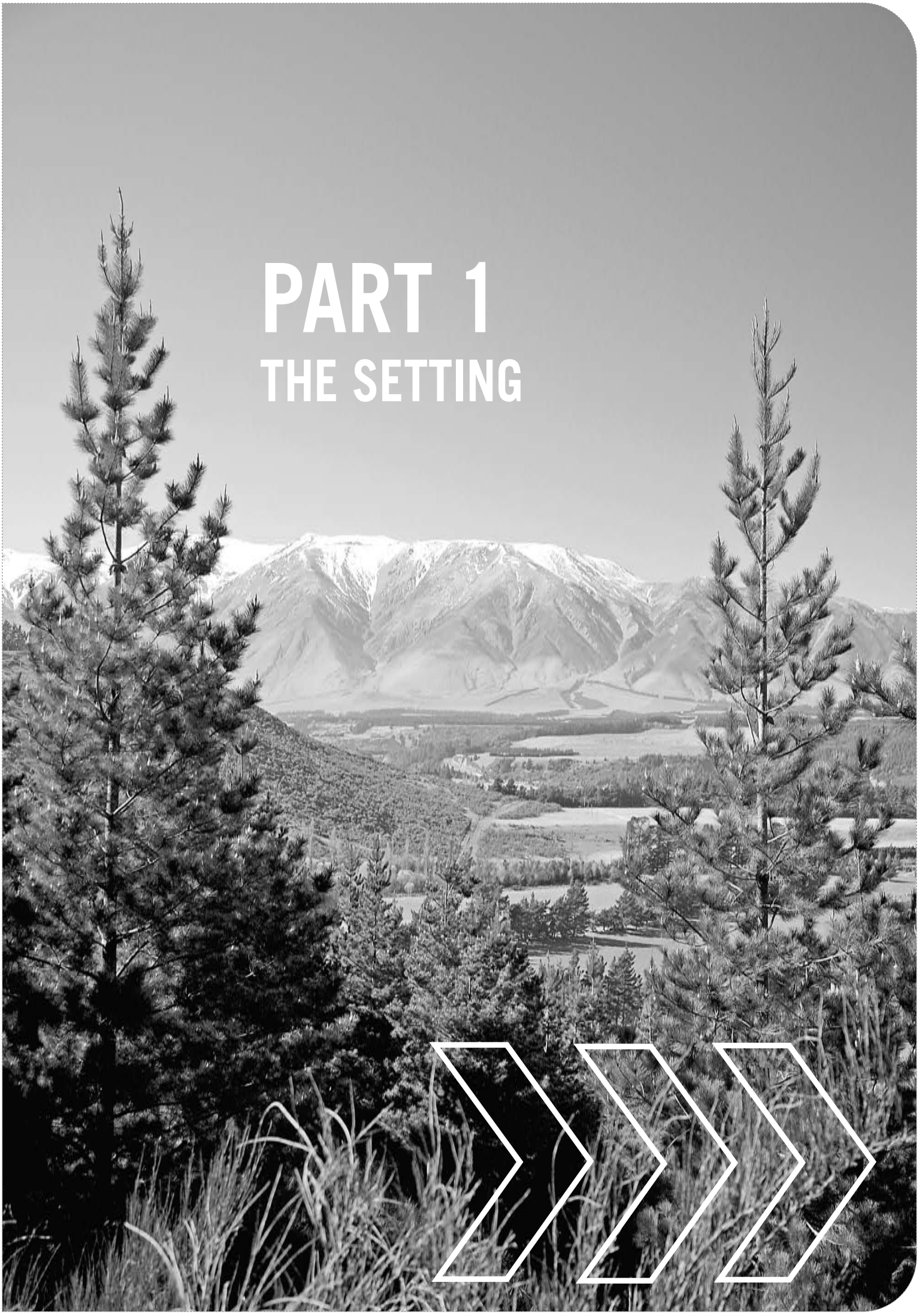
17. Timber supplies from indigenous and exotic hardwood forests are supplying all New Zealand's requirements for these types of timbers and there are no imports of tropical hardwoods. There are some imports of paper, though per capita paper use has reduced significantly since 2008.

› AN EXTREME VIEW?

At the far end of the "over-the-horizon" spectrum, the following is included, if for no other reason than to demonstrate the hazards of too much speculating.

Vast oil and gas reserves have been found in the Southern Ocean and other New Zealand territorial waters, and technological solutions to greenhouse gas emissions have been widely commercialised. In 2058 exploitation of these is in full swing. Export revenues from oil and gas are so large that the currency has soared against the Euro (which is now the oil-trading currency) to levels that make exports of anything else quite uncompetitive. Beyond supplying domestic needs (which includes Australia, with a common currency) plantation forests are largely for conservation, recreation and carbon farming. But there is a flourishing business in forest research and development, with the buoyant currency attracting the world's best forest and wood product researchers to New Zealand. (Note: to gauge possible consequences of such a scenario on New Zealand, a study of Norway in the 1970s-80s, with its North Sea oil, might be informative.)





PART 1
THE SETTING

DESCRIPTION OF THE EXISTING SECTOR

3

OVERVIEW

This chapter describes what the various industries of New Zealand's forestry sector look like at the time of publication. It looks at the structure of the industries and topics such as wood availability and trade, as well as describing the exotic forest resource.

DRIVERS

A number of situations drive the sector and cannot readily be altered. For example:

- The "proximity" (relative to other markets) of Australia, Pacific nations, Asia and North America drives the focus on the Asia-Pacific region.
- Just about all of any increase in wood production (potentially 50 percent in the next 5 to 10 years) will have to be exported and this drives a strong focus on global markets.
- New Zealand has a mostly scattered resource with limited areas of concentrated forest plantings (for example, as in the central North Island). An increasing amount of the future harvest will be on scattered and steep(ish) hillsides.
- The trees currently in the ground will determine the characteristics of the available wood over the next two or three decades.
- Ownership of production forestry is dominated by the private sector, is international and has an increasing proportion of small-scale forest growers.
- Sawmilling in recent years has been moving toward more consolidation, with fewer and larger mills.

Sawmilling is pivotal as it bridges the gap between log and other wood products and provides residues to make other products.

THREATS

Being a small player in a globalised market can present some threats. For example:

- New Zealand's wood products are a tiny fraction of world production. Therefore, in many of its export markets, New Zealand is a taker of prices set by bigger international players.
- Five markets take almost 80 percent of New Zealand's forest products exports.
- Clearfelling is the primary harvesting method in New Zealand but it has been significantly criticised in North America and parts of Europe, which could spill into New Zealand.
- New Zealand's second largest export lumber market, Australia, is increasing production, and lumber imports into Australia from Europe and Chile are rapidly increasing.

OPPORTUNITIES

However, domestic and international developments could provide opportunities. For example:

- A very diverse pattern of forest ownership may offer processors more options for log supply.
- Developments in Russia may reduce its log exports and put upward pressure on prices.
- There will be an extra 10 to 11 million cubic metres of logs available annually (above the 2007/08 harvest) by around 2020.
- If processing increases, volumes of wood residues will rise, enhancing the potential for biomaterials and bioenergy production.
- New Zealand radiata pine laminates well for use in engineering solutions, such as construction plywood and laminated veneer lumber.

NEW ZEALAND FORESTRY AND ITS PLACE IN THE WORLD

New Zealand is a small player in the international forest industry. It accounts for around 1.0 percent of the world's trade in forest products by volume. In comparison, Chile accounts for 1.4 percent of trade, Russian Federation 4.1 percent, Sweden 7.1 percent and Canada 15.9 percent. But in its main market of Asia, MAF estimates (Eyre, 2007[5]) that New Zealand's share of softwood forest products trade by value is much more significant, at almost 20 percent.

New Zealand exports wood products to over 30 countries, with total export earnings for the year ended March 2007 of $3.447 billion and substantial potential for export growth. The forestry sector's annual gross income is around $5 billion. This is off 7 percent of the country's land area. Gross income for the rest of the land-based primary sector is around $19 billion (MAF, 2008a: Table 2.3), off 50 percent of the country's land area. Forestry also contributes about 3 percent of New Zealand's GDP and directly employs around 20 400 people.

The sector consists of plantation and indigenous forest growing, log harvesting and exporting, sawmilling (lumber), pulp and paper, MDF and panel products, value-added products such as mouldings and furniture, and ancillary and service industries.

New Zealand's wood industry is built around radiata pine, a species that has strengths and weaknesses. It is a utility species, although it is versatile and has some good characteristics (it glues, nails, machines and holds paint and chemical treatments very well and is easy to treat, to name but a few). Its weaknesses include being technically difficult to dry correctly and its lack of durability for external and/or in-ground uses unless it is treated in some way.

5 Using data from Maplesden and Turner (2006).

New Zealand is a small player in the international forest industry.

On the world stage, radiata pine can be poorly perceived and struggles for recognition; there just isn't enough of it around the world to make a significant impact as a species, except in some specific market segments. On the other hand, in the New Zealand context and in reconstituted forms it is a different story. For example, it is recognised as producing fine-textured, even, light-coloured MDF that has a niche in furniture and fittings for both the domestic market and export markets. In some markets, such as appearance grades and mouldings, New Zealand's tree-pruning regimes can produce higher-value long-length clear lumber of wide dimensions.

Forestry also contributes substantially to New Zealand's environment, to climate change mitigation, to water and soil conservation and to New Zealand's longer-term sustainable development. Plantation forests are also a very important part of integrated land management (where land use is matched with land use capability).

Sustainable development may increasingly depend on wood-based biomaterials, rather than non-renewable materials. Wood-based products have the potential to grow their market share at the expense of materials such as plastics and metals, especially as energy costs rise and greenhouse gas emission costs are internalised.

FOREST RESOURCES

New Zealand has a total land area of just over 27 million hectares:

- Plantation forest accounts for 1.8 million hectares (7 percent of the land area).
- New Zealand's indigenous forests cover 6.2 million hectares (23 percent).
- Around 50 percent of the land area is classed as pastoral agriculture.

AFFORESTATION

The first significant exotic forest establishment took place in the early 1920s in response to a growing awareness that New Zealand's indigenous forests would be unable to meet New Zealand's future demand for forestry products. Large tracts of land were planted on the central North Island plateau where the land at that time was considered unsuitable for pastoral agriculture, but could profitably grow forests. Another objective of the forest establishment was to generate employment. Since the 1920s, the rate of afforestation has fluctuated significantly based on government policies, forest product market conditions and perceptions of forestry as an investment (see Figure 3.1).

PLANTATION FOREST LOCATIONS

Plantation forests are spread across much of New Zealand.

SPECIES COMPOSITION

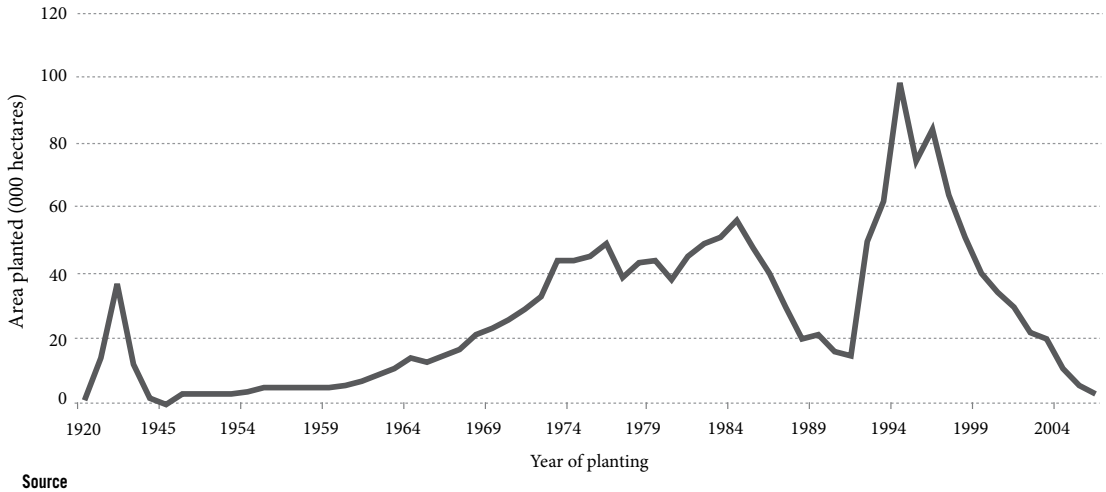
Radiata pine makes up almost 90 percent of the plantation forest area, although the species composition of the plantation forest area varies to some extent regionally. In the lower South Island, there is currently a move away from radiata pine to Douglas-fir, particularly on higher-altitude sites. Nationally, Douglas-fir makes up 6 percent (113 500 hectares) of the plantation forest resource, with the greatest concentrations in Otago and Southland, the Central North Island, Canterbury and Nelson. There is very little Douglas-fir in other regions.

New Zealand's focus on a single utility species has some advantages:

- Research into, for example, biomaterials does not need to be spread across multiple species.
- The wood properties of radiata pine are generally well understood.
- Multiple products can be integrated across different wood processing sites. For example, lumber sawn and dried at one site can be sent to another site to be made into furniture, another for prefabricated buildings, another for roof trusses and so on.

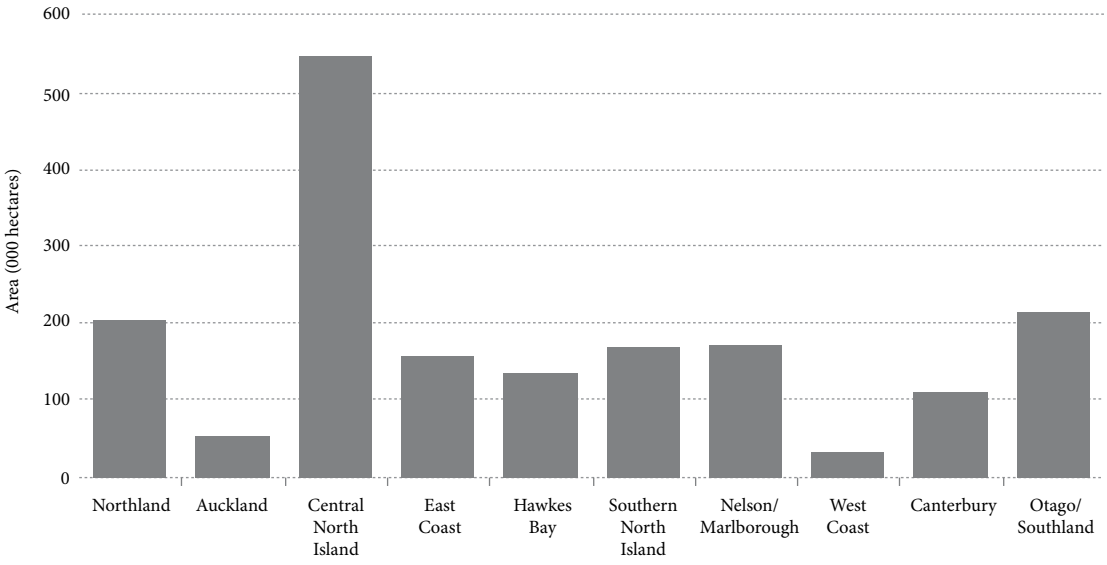
However, radiata pine's inherent deficiencies compared with some other species, such as natural durability and comparative strength, mean it can be poorly perceived. Other issues and risks around relying on a single exotic species are covered in Chapter 12 "Biological risks and their management".

FIGURE 3.1: EXOTIC AFFORESTATION IN NEW ZEALAND



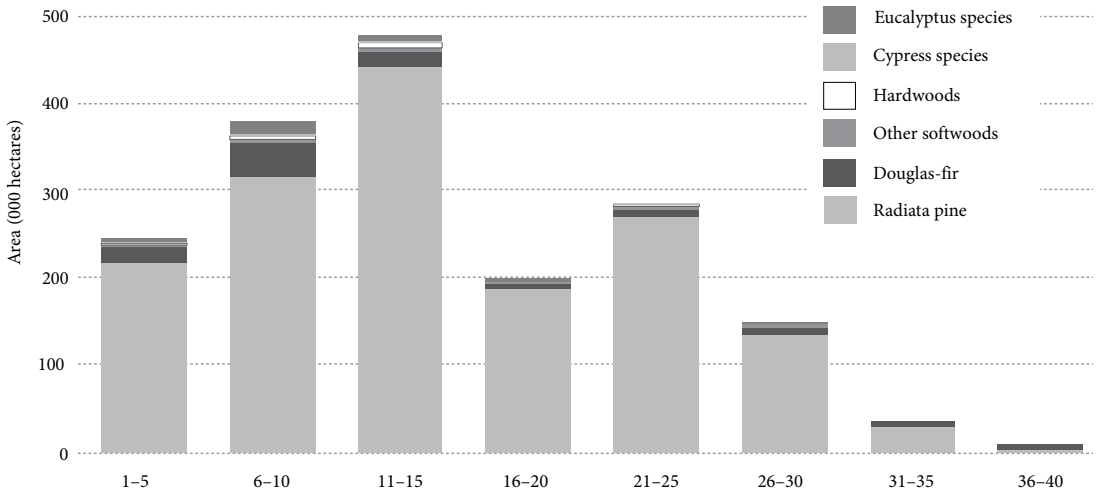
Source
MAF, 2008b

FIGURE 3.2: PLANTATION FORESTS BY WOOD SUPPLY REGION



Source
MAF, 2008b

FIGURE 3.3: FOREST AREA BY AGE CLASS AND SPECIES AS AT 1 APRIL 2007



Source
MAF, 2008b

› SILVICULTURE

New Zealand's plantation forests are intensively managed by world standards. Plantation forest stands usually contain a single forest crop tree species of uniform age, although in many situations there are a variety of understorey species, mainly indigenous shrubs and ferns.

Sixty-one percent of the radiata pine forest estate has been or is expected to be pruned to at least four metres in height. Of the area that has been pruned, approximately:

› 121 000 hectares (12 percent) is greater than 25 years old;
› 175 000 hectares (18 percent) is between 21 and 25 years old;
› 680 000 (70 percent) is 20 years old or younger.

Approximately 16 percent of the radiata pine area is currently or is expected to be production thinned.

The level of production thinning has declined over recent years.

HARVESTING

The volume of timber harvested from New Zealand's plantation forests has risen steadily over the last 50 years, based on available wood supply, market conditions and, prior to 1987, the policies of the New Zealand Forest Service.

From 2003 to 2005, the rate of harvesting declined because of deteriorating market conditions (mainly caused by increased competition in log and forest products markets), a strong New Zealand dollar and significant increases in shipping charges.

The reduced harvest was also caused by some forest owners harvesting less in order to restore the average rotation age of their forests back to around 30 years. Previous owners had taken advantage of a weak New Zealand dollar to boost their cash flow by increased harvesting, which resulted in a lowering of their average rotation age to around 24 or 25 years. (Logs could be sold for lower US dollar prices, giving them a price-competitive edge, but the weak New Zealand dollar translated to increased returns in New Zealand dollars). In some cases, this may have impacted negatively on New Zealand's reputation, as for many uses the wood from younger trees lacks the good-quality features present in older wood.

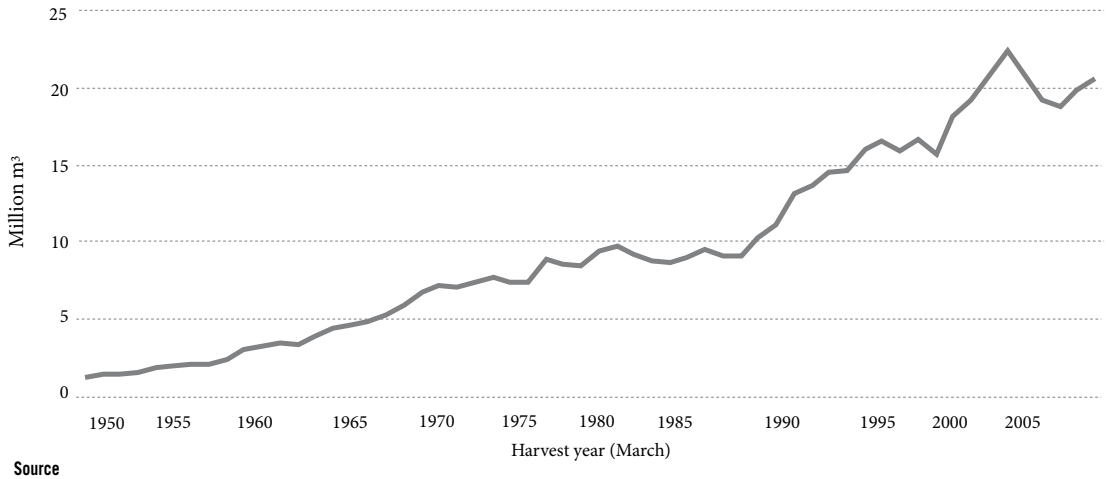
The provisional estimate of roundwood removals in the year ended March 2008 is 20.6 million cubic metres, 3.5 percent up on the previous March year. Log harvest is more than 99.9 percent from plantation forests.

LAND-USE CHANGE

A trend of not replanting forest after harvesting, and in a few cases converting immature forest to pasture, started to increase in 2004. New Zealand has always had a relatively dynamic landscape, so changes in land use are not unusual. Historically, however, little plantation forest land has been converted. In the year ended March 2007, approximately 13 600 hectares of clearfelled forest was converted to other land uses. This area represents 32 percent of the area harvested, and compares with historical information indicating that only about 3 percent of the area harvested per year was not replanted.

A survey of land-use change intentions in 2006 indicated that, under economic conditions

FIGURE 3.4: HARVESTING FROM PLANTATION FORESTS



Source
MAF, 2008b

TABLE 3.1: "HEAD OFFICE" LOCATIONS OF NEW ZEALAND PLANTATION FOREST OWNERSHIP, 2008

LOCATION	AREA OWNED (000 HA)	PERCENTAGE OF TOTAL AREA
New Zealand (large owners)	397	22
Mostly New Zealand (smaller owners)	626	35
US	544	30
Japan	89	5
Malaysia	113	6
China	25	1
Indonesia	17	1
Total	**1 811**	**100**

Source
MAF, 2008.

and government policies of the time, around 130 000 to 170 000 hectares could be at risk of deforestation in the period to 2020. The bulk of the changes are expected to occur in the South Waikato district and parts of the eastern Bay of Plenty, with some on the Canterbury plains. It is estimated that almost 60 percent of the change is likely to go into dairy farms and about 35 percent into sheep and beef farms, with the rest going into lifestyle blocks.

INDIGENOUS FORESTS

About 5 million hectares of indigenous forest are owned by the state. Much of this forest is located in mountainous areas, particularly on the West Coast of the South Island, although large tracts of forest are also located on the North Island mountain ranges. The Department of Conservation manages the bulk of this indigenous forest for conservation, biodiversity, catchment management and recreation purposes. Harvesting of government-owned indigenous forest is not permitted.

A further 1.3 million hectares of indigenous forest are privately owned. Harvesting of privately owned indigenous forest requires a sustainable management plan or permit under the indigenous forest provisions (Part IIIA) of the Forests Act 1949. MAF Policy administers the indigenous forest provisions of the Forests Act.

FOREST OWNERSHIP

The make-up of New Zealand forest ownership has changed substantially over a little more than a decade – now it is dominated by the private sector, is international and includes an increasing proportion of small-scale forest growers. As described later in this section, significant forest ownership changes continue to occur, with public companies selling their forestry assets to institutional investors.

There are currently 15 forest owners (with considerable offshore investment) that individually own over 15 000 hectares of forest. Collectively, these companies and organisations own almost 1 million hectares of forest or 56 percent of the plantation forest estate. A wide variety of small companies, local government, partnerships, joint ventures and thousands of small-scale forest owners own the remaining forests.

Table 3.2 shows the major plantation forest owners (note that this is ownership of trees, not necessarily of land – some trees are on leasehold or forest-licence land).

THE WOOD PROCESSING SECTOR

LUMBER (SAWN TIMBER)

The sawmilling industry is pivotal to the future of the sector. In addition to using over 7 million cubic metres of logs per year, it on-supplies more than

TABLE 3.2: LARGE-SCALE PLANTATION FOREST OWNERSHIP, MARCH 2008

ORGANISATION	AREA
Hancock Natural Resource Group[1, 2]	307 000
Rank Group[1]	20 000
Kaingaroa Timberlands (Harvard Endowment Fund via GFP)	170 000
Matariki Forests (RREEF)	143 000
Ernslaw One (includes 17 000 ha from Winstone Pulp International)[3]	86 000
Weyerhaeuser NZ Incorporated	60 000
Juken Nissho	56 000
Crown Forestry (MAF)	36 000
Pan Pac Forest Products	33 000
Timberlands West Coast	29 000
Blakely Pacific	28 000
Hikurangi Forest Farms (Glenealy)	27 000
Global Forest Partners[4]	27 000
Wenita Forest Products	25 000
Roger Dickie New Zealand	24 000
Forest Enterprises	22 000
Winstone Pulp International	17 000
City Forests (including Opio Forest)	17 000
New Zealand Superannuation Fund	12 000
Ngati Porou Whanui Forests	10 000
Lake Taupo Forest Trust	9 000
Selwyn Plantation Board	9 000
GSL Capital	9 000
Rotoaira Forest Trust Board	9 000
All other owners	626 000
Total	**1 811 000**

Notes
1 In late 2006, Rank Group sold most of its forest to Hancocks, retaining about 20 000 hectares for conversion to other uses, such as dairy farms and lifestyle blocks.
2 Hancock Natural Resource Group owns the forestry right to Tarawera Forest and is also the investment manager for Viking Global and the Ontario Teachers Pension Plan, both of whom purchased trees from Kiwi Forests Consortium following the Kiwi acquisition of the former Fletcher Challenge forest estate.
3 In late 2007, Ernslaw One bought the assets of Winstone Pulp International, including 17 000 hectares of forest.
4 In addition to this 27 000 hectares of forest, Global Forest Partners has financial interests in a range of other New Zealand forests.

Sources
MAF 2008; New Zealand Forest Owners Association, 2008.

3 million cubic metres of residues per year to the pulp, paper and panel sectors.

There are around 370 sawmills operating in New Zealand, ranging from a few sites producing more than 250 000 cubic metres per year (700 000 cubic metres per year and greater is considered to be world-scale) to small family mills producing less than 1000 cubic metres per year. For the year ended March 2008, these mills produced 4.34 million cubic metres of lumber. A breakdown of the number of mills by annual production shows:

- 12 mills produce over 100 000 cubic metres per year;
- 5 mills produce 50 000 to 100 000 cubic metres per year;
- 34 mills produce 20 000 to 50 000 cubic metres per year.

The general trend in sawmilling in recent years has been toward consolidation, with fewer and larger mills and the bulk of investment being in "brownfield" expansions and upgrades (that is, expansions and upgrades of existing sites). Parts of the sawmilling industry, particularly some smaller operators, have experienced a very difficult time since around 2000, with some mill closures. Those significantly exposed to export markets have been hardest hit because of external factors, such as high shipping costs and the strength of the New Zealand dollar, particularly against the US dollar.

On the other hand, larger sawmills are continuing to make capital investments to increase output, for example, Red Stag Timber Limited in Rotorua. Other more "medium-sized" players, such as Ernslaw One Limited, are also expanding. For mills that are able to make these investments, increasing output is one way (along with cost reductions and productivity gains) of countering external pressures.

MEDIUM-DENSITY FIBREBOARD AND PANEL PRODUCTS

The largest medium-density fibreboard (MDF) facility is at Nelson Pine Industries (a wholly owned subsidiary of Sumitomo Forestry New Zealand Limited). There are also MDF plants at Mataura (Dongwha – Korea) and Rangiora (Carter Holt Harvey Woodproducts). Tenon manufactures medium and high-density particleboard, hardboard, ceiling tiles and MDF at various plants. Particleboard is produced at three mills in New Zealand. Plywood and laminated veneer lumber production have been growth areas in New Zealand's forestry sector during the past decade. Modern plants are operated by Carter Holt Harvey Woodproducts (at Tokoroa and Whangarei), Juken Nissho (at Kaitaia, Gisborne and Masterton) and Nelson Pine Industries.

The sawmilling industry is pivotal to the future of the sector.

PULP AND PAPER

The New Zealand pulp and paper sector comprises seven mills, with the bulk of the capacity centred around the central North Island at Kinleith and Kawerau (both owned by Carter Holt Harvey Paper). Norske Skog and SCI Hygiene (tissue production) own paper plants at Kawerau, while Carter Holt Harvey has a paperboard plant at Whakatane. There are dedicated pulp mills at Karioi (Winstone Pulp, now owned by Ernslaw One) and Whirinaki (Pan Pacific Forest Industries), while in Penrose there is a small papermaking facility using recycled paper.

REMANUFACTURED PRODUCTS

Remanufactured products are a relatively small but expanding part of the forestry sector (around 9 percent of total forest product export values in the year ended March 2008). (In a wood processing

context, remanufactured products include mouldings, furniture and so on.) It is a very diverse sector of about 80 companies, ranging from Tenon's moulding plant in Taupo to small furniture businesses.

TRADE IN FOREST PRODUCTS

It is widely accepted that there is no looming global shortage of wood fibre. Instead, there is significant potential supply from existing forests and plantation forests in North America, Europe, South America and Oceania, from fast-wood forestry in the tropics, from greater use of recycled and non-virgin wood fibre and from other (non-traditional) fibre sources – as well as from continued (although possibly reduced) illegal logging.

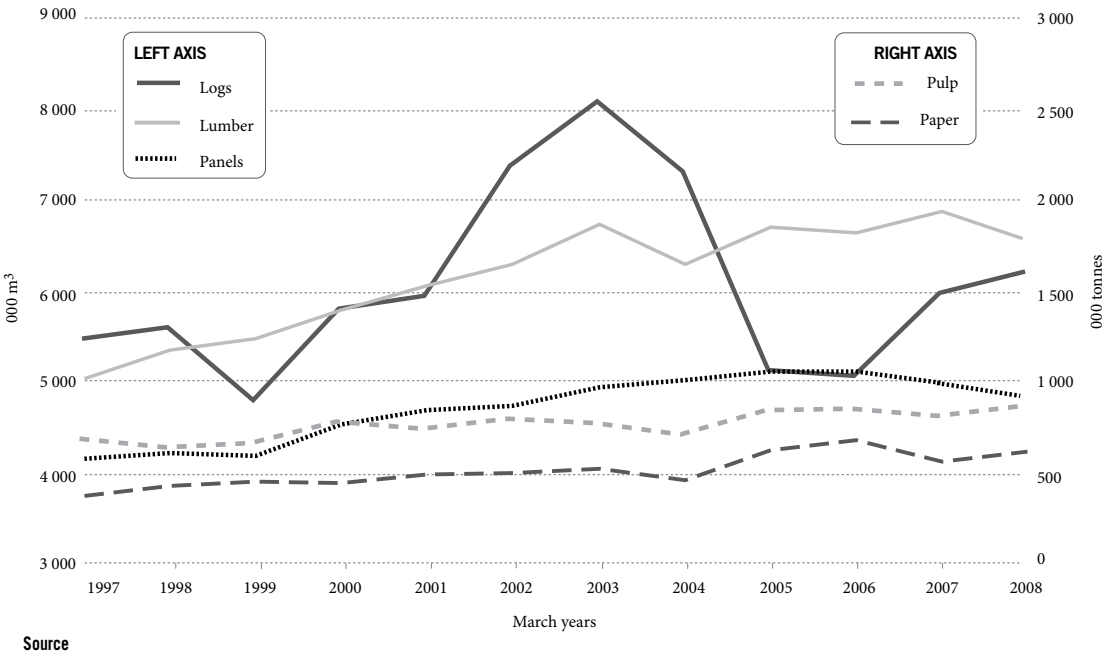
On the other hand, reductions in illegal and unsustainable logging in the Asia-Pacific region might lead to shortages in this particular region.

In 2006 (the latest date for global data), the global trade of forest products was over US$203 billion (Food and Agriculture Organization, 2007) and New Zealand's export values in 2005 were US$2.5 billion (NZ$3.6 billion – MAF, 2006a), 1.2 percent of the global value. However, New Zealand's main markets for forest products are around the Pacific Rim. Excluding paper and paper products[6], New Zealand's share of Pacific Rim trade is around 9 percent (Maplesden and Turner, 2006). If this is further refined to only softwood trade to Asia (excluding trade to North America), New Zealand's share rises to nearly 20 percent.

New Zealand, with its small population base and consequential small domestic market, depends greatly on international trade. Its closest and biggest single market is Australia, which takes 24 percent of total forest products exports. Other major markets are the all-important Asian markets of Japan (13 percent), China (14 percent) and the Republic of Korea (10 percent). The US is the fifth

6 There are so many different grades of paper and paper products that an inter-country trade analysis becomes very complicated.

FIGURE 3.5: EXPORTS BY VOLUME/TONNES



Source
MAF, 2008b

largest export market, taking nearly 10 percent of forest products (mainly in the form of lumber and mouldings but also including panels such as MDF). Fourteen Asian markets account for 57 percent of New Zealand's forest products exports, with the balance spread over more than 23 other countries.

› EXPORTS

Figure 3.5 shows exports by volume (thousands of cubic metres for logs, lumber and panels; and thousands of tonnes for pulp and paper).

LOGS

In the year ended March 2008, 30 percent of the logs harvested were exported. The reductions over the last four years are due largely to forest owners wanting to mature their forests, the high exchange rate and shipping costs. The Republic of Korea remains the largest market for log exports (at 3.2 million cubic metres), followed by China (at 1.4 million cubic metres) and Japan (at about 0.8 million cubic metres). The other significant log market is India, with over 0.6 million cubic metres in the year ended March 2008.

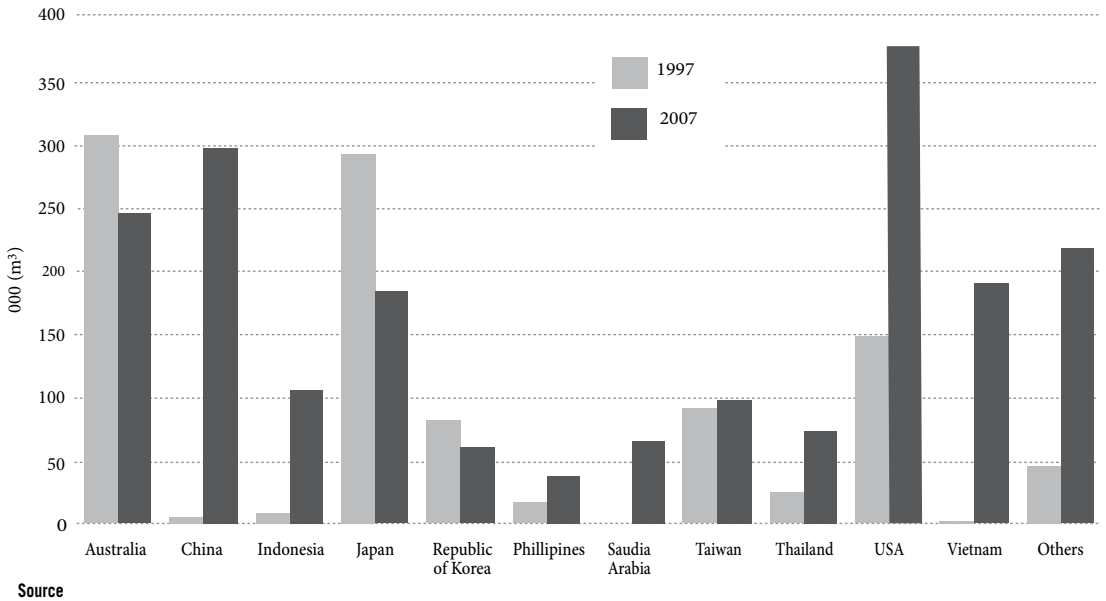
LUMBER

The export market base has expanded significantly in recent years but depends heavily on the Asia-Pacific region (see Figure 3.6). In 1983, New Zealand had three principal export markets, which were responsible for 96 percent of sawn lumber exports. By 2007, 11 markets take almost 90 percent, but the top five markets still collectively take over 60 percent or almost two-thirds of export production. The balance is spread over more than 50 other countries.

New Zealand's dominance in the Australian market is threatened by the increasing harvest of Australian radiata pine forests and increasing imports into Australia of European and Chilean lumber.

In 2002, the US surpassed Australia and became New Zealand forestry's major lumber market. However, the US may be a more vulnerable market for New Zealand in the medium-term due to the potential pressure of US imports from other countries, notably South America. The other point to note about Figure 3.6 is the huge increase in exports to China.

FIGURE 3.6: MAJOR LUMBER EXPORT MARKETS, 1997 AND 2007



Source
MAF, 2007b

PANELS

Exports of panel products are predominantly MDF. Japan is by far the major export market for fibreboard, reflecting the importance of the Japanese-owned New Zealand manufacturing plants and the market size.

Australia is by far the largest market for paper and paperboard products.

PULP AND PAPER

Exports of all paper and paperboard products have shown strong export growth over the last 10 years, rising from 368 000 tonnes in the year ended March 1996 to 682 000 tonnes in the year ended March 2006. Australia is by far the largest market for paper and paperboard products, and is likely to remain so in the medium-term. A problem for the New Zealand industry is that mills are not world scale and compared with big producers the technology is becoming dated. The previous advantage of cheap electricity has been reduced as New Zealand has moved to a commercialised model for electricity supply.

FUTURE WOOD AVAILABILITY FROM PLANTATION FORESTS

MAF has recently produced new wood availability forecasts looking out to 2040 for all regions with the exception of the West Coast, which only extends out to 2015, and Northland which is in preparation.

These new regional forecasts are being undertaken in association with forest owners, industry groups and consultants in each region. The forecasts show the range of log volumes potentially available from the plantation forest estate. Separate forecasts have been produced for large and small-scale forest owners. (Large-scale owners are defined as owners with more than 1000 hectares of forest.)

An interim national wood availability forecast has been produced for the Forestry Sector Study. This national forecast sums the forecasts for the five regions that had been completed at the time, along with interim forecasts for the remaining five regions.

The forecasts are based on supply, but incorporate the harvesting intentions of the large-scale owners[7] out to 2015.

While the forecasts show the potentially available wood supply, future harvesting decisions will be driven by a range of factors, including:

- individual forest owners' objectives;
- log prices;
- forest age;
- demand by local wood processing plants;
- harvesting and transport costs; and
- perceptions about future log prices and future wood supply.

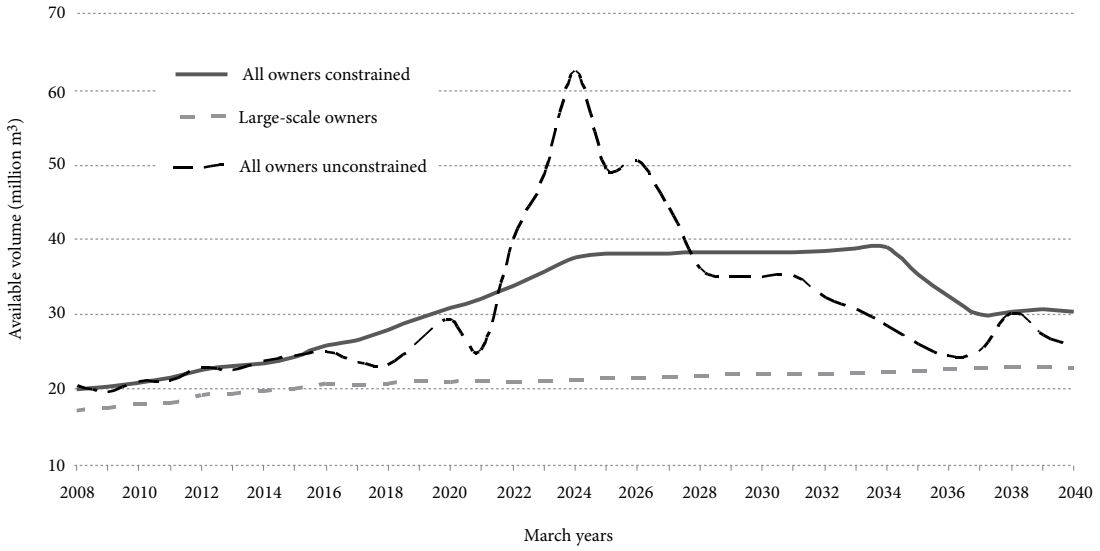
Log prices are one of the most critical factors that drive harvesting levels.

There are different levels of certainty associated with the wood availability from each component of the estate. The volumes forecast from the large-scale owners' forests are more certain than those forecast from the small-scale owners' estates. Not only are harvest intentions less clear for small-scale owners, but also the resource description is likely to be less accurate. Also, there was limited modelling of species other than radiata pine, due to limited data being available for these species.

The scenario presented in Figure 3.7 assumes that large-scale owners' wood availability is at stated harvest intentions until 2015 and then at a non-declining yield for the remainder of the current rotation (through to 2034). Thereafter, volumes may be reduced in the forecast model as the area available

7 For these interim forecasts, large-scale forest owners' harvesting intentions have been used in all regions, except Northland and Auckland. Harvesting intentions for Northland and Auckland were not available at the time these interim national forecasts were produced.

FIGURE 3.7: INTERIM NATIONAL WOOD AVAILABILITY FORECASTS



for harvesting decreases. Any increase or decrease in volume has been restricted to a maximum of 10 percent of the previous year's harvest.

An alternative scenario also shown in Figure 3.7 is to assume that wood availability from the small-scale owners is "unconstrained", closely following the age structure of these forests. In practice, such large increases in available volume could never be harvested over such short periods of time because of the significant amount of labour and equipment that would be required to harvest, transport and process the logs. The "constrained" scenario is probably more realistic.

INDIGENOUS WOOD SUPPLY

Productive management of indigenous forests is confined to privately owned forests. Timber production from these forests is less than 1 percent by volume of New Zealand's total timber production.

Some current issues concerning indigenous forests include:

- a difficult current transition from traditional timbers (for example, rimu) to more abundant but lesser-known timbers (predominantly beech);
- the lack of critical mass in the sector to develop and maintain a timber-processing industry for a different species (that is, beech);
- technical and marketing hurdles regarding beech timber;
- public perception/understanding regarding the legality of using indigenous timber, coupled with a lack of detailed information regarding the extent, quality and availability of indigenous timber;
- biodiversity conservation constraints on the ability to manage forests for sustainable timber production;
- additional processes and constraints with associated costs imposed through the RMA on approved sustainable forest management plans and permits; and
- timber imports from unsustainably managed and possibly with a dubious legality of harvesting.

Currently, around 121 000 hectares of forests are covered by approved sustainable forest management plans or permits:

- Plans contain a more comprehensive set of management considerations than permits and apply for a period of at least 50 years. The total approved annual volume able to be harvested under existing sustainable forest management plans is about 80 000 cubic metres.
- Permits cover a 10-year term and provide for

a restricted maximum cut. The total 10-year approved volume under existing sustainable forest management permits is about 132 000 cubic metres.

Sustainably managed indigenous forests produce a range of timbers for furniture and speciality areas. Approximately 1.1 million hectares of private indigenous forests have the potential to be sustainably managed.

GOVERNMENT INVOLVEMENT

The Government's involvement in New Zealand's forestry sector is mainly through MAF (which includes Crown Forestry and Biosecurity New Zealand) and the Department of Conservation. The Department of Corrections also owns or manages some plantation forests. A number of other agencies play important roles including the Ministry of Foreign Affairs and Trade, New Zealand Customs Service, Ministry for the Environment, and New Zealand Trade and Enterprise.

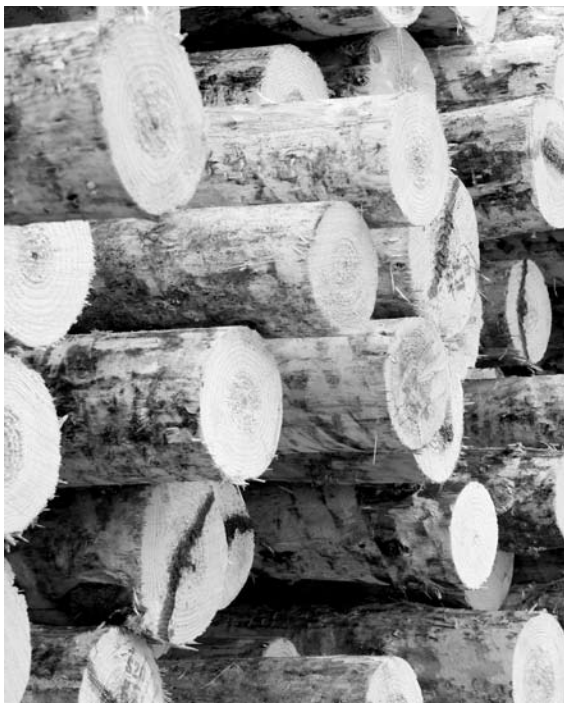


Photo courtesy of NZ Wood.

CROWN FORESTRY

MAF's Crown Forestry business unit administers the Government's interests in commercial forestry, such as forestry leases on Māori land, residual Crown forest assets and a portfolio of Forestry Encouragement Loans established under the Forestry Encouragement Loan Regulations 1967.

These assets all result from government decisions from the 1960s to the 1980s. Since the late 1980s, it has been government policy to withdraw from direct investment in forestry and to dispose of its forestry interests. The forestry assets managed by Crown Forestry are those that the Crown was not able to sell immediately. The Māori leasehold interests are not assignable, so a Crown exit has to be negotiated for each one, and any disposal of Crown forest land has to await the settlement of any relevant Treaty claims. The Forestry Encouragement Loans are not repayable until the forests are harvested.

MAF BIOSECURITY NEW ZEALAND

By far, the biggest amount of government resource directly applied to the forestry sector is through the provision of pre and post-border biosecurity and at-border biosecurity and quarantine services. These are discussed further in Chapter 12 "Biological risks and their management".

Indigenous timber production is less than 1 percent of New Zealand's total timber production.

INSTITUTIONAL FRAMEWORKS

4

OVERVIEW

Following on from the description of the forestry sector, this chapter looks at the institutions that support it: forest ownership, industry associations and regulatory issues.

DRIVERS

Influences on the make-up of New Zealand's forestry sector include:

- Significant changes in forest industry ownership have impacted on overall strategic focus and co-operation. There is an increasing disaggregation of ownership and separation of forest ownership from wood processing.
- The forestry sector is relatively complex, with a range of industries each focused on either increasing or capturing value.
- Small-scale growers own 30 percent of exotic plantation forests, and 81 percent of this resource is less than 15 years old, tends to be in quite small blocks and is widely spread geographically. For a number of small-scale growers, forestry is not their main source of income.
- Local government and the RMA processes.
- There tends to be limited industry-wide leadership at a strategic level; most industry associations depend heavily on "free" input from member companies' staff and less on paid industry association employees.

THREATS

The drivers can lead to a number of threats, for example:

- Sub-optimal investment by the industry and/or government.
- Some significant forest owners not being fully committed to wood supply at a scale sufficient enough to encourage the development of new markets or to support new wood processing investment.
- A sudden increase in log prices that could prompt small-scale growers to harvest (if this happens all at once, there will be a major strain on resources).
- The cost and time involved in consultation and participation in the RMA process for the sector and other participants.

Since 2003, there have been significant changes in plantation forest ownership.

OPPORTUNITIES

The structure of the forestry sector can provide a number of opportunities, such as:

- a better understanding of supply chains and the interdependency required across the whole sector;
- more engagement of Māori owners in important issues in the sector;
- the fact that small-scale growers may have different motivations than corporate forest owners for planting – they can plant various species, plant trees on longer rotations and combine planting for financial gain with planting for amenity purposes;
- the benefits of co-operatives, such as information sharing, managing for multiple benefits and bulk purchasing/selling power;
- the use of the global consent process in the governance of the forestry sector by local authorities; and
- certification from the Forest Stewardship Council (FSC) (which is used by some New Zealand forest owners and processors), or similar, to differentiate products in the market.

FOREST OWNERSHIP

For the purposes of this publication, forest ownership is divided into two categories:

- those owning and/or managing more than 1000 hectares – "large-scale growers";
- those with less than 1000 hectares – "small-scale growers".

LARGE-SCALE GROWERS

Since 2003, there have been significant changes in plantation forest ownership in New Zealand. Publicly listed forest companies such as Fletcher Challenge Forests and Carter Holt Harvey Forests have divested their forest assets to Timber Investment Management Organisations (TIMOs), such as Kaingaroa Timberlands (Harvard Endowment Fund via GMO Renewable Resources), Hancock Natural Resources Group and Rayonier-Deutsche Asset Management.

Following the sale of the Fletcher Challenge forest estate to the Kiwi Forests Consortium, a wood processing company called Tenon was established and a significant amount of capital from the sale of the Fletcher Challenge forest estate was returned to shareholders. Fletcher Challenge no longer exists.

In early 2006, the Rank Group acquired 100 percent of Carter Holt Harvey's shares and de-listed Carter Holt Harvey from the New Zealand Stock Exchange. In late 2006, the Rank Group sold most of its forest to Hancock Natural Resources, retaining about 20 000 hectares for conversion to other uses, such as dairy farms and lifestyle blocks. With that sale, and the sale and subsequent de-listing of Evergreen Forests in 2005, there are no longer any New Zealand listed public companies that own forests. It appears that publicly listed companies may not be well suited to forest ownership, possibly due to the short-term (quarterly) imperatives of many share market investors.

It appears that publicly listed companies may not be well suited to forest ownership.

Forest ownership changes are not unique to New Zealand. In the last decade, the US South has seen over 7.3 million hectares of forest change ownership, predominantly from vertically integrated forest products companies to institutional investors and companies focused on forestry. Similar changes are also occurring in Scandinavian countries.

I. REASONS FOR FOREST OWNERSHIP CHANGES

The sale of forest assets by forest products companies has a number of drivers.

- Poor shareholder returns of forest products companies have forced them to sell forest assets.
- Forest products companies have been undervalued (on an asset basis) by share markets, which makes them attractive acquisitions targets. Investment companies have been purchasing forest products companies and on-selling the assets at a profit.
- Forest assets were sold to reduce company debt arising from past acquisitions.
- The expansion of global wood availability has made log markets more competitive.
- Significantly, there are tax advantages in the US that favour TIMOs rather than corporate structures.

Institutional investors are investing in forests for several reasons. Historically, forests have had good risk-adjusted returns, and returns are considered counter-cyclical to other investments and are correlated with inflation, providing a "hedge" against inflation.

Institutional investor management strategies have implications for the management and supply of wood from their forests. For further information, see the section below on "Implications of current and future ownership changes".

II. OTHER FOREST OWNERSHIP TRENDS

The other trend that is unique to New Zealand is the potential return of significant areas of forest land to Māori through the Treaty of Waitangi settlement process. Māori are already significant forest and forest land owners.

In addition to the 24 000 hectares of forest on Māori land that are managed by Crown Forestry, other Māori owners include Ngati Porou Whanui Forests (10 000 hectares in a joint venture with Hansol Forem from Korea), Lake Taupo Forest Trust (12 000 hectares), Rotoaira Forest Trust (3000 hectares), Mangatu Incorporated (5000 hectares) and Taitokerau Forests (5000 hectares).

The Central North Island arrangement with Māori (known as the "Treelords Deal") is expected to return 170 000 hectares of licensed Crown forest land to Māori in mid-2009.

There are also a further 25 000 hectares of forest on Ngai Tahu land on the South Island West Coast.

Māori are also involved in other forestry projects by way of leases, forestry rights and joint ventures of Māori land administered by many Māori trusts and incorporations.

Successful Māori land claims are likely to result in the area of plantation forest on Māori-owned land increasing over time. This may lead to Māori having a significant influence on the future forestry sector in some regions of New Zealand, particularly in the central North Island.

III. IMPLICATIONS OF CURRENT AND FUTURE OWNERSHIP CHANGES[8]

Institutional investor management strategies have implications for the management and supply of wood from their forests. They want their forests to be geographically diverse as a way of reducing the impact of regional changes in supply and demand – they can sell when prices are high in one region and delay harvesting in regions where prices are low. This is likely to increase the volatility of wood supply and prices.

Institutional investor management strategies have implications for the management and supply of wood from their forests.

The 10 to 15-year investment period of TIMOs and their focus on returns over the lifetime of the investment have led to more rapid turnover in forest ownership. For example, in the US South, forests have been sold into real estate markets to cash in on real estate opportunities. This has a potentially negative impact on the stability of log supply. The focus on returns from the sale of forests has also led to changes in silvicultural intensity and productivity, with less investment that has long-term benefits (for example, silviculture research) and less expansion of plantation forest area (they prefer to buy existing forests). These affects are starting to be seen in New Zealand.

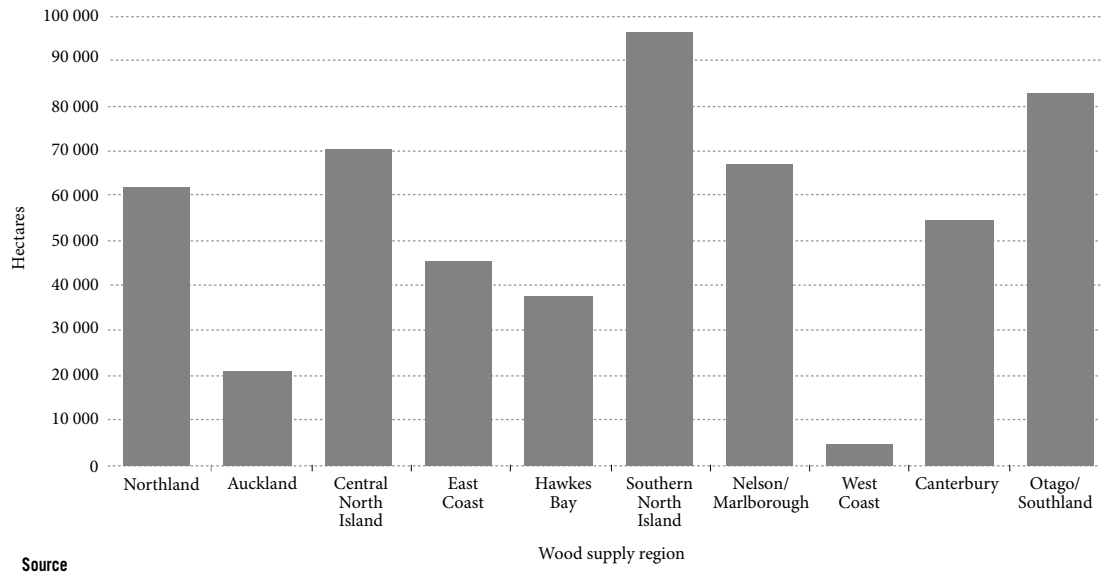
Forest products companies responded to changes in the US South and Scandinavian forest ownership by increasing the use of long-term contracting and long-term co-operative agreements as alternatives to vertical integration. Time will tell if the same happens in New Zealand, but for now TIMOs operating here have generally not put such agreements in place, which increases uncertainty of supply for wood processors and perhaps acts as a disincentive for new investment.

› SMALL-SCALE GROWERS

The term "small-scale grower" is used throughout this report to refer to a group of individuals

8 This section is largely based on research work by Maplesden and Turner (2006) that was commissioned by FIDA and majority funded (75 percent) by MAF.

FIGURE 4.1: PLANTATION FOREST OWNERSHIP BY SMALL-SCALE GROWERS



Source
MAF, 2007a

who each own less than 1000 hectares of exotic plantation forest. In total, they own 30 percent (MAF, 2006a) of the exotic plantation forest estate. Eighty-one percent of this resource is less than 15 years old, so while small-scale growers do not make up a large percentage of the current harvest, they will have an increasing role in the future log supply.

The largest area owned by this group is in the southern North Island (see Figure 4.1). The resource tends to be in quite small blocks and widely spread geographically. In the past, trees have often been planted in remote or steep areas where the land was unprofitable for other uses. Planting in difficult or remote areas often has substantial environmental benefits, but also higher harvesting and transport costs and consequently lower profitability compared with less difficult and remote areas.

Besides the regions in which these forests are located, not much is known about the small-scale forest owner resource when compared with our knowledge of the large-scale corporate resource. What we do know indicates it is likely to be more variable in a number of key areas, such as species and quality of silvicultural management.

Small-scale growers may have different motivations for planting compared with large-scale forest owners.

As forestry is not usually their main source of income, small-scale growers may have different motivations for planting compared with large-scale forest owners, and they can plant various species, plant trees on longer rotations and combine planting for financial gain with planting for amenity purposes.

In the past, there have been some hit-and-miss examples of matching species to site, quality of planting and quality/quantity of tending that will affect the quantity, quality and variability of wood harvested from these woodlots.

I. IMPACTS

Both the less precise information about the resource and the decision-making characteristics of small-scale forest growers raise some important questions for the future. One of the most significant is how much volume will come from the small-scale estate and when? Problems with trying to estimate available volumes from the small-scale estate are

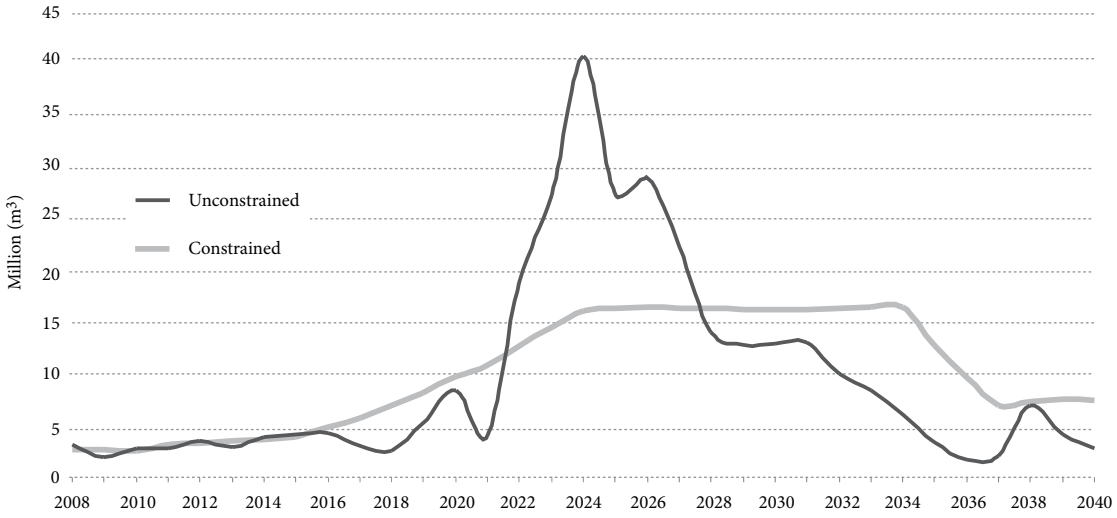
compounded by significant uncertainties around area descriptions.

An increase in available wood from small-scale growers will impact on many aspects of the forestry sector and on rural life. The sector and central/local government need to be planning now to ensure that this largely unallocated and variable forest resource is successfully and sustainably marketed and harvested. It will require investments in developing and maintaining a skilled labour force and in developing specialised machinery and equipment for the harvesting of these smaller, steeper and often remote blocks. In some instances, there may be opportunities for more use of portable sawmills to help overcome some of the logistical issues.

The decision on when to harvest will be based on different factors. Economic rotation age and meeting wood supply contracts may be a driver for larger owners but small-scale owners may change their objectives depending on changes in personal attitudes and/or circumstances, and the value they (and/or others) may place on downstream effects.

Based on the age structure of the small-scale growers' estate and assuming a harvest age of 30 years for radiata pine, theoretical wood availability from this estate could look like the "unconstrained" supply line in Figure 4.2. In reality, market pressures may temper this somewhat, for example, the price might be right but a shortage of harvesting crews may slow a potential flood, smoothing it out so that it might look something like the "constrained"[9] supply line in Figure 4.2.

FIGURE 4.2: WOOD AVAILABILITY FROM SMALL-SCALE FOREST GROWERS



The impact of the small-scale resource on total wood availability at the national level is described in Chapter 3, under the section "Future wood availability from plantation forests".

There may be a question over just how much of the small-scale resource might be harvested. A GIS[10] analysis by MAF in 2007 showed there are over 12 000 hectares of pine forests that are in blocks of less than 40 hectares, more than two kilometres from a road and on steep land (Class VI or more).

9 The constrained supply was modelled as part of developing the interim wood availability forecasts described in Chapter 3, in the section "Future wood availability from plantation forests".

10 GIS – geographic information system.

If we assume the areas are net stocked areas and the yield would be about 400 cubic metres per hectare, then there is a potential for nearly 5 million cubic metres per year to be taken out of the equation as described in Figure 4.2 (too small, too remote and too steep).

II. ECO-VERIFICATION FOR SMALL-SCALE GROWERS

Another issue facing the forest owner or wood buyer is environmental verification of wood products.

FSC certification is used by some New Zealand forest owners and processors to differentiate their product in the market. Some of the current FSC requirements are not able to be met by small-scale growers individually because of issues of scale. For example:

- The area of set-aside for indigenous vegetation reserves being demanded by environmental NGOs as a requirement for their endorsement of national standards would make FSC certification uneconomic for small-scale growers.
- The provisions around continuous harvest requirements would make it difficult, as it is possible that some small blocks would not be replanted because of owners' changing circumstances and/or investment needs.
- The cost of getting certified and maintaining certification is prohibitive.

Schemes for small-scale owners have been set up by a number of forest management companies so, as a group, they can overcome some of these barriers and get FSC certification. The New Zealand Forest Owners Association (NZFOA) has developed a national forest standard, but it hasn't yet been ratified by any of the main forest certification organisations such as FSC, or the Programme for the Endorsement of Forest Certification (PEFC).

While there are other sustainable forest management certification schemes available, FSC is currently the only one operating in New Zealand. If NZFOA's national forest standard is recognised by another scheme (for example the PEFC), then that would provide an alternative.

III. CO-OPERATIVE STRUCTURES

Co-operatives (co-ops) have a number of benefits, whichever sector of the economy they operate in, namely:

- information sharing;
- managing for multiple benefits; and
- bulk purchasing/selling power.

Forestry co-ops have been very successful overseas, with some owning infrastructure, machinery and processing facilities. The most frequent examples cited are those in Scandinavia, particularly Sweden and Finland, which have been in place for many decades, have thousands of small-scale members and, in some cases, even own pulp mills.

There are not many examples of forestry co-ops that have worked in New Zealand. Several have been set up, but most have collapsed. The reasons why forestry co-ops don't seem to work all that well in New Zealand are rather basic, and not dissimilar to the experience of failed forestry co-ops in the US (Turnbull, 1981):

- insufficient interest and support by members;
- inadequate capital;
- lack of sufficient volume of business; and
- inadequate management.

There is anecdotal evidence that many small-scale growers would rather forgo $10 per cubic metre in income than join a co-op, due to the fear of losing decision-making control, especially about the timing of harvest.

COLLECTIVE ACTIVITY

A lot of effort over the last few years has gone into building a more coherent view and voice across the forestry sector, which includes a wide range of ownership structures and investors. Four of

TABLE 4.1: INDUSTRY ASSOCIATIONS

NAME	WEB ADDRESS
Wood Council of New Zealand (WoodCo)	
New Zealand Forest Owners Association (NZFOA)	http://www.nzfoa.org.nz
Farm Forestry Association (FFA)	http://www.nzffa.org.nz
Wood Processors Association of New Zealand (WPA)	http://www.wpa.org.nz
Pine Manufacturers' Association (PMA)	http://www.pine.nz
New Zealand Timber Industry Federation (TIF)	http://www.nztif.co.nz
Forestry Industry Contractors Association (FICA)	http://www.fica.org.nz
Federation of Māori Authorities (FOMA)	http://www.foma.co.nz
New Zealand Douglas-fir Association (DFA)	http://www.douglasfir.co.nz
New Zealand Institute of Forestry (NZIF)	http://www.forestry.org.nz

the industry associations – Wood Council of New Zealand (WoodCo), Wood Processors Association (WPA), NZFOA, and Farm Forestry Association (FFA) – share office premises in Wellington. The close working relationship of these four associations, and the New Zealand Pine Manufacturers' Association (PMA) based in Nelson, can help the sector move forward in a coherent manner.

The forestry sector has a comparatively large number of industry associations, as well as cluster groups. Forestry cluster groups are active in several regions and each regional group tends to differ in its membership profile and activity. Key organisations are shown in Table 4.1 and more information about them is available on their websites.

WOOD COUNCIL OF NEW ZEALAND (WOODCO)

WoodCo is a pan-sector organisation owned by the sector's associations. Its primary objective is to provide a focal point for the sector. The WPA provides administration for WoodCo.

WoodCo is divided into two groups:

- The Log Producers Group comprises associations involved in forest ownership, forest management, harvesting, transportation and log marketing.

The forestry sector has a comparatively large number of industry associations, as well as cluster groups.

- The Timber Processors Group comprises associations involved in processing of logs and log derivatives, right up to distributing and marketing the products. The New Zealand Timber Industry Federation is the only major association that is not in this Group.

EFFECTIVENESS OF INDUSTRY ASSOCIATIONS

The associations generally have a low level of resourcing, especially when compared with other sector associations such as Federated Farmers or the New Zealand Seafood Industry Council. Most of the associations rely heavily on committee structures to carry out activities, with member companies donating staff time. While this often works well, the associations tend to lack capacity for the depth of work that is undertaken in other sectors.

The certainty of funding provided through a compulsory commodity levy (or similar) would help overcome some of these difficulties, but there is reluctance within the sector to pursue this option.

Reasons for this among forest growers include the belief that:

- the current voluntary systems are working well;
- the structure of the forest-growing sector (a few large dominant owners) is different from those industries for which the Commodity Levies Act 1990 was designed (for example, dairying, with many individual farm owners).

ENGAGEMENT BETWEEN THE FORESTRY SECTOR AND LOCAL GOVERNMENT

In New Zealand there are 12 regional councils, four unitary authorities (which act as both regional and district/city councils) and 70 district/city councils. In general, regional councils look after air, water, soil, the coast and discharges, while district/city councils look after land use, noise and subdivisions.

Three questions should be asked regarding engagement between the forestry sector and local authorities:

- Is the level of engagement by forestry companies and/or associations with local authorities sufficient to ensure the voice of forestry is heard?
- Are there recognised forestry sector representative bodies that local authorities can liaise with at the district and regional level?
- Do local authorities understand the needs of the forestry sector?

For example, councils are required to prepare long-term council community plans every three years. It is essential that the forestry sector participates in the plan process, as the plans will set the framework for council development, transportation and development contributions, the basis for the setting of rates, and the activities that a council will become involved in. The plan development process provides the opportunity to approve or object to a council's involvement in a range of activities that have an impact on rates.

RESOURCE MANAGEMENT ACT 1991

The Resource Management Act (RMA) should be able to help the forestry sector by streamlining the planning process and balancing investment and environmental management. That, however, has not happened in practice, and many in the sector claim it is more complicated and expensive than under the previous regime of the Town and Country Planning Act 1977. Provisions affecting forestry occur in a multitude of places within a regional or district plan. Previously, there was one principal provision for each rural zone.

In theory, the RMA concentrates on avoiding, remedying or mitigating the effects of activities, rather than regulating the activity itself. In practice, however, some argue that it ends up controlling activities, because activities are generally easier to define.

It is essential that the forestry sector participates in the plan process.

The RMA has a major role in forestry sector governance. The Act is often singled out by the forestry sector as a major frustration and, at times, a barrier to its development. The following are some of the concerns of many forestry sector participants:

- Consultation and participation in the RMA process is critical, but costly and time consuming for the sector.
- The statutory role of the Department of Conservation in providing advocacy for the natural environment is not counterbalanced by government agencies with responsibilities for economic or social development.
- Local authorities seem to inconsistently implement the RMA.
- There is a (at least perceived) lack of equitable treatment among land uses when implementation moves from controlling adverse effects to controlling activities.
- Central government (at least initially) does not

seem to have provided good guidance on how plans should be produced and structured. Therefore, the first round of plans that everyone has to operate under are mostly very poor.

- Many of the issues/effects that are used to oppose forest growing and wood processing development are subjective (for example, landscape, natural character), cannot be addressed through standards and therefore attract debate and controversy.
- Including landscape in section 6 of the RMA (matters of national importance) set forestry up for widespread control throughout New Zealand.
- Councils have failed to implement aspects of the RMA, such as "polluter pays".
- The level of overlap between district and regional plans raises the question of whether or not the unitary authority model provides a better system.

The 10-year reviews of existing regional and district plans began in 2007 and provide the forestry sector with an opportunity to challenge and resolve areas of concern.

WOOD PROCESSING AND THE RMA

It reportedly cost Blue Mountain Lumber $1.5 million to go through the resource consent process, and subsequent Environment Court hearing, for its Whangapoua sawmill proposal (McLean, 2005). The appeals by a community group were in large part upheld by the Court and the sawmill proposal was abandoned.

There have been high profile cases over the last decade or so that have followed a similar path. Wenita Forest Products proposed to establish an MDF plant at Allanton on the Taieri Plains, but the Otago Regional Council declined the air-discharge consent for the proposal. The company lodged an appeal, but then withdrew it and the proposal was abandoned. City Forests sought to establish a timber processing facility in North Taieri, but the land-use consent was appealed by two community groups, the appeals were upheld and the proposal

"The RMA constitutes the single biggest obstacle to the development of wood processing investment in New Zealand."

was relocated to another district. The costs to the companies have never been publicly stated.

In reviewing the forest wood processing investment environment, Brown and Ortiz (2001) reported that:

> *"The consistent message from interviewees was that the RMA constitutes the single biggest obstacle to the development of wood processing investment in New Zealand".*

Brown and Ortiz also reported that one company noted that the entire process, including consultation, hearings, legal advice and the installation of mitigating technology, had added 8 percent to the project cost. Another company estimated that re-zoning rural land for industrial use for a medium-sized sawmill would cost at least $300 000.

Some brownfield (existing site) expansions have been pursued because of potential difficulties with consents for greenfield (new) proposals. This could lead to sub-optimal mills and contribute to the New Zealand wood processing industry's lack of overall increase in competitiveness.

But is there another side to the issue?

When MAF considered some wood processing consents and Environment Court decisions in 2005, there was an indication that the sector was being somewhat unrealistic in its expectations, given the provisions in the district plans. That is not to say the provisions are entirely appropriate, but they are the existing provisions and therefore are what determine the success or failure of the applications. If one seeks to establish quite major industrial processing plants in rural zones when the plans fairly clearly advise that such ventures should be in industrial

zones, then it could suggest that the odds are against acceptance of the proposals.

So, what are the solutions?

One option could be a wider use of industry-agreed codes of practice or best management practices. The forestry sector has been active in developing and adopting Environmental Management Systems (EMS), Best Management Practices (BMPs) and Forest Accords and adopting certification standards. Examples include the New Zealand Environmental Code of Practice for Plantation Forestry 2007.

Many forest companies have comprehensive BMP manuals and environmental policies and can obtain global consents for many of their operations. Adhering to the BMP becomes a condition of such consents and the process also requires a good working relationship and trust being developed between a forest company and the local authority staff.

Global consents are resource consents that cover multiple activities in separate locations. The consents normally cover a series of activities that, although often geographically separate, are similar enough to enable relevant consent conditions to be drawn up to relate to all activities. It would appear that there is further potential for the use of the global consent process in the governance of the forestry sector by local authorities.

Expanding operations on more brownfield sites may be possible in some situations, for example, by increasing the number of shifts and/or putting in additional equipment. However, this is unlikely to accommodate the additional quantity of wood forecast to become available over the next decade and more. Moreover, mill upgrades may not lead to optimal mill design (such as the flow of wood through the mill) or location. On the other hand, total rebuilds might be possible in some situations

Wider use of industry-agreed codes of practice or best management practices.

and many sites developed in the 1970s and 1980s now have more land than is needed for modern mill configurations.

When selecting new wood processing sites greater focus could be put on the provisions of district plans and locating in industrial zones, rather than on operational considerations. But that also may lead to sub-optimal outcomes in terms of location and traffic flows.

It is vital that the forestry sector, especially the wood processing industry, participates in the 10-year reviews of district and regional plans. This is needed to promote appropriate provisions for future forestry and wood processing facilities. Ultimately, it is the policies, objectives and methods of implementation contained in the plans that determine where resource consents are needed and whether they will be approved. This is possibly the best option for the forestry sector if it is to ensure better regulatory outcomes.

FORESTS ACT 1949 AND TE TURE WHENUA MĀORI ACT 1993

FORESTS ACT

The Forests Act 1949 has two main operational parts: Part IIIA, relating to indigenous forests, and Part IIIB, allowing landowners to access value created by the Kyoto Protocol of carbon sequestration on land through the establishment of forest sink covenants.

Part IIIA requires any mill processing indigenous timber to be registered. A registered mill can only process indigenous timber harvested under:

- an approved sustainable forest management plan;
- an approved sustainable forest management permit;

› "other provisions" of the Act that cover salvage timber, windthrow (uprooted) trees or dead standing trees, timber felled for a public work, for a mining operation, for building or maintaining an accessway or water impoundment or for scientific research, timber for personal use and timber from exempt land.

Part IIIB of the Forests Act enables landowners to establish permanent forest sinks and earn tradeable Kyoto-compliant carbon credits under certain conditions. These conditions include that the:

› land must not have been in forest cover as at 31 December 1989;
› forest must be the result of direct human involvement, for example, through planting, seeding and/or the human-induced promotion of natural seed sources;
› landowners' rights and obligations will be specified under contracts operating in perpetuity that are registered against land titles;
› landowners will be required to replace carbon credits earned for any carbon dioxide that is released back into the atmosphere;
› harvesting will be allowed under continuous canopy forest management.

As the terms of the Kyoto Protocol have only been negotiated for the first commitment period (2008 to 2012), the long-term eligibility of carbon credits from forest sinks under the Protocol is yet to be established.

Part IIIB will be administered by MAF Policy on a cost-recovery basis. Section 15B also provides for the collection and dissemination of statistics by MAF.

› TE TURE WHENUA MĀORI ACT

Te Ture Whenua Māori Act 1993 has its foundations in the Treaty of Waitangi, and is described as a code for dealing with Māori freehold land. It has three key areas of focus:

New Zealand does not have a "comprehensive" national forest policy.

› confirmation by the Māori Land Court of all transactions involving Māori freehold land;
› the land should stay with the owners, their whānau and hapū, the descendant group associated with the land;
› when an owner wishes to sell or deal with land, consent of the owners is required.

The Act has important implications for the way Māori land can be managed. It makes it difficult to purchase Māori land, but seeks to overcome the problem of fragmentation of titles among multiple owners by providing for various kinds of trusts under which Māori land can be managed.

»» NATIONAL FOREST POLICY

New Zealand does not have a "comprehensive" national forest policy. Domestically, there have periodically been calls for a "comprehensive" forestry policy from forestry sector representatives; and internationally, New Zealand is often asked about the absence of such a policy.

Westoby (1983) concluded that there are at least three reasons why a declared forest policy is desirable:

› **EDUCATIONAL** – An effective national policy for any resource depends as much on informed public opinion as on official statutes, decrees and regulations, or actions by specific interest groups. If the ideas and principles underlying such a policy are widely known, discussed and understood, the tasks of implementing the policy are greatly simplified.
› **LONG-TERM CONTINUITY** – If a country has a declared policy that is clearly aligned with the long-term national interest and commands a broad consensus, there is less temptation to depart from it for short-term expediency and any departures are likely to be exposed in public debate.

› **MANAGEMENT DECISIONS** – Agencies will find it easier to exercise sound judgement if guided by a clearly understood policy.

For the last couple of decades the economic and regulatory regimes set by New Zealand governments have provided the framework within which strategic decisions have been made. A national forest policy might provide a co-ordinating mechanism for government and private sector initiatives, but there are also questions about whether such a policy would deliver superior outcomes to those achieved under the current approach.

The co-operation that was the hallmark of the New Zealand forestry sector up until the 1980s has been lost through diverse ownership and corporate manoeuvrings.

Forests and forestry have a strong connection with a good deal of government policy. There are many existing policies (and associated legislation) and mechanisms that deal with specific parts of the forest estate and with the business of forestry, or have significant impacts on forestry. These include:

› Parts IIIA and IIIB of the Forests Act 1949;
› Conservation Act 1987;
› Biosecurity Strategy;
› Biodiversity Strategy;
› Forest Industry Development Agenda (FIDA);
› Sustainable Land Management Programme;
› East Coast Forestry Project;
› Emissions Trading Scheme (currently under review)
› Permanent Forest Sink Initiative;
› Afforestation Grant Scheme;
› international conventions and negotiations relating to sustainable forest management;
› illegal logging;
› public good science funding;
› objectives, policies and rules in regional and district plans.

The commercial forestry sector has also moved over the last couple of decades from one dominated by large(ish) vertically integrated corporates to one operating in a more fractured nature. The co-operation that was the hallmark of the New Zealand forestry sector up until the 1980s has been lost through diverse ownership and corporate manoeuvrings that are sometimes focused on short-term strategies. Initiatives since the late 1980s to establish a pan-sector body have not succeeded in the long-run. It is clear that the sector has a long-held interest in establishing a mechanism that provides it with a focal point. WoodCo is the most recent initiative that will hopefully provide some long-term benefits. Equally clear are the difficulties the sector has in supporting an enduring mechanism; for example, the suggested concept of "flying in formation" (Edgar et al, 1992) only highlights the underlying approach of preparing individual flight plans.

Given the apparent desire to act independently, would a co-ordinating mechanism make any practical difference?

THE ROLES OF GOVERNMENT

5

OVERVIEW

This final chapter dealing with the setting within which the forestry sector operates concerns the roles of government. Historically, central government did not just have a major influence on the operating environment, but was directly involved in the development of the commercial forest industries. That has changed dramatically over the last 20 years, but other roles that support or indirectly influence the development of the forestry sector are enduring.

DRIVERS

The institutional foundations that impact on sustainable development in New Zealand are unlikely to change, with:

- historically secure property rights, an independent, transparent and efficient legal system, and lack of corruption favouring long-term investment in the New Zealand forestry sector;
- the Treaty of Waitangi focusing the Crown and Māori on making genuine efforts to reach agreements over government actions that may affect Māori use of their lands and forests.

Government engagement has been critical in the development of the forestry sector and will continue to influence it because:

- governments set the macro-economic and regulatory environments within which investment and management decisions are made;
- there are circumstances when markets fail to deliver the best outcomes for society.

THREATS

However, government actions may:

- create uncertainty around policy stability and property rights that will impact on long-term forestry investment decisions;
- result in inequitable outcomes for different sectors of the economy;
- fail to achieve the desired outcome.

OPPORTUNITIES

The key opportunities for government engagement in, or through, the forestry sector include:

- providing mechanisms to recognise positive externalities associated with climate change and sustainable land management (particularly soil erosion and water quality);
- leading international forestry-related negotiations where government has a critical role that the private sector cannot fulfil;
- ensuring access to knowledge systems that support good decision-making.

Government engagement in the establishment of long-term personal savings schemes may provide opportunities for forestry through lower costs of capital and more venture capital and infrastructure investment.

CORE FUNCTIONS

Cullen (2003) notes that:

> *Any discussion of the role of government needs to begin with the core functions of government which are timeless. Governments create the nation state and ensure the safety and security of the citizenry. They create internal order, and they create markets through which citizens can specialise in economic production and exchange the rewards from their labour and the returns to their capital.*

Within the economy, the Government acts as a regulator and a definer of property rights, it redistributes resources within the community,

it provides infrastructure and a range of goods and services to businesses and the public. The Government also seeks to create an environment within which market activity can flourish, and provides leadership to sectors of the economy and to communities.

Governments have an important role in establishing and maintaining economic, social and environmental knowledge systems, and facilitating access to them. Sound knowledge systems are required to support the development and implementation of policy by government, for public participation in government and for decision making by resource managers, investors and the public. The Official Information Act 1982 is intended (in part) to enable more effective participation by the people of New Zealand in the making and administration of laws and policies.

»» PROVIDING STABLE INSTITUTIONAL FOUNDATIONS

The economic development of a country rests as much on its legal and institutional foundations as it does on its physical resources. While a country may have abundant natural resources, it is unlikely to attract capital and skills unless investors can be assured that their property rights are secure and that contracts will be honoured. Countries with high levels of corruption, inefficient judicial systems and insecure property rights struggle to attract and retain capital. The increasing mobility of capital (and labour) over recent decades has brought this issue to the fore in many countries (Riddell, 2000).

New Zealand is competing for scarce capital and labour resources. In some respects, New Zealand has required more overseas capital than many other countries in the Organisation for Economic Co-operation and Development (OECD), due to the nation's historically low rate of domestic savings.

However, New Zealand is well placed to attract overseas capital because it fulfils the criteria mentioned above. It:

- has a secure system of property rights;
- has a strong reputation for a fair and efficient judiciary;
- is viewed as one of the least corrupt countries in the world.

The Government acts as a regulator and a definer of property rights.

Moreover, the Treaty of Waitangi is the foundation for the relationship between the Crown and Māori, including how government actions may affect Māori use of their lands and forests. Government also sets the macro-economic and regulatory environments and is able to intervene if the market fails.

› SECURE PROPERTY RIGHTS AND NEW ZEALAND'S LAND TENURE SYSTEM

Internationally, New Zealand is seen as having a stable system of property rights that is supported by a legal and judicial framework that upholds individual ownership and the enforcement of contractual arrangements. These legal foundations are a major drawcard for international forestry investors, whether they are seeking direct ownership of forestry assets, secure long-term lease arrangements or joint partnerships. The number of lease and management agreements signed over the past 20 years is a clear sign that international investors respect the legal and property rights framework in New Zealand.

Moreover, where a country has established property rights legislation and a record of upholding these rights, investors generally move their focus from extracting the maximum benefit from a resource, in the shortest amount of time, to building the quality of the asset. This frequently means investment in broader infrastructure, environmental management and even the social capital of the community.

Internationally, New Zealand is seen as having a stable system of property rights.

However, in recent years, prominent property rights issues have come to the fore in New Zealand. These have been associated with the seabed and foreshore legislation, policy development concerning land access provisions and the use of water, and (for the forest-growing industry) with respect to deforestation, access to carbon credits, and the regulation of land use to mitigate nitrogen leaching. Government actions that impact on property rights are invariably contentious. At the RMA level, the presumption is that compensation is not payable in respect of controls on land, although provisions in plans can be challenged if they would render the interest in land "incapable of reasonable use" (RMA, section 85).

The potential for erosion of property rights without compensation results in uncertainty, which is an issue for forest owners, perhaps particularly for international forestry investors who have experienced changes in property rights that impacted on their businesses in other countries.

THE ROLE OF JUDICIAL SYSTEMS IN SUPPORTING ECONOMIC GROWTH

From a commercial perspective, a fair and efficient judiciary is essential for promoting business activity, resolving commercial disputes and preventing the misuse of discretionary powers by individuals or institutions (Posner, 1998: 1). New Zealand has a strong reputation in this respect.

The time delay associated with Environment Court cases has been an area of concern, but due to additional resourcing an appeal to the Court for a resource consent can now be heard within six months (Ministry for the Environment, 2006c), whereas previously delays could be between 18 and 24 months.

INVESTMENT AND CORRUPTION: HOW IS NEW ZEALAND PERCEIVED?

Persistent corruption has serious implications for the economic and social well-being of a country. Wei (1998) summarised the implications of high levels of corruption by stating that corruption:

- places additional costs on carrying out business (for example, unofficial payments, additional inspections and an expectation of free goods and services);
- discourages foreign capital, as companies are turned away by the additional costs of doing business and the lack of investment certainty;
- has the potential to reduce domestic growth rates;
- tends to skew public investment from areas such as education and health to projects where bribes can be more easily extracted (such as defence);
- causes distortions in the labour market;
- can accentuate income imbalances within a country.

Internationally, New Zealand is viewed as one of the world's least corrupt countries to operate in (Transparency International, 2005; World Audit, 2006). A number of forestry companies have stated this as a key factor in investing in New Zealand.

New Zealand's lack of corruption stems from a number of interrelated factors:

- no historical culture (or ethic) of informal payments or bribery;
- an independent judicial system and police force, which have stringent audit and complaint procedures;
- a relatively well-paid civil service that does not depend on secondary sources of income;
- freedom of the press, which allows cases of corruption to be readily identified;
- a strong public commitment to the rule of law.

THE TREATY OF WAITANGI

The Treaty of Waitangi establishes the foundation for the relationship between the Crown and Māori.

It gives rise to duties on the Crown as matters of conscience, where the Crown should comply as far as practicable. The Treaty does not generally give rise to legal obligations on the Crown, unless given force of law by an Act of Parliament (Te Puni Kōkiri, 2001).

The Courts have emphasised that there are two core principles arising from the Treaty. The principle of partnership between the Crown and Māori has been regarded by the Courts to:

- include the obligation on both parties to act reasonably, honourably and in good faith;
- not necessarily describe a relationship where the partners share national assets or resources equally;
- involve fiduciary duties[11].

(Te Puni Kōkiri, 2001)

The principle of active protection has been considered primarily in association with property interests guaranteed to Māori under Article II of the Treaty. It has been interpreted by the Court of Appeal (New Zealand Māori Council v Attorney General, 1987 – the Lands case) "as not merely passive, but extending to active protection of Māori people in the use of their lands and waters to the fullest extent practicable".

There have been a number of prominent Treaty claims relating to indigenous forests that contended that the Crown was in breach of the principles. The WAI 158 Claim on behalf of South Island Landless Natives Act 1906 (SILNA) landowners asserted that the Crown's indigenous forest policy breached the Treaty with respect to potential restrictions on clearfelling and the export of wood chips. WAI 1090 was similarly focused on the removal without compensation of the claimed right to export unsustainably harvested timber.

11 Fiduciary duties arise where one party to a relationship has a legal power that may affect the interests of the other party, and thus has a duty to act in a way that protects the interests of the affected party.

Māori have fundamental interests in any government policy initiatives that may affect Treaty rights associated with their lands and forests.

The WAI 262 claim is currently before the Waitangi Tribunal and contends that the Crown has:

- failed to actively protect the exercise of tino rangatiratanga and kaitiakitanga by the claimants over indigenous flora and fauna, other taonga and matauranga Māori (traditional knowledge);
- failed to protect the taonga itself;
- usurped tino rangitiratanga and kaitiakitanga of Māori in respect of flora and fauna and other taonga through the development of policy and the enactment of legislation;
- breached the Treaty by agreeing to various international agreements and obligations that affect indigenous flora and fauna, intellectual property rights and rights to other taonga.

(Ministry of Economic Development, 2007)

Clearly, Māori have fundamental interests in any government policy initiatives that may affect Treaty rights associated with their lands and forests.

Treaty claims have also been lodged over the 90 former Crown (plantation) forest lands. At March 2008, there were 53 Crown forest lands claims to be resolved (Crown Forestry Rental Trust, 2008). In 2001, it was estimated that, when Treaty claims have been resolved, Māori could own up to 41 percent of the land underlying New Zealand's plantation forests (MAF, 2001), but some areas subsequently secured through settlements have been on-sold.

A MARKET-BASED ECONOMY, MARKET FAILURE AND INTERVENTION

A market-based economy theoretically optimises social benefits in an environment of perfect competition without government intervention. Markets send price signals through changes in

supply and demand that guide resources to their most highly valued uses over time, and work to maximise the returns on investments.

Should the market not work perfectly (market failure), however, the Government may consider intervention. The four traditional market failures concern:

- **PUBLIC GOODS** – where goods are non-rival and non-excludable, that is, they can be consumed by everyone and no one can be excluded;
- **EXTERNALITIES** – where the actions of individuals or firms affect others, but the costs or benefits are not reflected in the values of their transactions;
- **MONOPOLIES** – where there is only one seller of a product who generally has market power to raise (or lower) the product price;
- **INFORMATION ASYMMETRY** – where transactions between the seller and the buyer involve different sets of information.

The mechanisms available for intervening in the market include:

- legislation and regulation to direct activities;
- a public service to provide policy advice, implement agreed policies and deliver agreed services;
- finance for the provision of goods and services through private enterprise;
- facilitation through a range of active and passive approaches to encourage behaviours consistent with aspirations.

While market failures provide some justification for government intervention, the benefits must still exceed the costs of intervention. Interventions should aim to deliver an effective and efficient regime that fosters an entrepreneurial environment where innovation and growth can be rewarded and compliance costs can be minimised. It must also be remembered that government interventions can fail too.

The extent of intervention and the mix of delivery mechanisms that are applied depend on the nature of the issue being addressed and on the underpinning philosophy of the Government. In the 1970s to the mid-1980s, the style was strongly interventionist. From the mid-1980s through the 1990s, the style was strongly market-based. Recent years have seen a focus on structured industry engagements.

GOVERNMENT ENGAGEMENT IN THE FORESTRY SECTOR

The plantation forestry sector was largely established and developed through government vision, targeted policies, direct involvement through forest and sawmill ownership, and a range of incentives to encourage private investment.

Providing leadership in partnership with the private industries, sending clear signals about its vision for forestry, and ensuring effective and efficient regulatory and economic frameworks are important roles for government.

In the mid-1980s, the Government considered it was not the most appropriate entity to run a commercial forestry business (or other businesses), with management decisions too easily influenced by political objectives. The shift from direct participation and a strongly interventionist role to a position focusing on the macro-economic and regulatory environments represented a huge shift in government policy for the forestry sector. However, the replacement of, at times, unpredictable government policy with free market signals was soon seen by a mature industry as more sustainable (Rhodes and Novis, 2002).

Providing leadership in partnership with the private industries, sending clear signals about its vision

for forestry, and ensuring effective and efficient regulatory and economic frameworks are important roles for government in creating a positive environment for decision making and investment that supports sustainable development. For the forestry sector, recognition of the long-term nature of investment is also critical.

Local government exists (in part):

- where central government has transferred its authority to a lower level of government (devolution);
- as an implementing agent for central government policy (decentralisation);
- to provide local public goods, services and some infrastructure.

The major engagements by local government that impact on the forestry sector are through implementation of the Local Government Act 2002 and the RMA.

THE NATURE OF ENGAGEMENT IN THE FORESTRY SECTOR

Two levels of central government engagement in the forestry sector can be recognised, although the boundaries are not always distinct. The first is about the provision of such things as education, research, biosecurity, statistics, some infrastructure, the undertaking of international dialogues and negotiations, and the setting of the broad economic and regulatory regimes. These may be seen as enduring "core functions", although the nature and extent of their undertaking and delivery may vary as government objectives change.

The second is about "actions" that are more direct and issue-specific, which tend to have a short to medium-term focus. In a forestry context, they have included the provision of subsidised government-owned wood to support processing investments and regional development, the provision of financial incentives to encourage afforestation, the undertaking of joint venture investments with Māori landowners and the provision of extension services.

Internationally, the focus will be on sustainable forest management, illegal logging, avoiding deforestation and trade-related issues.

Historically, the direct involvement of the state in the forestry sector through large-scale ownership of forest resources and processing plants provided for more engagement through resource control, product innovation and sector leadership. Since the year 2000, there has been a return to more active industry policy and structured engagements between industry and government. For the forestry sector, this has evolved through the Wood

TABLE 5.1: CASH EXPENDITURE ON MAJOR FORESTRY SECTOR ACTIVITIES BY GOVERNMENT, 2000 TO 2007

SERVICE	AMOUNT ($)
Research	139 500 000
Biosecurity	84 432 000
Wood Processing Strategy	43 445 000
Forest Industry Development Agenda	18 200 000
East Coast Forestry Project	17 041 000
Sustainable Farming Fund	2 962 000
South Island Landless Natives Act 1906 land	1 347 000
Research etc to support forest policy advice	964 000
Total	**307 891 000**

Source: Eyre, 2007.

Note
These figures represent cash payments for services and do not include departmental operational costs.

Processing Strategy, the Forest Industry Framework Agreement and the current Forest Industry Development Agenda (FIDA).

› FUTURE GOVERNMENT ENGAGEMENT IN THE FORESTRY SECTOR

The "core functions" that central government provides will continue to influence the development of the forestry sector.

Central government's role is predominantly where forestry or land use may have national or international environmental costs and benefits, such as sustainable land and forest management, carbon sequestration, deforestation and illegal logging. The need for engagement is also influenced by consumer demand, for example, for products from the sustainable management of resources.

Domestically, additional attention is likely to focus on the use of trees and forests to mitigate environmental externalities from activities that produce greenhouse gases and from unsustainable land uses (in addition to the economic benefits). Engagement to address environmental externalities is likely to follow a similar path to past economic interventions, that is, an initial focus on regulatory and incentive-based interventions, with progressive moves to more market-based instruments such as tradeable rights and the facilitation of environmental markets.

Internationally, the focus will be on sustainable forest management, illegal logging, avoiding deforestation and trade-related issues. The importance of international forestry-related issues and negotiations around sustainable forest management and trade is increasing, and the pressure to deliver solutions to environmental problems in the global arena will continue to develop. These are largely intergovernmental activities where government must take a lead, with the private sector in support.

Engagement needs to be supported by effective monitoring of the outcomes, intended and otherwise. This is made more difficult in the forestry sector by the longer timeframes that may be associated with responses to new initiatives.

› FOREST INDUSTRY DEVELOPMENT AGENDA

The FIDA is a relationship between the forestry sector and the Government. It provides a means for the Government and the sector to develop a strategic approach for the sector's future growth. The Government is doing this because it recognises the sector's significant economic, social and environmental contributions, including in respect of climate change, and its potential to become New Zealand's number one export earner.

TABLE 5.2: FUNDING FOR THE FORESTRY INDUSTRY DEVELOPMENT AGENDA

INITIATIVE AREAS	GOVERNMENT FUNDS ($ MILLION, EXCLUDING GST)	EXPECTED INDUSTRY FUNDS ($ MILLION, EXCLUDING GST)	DURATION OF FUNDING
Market development	8.00	2.66	2005/06 to 2008/09
Market access	1.24	0.42	2004/05 to 2008/09
Bioenergy	2.49	N/A[1]	2004/05 to 2008/09
Labour and skills	4.44	N/A[1]	2004/05 to 2008/09
Excellence in wood design	2.01	0.68	2004/05 to 2008/09

Source: Eyre, 2007.

Note
1 These initiative areas are fully government funded.

The FIDA has been running since April 2005. The Government allocated $18.2 million (excluding GST) to the FIDA process through to July 2009 (Table 5.2). Industry co-funding is required for some projects.

These long-term saving schemes could result in lower costs of capital to businesses, and more venture capital and infrastructure investment.

› POOLS FOR CAPITAL INVESTMENT

Interventions directed at other parts of the economy and at society can also have important outcomes for the forestry sector. In the last few years, there have been two major government initiatives to address long-term savings for superannuation: the New Zealand Superannuation Fund and KiwiSaver.

Both of these long-term saving schemes are likely to generate sizeable funds for investment in international and domestic markets and could result in lower costs of capital to businesses, and more venture capital and infrastructure investment (Daniels, 2007). These outcomes may be very positive for the forest industries.

The New Zealand Superannuation Fund will receive $2.2 billion per year in government contributions for the next 20 years, and is expected to grow to around $120 billion by 2025 (Peart, 2007). The investment strategy developed by the fund's Board of Guardians will result in a significant proportion of the fund being invested locally, and the new National-led Government has signalled its desire to increase this further. As at October 2007 the fund had a 5 percent target strategic asset allocation to the private timber market.

KiwiSaver is also expected to result in billions of dollars in private savings schemes. While much of this will go to offshore investments, a significant amount of capital is likely to be available for investment in New Zealand.

› OUTCOMES OF SOME RECENT GOVERNMENT ENGAGEMENTS IN THE FORESTRY SECTOR

Government has undertaken a number of significant on-going or targeted activities within the forestry sector over the last couple of decades, with a range of outcomes.

One of Government's major engagements in the forestry sector is through the provision of biosecurity services for the protection of the country's flora and fauna (addressed in Chapter 12). As no serious forest pests or diseases are known to have become widely established in the last 10 years, the engagement should be regarded as largely successful.

Several government departments are involved in international forestry work that focuses on market access and sustainable forest management. World Trade Organization (WTO) negotiations to reduce or eliminate tariff and non-tariff barriers, and bilateral negotiations to address market access issues, are of fundamental importance to an export-oriented sector. Sustainable forest management and the role of plantation forests have become increasingly prominent global issues since the Rio de Janeiro Earth Summit in 1992, and are now closely linked to the acceptability of trade in forest products. Success is commonly masked by the slow pace of international negotiations, but the potential economic and environmental gains are considerable.

Climate change policies have been a key focus in recent years, given the important roles of forests in sequestration and storage of carbon. This work has been contentious and resulted in, at times, heated dialogue between the Government and the private sector. It is an example of the complexities and difficulties of engagement in an issue associated with

common pool resources, the pricing of externalities and perceptions of property rights.

The FIDA has produced a number of outputs, such as the NZ Wood programme to promote the benefits of wood, the development of training facilities for wood processing, and the establishment of professorial positions in wood design. However, its outcomes in moving the industries forward can only be assessed in coming years.

In 1992 the East Coast Forestry Project set out to establish 200 000 hectares of forest over 28 years. After 14 years, 33 000 hectares have been established, and the project has undergone two major reviews to re-focus its objectives. The reviews highlighted the limitations of financial grants and the importance of their design in achieving land-use change. The forestry loans and grants schemes of the 1960s, 1970s and 1980s faced similar problems and numerous reviews.

The indigenous forestry provisions in Part IIIA of the Forests Act 1949 have stopped clearfelling of indigenous forest, while providing a robust framework to sustainable levels of harvest. However, over the 15 years during which Part IIIA has operated, the sustainably harvested volumes of indigenous timber have dwindled to insignificance compared with exotic plantation forests. Reasons for this include competition from imported timber products free of similar constraints on sustainability and legality of harvesting, and the high costs of administering and meeting the requirements in the legislation.

The collection and dissemination of forestry statistics is an engagement that is widely regarded throughout the forestry sector as successful. The independence of government is important in establishing the credibility of the information. To the fore has been the National Exotic Forest Description (NEFD), which has operated as a

Sustainable forest management and the role of plantation forests have become increasingly prominent global issues.

partnership between the Government and the forestry sector for more than two decades. It perhaps provides a model for managing some future long-term engagements between the Government and the forestry sector.

› MINISTRY OF AGRICULTURE AND FORESTRY

MAF is the Government's primary advisor on the forest industries, on their economic and environmental performance and on legislation governing forestry activity. MAF leads New Zealand's biosecurity system and also has lead roles in international forestry matters with the Ministry of Foreign Affairs and Trade, in particular relating to sustainable forest management and trade, and in biosecurity.

I. MAF BIOSECURITY NEW ZEALAND

MAF Biosecurity New Zealand is the lead agency in New Zealand's biosecurity system. It has a "whole of system" leadership role, encompassing economic, environmental, social and cultural outcomes. It also has international trade and animal welfare responsibilities. Fundamental to its outcomes are the prevention and reduction of harm from pests and diseases to the natural environment and resources of economic and cultural value to Māori.

II. MAF POLICY

Forestry-related activities are spread across most of MAF Policy's business groups, with a broad portfolio of engagement in international forestry policy, trade development, economic policy and industry development, sustainability and environment, resource management and allocation, climate change, and information and statistics.

a. East Coast Forestry Project

MAF Policy administers the East Coast Forestry Project. The Project's objective is to target for protection 60 000 hectares of the most at-risk (erodible) lands plus immediately surrounding areas. This will be achieved mainly through commercial forest planting.

b. Indigenous Forestry

MAF Policy also administers the indigenous forestry provisions (Part IIIA) of the Forests Act 1949. It is responsible for the registration of sawmills approved to process indigenous timber, the approval of sustainable forest management plans and permits, and the monitoring of timber exports.

c. Statistical information

The collection and disclosure of statistical information is a function specifically identified in the Forests Act 1949 that is administered by MAF Policy. The NEFD records the area of exotic plantation forest and is run as a partnership between MAF and the NZFOA. In addition, MAF holds an important independent position that enables it to collect, compile, interpret and disseminate authoritative statistical and associated information on the New Zealand forestry sector.

MAF also contributes to New Zealand's obligations to provide key statistical information to the international community by responding to international questionnaires for organisations such as the Food and Agriculture Organization (FAO) of the United Nations, the International Tropical Timber Organisation (ITTO) and the OECD.

d. Climate change

MAF is a key agency in the provision of statistics and information to enable the calculation of the national greenhouse gas inventories for forestry (and agriculture) under the United Nations Framework Convention on Climate Change (UNFCCC). MAF also contributes key forestry data on planting rates, harvesting and estimates of deforestation, and inputs into UNFCCC and domestic policy processes. The forestry (and agriculture) components of an ETS, if implemented, will probably be administered by MAF under a memorandum of understanding with the Ministry of Economic Development (the administering agency of an ETS).

PART 2
FORESTRY SECTOR INPUTS AND OUTPUTS

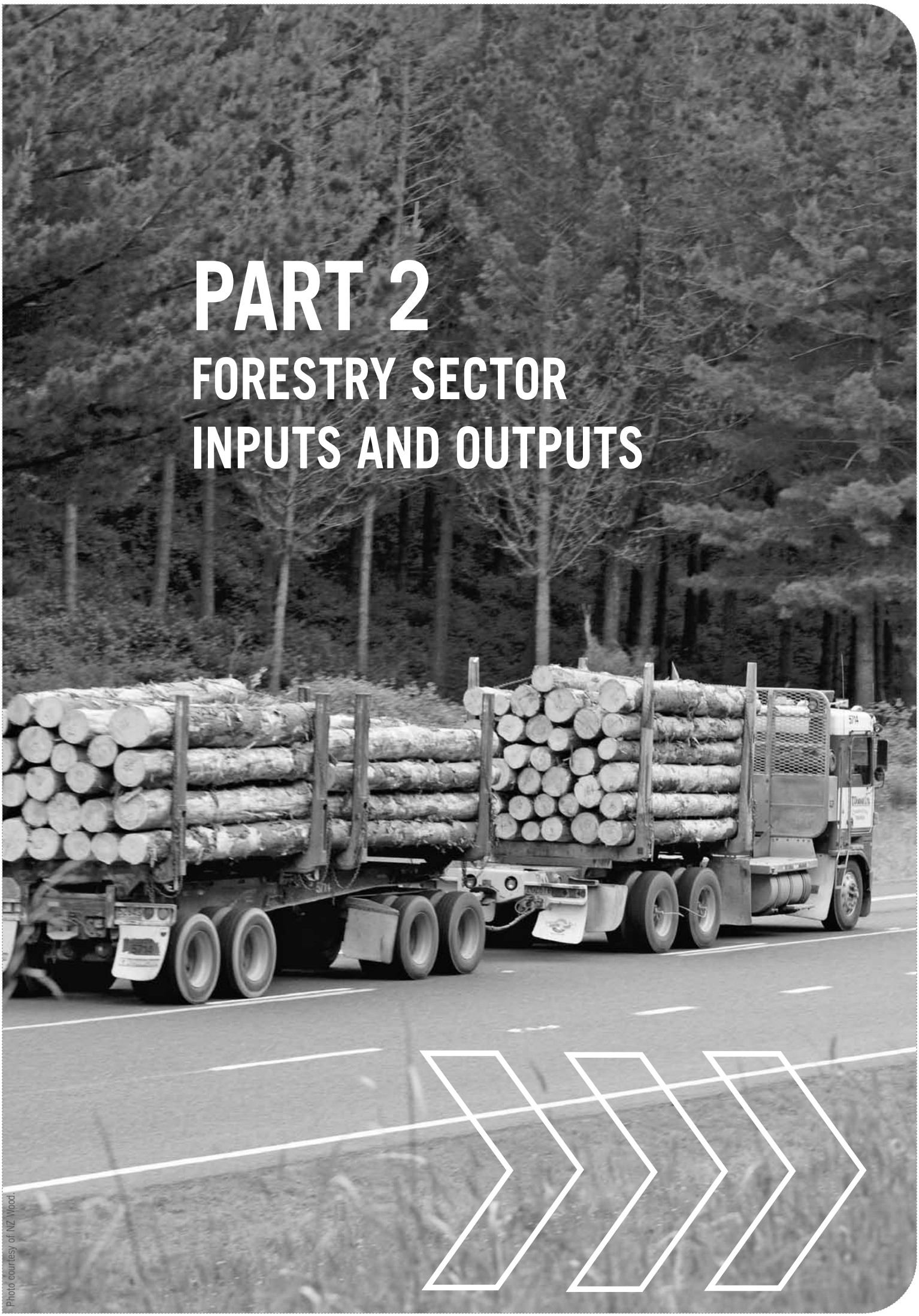


Photo courtesy of NZ Wood.

FORESTRY SECTOR INPUTS

6

OVERVIEW

This chapter considers what the forestry sector needs to make it work, such as people, finance, energy and transport.

DRIVERS

Energy and transport are important inputs that drive the forestry sector:

- The wood processing sector is New Zealand's major energy consumer and also a major energy generator.
- The wood and paper product industry is New Zealand's second-largest electricity user (after metal manufacture).
- A modern transport network is required to move wood efficiently from the forest to processors, wholesalers and customers (both domestic and international).
- New Zealand's annual sea cargo is a small fraction of international trade and it is generally treated as an extension of Australian trade routes.
- New Zealand is an isolated country at the end of the sea freight network; its closest market, Australia, is a minimum of four days' travel by sea.

THREATS

Input-related threats to the forestry sector include:

- The uncertain availability of labour with the required skills.
- New Zealand's environmental performance requirements and legislation, where these are higher than those in competing countries.
- Sawmilling profitability suffering from squeezed margins, which is exacerbated by the separation of forest ownership from sawmill ownership and the former's push for log export parity pricing.
- The silviculture and harvesting contract bidding system may keep costs down in the short-term but provides little incentive to invest in skill development.
- New Zealand's comparatively low wage rates for forestry employment, which makes the sector vulnerable to "cherry picking" by overseas companies, research institutions, other sectors and government agencies.

OPPORTUNITIES

There are a number of opportunities, however:

- A vibrant processing sector paying high prices and demanding ever-increasing volumes of wood will encourage new investment.
- Revenue may be gained from selling forest ecosystem services or carbon offset potential.
- There are opportunities for reducing the burden of freight costs, including sea freight.
- Where forestry companies include incentive payments for training, there are positive gains in workforce stability and productivity. Longer-term contracts with training recognition clauses are a significant opportunity.

INVESTMENT

Investment in the New Zealand forestry sector can be split into two related areas:

- the investment needed to maintain and/or expand the existing level of resource;
- the capital necessary to process that resource and respond to consumer demand.

A perceived lack of profitable processing alternatives will make it hard to attract new (or maintain the existing) investment in forest growing. Yet, whether it is concerns about climate change and New Zealand's options for dealing with this or about the sustainability of existing land uses, trees are increasingly being seen as an answer (Oram, 2007).

When environmental externalities are brought into the equation, the value of trees can be seen more clearly.

General factors that influence investment decisions in forest growing and wood processing include (not in any order):

- operating costs, capital costs, size of margins and an acceptable return on capital;
- availability of labour with the required skills;
- tax regimes;
- environmental performance requirements and legislation;
- good infrastructure;
- stable institutional foundations;
- availability of government and sector support;
- belief by company managers that wood processing is desirable.

INVESTMENT IN FOREST GROWING

The most immediate challenge to ongoing investment in the forest-growing industry is to convince potential investors that it is capable of offering reasonable investment returns. A vibrant processing sector paying high prices and demanding ever-increasing volumes of wood might make it easier to formulate that case. However, real log prices today are half what they were in 1993, and MAF's price projections do not indicate that real increases are likely; while demand is relatively buoyant at present, the harvest level today is still 10 percent lower than that recorded in 2003. (Some factors associated to current market conditions are also described in Chapter 3 sections "Harvesting" and "Land-use change".)

Differential rates of change in land prices for different uses always offer prospects of capital gain for the landowner who can sell or convert from a use with low or slow increases to one where the prices are rising rapidly. However, for such gains to be sustainable in the longer term, the increase in land value needs to be accompanied by a corresponding increase in the value of output from the land. Otherwise, the higher land price simply results in a reduced rate of return on the capital invested in the land. MAF data indicates that, excluding the capital gains from rising land prices, farming returns are typically 1 to 3 percent of invested capital. Manley (2005) indicates that forest investors typically target a 6 to 8 percent return.

A key challenge for the forest product industries is to create value through wood processing and solution delivery.

Leaving aside the question of capital gains, investors might be willing to invest in forestry if their expectation was of a product worth on average $125 per cubic metre (low end) to $190 per cubic metre (high end). All-grade four-quarter average log prices for the September 2008 quarter were only $80 per cubic metre (domestic) and $91 per cubic metre (export).

There are a number of ways to close the gap between current market prices and the price required to apparently justify investing.

Firstly, investors may be prepared to accept a lower return to that indicated – particularly if forestry is only part of an investment portfolio and if, by including forestry in the portfolio, the overall risk/return trade-off for the portfolio is reduced. Investors might also believe that, over the next 30 years, either real wood prices are likely to rise or real agricultural returns (the opportunity cost of the land) will fall. Something like a 1 percent per year real price rise over the period would in some cases be sufficient to close the gap.

Secondly, because each investment is site specific, there will be cases where costs are lower than the numbers indicated or where, because of the choice of genetic material (Sorensson, 2006) and/or better product differentiation, the returns expected are

greater than those indicated by the analysis.

Finally, there is the possibility of gaining revenue from more than just the sale of wood – possibly as a result of selling the ecosystem services of the forest and/or its carbon offset potential through either the compliance market or voluntary carbon markets (Pearce, 2007).

The important point, though, is it should be possible to make a case that investors in forest growing could expect to make reasonable returns, so long as there is underlying strength in consumer demand for forest products or there is additional market value for the environmental services supplied by forests and embodied in forest products.

› WOOD PROCESSING

The second leg to forestry investment is attracting the capital necessary to process the resource. Unlike the growing side of the sector, here the capital requirements are often large and lumpy. Capital markets, though, are perhaps the most globalised and "free" of all international markets. For a small country such as New Zealand, the critical factor in getting investment in forest processing is being able to indicate that investments in the sector here are likely to produce an adequate risk-adjusted return compared with returns available elsewhere. Provided there are reasonable grounds for believing that is possible, and given the existence of the globalised capital markets, there is no obvious constraint in terms of a limit to the available capital for investing in forest processing.

A key challenge for the forest product industries is to create value through wood processing and solution delivery, and offer better returns on investment compared with log exports (for example, Maplesden and Turner, 2006). This issue needs to be understood in the context of New Zealand's long-term forest harvesting trends and the relationship between harvesting volumes and the proportion of logs processed into more valuable wood products (such as MDF and plywood) and remanufactured products (such as mouldings and furniture). Further processing only makes sense if it is profitable, and low profitability has been a constraint on processing investment. Some forms of processing investment require very high volumes of throughput and much of New Zealand's forestry resource is dispersed and unsuited to this type of investment.

While volumes of processed wood are increasing, they are not keeping pace with increases in the wood available for harvesting.

Much of the investment needed may have to be financed offshore because of the magnitude of investment required, although the recent advent of domestic savings and/or retirement schemes like KiwiSaver may, in the medium to long-term, provide a source of domestic-based investment funds. Increased processing investment must be complemented by corresponding market and product development initiatives. If investment in domestic processing continues to lag behind the forecast increases in the availability of wood, then log exports are likely to increase. However, it should be noted that even log exporting requires market access, appropriate infrastructure, process-efficient regulation (for example, through the RMA) and a supportive business environment.

A challenge for the sawmilling sector is squeezed margins.

A challenge for the sawmilling sector, in particular, is maintaining and enhancing profitability in a climate of squeezed margins. Profitability is necessary to encourage investment. The issue has been exacerbated by the separation of forest ownership from sawmill ownership and the

former's push for log export parity pricing. When log export prices fall, the forest owner has the option to not harvest, so the sawmiller has to raise prices to purchase logs but has limited ability to raise lumber prices, thus squeezing margins. When log export prices are high, the sawmiller has to match them, thus going around the same circle. One strategy might be for sawmills to secure a cornerstone log supply, but that is difficult in regions that have a lot of smaller-scale owners, like the southern North Island.

HUMAN RESOURCES

If the forestry sector is to maintain, and improve, its relative competitiveness, it needs to invest in both human and built capital (Ministry of Research, Science and Technology, 2006b: 9).

Some findings from Business and Economic Research Limited's report on *Forestry Industry Training Requirements to 2011* (July 2008) are also relevant:

- The industry places a high importance on most types of skills, especially applied technical skills and soft skills like interpersonal and leadership skills.
- 37 percent of all firms surveyed in the forestry industry said they are likely to expand in the next five years.
- Projections of additional employees needed by the forestry industry from 2008-2011 show about 600 to 1000 additional people will be needed each year due to industry growth (assuming current productivity). Simply replacing employee turnover requires a further 4000 people per year.
- The type and scope of training needed are changing as firms need to support their investment in changed production systems. This investment incorporates more automation and other innovation.

Building the skill base and productivity of the forestry sector to match the top echelons of the OECD will not occur overnight. It needs a co-ordinated effort by industry, government, the Crown Research Institutes (CRIs) and the major training providers. Together, it should be possible to develop the appropriate employment, investment and training structures needed to build the sector's human capital.

Importantly, the full benefits of new technology can only be achieved by upskilling the operators who use the equipment.

RECOGNISING AND VALUING SKILL ATTAINMENT

Successive governments have stressed the need for New Zealanders to undertake further training, and for the country to become a high-tech and high-skill economy. The educational reforms of the past 20 years have been directed at encouraging further, specialised training, and at developing an innovative workforce.

Why then has New Zealand struggled to maintain its competitiveness against our major trading partners, and why do some international measures show us as falling behind in the competitiveness stakes (Brown and Ortiz, 2001: 53)?

One answer could be that the business models used in New Zealand do not always adequately value skill attainment and application. In the case of harvesting and silviculture work, forest owners are generally looking for the lowest tender price. Contractors are in a perpetual bidding war. While this may keep costs down in the short-term, it provides little incentive for contractors to invest in skill development.

In the small number of cases where forestry companies do include incentive payments for training, there are positive gains in workforce stability and productivity. A fundamental rethink

needs to be undertaken of what are the appropriate business models for encouraging sustained, long-term productivity gains. Longer-term contracts with training recognition clauses could be an important component.

Importantly, the full benefits of new technology can only be achieved by upskilling the operators who use the equipment.

In the modern, competitive world, we cannot rely on the willingness of the New Zealand worker to try and understand how a piece of machinery operates (that is, the number 8 wire approach). Our competitors are prepared to invest heavily in upskilling, and we need to follow suit. This investment also needs to be in wages. If the sector expects a more highly skilled workforce, then forestry companies need to be prepared to pay accordingly and offer at least a degree of employment stability.

› THE STRENGTHS OF THE CURRENT LABOUR AND TRAINING MARKET

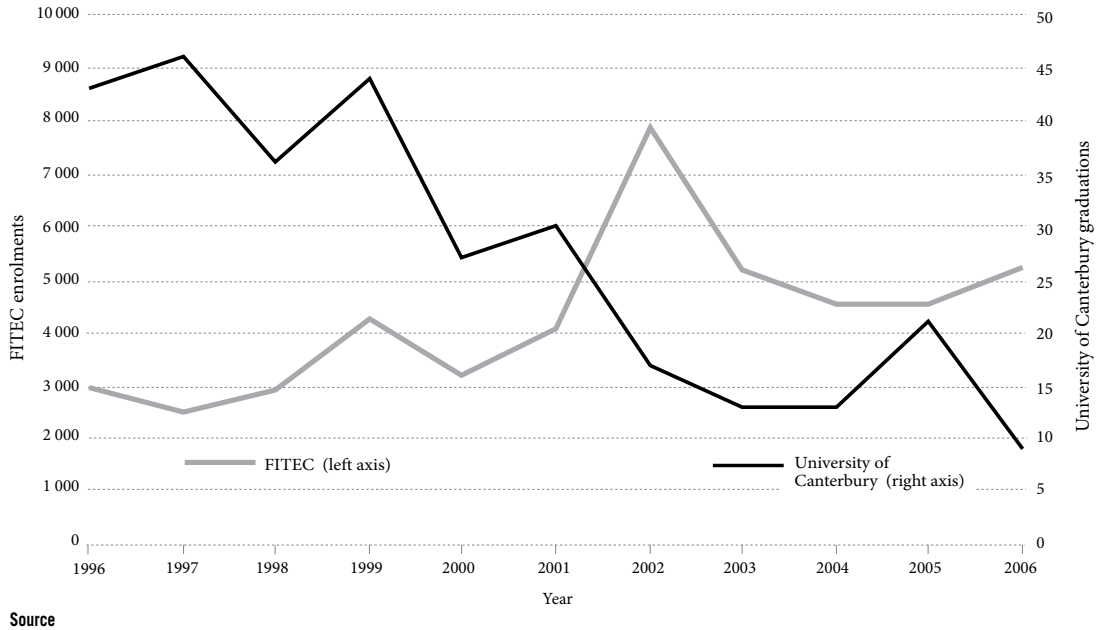
I. TRAINING STRUCTURES

There is one Industry Training Organisation (ITO) covering forestry establishment, harvesting, solid wood processing, wood panels, forest health and pulp and paper production – the Forest Industries Training and Education Council (FITEC). FITEC enrolments[12] have been increasing over time (see Figure 6.1), which partly reflects a sector-wide policy of having all workers trained or in training for the work they are or will be doing. The spike in 2002 was due to both a drive by FITEC for new enrolments and a clean-up of old enrolment records acquired through the merger of FITEC and the Logging and Forest Industry Training Board that had previously managed forestry sector training.

At the university level, New Zealand has an internationally recognised programme of forestry training through the School of Forestry (based

12 These enrolments include students training at polytechnics.

FIGURE 6.1: FORESTRY SECTOR TRAINING ENROLMENTS/GRADUATIONS, 1996 TO 2006



Source
FITEC and University of Canterbury, 2007.

at the University of Canterbury). A significant proportion of enrolments are drawn from outside of New Zealand.

There are opportunities to improve the delivery of forestry training. Areas to explore include:

- greater co-operation between the providers, so that specialist (and niche) aspects of forestry training can be delivered nationally (at a reasonable cost);
- increased dialogue nationally and regionally between the sector, FITEC and the major providers, to align sector needs with training delivery;
- formal links with Australian institutions and companies.

II. LABOUR MARKET

New Zealand has an open labour market, which allows the ready movement of staff between operations. The labour arrangements also enable overseas staff to be employed on short or longer-term contracts. These arrangements encourage the transfer of management and operational innovations.

There is increasing reliance on overseas management, scientific expertise and workers (for example, for silviculture). It is important to ensure that industry and government maintain an ongoing dialogue on workforce availability and immigration arrangements for these categories of workers. A working party, made up of sector representatives and officials, could be established to periodically review labour market issues.

› HUMAN RESOURCE CHALLENGES FACING THE SECTOR

The public perception of the forestry sector as an employer is covered in Chapter 14, "Forestry in the eyes of society".

New Zealand's wage rates for forestry employment are low.

I. CYCLICAL ENROLMENT TRENDS

The cyclical nature of enrolments in training courses impacts on the required stream of labour for the sector. Labour shortages are currently being experienced in both specialised and mainstream areas of plantation forest management and processing. These shortages may result in a more protracted recovery, particularly if companies struggle to access experienced labour, whether at the harvesting or first-stage processing level. There is a need for a steady stream of new labour, even during periods of economic downturn.

The Tertiary Education Commission, FITEC and the principal training providers could investigate the industry needs, the cyclical nature of enrolments, and the respective delivery of courses.

II. REMUNERATION RATES IN NEW ZEALAND

Compared with other OECD countries, New Zealand's wage rates for forestry employment are low. This makes the sector vulnerable to "cherry picking" by overseas companies, research institutions, other sectors and government agencies. The loss of emerging leaders and talented operational and scientific staff acts as a brake to innovation, investment and expansion.

Forestry companies and research institutions can recognise the contribution staff make to an operation in many ways (in addition to their base salary), such as:

- security of tenure;
- quality of the work environment;
- job flexibility.

»» ENERGY

The forestry and wood processing sector is New Zealand's major energy consumer (see Table 6.1). It is also the major user of renewable

TABLE 6.1: ENERGY USE BY MANUFACTURING INDUSTRY GROUP FOR YEAR ENDED MARCH 2006

INDUSTRY GROUP	ENERGY USE (PETAJOULES) (ROUNDED)	PERCENTAGE
Wood and paper product manufacturing	58.0	38
Food, beverage and tobacco	36.0	24
Metal product manufacturing	31.0	20
Petroleum, coal, chemical and associated product	13.0	9
Non-metallic mineral product manufacturing	9.0	6
Other	5.5	3
Total manufacturing industry	**152.5**	**100**

Source
Statistics New Zealand, 2007a.

The forestry and wood processing sector is New Zealand's major energy consumer.

woody biomass as an energy source. In 2005, use of woody biomass energy by the sector was an estimated 45 petajoules per year, compared with the 58 petajoules shown in Table 6.1 for 2006, with a main driver for the increase being the rising cost of disposing of processing residues as waste.

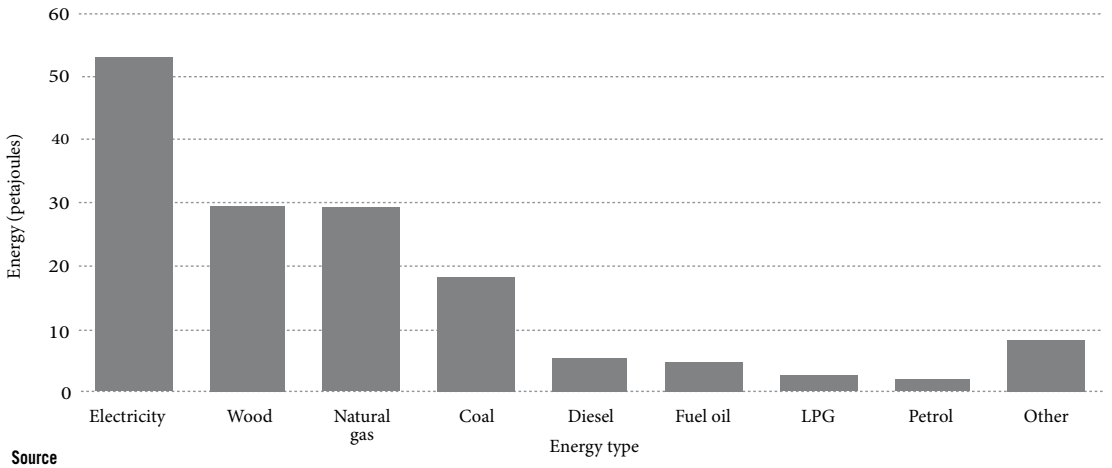
Of the 152.5 petajoules used by the manufacturing industry groups, electricity is the energy type used in greatest quantity – it accounts for almost 35 percent of all the energy used by that sector. The metal product manufacturing industry is the largest user of electricity (47 percent), with the second-largest being the wood and paper product industry (just under 25 percent of the total), followed by the food industry (under 15 percent).

The second most important energy source for the manufacturing sector is wood and wood waste (see Figure 6.2). It makes up 19 percent of total manufacturing energy use (29 petajoules) and the wood and paper product industry is the largest user of this type of energy (99 percent of the total wood energy use).

› THE FUTURE

The share of wood fuel in the national fuel mix and its role in industry is growing. Realistically though,

FIGURE 6.2: TOTAL MANUFACTURING ENERGY USE BY ENERGY TYPE FOR THE YEAR ENDED MARCH 2006



Source
Statistics New Zealand, 2007a.

the wood processing industry and the residential sectors are likely to continue to be the major users of woody biomass as an energy source. At present, 94 percent of all South Island sawmills and 74 percent of those in the North Island use biomass as fuel. Wood fuel use by sawmilling is currently some 9.5 petajoules per year.

Assuming sawmill energy use continues to follow the present fuel mix trends, a scenario where increased processing up to the point that current mill capacity is fully utilised could result in the use of wood energy increasing to approximately 50 petajoules per year by 2020. On the other hand, a scenario where log exports are around 33 percent of the total harvest and the rest of the harvest is processed before export (that is, extra mill capacity) could see sawmill energy use increasing to some 59 petajoules per year by 2020 and stabilising at around this level.

In addition to processing residue, there is also a considerable resource of residues at forest landing sites. Presently, about 250 000 tonnes of forest residues are recovered annually and used to fuel energy plants for wood processing facilities, mostly in the central North Island and some in Nelson and the Hawkes Bay (Hall and Gifford, 2007). Modelling suggests that a carbon price of $15 per tonne of carbon dioxide would, by 2020, result in a further 7 petajoules per year of harvest residues being economically competitive with coal as a source of industrial heat in the North Island. However, the significantly lower cost of coal in the South Island means that, at a price of $15 per tonne of carbon dioxide, forest residues are still not competitive with coal. A major issue for increasing the use of harvest residues is efficient and economical collection and delivery.

In 2005, it was estimated that the residential sector used about 8 petajoules of wood fuel, primarily in the form of firewood, which accounts for about 38

The second most important energy source for the manufacturing sector is wood and wood waste.

percent of estimated total domestic space heating energy. Following international trends, wood pellets are likely to have a significant impact on the fuel mix for heat in the residential, commercial and institutional sectors and are possibly a replacement for gas.

Currently, around 30 000 tonnes (0.6 petajoules) of wood pellets are sold each year. Based on current consumer interest, the use of pellets could increase to 2.5 petajoules per year by 2020 (125 000 tonnes of wood pellets per year). Increasing use of wood pellets is likely to be driven by the increasing cost of other fuels and air emission restrictions, but it could be constrained by the supply of raw material for making pellets.

Any growth in the use of wood pellets could result in increased demand for specific types of wood processing residues, especially sawdust. Currently, by utilising all of these residues, sawmills are able to be effectively self-sufficient in process heat. But a growing demand for these residues by the pellets industry could mean that mills might sell some of their higher-quality residues if a cheaper substitute fuel is available. This substitute fuel could be forest residues or possibly coal. Thus, an expanding industry for wood pellets (or, for that matter, liquid biofuels) could, perversely, result in sawmills switching to coal. One possible consequence of the success of a pellets industry, if that success is not accompanied by moves to improve forest residue recovery or to get wood waste out of landfills and into energy, is that the use of wood biomass in the sawmill industry drops by 2 to 4 petajoules per year between 2020 and 2030.

Use of wood residues in other forms, such as liquid and solid biofuels, for bioenergy production is almost certain to feature strongly over the next couple of decades, as the costs of traditional (generally non-renewable) fuels rise and concerns over climate change increase (see also Chapter 8, under the section "A biofuel future?").

TRANSPORT

Maintaining New Zealand's competitiveness as a forest products producer requires continuous investment in the nation's transport infrastructure. A modern, integrated transport network (consisting of road, rail and sea freight) is required to efficiently move the annual harvest from the forest to processors, wholesalers and customers (both domestic and international). The degree to which infrastructure developments are in place and functioning on a continuous basis is a measure of economic sustainability.

ROADING INFRASTRUCTURE

In the recent past, there have been examples of poor roading infrastructure negatively affecting the development of wood processing and exporting, for example, in Northland and the Gisborne region. That situation is being addressed.

The movement of logs from harvest sites to processing facilities can be a significant proportion of the final production cost (20 to 25 percent). Commercial forest growers rely on New Zealand's transport planners and agencies to provide a well maintained and efficient roading network that minimises the cost of movement. Through the regional land transport planning process, the forestry sector can identify those roads that need upgrading to meet wood-flow demands. This forward planning is critical to ensure that key infrastructure is in place when it is required, and that adequate funding is provided.

The roading network is funded through a combination of district council rates paid by landowners, usually in relation to land value, and funds from government-derived road user charges, vehicle registrations and fuel excise. Currently, the level of government funding for roading exceeds the revenue collected. The main issue for the forestry sector is the funding of local roads through rates. District councils have adopted varying approaches to the payment of additional roading contributions. These include:

- contributions at the time of harvest; or
- rating differentials on different categories of land (with potentially higher differentials for forestry); or
- targeted roading rates on forest growers to offset the perceived, or actual, costs of log transport on district roads.

The movement of logs from harvest sites to processing facilities can be a significant proportion of the final production cost.

Forest owners consider differential rates or targeted rates on land used for forestry to be unjustified and inequitable.

Some districts struggle to contribute their share of the local road funds due to the size of their rating base. This was recognised by the Government in the two major forest-growing regions of Northland and Tairawhiti, where a Regional Development Transport Fund of $30 million per year was established in 2002, with 100 percent government funding for agreed priority road upgrades.

In November 2006, the Government established an independent inquiry into the funding of local government. The purpose of the Rates Inquiry was to provide an independent assessment of New Zealand's local government rating system and identify options to enhance rates as a funding tool for local authorities.

In August 2007, the Rates Inquiry panel produced a report with 96 recommendations (Local Government Rates Inquiry, 2007). While a significant number of the inquiry's recommendations are not specific to the forestry sector, the following may have some more direct relevance:

4 That councils review and reduce forecast rate increases where that is consistent with their longer-term funding policies.

8 That rating differentials be removed from the Local Government (Rating) Act 2002 from an operative date of 1 July 2012.

11 That councils be encouraged to make more use of their powers for flexibility in rating so that the rating burden better reflects value in use.

21 That the Government remove legislative barriers to the funding of transport projects through the use of tolls.

33 That councils be permitted to set all fees and charges on an actual and reasonable cost recovery basis, and any Government regulations that limit such fees should be removed.

Further information is available on the Rates Inquiry website at http://www.ratesinquiry.govt.nz.

ROAD AND VEHICLE SAFETY

Over the last few years, there have been major improvements in log truck safety through changes in load configuration and increased education and training. This has been partly responsible for a 65 percent reduction in log truck crashes, along with a 75 percent reduction in rollover crashes. The risk of a logging truck rolling over is now very similar to that of any average heavy vehicle.

This improved safety situation has enabled the forestry sector to be involved in the joint Ministry of Transport and Transit New Zealand project to investigate the potential for increasing transport productivity through concessions in the application

There have been major improvements in log truck safety.

of the existing Heavy Mass and Dimension Rules. The potential to increase heavy vehicle weights on some routes and through changes in truck configuration could have a major benefit for the industry, as forest products have a relatively low value-to-weight ratio and therefore freight costs have a significant impact on the overall costs of production. The forestry sector is actively engaged in this project.

SHIPPING

Ports in New Zealand are generally seen as being more unregulated and efficient that those in, say, the US and Australia. New Zealand has 12 ports with significant volumes of forestry exports or imports at Whangarei, Tauranga, Gisborne, Napier, New Plymouth, Wellington, Nelson, Picton, Lyttelton, Timaru, Port Chalmers and Bluff.

Storage facilities for logs and timber products at New Zealand's major ports are generally underused, so there is potential to increase throughput without the need for large amounts of additional capital.

There are also opportunities at some ports to extend loading times (for example, 24-hour loading). This would mean shorter stays in port and reduced charter and port costs. Some port activities are, however, constrained through noise, fumigation and discharge impacts when located near residential areas. The use of methyl bromide as a fumigant is of increasing public concern and the Ministry for the Environment and MAF are working with the industry on potential alternatives.

New Zealand's 40 million tonnes of cargo (annually) is a small fraction of international trade. The country is generally treated as an extension of Australian trade routes. Consequently, when there is a squeeze on capacity (as has occurred in recent

years), low-volume and/or longer routes are generally the first to be restricted. This means that New Zealand industries in general (not just the forestry sector) and/or the Government have little opportunity to influence international sea freight rates. New Zealand is very much a price taker in this matter.

TYRANNY OF DISTANCE: THE COST OF SEA FREIGHT

The forest industries face one insurmountable fact – New Zealand is an isolated country at the end of the sea freight network. Our closest overseas market, Australia, is a minimum of four days travel by sea, while the delivery time to customers in Europe or the eastern US can be upwards of four weeks.

Extended supply chains add to the cost of doing business, and they reduce the flexibility a firm has in responding to changing market conditions. If your product is on the other side of the world, it is difficult to take advantage of short-term market opportunities, for example, seasonal shortages of plywood during the US hurricane season.

Sea freight costs have often been overlooked in discussions on the competitiveness of the New Zealand forest industries, yet they are a critical component of the overall cost of supplying forest products to the market. The sea freight burden is felt particularly at the log trading end of the industry, where exporters are handling a low-value, bulk commodity.

In recent years, sea freight charges have constituted up to 50 percent of the delivered value of pulp logs to our key Asian markets. For pruned and unpruned logs, the percentage has been as high as 30 to 40 percent of the delivered value. As the manufacturing component in the forest product increases, the freight burden declines, but it is still a significant cost to carry (20 to 25 percent for rough-sawn lumber and 15 to 20 percent for pulp and paper).

The cost of moving container and bulk freight has increased sharply since the turn of the century. The pressure on freight rates has been driven by strong growth in international trade volumes (particularly from China and India), a squeeze on shipping capacity, higher insurance and security costs and the increasing cost of bunker fuel.

Our closest overseas market, Australia, is a minimum of four days travel by sea.

Between 2002 and 2004, the charter rates for "handy size"[13] and "handy max"[14] vessels more than tripled. For a 30 000 tonne vessel, the daily charter rate increased from US$6000 to US$20 000 over this period. Charter rates have decreased over the past two years (due to additional capacity coming on stream), but they are still high compared with rates during the 1990s. The charter rates for container vessels have followed a similar pattern, and these charges have flowed through to box rates. In the latter part of 2008, however, shipping costs tumbled due to the economic crisis.

There are options for reducing the freight burden. For example:

- Reduce loading times in New Zealand, particularly at secondary ports (for example, 24-hour loading).
- Pool log exports, to gain leverage with shippers and to ensure vessels are fully loaded.
- Use innovative forms of back loading, such as using car carriers for MDF and lumber cargoes.
- Where sawmillers are supplying a common market, co-ordinate freight movements and develop their own shipping arrangements.
- For small shipments of logs, carry logs on container vessels using modified sea containers.
- Investigate the option of using multiple transport modes for delivering products to the market

13 20 000 to 40 000 tonnes (deadweight).
14 40 000 to 60 000 tonnes (deadweight).

(for example, for loads to the eastern seaboard of North America, it may be more cost effective to offload cargoes in a western port and rail the cargo to its final destination).

- Use feeder services from secondary ports so that larger-capacity vessels can be used.
- The stock answer – increase the level of processing, so that manufactured (lower-volume) products are being exported.

Looking to the future, coastal shipping could play a greater role in moving forest products, particularly logs. As the capacity of international vessels increases, the number of New Zealand ports they can service is likely to decline. This will create opportunities for coastal feeder services to move logs and processed lumber products to key export hubs. This trend is also being driven by the major shipping lines, which are looking to schedule fewer port calls in New Zealand. A downside to this is that it could add significant costs because of double handling that would probably have to be balanced with efficiencies and/or savings elsewhere.

RAIL

New Zealand's rail infrastructure is owned and maintained by the Crown (through a business entity called ONTRACK), which has allocated $200 million to rebuilding the system after a decade of underinvestment. The Crown, through KiwiRail, now also owns New Zealand's rail business having recently purchased this from Toll New Zealand.

The Government's National Rail Strategy to 2015 has a priority to encourage more freight to be carried by rail. It is recognised, however, that only a small proportion of log and containerised lumber movements would be of sufficient distance or volume to justify the cost of double handling inherent with rail cartage. ONTRACK has been pro-active in developing projects tailored to meet the needs of key sectors, including forestry. Examples include creating opportunities for increasing forestry loadings on the rail network (such as reactivating sidings and establishing loading areas or short spur lines) and improving rail links to forest product export ports.

One of the threats to the rail infrastructure is the potential for rail users to be reluctant to commit their cargoes if there is a likelihood of delays due to the state of the lines and bridges. The Government has outlined in the Rail Strategy that one of its key priorities will be to bring the network up to a standard necessary to maintain and improve market share for freight and passenger services.

Only a small proportion of log and containerised lumber movements would be of sufficient distance or volume to justify the cost of double handling inherent with rail cartage.

NZ FORESTRY'S COMPETITIVENESS AND COMPARATIVE ADVANTAGE[15]

7

Because New Zealand's forest industries operate in a global marketplace, their success largely depends on how competitive they are. A part of competitiveness is being able to use any advantages that New Zealand's forest industries might have compared with other countries. This chapter looks at both of these aspects.

OVERVIEW

DRIVERS

Costs are an important driver of our competitiveness and comparative advantage:

- The cost competitiveness of New Zealand's forestry sector is reduced where relatively higher environmental and health and safety compliance costs exist.
- Delivery costs are 50 to 60 percent of the total value of lumber at the sawmill.
- In a globalised world, the exchange rate is generally not a major competitive advantage or disadvantage.

THREATS

New Zealand's ability to compete faces a number of challenges:

- Chile has relatively lower labour costs, efficiency of manufacturing and tariff-free advantages in many competing export markets.
- New Zealand's timber-processing facilities are generally small by international standards and they use older and more labour-intensive systems.
- Labour productivity in harvesting may decline due to an increase in harvest from less accessible land areas, where conditions are more difficult and there are fewer opportunities to use machines.
- Structural and appearance grade sawnwood are competing with non-wood substitutes that are becoming increasingly competitive.

OPPORTUNITIES

Strategies for improving New Zealand's labour productivity and non-price competitiveness include:

- Innovation, a positive culture and leadership from employers.
- Research into workplace productivity and improvements in industry training.
- Policy improvements in market competition, business taxation, infrastructure provision, labour markets and human capital formation.
- Marketing New Zealand's FSC-certified resource when there are demands for environmentally certified products.
- Promoting wood as an environmentally friendly product with high embodied energy.

COMPETITIVENESS

The competitiveness of any particular company in the forestry sector is influenced by the competitiveness of:

- New Zealand overall against other countries;
- the New Zealand forestry sector against other forestry sectors competing in its markets;
- each industry within the New Zealand forestry sector (growing, sawmilling, MDF, pulp and paper) against (a) each other, (b) its competitors in its markets and (c) competing non-wood products both domestically and in export markets.

Competitiveness has two components: price (or cost) and non-price.

COST COMPETITIVENESS

Comparative studies show that the New Zealand forestry sector cannot compete on price alone with other forest-growing countries, particularly in South America.

The cost competitiveness of New Zealand's forestry

15 This chapter largely summarises research work by Maplesden and Turner (2006) that was commissioned by the Forest Industry Development Agenda and majority funded (75 percent) by MAF.

sector is affected by the costs of inputs, as described in Chapter 6. The relative movement in our input costs compared with those of producers in other countries makes for a dynamic competitive environment.

For example, New Zealand may enjoy a competitive advantage in raw material availability, environmental performance and stable institutional frameworks. Other producer countries, such as Chile and Malaysia, and to a greater degree China and Indonesia typically base their competitive position largely on their relatively low personnel costs. Chile has also built its successes on efficient manufacturing processes and tariff-free advantages. New Zealand's overall interest is to maintain and improve our global ranking as a high-wage economy. Consequently, rather than compete on the basis of lower wages New Zealand is looking for opportunities to make productivity gains in the forestry sector.

Some of the productivity gains will come for example through enterprise, investment, innovation, natural resource, skills and training and public sector initiatives.

The New Zealand forestry sector cannot compete on price alone.

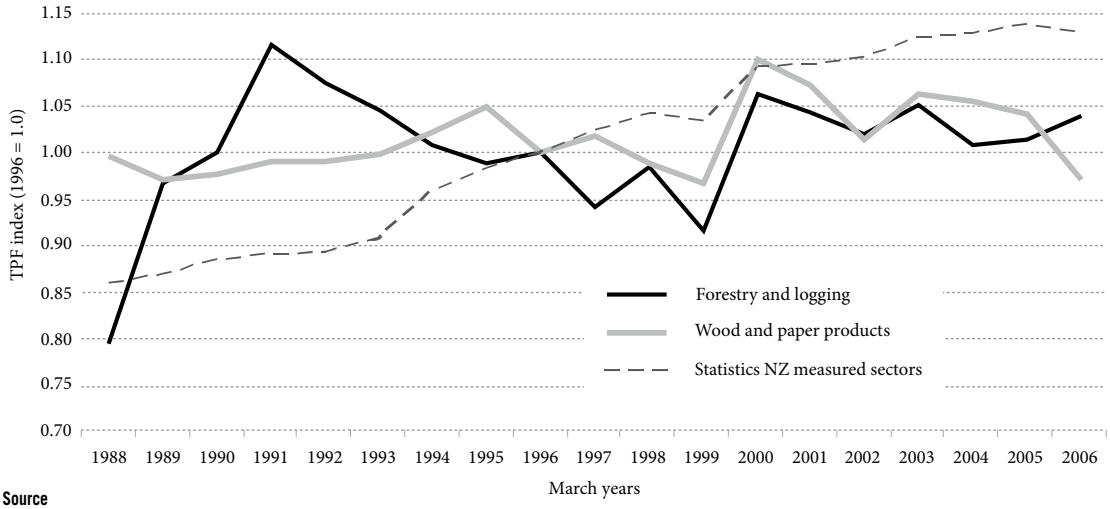
› PRODUCTIVITY[16]

Recent research by MAF on sector productivity showed that, from 1988 to 2006, total factor productivity (TFP) growth in forestry and logging was 1.5 percent per year on average. This is similar to the national average productivity growth estimated by Statistics New Zealand (2007c) for the same period. Productivity growth in wood and paper processing during this period was flatter, at –0.1 percent (see Figure 7.1). Comparing internationally, New Zealand's wood and paper processing TFP growth is lower than that of Canada (1.5 percent) and Finland (5.1 percent) during a similar period (1989 to 2000), but relatively higher than that of the US (–0.4 percent) (Center for the Study of Living Standards, 2003).

Productivity growth of forestry and logging peaked in 1991 when labour input was the lowest in the

16 This section is largely based on recent research by MAF on sector productivity (see, for example, MAF, 2007d) and research work by Maplesden and Turner (2006) that was commissioned by FIDA and majority funded (75 percent) by MAF.

FIGURE 7.1: NEW ZEALAND PRODUCTIVITY IN VARIOUS SECTORS



Source
Statistics New Zealand, 2007c; MAF, 2007c; Cao and Forbes, 2007.
Note
TFP = total factor productivity.

period but output kept increasing strongly at 15 percent per year for three consecutive years. The decrease in labour input was associated with the Government's decision to sell large state-owned forestry assets to the private sector.

If the gains from privatisation in the early 1990s are removed and figures for the last 10 years are used, TFP growth in forestry and logging is 0.5 percent and is –0.8 percent for wood and paper products, compared with a 1.4 percent national average. The slowdown of productivity growth for both forestry and forestry processing at the end of the 1990s reflected the impact of the Asian financial crisis around this time. Productivity peaks for both sectors in 2000 were a result of strong output growth (11 percent for forestry and 15 percent for forestry processing compared with the previous year). Also, forestry labour input reduced by 25 percent in 2000, while forestry processing inputs remained constant.

The slow rate of productivity growth in the wood processing industry has a number of causes. In all but a few cases, New Zealand's wood processing facilities are small by international standards and use older and more labour-intensive systems. A significant proportion of the small- to medium-sized mills established over the past 10 years have used second-hand mill equipment from Australia, the US and the like. This immediately puts these operations at a disadvantage. While set-up costs might be lower, the technology is already 10 or even 20 years out of date. New Zealand's mills are also viewed as being undercapitalised. Companies have been prepared to use additional labour, rather than invest further capital to maximise site (and individual) productivity.

While MAF has not researched reasons for the high TFP growth in Finland's wood and paper processing industry (5.1 percent versus New Zealand's –0.1 percent), it is possible that strong investment in high-tech equipment is a significant contributor.

The impact of mill size on productivity and costs is always a debatable point. Some advocate large (or even supersize) mills, while others argue that small mills are more able to switch production to take advantage of niche opportunities. However, it has been demonstrated that large mills, especially those using modern technology, have lower costs than small and medium mills (see Table 7.1).

New Zealand has 12 medium-sized sawmills, while the rest (358 sawmills) are categorised as small.

Another argument in favour of smaller-scale mills is that New Zealand is a country of small-to-medium enterprises and has a lot of experience in this area. This could support an approach of multiple small mills with a widely distributed infrastructure – high tech but low carbon footprint. But high technological input is the important productivity driver, and more investment is needed compared with the current New Zealand small mill model.

TABLE 7.1: RELATIONSHIP BETWEEN MILL SIZE AND MANUFACTURING COSTS

SIZE OF MILL	SMALL	MEDIUM	LARGE	SUPERSIZE
000 m^3 per year	<100	100–350	350–700	>700
Total costs index	100	86	73	64

Source
Campbell, 2005.

In the harvesting area, productivity gains have been made in log grading, with the increasing use of acoustic technology to measure wood quality and hand-held data collection devices. Significant productivity gains can be achieved with new-generation harvesting and extraction equipment, but the large capital requirements pose a barrier for self-employed contractors.

New Zealand labour productivity in harvesting may in fact decline in the future due to the increase in harvesting from less accessible stands outside of the central North Island.

From a Government perspective, it is important to identify what financial or regulatory signals would be required to encourage further productivity gains.

In addition to capital investment, industry needs to be encouraged to examine whether their existing management practices are holding back innovation adoption and productivity gains. For example, encouraging worker participation could assist innovation and a workforce that is more likely to take on board the need for progressive change and productivity improvements.

Broadly, strategies for improving New Zealand's labour productivity (many of which apply to the forestry sector) include:

- innovation, a positive culture and leadership from employers;
- research into workplace productivity;
- improvements in industry training;
- policy improvements in product market competition, business taxation, infrastructure provision, labour markets and human capital formation.

COSTS OF WOOD

The cost of extracting logs from the forest and transporting them to the sawmill is the most significant component of the total cost of lumber (on average, in the order of 50 to 60 percent), and is determined by delivered log costs and lumber recovery. New Zealand sawlog costs are relatively low compared with our competitors, reflecting reasonable delivered log costs (or comparatively low stumpage to the grower, depending on one's point of view) and relatively high lumber recovery rates.

There are two main areas affecting sawlog costs: productivity and conversion. Productivity has been discussed. The cost to convert logs has been reduced by many mills installing improved log and flitch scanning, saws with narrower kerfs[17] and improved size control.

INTERNATIONAL EXCHANGE RATES

Recent appreciation of the New Zealand dollar has been a major factor in reducing New Zealand's relative competitiveness in the world markets. As the New Zealand dollar increases in value, New Zealand's export values are worth less and the ability to compete internationally reduces, with the converse also being true.

However, it is important to remember that, in a globalised world, the exchange rate is not always a major competitive advantage or disadvantage. Exchange rates tend to be cyclical. It may have significant short-term effects, but it should not be the deciding factor when developing an investment strategy. In most countries, floating currencies mean minimal opportunities to influence exchange rates. In some cases, several competing export countries will be affected simultaneously by exchange rate changes, so effects may balance out.

NON-PRICE COMPETITIVENESS

Non-price competitiveness explains why a product might sell at a higher price than a competing product. A number of factors are included in non-price competitiveness, such as a product's quality, image and post-sale service.

17 Width of saw cut.

Non-price competition is common in young, innovative product industries, such as engineered wood products (EWPs) like laminated veneer lumber. These industries are characterised by a few suppliers (possibly protected by product patents) that produce a unique product (through product characteristics, branding and so on), with few competing substitutes.

Few New Zealand forest products are currently non-price competitive in export markets because there are a relatively large number of suppliers (throughout the world) producing undifferentiated products for a small number of price-conscious buyers. As such, suppliers have little power, while buyers have considerable power and are able to set prices for products. The structural and appearance grade sawnwood sectors are also currently uncompetitive because they are competing with non-wood substitutes that are improving their profitability and/or price-performance trade-off.

Large-scale operations in New Zealand, such as pulp and paper, have high start-up costs which discourage the entry of new players. These operations have also struggled to stay internationally competitive, through increasing their size and expanding economies of scale, and the domestic market is too small to support expansion of already large-scale export dependent operations.

Other forest industries have been competitive in the supply of forest products to profitable and growing markets, where product price is less important than product quality, for example, EWPs and wood products for interiors.

› TECHNOLOGICAL INNOVATION

Technological innovation is a key to maintaining cost and non-price competitive advantage.

New Zealand forest product exports face increasing competition from lower-cost producers and from

Technological innovation is a key to maintaining cost and non-price competitive advantage.

lower-cost, better-performing non-wood products. As such, low costs and high fibre recovery, achieved through process innovation, are important to competing in forest products markets. However, to achieve a competitive advantage against competing non-wood products, the New Zealand forestry sector needs to look at product and business systems innovation. For example, Chile's low-cost advantage resides not only in low labour and fibre costs and tariff advantages, but also in an overall efficiency and new investment.

Given the potential for increased delivered log costs and labour costs in New Zealand, the forestry sector will be under increasing pressure to further improve product recovery and labour productivity to reduce operational costs. Some of the process innovations that are in the pipeline and may help achieve this aim include:

- improvements in sensing technologies to improve inventory control, particularly control of material quality, for example, GIS[18] and remote-sensing technologies, and X-ray technologies;
- improvements in waste minimisation;
- tools for measuring in-field wood quality to improve log segregation;
- technology for improving log bucking to match mill demand;
- process automation systems to reduce the labour component;
- just-in-time manufacturing process control to allow rapid product line changes (for example, planer moulders);
- automated quality control systems to reduce downgrade (for example, online monitoring of density and resin loading in panels);
- energy-saving processing technologies.

18 GIS – geographic information system.

There are two main areas where the New Zealand forestry sector could improve its competitiveness and comparative advantage through technical innovation in the next 10 to 15 years: product innovation and system innovation.

I. PRODUCT INNOVATION

- Use environmentally acceptable wood protection, preservatives and additives (for example, acetylated wood, thermally treated wood).
- Explore new construction opportunities using wood in multi-storey and large-span buildings.
- Combine materials for new end uses (for example, wood-plastic composites, solidwood-steel structural systems, improved plastic overlay technologies).
- Improve existing products to extend market applications (for example, exterior, durable MDF).
- Use a bio-refinery approach to wood processing, leading to new products from elements of the log traditionally underused (for example, chemicals from bark, bioenergy).
- Use environmentally acceptable adhesive technologies.

II. SYSTEM INNOVATION

- Enable better and more efficient matching of buyers and suppliers through e-commerce, for example, the recent move of US do-it-yourself (DIY) stores to seek tenders from product suppliers.
- Increase consolidation and vertical integration in the housing sector to single companies providing land purchase, neighbourhood and house design, financing, construction, interior design and appliance fit-out.

› OPPORTUNITIES TO IMPROVE NEW ZEALAND'S NON-PRICE COMPETITIVENESS

Non-price competition exists in a number of forest products markets and can include branding, design and packaging, quality features, mode of production, service and support, research and development support, protected products and production of differentiated, focused products.

New Zealand has some important non-price opportunities. For example, over half of New Zealand's resource is FSC certified. Certification is becoming a strong marketing tool in markets, such as North America and Europe, that are sensitive to environmental issues.

Over half of New Zealand's forestry resource is FSC certified.

In products such as appearance grades and mouldings, New Zealand's current and historical tree-pruning regimes give it significant advantages over competing countries such as Chile. While pruning is generally an expensive operation, New Zealand can produce higher-value clear lumber of wide dimensions.

Marketing (as opposed to just selling/order-filling) can significantly improve non-price competitiveness. Market research in Malaysia, Korea, China and the US[19] indicated that New Zealand radiata pine lumber products had some favourable non-price aspects, which included the following:
The products are:

- abundantly available;
- sustainable;
- of consistent quality relative to grade/specification;
- fit for purpose for a wide range of end uses.

The service is:

- good and the people are easy to do business with;
- peopled with reliable, honest suppliers;
- responsive to requests and problems;
- known to deliver on time.

19 This research was undertaken in 2003 by Trade New Zealand for the New Zealand Forest Industries Council (NZFIC). It is unpublished. The NZFIC has since been disestablished and Trade New Zealand restructured.

However, the research also noted that New Zealand was not perceived as a centre of excellence internationally in terms of processing and manufacturing technology, and radiata pine, although fit for use and a good utility timber, was (and still is) inferior in particular characteristics and/or qualities to many substitute species and products. There were no geographic or sectoral markets in which New Zealand radiata pine lumber products appeared to have a clear competitive advantage based on its inherent properties.

If cost leadership is not possible, then the sector should aim to differentiate its products on non-price factors.

LESSONS FOR NEW ZEALAND COMPANIES

There are a number of lessons that New Zealand wood industry companies can take from analysis of relative competitiveness issues. These include:

- The cost of fibre is very important for developing a globally competitive wood processing strategy. Integrated businesses that incorporate fibre ownership into their operations may translate this into a competitive advantage by having security of supply and lower procurement costs.
- Competing on cost usually means achieving relatively large-scale operations.
- If cost leadership is not possible, then the sector should aim to differentiate its products on non-price factors.
- In a globalised world, the exchange rate may have significant short-term positive or negative effects, it should be taken into account but not be the deciding factor when developing a strategy.

FORESTRY SECTOR OUTPUTS NOW AND INTO THE FUTURE

8

OVERVIEW

The forestry sector contributes at a number of levels to New Zealand's social and economic development. Chapter 3 looked in some detail at the contribution that harvesting, processing and forest management make to economic activity and New Zealand's export receipts. This, however, is just part of the story. The forestry sector is recognised as one of the drivers of community development, particularly in smaller centres. New Zealand's 1.8 million hectares of plantations also provide valuable environmental services, ranging from erosion mitigation to land rehabilitation. The forestry sector also contributes to tourism and energy production.

Looking to the future, the sector has the potential to play a significant role in sustainably growing the New Zealand economy. While the basis of this growth will continue to be processed wood products, new opportunities are emerging with secondary crops, the use of wood residues for energy production and the development of new products from wood fibre, such as speciality chemicals, moulded plastics and composites.

DRIVERS

The drivers for change in the forestry sector cover a broad spectrum, from future wood availability through to environmental pressures and scientific opportunities:

- The plantation estate has grown by approximately 154 percent over the past 30 years. As this resource matures, harvest volumes, processing activity and employment can be sustainably increased. This growth and development will be spread more widely (in a geographical sense) than has been the case to date.
- The increasing environmental pressure on New Zealand's natural resources has focused attention on the benefits forestry can make in areas such as catchment management and nutrient interception. Decision makers are recognising the value of these environmental services, and the need to maximise them.
- The science around biomaterials and wood residues is identifying new and innovative ways to use the forest resource. These innovations are opening the door to niche markets and additional revenue streams.
- The escalation in rural land prices since the late 1990s means New Zealand's next generation of plantings are likely to be developed on more marginal and remote land. This is likely to include the erosion-prone catchments of the lower North Island.

The science around biomaterials and wood residues is identifying new and innovative ways to use the forest resource.

THREATS

The forestry sector faces a number of challenges in building additional wood processing capacity and in expanding the resource base:

- The cyclical nature of log and lumber prices has negative consequences for business confidence, investment patterns and productivity.
- New Zealand's international image as a location for plantation forestry and wood processing investment has suffered in recent years by concerns over the regulatory environment, exchange rate volatility and climate change policies (as they affect forestry).
- The forestry sector is struggling to attract new entrants. Without an adequate skill base, the

sector will struggle to handle an increasing harvest, and to attract investment in domestic wood processing.

› A lack of industrial land is limiting the establishment of new ("greenfield") wood processing facilities. This situation has compelled companies to apply for development consents on rural sites. This can be a drawn-out and uncertain affair.

The challenge for the forestry sector, and the Government, is to take advantage of this growing resource and create additional economic, environmental and social benefits for New Zealand.

› OPPORTUNITIES

There continue to be opportunities to raise the socio-economic and environmental contributions the forestry sector makes to New Zealand society:

› The forestry sector has the potential to be one of the major drivers of New Zealand's sustainable growth. More than a quarter of the annual harvest currently leaves New Zealand in an unprocessed state, and the maturing resource offers substantial opportunities for new forms of investment.

› Internationally, there is an increasing focus on the environmental services generated by the forestry sector, and how these services can be valued.

› The sector is sitting on a largely untapped energy resource, in the form of forest residues. If used effectively, this resource could play a significant role in meeting future energy needs (through heat energy and biofuels).

› The forestry sector can play an important role in regional development and in building the social capital of communities.

› There are emerging opportunities around secondary crops (such as mycorrhizal mushrooms and ginseng), carbon farming and tourism that will assist companies and individuals to diversify their income streams.

»» THE CONTRIBUTION OF THE FORESTRY SECTOR TO SUSTAINABLE DEVELOPMENT

New Zealand has an intensively managed forest resource that has the potential to grow the domestic economy without degrading the quality of the resource. This growth will occur through wood processing (such as lumber, mouldings and remanufactured products), the provision of environmental services, energy production, tourism and secondary crops.

› A SECTOR WITH SIGNIFICANT POTENTIAL FOR INTERNAL GROWTH

New Zealand's plantation forests have increased by 1.1 million hectares (or 154 percent) over the past 30 years. This expansion provides a platform for sustainable growth over the next generation. In regions such as Gisborne, Northland and Otago, the maturing forests will provide opportunities for new investment and employment in harvesting, wood processing and associated industries.

Nationally, the forestry sector is an important component of New Zealand's export base. In the year ended March 2008, forestry exports stood at $3.5 billion, or 10 percent of all merchandise exports (free on board[20]). The sector has significant potential to increase this contribution over coming decades, with the maturing of the plantation estate. New Zealand's forestry sector can contribute not only to sustainable economic growth (through increased harvest volume), but also to the improvement of environmental indicators (as the new forests mature), particularly in the areas of catchment management, erosion control and the enhancement of water quality.

The challenge for the forestry sector, and the Government, is to take advantage of this growing

20 The value of goods at New Zealand ports before export.

resource and create additional economic, environmental and social benefits for New Zealand. This will not be a simple task as New Zealand sits at the end of an extended supply chain, and our comparative advantages in plantation growth rates and renewable energy can be (and often are) outweighed by competitors who use the latest technology or employ economies of scale that dwarf our own processing capacity. Prospering in this competitive environment will require on-going improvements in productivity, the adoption of new and innovative technology and the up-scaling of processing facilities. Both the Government and industry have critical roles to play in fostering the adoption of new technology and in attracting domestic and international capital.

The Government can assist this process at a number of levels. The Government has been investing heavily in infrastructure, training and research with the aim of creating a more flexible economy and workforce that can adapt to the demands of new technology and global trends. More generally, the Government has worked to provide investors with a stable macro-economic environment, secure property tenure and a balanced regulatory framework. Providing a stable economic environment is critical for attracting the scale of investment needed to process the wood volumes that are coming on stream over the next two decades.

The sector itself has a significant role to play in developing favourable investment and market conditions. The existing management and production models used in New Zealand are coming under increasing pressure from Pacific Rim competition. To compete internationally (and stay profitable), New Zealand forest owners and the wood processing sector must take on board the lessons learnt by our major competitors over recent decades, such as progressively increasing their scale of production, adopting more capital-intensive

The forestry sector has the potential to be one of the major drivers of New Zealand's sustainable growth.

plant, developing longer-term relationships with customers and investing in human capital (to raise productivity and skill levels).

Encouraging local wood processing has multiple benefits for the economy and for society at large. Increased domestic wood processing would:

- Generate additional direct and indirect employment.
- Raise the industry's GDP contribution.
- Reduce the cyclical fluctuations in pricing and demand.
- Help to develop long-term supply arrangements with overseas customers.
- Give producers more control over how the resource is used.
- Encourage the development of value-added products such as mouldings, laminated boards and component pieces for furniture.
- Reduce sea freight costs (and the sector's carbon footprint).

THE ROLE OF FORESTRY IN COMMUNITY DEVELOPMENT

The forestry sector can play an important role in building the economic resilience of rural communities, by diversifying economic activity, providing new skill sets and attracting new, and younger workers. These benefits come to the fore particularly in districts with more marginal land. In these areas, forestry can out perform agriculture on an economic and employment basis. This contribution grows with the maturing of the forest resource. Areas with a relatively young forest resource, such as Southland District, will see the contribution of this sector grow progressively over the next 20 years.

The forestry sector's contribution to building economic resilience and social capital is not well understood by decision makers. The research undertaken on this issue has generally focused on the impacts of land conversion or the consequences of restructuring. Although important, these issues do not examine the ongoing (and positive) contribution forestry makes to sustaining and building rural communities. It is only in the past 10 years that forestry companies have started to look seriously at this issue (for example, as part of their FSC reporting).

> *The wide regional distribution of the people working in the forest and wood sector means that a large number of small communities benefit from incomes generated by the sector. The permanent nature and types of employment mean that there is stable employment for a range of people to move to and live in the smaller communities in the region. The fact that a high proportion of those employed are in younger age groups assists communities to retain active sports clubs, the schools and the retail services and other facilities of young, vital communities. (Sanderson et al, 2005: 25)*

The sector contributes to community formation at a variety of levels:

- Forestry sector employment diversifies the economic base of communities.
- Communities with both forestry and agricultural employment tend to have a more even growth pattern.
- Forestry provides both seasonal and permanent employment. The seasonal employment can be incorporated into the low seasons for agricultural activity (for example, planting can be combined with meat-processing employment).
- Forestry activity brings additional skills to communities. In particular, it provides a management layer that is important for managing public affairs (for example, school boards of trustees, community boards and sports halls).
- Plantation management and timber processing generally attract a younger workforce than the agricultural sector.
- Forestry investment has helped to stem out-migration and provide local career opportunities. This can be seen particularly in the central North Island, where forestry development has helped to retain the Māori population and traditional community structures.
- The industry generates significant employment in related manufacturing, servicing and transport activities.[21]

THE AGE STRUCTURE OF THE FORESTRY WORKFORCE

One of the challenges facing rural communities is the retention of younger workers and families. The forestry sector can play a positive role in this respect, as it has an appreciably younger age profile than agriculture (particularly in the harvesting and silviculture workforce). The sector provides an employment source for local workers, and it attracts new residents (and families) to a district. The forestry workforce helps to bolster the school-age population and is an important source of recruits for sporting clubs and community services, such as the volunteer fire brigade.

LABOUR DEMANDS ASSOCIATED WITH FORESTRY INVESTMENT

The employment opportunities associated with forestry development vary as a crop matures. The benefits are maximised when the estate reaches its sustainable harvest. The transition to this mature state can take from 15 to 50 years (depending on the crop). This extended transition period is often difficult for a community to appreciate, and there can be concerns over employment opportunities and the impact on population levels. In New Zealand,

21 A 2005 study by Business and Economic Research Limited (BERL) found that core sectors, such as forestry, play a critical role in building job opportunities in their immediate communities. From a study of 13 communities and towns, BERL concluded that, for every 100 jobs in a core industry, a further 115 positions are created in the local finance, retail, hospitality and public service sectors (Sanderson et al, 2005: 24). This means a new processing plant in Milton or Winton with 100 staff would generate approximately 215 positions in the immediate community.

a long transition period to full production is often considered to be two to three years, not 50.

The New Zealand research on this issue was reviewed by Fairweather and others in 2000. They found that forestry has significant potential to increase net employment in districts with areas of marginal or unimproved land. The net employment benefits decline as the livestock capacity of the land increases. Their assessment made a series of observations (Fairweather et al, 2000: 15):

- The on-land employment generated by forestry development (at maturity) is generally higher than that produced by agriculture (on comparable land).
- The ratio of total employment (on-land, processing and indirect but not induced) to on-land employment is similar for both agriculture and forestry (at about three to one).
- Forestry processing employs approximately the same as on-land employment.
- The total employment generated by forestry can be several times that of agriculture, depending on the type of farming, soil conditions and climate.

Fairweather and others (2000: 33) noted that a significant proportion of the exotic estate is still in its first rotation and has not reached maturity. As such, "it is reasonable to expect that total employment per 1,000 hectares will increase in [the] future as relatively more wood matures". It is also important to recognise that the employment generated in silviculture management and harvesting is not tied to specific sites, as is the case in agriculture. This means individual communities may experience a loss of employment, while the broader district has a net gain in employment opportunities and population.

In looking at employment trends, it is important to recognise that forest growers and processors are under as much pressure as agricultural producers to increase their productivity and to adopt more capital-intensive systems. This means the labour input (per thousand hectares) will progressively decline. The social impact of capital replacement is more visible in the forestry sector, as there are relatively few companies (and contracting firms) compared with the approximately 70 000 full and part-time farmers in New Zealand.

ENVIRONMENTAL BENEFITS THAT NEW ZEALAND DERIVES FROM FORESTRY ESTABLISHMENT

The contribution that plantation forests and regenerating indigenous forests can make to soil stabilisation, catchment improvement and wildlife protection has been known for generations, but only in recent decades have these services come to be seen as having a tangible financial value (NZFOA, 2005: 4). These environmental gains were viewed as a "public" or "free" good. For example, property owners in flood-prone catchments have not recognised that upstream plantings add to the income of their properties (through reduced maintenance and improved pasture). This attitude is starting to change, as community and political leaders recognise the need to maximise these environmental benefits for society.

In New Zealand, forestry can play a critical role in soil stabilisation and in buffering waterways from nutrient run-off.

The range of environmental services provided by forestry varies, depending on climate, soils, topography and current land uses in a locality. In New Zealand, with its steeper topography and intensive forms of agriculture, forestry can play a critical role in soil stabilisation and in buffering waterways from nutrient run-off.

While forestry is generally viewed as having positive environmental benefits, there are situations where

the establishment and harvesting of plantings raise some concerns. These concerns have focused around wilding tree spread at higher altitudes, water draw-off in sensitive catchments, post-harvest sediment run-off and the establishment of monocultures (that is, single species plantings). Mitigation measures, such as excluding take-off zones from planting and using the latest management practices for harvesting, can minimise some of these concerns.

THE RANGE OF ENVIRONMENTAL GOODS AND SERVICES GENERATED BY FOREST ECOSYSTEMS

The principal benefits provided by indigenous and plantation forests can be grouped into six broad categories:

- Hydrological services.
- Erosion mitigation and the protection of soil productivity.
- Biodiversity and conservation services.
- Land rehabilitation and the absorption of pollutants.
- Carbon storage and sequestration services.
- The provision of a sustainable timber resource.

I. HYDROLOGICAL SERVICES

Forestry plantings have been used widely in New Zealand to mitigate the effects of extreme rainfall events. Forests have a large capacity to absorb and retain rainfall. This is important, particularly in areas with unstable soil structures that are prone to periods of intense storm activity (Powell et al, 2002: 5). The lower North Island floods of early 2004 demonstrated the damage that can occur on poorly structured and exposed soils. This event has encouraged regional and central government to look at the opportunities for developing new plantings, to minimise the damage from future storm activity. A similar event in 1987 (Cyclone Bola) resulted in the Government establishing the East Coast Forestry Project, discussed later in this section.

While forests can minimise the damage from peak flows, there are concerns about the impact plantings can have on the annual flow from a catchment. As the percentage of forest cover in a catchment increases, more of the precipitation will be intercepted. Long-term flow studies are indicating that forestry plantings have more impact on the total yield from a catchment than on the annual low flow rates. This is of particular concern in the drier, eastern regions of New Zealand, such as Canterbury. This matter is examined in more detail in this chapter under "Negative outputs".

Plantation forests are increasingly being used as a tool to improve water quality and filter bacteria. Testing of water quality has shown that even relatively small areas of forest (and riparian margins) can reduce the level of nutrient run-off and *E. coli* counts from animal waste contamination. This role as a filtering agent is becoming increasingly important in New Zealand, as agricultural activity is intensified.[22]

II. EROSION MITIGATION AND THE PROTECTION OF SOIL PRODUCTIVITY

Well-managed indigenous and plantation forests are able to stabilise erosion-prone sites by "dry[ing] out the soil and, perhaps more importantly, bind[ing] it with their roots to a greater extent than pasture" (Maclaren, 1996: 44). Forestry plantings can be used to mitigate most forms of erosion, from small-scale stream bank and gully erosion through to slumping, soil slip and wind erosion. Forestry plantings are less effective on deep-seated landslides or where tectonic activity causes mass movement.

New Zealand's geology and topography lead to a high rate of erosion and sediment transfer.

> *Eyles [1993] estimated that only 32 percent or 8.4 million ha of New Zealand can be maintained in pasture without the application of specific conservation measures (i.e. wide-spaced or block tree planting; temporary retirement; or other*

22 The effectiveness of plantings, particularly riparian zones, varies depending on climatic, soil and slope conditions.

pastoral management aimed at minimising erosion). (Maclaren, 1996: 45)

Forestry plantings have helped restore some of the worst-affected pasture land by stabilising steep hillsides and regulating the rate at which water runs off. Looking to the future, this role will continue to increase if New Zealand's 5.5 to 6.1 million hectares of vulnerable pasture land are to remain in grazing or other forms of production (Maclaren, 1996: 45; Ministry for the Environment, 1997: 8.76–8.77).[23] The nature of these plantings will vary depending on the physical characteristics of the property and the climatic conditions within the catchment or district. For localised erosion problems, small blocks or strips of planting may be sufficient to control the problem, while the large-scale erosion problems in parts of Rangitikei, the Manawatu and the East Cape will require larger-scale and more inventive forms of control.

An often overlooked area in the erosion debate is the power of the wind to transport sand and soil particles. New Zealand is prone to high speed and destructive winds, particularly in spring and early summer. Shelter plantings can impede wind flows and reduce their carrying capacity.

a. The East Coast Forestry Project (ECFP)

Periodic, high-intensity storms, coupled with steep terrain and unstable geology, have combined to make the East Coast region of the North Island highly susceptible to flooding and destructive erosion. The region occupies about 8 percent of the North Island but has some 26 percent of the land that is classed as "severely eroding".

In an effort to promote soil erosion control measures, the Government established the ECFP in 1992. The ECFP aims to:

Forestry plantings can be used to mitigate most forms of erosion, from small-scale stream bank and gully erosion through to slumping, soil slip and wind erosion.

- promote large-scale commercial forestry as a means to control soil erosion;
- provide employment and regional development;
- recognise environmental needs on individual properties.

The ECFP provides grants for planting, re-establishing indigenous vegetation and applying alternative management treatments (such as poplar and willow poles). Grants are allocated using a tender process, with grant applications assessed against set criteria and ranked according to a weighting system.[24]

The original target was to plant 200 000 hectares of land over 28 years at an average rate of 7000 hectares per year. At least half of this area would be on eroded or seriously eroded land. A 1998 review of the ECFP recommended that this target be modified to 60 000 hectares of the most erosion-prone land. Other modifications to the scheme included:

- a widening of the erosion control options beyond just commercial forestry;
- the development of a more flexible tendering system (including a reduction in the minimum grant area to five hectares);
- areas of scattered, or stunted, scrub that are not providing effective erosion control being made eligible for funding, subject to resource consent requirements;
- work with the Gisborne District Council to introduce regulatory controls to address severe erosion.

A further review of the ECFP in 2005 concluded that the Government should target landowners who have actively eroding gully systems.

23 The pasture estimates quoted in this section are based on data prepared in 1993. MAF figures indicate that the area in grazing, arable production, horticulture or fallow land has declined from 13.64 million hectares in 1994 to 11.83 million hectares in 2004. Factors influencing this trend have been land conversion to forestry, the reversion of marginal land and the return of leasehold land to the public estate under tenure review.

24 A distance equalisation factor is applied to commercial forestry applications to ensure that those applications more distant from the Port of Gisborne are not disadvantaged.

Landowner uptake of the scheme has been slower than anticipated. Nevertheless, an area of approximately 33 000 hectares has been established in forestry plantings. The majority of this has been in radiata pine, with small areas of Douglas-fir, cypress, eucalypts, poplar and willow. The scheme has also assisted a number of landowners to re-establish indigenous vegetation (primarily through reversion). The plantings established over the past 15 years are already having a tangible impact on the rate of gully erosion.

The revised soil conservation regulations introduced by the Gisborne District Council in late 2006 will aid the objectives of the ECFP. The regulations deal specifically with the management of severely eroded land, including mandating forestry planting.

III. BIODIVERSITY AND CONSERVATION SERVICES

The contribution plantation forests can make to New Zealand's biodiversity outcomes has been overshadowed by a longstanding debate on the extent of flora and fauna in New Zealand's indigenous forests compared with plantation forests. This comparison had some validity when there was significant conversion of indigenous forest to plantation forest but this has not been the case for some time: the plantings during the 1990s were almost exclusively on ex-pasture land.

Both regenerating indigenous bush and exotic plantations have a significantly higher level of biodiversity than modified pasture (Maclaren, 1996: 127; Parsons et al, 2006: 16). Forestry companies are finding that a number of native insect-feeding birds (including some of New Zealand's rarer species) thrive in stands of older exotic forests (Maclaren, 1996: 130; NZFOA, 2006: 7).

IV. LAND REHABILITATION AND THE ABSORPTION OF POLLUTANTS

A new role is emerging for forestry plantings in the area of land rehabilitation and the disposal of organic contaminants. The science is still evolving in this area, but the research is showing that certain tree species are effective at restoring soils contaminated with organic chemical wastes, such as solvents, petrochemicals, wood preservatives, explosives and pesticides. As part of this research, scientists are looking at the opportunities for mineralising organic contaminants to carbon dioxide and water, rather than storing or immobilising these products. The New Zealand trials have looked particularly at the opportunities for using willow and poplar for removing cadmium contamination in pasture.

With forests containing about 40 percent of total terrestrial carbon, this tool could help mitigate the emissions that are being produced by the industrial and industrialising world.

V. CARBON STORAGE AND SEQUESTRATION SERVICES

The ability of forests to sequester carbon is becoming a critical factor in national and international efforts to address global climate change. With forests containing about 40 percent of total terrestrial carbon, this tool could help mitigate the emissions that are being produced by the industrial and industrialising world (Powell et al, 2002: 5). Additional forestry plantings and improvements to the management of our existing forests will increase the store of carbon. Using forests as a carbon sink is a short-term mitigation measure. It provides a breathing space while countries search for longer-term solutions to their energy demands and industrial output.

VI. THE PROVISION OF A SUSTAINABLE TIMBER RESOURCE

It is important to remember that timber is a renewable resource that is created using naturally occurring inputs (solar energy, water and carbon dioxide). This contrasts with other building

products (aluminium and cement), which are produced using energy-intensive processes and which use non-renewable raw materials.

Timber products are also biodegradable and, in many cases, reusable.

FUTURE ENVIRONMENTAL ISSUES

The New Zealand forestry sector has been pro-active in adopting forest management standards that meet or exceed international best practice. This is illustrated by the stance taken by the sector regarding environmental certification. The majority of New Zealand's plantation companies (and larger mills)[25] have gained, or are in the process of gaining, environmental certification (principally FSC accreditation). New Zealand companies were some of the early adopters of the scheme, and in a number of cases they sought certification from the International Standards Organization as a preliminary step. The motivation for taking this step has been growing consumer demand for sustainably harvested and managed forest products. Certification may not increase the financial return from a container of lumber or mouldings but companies are reporting that it is helping to maintain access to high-value markets and consumers (such as the Home Depot in the US and B&Q in the United Kingdom).

It is also important to remember that New Zealand's indigenous timber industry has operated under sustainable management provisions since 1993, with the Part IIIA amendment to the Forests Act 1949. Landowners operating under this Act are required to prepare a forest inventory and develop management practices that retain the natural values of the site. Harvesting occurs on the basis of an approved management plan or permit, which sets out the harvest limits for each timber species in a block (these rates are no greater than the forests' natural ability to replace the harvested timber).

As part of the industry's move to improved environmental monitoring and management the New Zealand Forest Owners Association released The National Standard for Environmental Certification of Plantation Forests in 2005 (NZFOA, 2005). The NZFOA encourages members to use the standard as the basis of their operational management. More recently, the NZFOA, in association with the Farm Forestry Association and other stakeholders, released the New Zealand Environmental Code of Practice for Plantation Forestry (NZFOA, 2007b). The code replaces the previous Logging Industry Research Organisation (LIRO) Code, and aims to be a reference tool for those involved in forestry management.

While the sector has made significant environmental gains in recent decades, progress needs to continue on a number of fronts if the sector is to retain its image as a leader in sustainable forest management and harvesting. This image is critical for gaining, and retaining, access to key markets. The major challenges for the medium to longer term are:

- ensuring the whole industry is meeting environmental best practice, as individual cases of poor performance can tarnish the image of the entire sector (this includes small-scale growers and private contractors);
- identifying innovative engineering and harvest solutions to reduce soil and water disturbance;
- reducing the potential for wilding tree spread in mid- and higher-altitude locations, through better project design and ongoing management practices;
- increasing internal transport efficiency (for example, reducing the number of empty backloads through industry co-operation and the use of electronic docketing) – these initiatives will reduce costs and the sector's energy footprint;
- continuing research on insecticide and pesticide use, with the aim of reducing use and identifying practical non-chemical management solutions;
- researching, and adopting, new-generation

25 This includes two indigenous forests and a short-rotation eucalypt operation.

preservative treatments and alternatives to methyl bromide for fumigation;
- encouraging small-scale forest growers to enter group certification schemes;
- developing national systems to monitor (and assess) the biodiversity values in plantation forests.

VALUING THE NON-MARKET BENEFITS AND COSTS OF FORESTS

Forests in New Zealand are normally valued on the volume and grade of recoverable timber. While this provides an assessment of the standing crop, it fails to recognise the broader benefits of afforestation, as discussed above; that is, sustainable development, community development and environmental protection.

Underestimating the true value of forestry plantings can lead to sub-optimal decisions when assessing changes in land use and management.

Assessing the full value of forests can be difficult, as many of the non-timber benefits and costs are not currently traded. A trading system provides a mechanism for determining a market price for outputs. In the absence of a trading system, these outputs are likely to be viewed as having a negligible value, or will be seen as a public good.

A range of valuation methods are used internationally to estimate the benefits and costs of non-traded activities. One of the principal areas where these methods are used is in valuing on and off-site environmental effects. These valuation methods can be categorised under four general headings:
- cost-based methods (also known as market value approaches);
- revealed preference methods (also known as surrogate market approaches);
- stated preference methods (also known as simulated market approaches);
- benefit transfer techniques.

The decision as to which valuation method should be used in a particular situation will depend on the environmental attributes being assessed. For example, different methods would be used to examine direct values such as stock protection compared with indirect values (water quality enhancement), future values (flood mitigation) or non-use values (habitat protection). The practicality of using these methods depends on how well the relationship between the forest resource and the particular effect is known, and the availability of associated economic or survey data.

These valuation methods are being used increasingly to identify the public demand for various attributes (and the need for government intervention). From a policy perspective, it is important to assess whether the costs of intervention will generate sufficient benefits to outweigh the costs associated with the policy.

FUTURE TRENDS IN PLANTATION DEVELOPMENT

OPPORTUNITIES ASSOCIATED WITH EMERGING COMMERCIAL TIMBER SPECIES

Interest in alternative species is being driven by a combination of market, physical and biosecurity factors:
- Investors are looking for species that have established international reputations and a strong market image.
- There are some concerns about the concentration on radiata pine and how this is leaving the sector vulnerable to biosecurity risks.
- The new generation of overseas investors has experience in managing a range of timber species.
- The opportunities around biofuels (including specialist chemicals) and biomaterials are encouraging investors to examine a range of species.
- The rising price of land is encouraging investors (particularly in the southern South Island) to look

at higher-altitude blocks, where radiata pine is not always suitable.

- A wider selection of timber species would enable forest managers to match species to site conditions. Considerable gains in productivity and land-use efficiency can be achieved by appropriate species selection (coupled with suitable silvicultural practices).
- The species under investigation have significant potential for high-value end products, including flooring, furniture and mouldings. For example, City Forests Limited aims to use the cypress resource that it has developed over the past 25 years to encourage additional furniture-making industries in Otago.
- The development of higher-altitude plantings has the potential to diversify and enhance the economies of the communities that service these areas (Höck et al, 2001).

Interest in alternative timber species has been driven primarily by the farm forestry community and a number of overseas plantation forest companies. Blakely Pacific and Ernslaw One are both committed to expanding their holdings of Douglas-fir, while the New Zealand Redwood Company is progressively developing a 30 000 hectare estate of redwoods. These companies believe New Zealand's climatic and soil conditions suit a range of species.

The Farm Forestry Association places a strong emphasis on educating its members, and the wider community, about the opportunities associated with alternative timber species. It operates five special interest groups, which cover both indigenous and exotic species. The investment power of the farm forestry community should not be underestimated, as a single workshop on cypresses, held in northern Southland, produced nursery orders of approximately 250 000 trees.

Looking to the future, a number of Māori land owners are seriously considering the options

Considerable gains in productivity and land-use efficiency can be achieved by appropriate species selection.

associated with forestry development.

Forestry plantings provide an opportunity to use poorer-quality land that has a number of environmental limitations for agricultural production. While radiata is likely to be the major species planted, alternative species (including indigenous timber species) will be considered. The Government's Permanent Forest Sink Initiative would support a move in this direction.

WHERE WILL THE NEXT GENERATION OF FORESTRY PLANTINGS BE DEVELOPED?

The large-scale plantings of the next 10 to 20 years are likely to be located in the hill country of the North and South Islands, due to land costs and site availability. Planting in the hill country poses a number of challenges (from a management, harvesting and transport point of view), but the potential area available makes the challenge worthwhile.

Forty-one percent of New Zealand's land area is defined as having a restricted ability for pastoral farming, and as being more suited to forestry or indigenous vegetation. These areas are more generally known as Class VI and VII land (Ministry for the Environment, 1997: Table 8.3). Only a small proportion of this area is currently in shelterbelts, woodlots or commercial forests. Forestry would provide not only an alternative income stream for these areas, but could be used as a tool in erosion and flood mitigation. To advance this work, MAF oversees the Sustainable Land Management (Hill Country Erosion) Programme, working with regional councils in finding practical solutions to hill country erosion.

› CHALLENGES TO FUTURE DEVELOPMENT

The forestry sector faces a number of challenges in sustainably growing the industry. These include:

- demonstrating to the public, local authorities and farmers that forestry plantings are an integral part of catchment management and that they make a positive contribution to local communities and sustainable land management;
- moving the industry to a more value-added operating environment;
- improving the financial performance of the sector so that it is viewed as a positive investment opportunity;
- encouraging local authorities to adequately provide for plantation development and associated processing facilities;
- co-ordinating the resources of the industry, to make progress on major logistical and technological issues;
- encouraging public debate on the wider environmental benefits that forestry brings to the community (and the relative impacts of different land uses);
- supporting research into higher-value, and higher-altitude, timber species;
- establishing frameworks to address externalities (including environmental services).

»» OPPORTUNITIES ASSOCIATED WITH NON-TIMBER FOREST PRODUCTS

The commercial opportunities associated with secondary crops, plant extracts, medicinal herbs and ecological tourism are not well understood by New Zealand forest managers, or the population at large.

New Zealand's commercial plantation forests have been managed primarily for log and chip production, and limited attention has been paid to secondary sources of income. Non-timber forest products (NTFPs) can supplement forest revenue and provide critical income during the rotation cycle. International experience shows that NTFPs represent a sizeable proportion of total revenue from forested areas in both developing and developed countries.

> *By far, the largest segment of the NTFP industry, in terms of value, is the medicinal and dietary supplement segment. By some estimates, the world-wide market for herbal medicines is valued at $7.5 to $8 billion [USD], and is expected to grow to between $12 and $14 billion [USD] by 2000. Other studies suggest that this segment already exceeds $14 billion [USD]. (Chamberlain et al, 1998: 16)*

The NTFPs currently produced in New Zealand include game meat (from feral deer, goats and pigs), pelts (from the Australian brush-tailed possum), sphagnum moss and honey production (including honeydew). In addition to this, small quantities of berries and fungi are harvested each year, along with plant extracts for medicinal remedies (these commodities are harvested mainly for personal and community use).

Local research organisations have undertaken work on a selection of crops that could be managed in conjunction with timber production. They include: mycorrhizal mushrooms, ginseng, goldenseal[26] and a number of berry and nut species. The financial advantages of developing secondary (or complementary) crops are three-fold:

- After an initial establishment period, they provide landowners with an annual income, which will help to cover the costs associated with managing the estate.
- An additional crop improves operating cash flow and increases the overall return from the property.
- A secondary source of income reduces the financial uncertainty associated with long-term forestry investment.

While secondary crops have generated considerable interest at industry forums and field days, the uptake has been limited to a few trial blocks and small-scale

26 *Hydrastis canadenis L.* is a high-value medicinal herb from North America. It is used as a muscle stimulant and as a laxative.

plantings of mycorrhizal mushrooms and ginseng. MAF examined the reasons for this slow uptake in January 2004 (via a round of meetings with science and industry representatives, including Crop and Food Research and Crops for Southland). It seems that investors recognise the opportunities associated with secondary crops but are reluctant to commit resources until they can be assured that there are markets and distribution networks.

Therefore, any promotion of secondary crops in plantation forests needs to have a strong focus on the avenues for marketing these commodities and the transport arrangements needed to get these crops to the consumer in optimal condition.

Raising investor understanding and interest in secondary crops will require an extended programme of technology exchange that draws together the research on these crops, and the organisations that could help growers establish market contacts. A critical factor in developing the industry will be the level of corporate support. A number of corporates would be required to champion the industry. They would provide the scale of production necessary to establish permanent domestic and export markets and act as a catalyst for private investors to commit their resources. Corporate involvement is also critical for developing the skills and workforce for managing and harvesting these crops.

FOREST-BASED RECREATION AND TOURISM

Nature-based tourism is important not only as a social activity, but as an economic driver of regional economies. New Zealand's forests are a particular drawcard for overseas tourists. In the year ended March 2007, international tourists contributed an estimated NZ$6.3 billion to the economy (Ministry of Tourism, 2007). Research by the Department of Conservation and the Ministry of Tourism has shown that "nature-based tourism is a key growth

Any promotion of secondary crops in plantation forests needs to have a strong focus on marketing and transport.

area, and a significant portion of it is based on access to public conservation areas and protected wildlife" (Department of Conservation, 2005: 69).

Nature-based tourism in New Zealand can range from scenic drives and wildlife encounters to back country hiking and hunting. The revenue generated from these activities ranges from $50 to $100 per night for hut fees and local services through to several tens of thousands for a trophy animal head.

The majority of these activities occur within the public estate, managed by the Department of Conservation.

New Zealand's plantation forests are not managed for recreational purposes but there has been a tradition of allowing public access where it does not impinge on harvesting operations or create occupational safety issues. For more than half a century, plantation forests have been used by recreational hunters, mainly in search of wild deer and pigs. Most commercial forest owners operate a permit system, whereby they manage the number of recreational hunters operating in their forests and the locations in which they hunt (to prevent accidental shootings).

New Zealand's larger commercial forests have a number of horse riding, mountain biking and walking tracks. The majority of these facilities are in the former state forests that were privatised during the 1990s. The investors that purchased these forests have normally maintained the facilities, and some have shown a commitment to enhancing them. Major forestry companies, such as City Forests, Ernslaw One and Wenita Forest Products, all have policies of encouraging community use of their forests and promoting events such as

bike and rally racing. These companies are also putting resources into promoting community awareness of New Zealand's forestry resources, primarily through educational programmes. Local communities are showing increasing interest in accessing these forest areas, for cultural, recreational and sporting reasons. This is particularly the case for walking tracks that are in close proximity to urban centres.

NEGATIVE OUTPUTS

PLANTATION FORESTRY

The rapid growth of plantation forestry during the 1970s and 1980s generated considerable community and political debate over the role of large-scale plantings in the rural landscape. These debates focused on the impact that plantings were having on rural employment, the provision of services and the sustainability of agricultural and community structures. These tensions frequently led to calls for councils to restrict plantings or to protect productive soils. In hindsight, many of these concerns have not materialised.

The debate has moved on in the past decade to focus primarily on environmental issues, such as:

- activities that result in sedimentation;
- impacts on riparian values;
- impacts on landscape and aesthetic values;
- clearance of significant indigenous vegetation;
- reductions in water yield.

As discussed previously, the forestry sector has taken a proactive stance in addressing community and market concerns over environmental issues (through the development of codes of practices and the acceptance of international auditing). The New Zealand forestry sector has generally been ahead of the other primary sectors in meeting the developing environmental challenges and in moving to sustainable development.

I. HARVESTING AND TRANSPORT ISSUES

Harvesting operations are periodically criticised for causing increased sedimentation, but the actual harvesting of trees usually has little effect. "Where landslides are not a major problem, overseas and New Zealand studies consistently show that the major sources of sediment supply to streams after harvesting are roads, tracks and landings" (O'Loughlin, 2005a: 13, referring to Sidle et al, 1985 and Grace, 2000). These soil disturbance activities (earthworks) are subject to controls under district plans and to industry codes of best practice.

One unresolved issue concerns damage to roads from the concentrated use of logging trucks. Chapter 6 looks in detail at this issue.

II. RIPARIAN AND STREAMBED VALUES

The establishment of forestry plantings in riparian zones has been an area of ongoing debate. While the environmental benefits of establishing plantings are recognised (for example, improved water quality, mitigation of stream bank erosion and provision of terrestrial and in-stream habitat), there is sensitivity over the impact that harvesting operations may have on streambed values. This debate has resulted in the majority of district councils imposing controls on harvesting within riparian zones. The sector is supporting research to better define the impact of forestry on in-stream values (particularly at the harvesting phase), and contractors have made major progress in adopting best management practices for harvesting these areas.

III. LANDSCAPE CHANGE

There is no doubt that moving from a grassland or tussock environment to a forest-dominated landscape is a significant visual change. While there are design and planting approaches to smooth boundaries, restrict the spread of wildings and lessen the visual impact of afforestation, it can be difficult to build community acceptance of this change. This is particularly the case where

communities are closely tied to a prominent landscape (such as in the high country). Section 6(b) of the RMA requires the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development. This provision has proved a stumbling block for forestry companies, particularly in areas where plantation forestry is not currently a major land-use option.

IV. WATER QUANTITY AND QUALITY

Afforestation of pasture catchments can result in significantly reduced annual water yields, with experimental studies showing reductions of between 30 and 80 percent (Davie, 2006). The cause is the evaporation back into the atmosphere of rainfall intercepted by the forest canopy. Transpiration is not the issue, as radiata pine does not transpire at greater rates than pasture, all other things being equal (Duncan, 2003). While "trees are considered to extract moisture from soils to greater depths than pasture, evidence does show that pasture can extract moisture over 150 cm down the profile and at similar depths to trees. Both trees and pasture prefer to extract moisture from the top 60 cm or so of a soil profile" (Rowe et al, 2002: 68).

Rowe and others (2002: 122) conclude that:

> *Interception loss for radiata pine plantations averages 22 percent of precipitation whereas for Douglas fir plantations the loss is 28 percent, and for New Zealand native forests and scrub the loss is about 35 percent. For tussock grassland interception loss has been measured at 21 percent of precipitation, and that by pasture is very rarely measured and considered negligible.*

Afforestation's effects on in-stream low flows are less well studied. "Low flows are reduced following afforestation but it appears that in some cases low flows are affected to a lesser extent than annual yield" (Davie, 2006: 8, referring to Davie and Fahey, 2005). The effect on peak flows is considerable, but is generally thought to be positive as afforestation can mitigate flood activity.

The sector is supporting research to better define the impact of forestry on in-stream values (particularly at the harvesting phase), and contractors have made major progress in adopting best management practices for harvesting these areas.

Turning to the issue of water quality, most scientific evidence suggests that forestry is extremely good for general water quality (Davie, 2006). There can be short-term sedimentation effects, however, following harvesting activity.

V. SIGNIFICANT INDIGENOUS VEGETATION

The protection of significant indigenous vegetation is an issue affecting all the land-based sectors. The debate on this issue has generally been more contentious in the agricultural sector than in forestry. The issues have normally been around what is "significant" and what protection measures should be introduced by councils. The principal forestry companies expend significant resources to maintain (and enhance) the values of their indigenous forest reserves, through pest control and environmental monitoring.

VI. MOVING FORWARD

The experience of the past 30 years has shown that the sector needs to work collectively to tackle these issues, whether it is presenting scientific research to challenge historical misconceptions or to develop best management practices where there are performance issues. A collaborative approach allows resources to be pooled to address problems faced by multiple forest owners, which are often beyond the capacity of a single forest owner to deal with.

› WOOD PROCESSING

Wood processing activities can generate a range of adverse effects on the environment. The nature of

the effects, and their significance, will depend on the type, scale and location of the processing unit, but will involve some combination of:

- discharges into the air of dust, smoke, particulate matter and odours;
- discharges of waste water and storm water;
- water take;
- use of hazardous substances and associated potential for contamination;
- disposal of solid waste, including green waste and non-inert materials;
- noise generation;
- impacts on aesthetic values, amenity values and natural character;
- traffic movements, particularly of heavy vehicles;
- use of lighting.

The more transparent and potentially serious adverse effects (such as discharges to water, the use of hazardous substances and traffic congestion) can normally be addressed by performance standards in regional and district plans. While it may be expensive to design a processing facility that achieves these standards, they at least provide certainty for the investor.

Mitigating the adverse effects on aesthetic values or the natural character of a site has proved a more difficult hurdle for investors, as they are open to wide interpretation. Councils have struggled with these values as they can not be readily addressed through performance standards in regional or district plans. Recent Environment Court decisions (Environment Court 2004 and 2005) have shown that the Court expects investors to take full account of amenity and character issues. While the Court has provided some direction on these issues, investors continue to face a degree of uncertainty.

The difficulties that investors have faced in establishing new wood processing facilities relate in part to a shortage of industrial land near the forest resource. Limited attention was paid in the initial round of district and regional plan development to the need for additional rural wood processing sites. This could be put down to an assumption that new wood processing facilities would be located within existing industrial zones. The reality has been that some major proposals have sought to locate in rural zones.

Good decision support systems can help managers understand the consequences of actions and identify the best approach to follow.

OPTIONS FOR ADDRESSING THE NEGATIVE IMPACTS

I. CODES OF PRACTICE AND BEST MANAGEMENT PRACTICES

The value of codes of practice and best management standards is as much about understanding the nature of the issues, as it is about how the issues might best be addressed in planning and operational contexts. *The New Zealand Forest Code of Practice* was first published in 1990 and has recently been re-drafted as the *Environmental Code of Practice for Plantation Forestry* (officially launched in August 2007)(NZFOA, 2007b). The longevity of this code of practice demonstrates its worth.

Best management practices are developed by businesses in an effort to identify how they will meet the challenges of their operations. They are valuable for demonstrating a commitment to high standards and pinpointing weaknesses.

II. DECISION SUPPORT SYSTEMS[27]

Good decision support systems can help managers understand the consequences of actions and identify the best approach to follow. A decision support system for riparian management in radiata pine forests was developed by the National Institute for Water and Atmospheric Research (NIWA), the New Zealand Forest Research Institute (NZFRI) and Landcare Research, working with an end

27 A class of computerised information system that supports business and organisational decision-making.

users group. A lack of funding meant it was never completed, unfortunately. There may be potential to develop a decision support system for forestry and landscape issues.

III. THIRD-PARTY ECO-VERIFICATION

Eco-verification is a process by which a third party certifies that a product, process or service meets internationally recognised and agreed standards. Eco-verification is not a replacement for government regulations and legislation, but it can complement these policy tools.

Most companies view eco-verification as a commercial tool for progressively improving their management systems. It also provides a "paper trail" for demonstrating changes in management practices and performance levels. This can be of practical use when developing new markets or lodging consent applications.

Eco-verification in New Zealand

The past decade has seen a steady trend in the New Zealand plantation and wood processing industries towards eco-verification. This trend has been encouraged by increasing consumer demand for products that are certified as coming from sustainable sources and that meet specific environmental standards. In the case of integrated forestry companies, environmental certification systems cover the full chain of production, from forest management to wood processing.

A number of market-driven schemes or "standards" have appeared over the last few years. The two principal schemes for verifying sustainable forest management are the Programme for the Endorsement of Forest Certification schemes (PEFC) and FSC certification. These schemes currently seem to be disconnected from the intergovernmental processes dealing with sustainable forest management and appear to be competing with each other for market share.

The New Zealand forestry sector has made considerable progress in moving towards eco-verification of the country's commercial forests, with over half the area being FSC certified.

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In November 2005, the NZFOA released *The National Standard for Environmental Certification of Well-managed Plantation Forests in New Zealand* (NZFOA, 2005). The National Standard was developed in consultation with a broad range of stakeholders, and aims to provide producers with a clear standard of sustainability against which to benchmark and improve their practices.

IV. PROVISIONS IN DISTRICT AND REGIONAL PLANS

Provisions in district and regional plans can influence where activities are undertaken and encourage them to locate in areas where the environment is less sensitive to particular adverse effects. This is a form of mitigation.

It is expected that forestry will be provided for throughout rural zones, subject to varying levels of standards and controls, but wood processing activities will generally be encouraged to locate in industrial zones. The forestry sector needs to submit on district plans as they come up for review to ensure that industrial and rural/industrial zonings are appropriate for future wood processing initiatives. A strategic approach might involve:

- evaluating wood availability forecasts and inter-regional woodflows;
- considering the wood processing opportunities;
- evaluating existing wood processing capacities and the potential for brownfield expansions (that is, expansions of existing plants);
- focusing input on those plans where greenfield

(or new) wood processing capacity is likely to occur (based on projected volumes and industry feedback).

V. EDUCATION

There is a need for the dissemination of authoritative information on the real and perceived negative and positive outputs of plantation forests and wood processing to lift public understanding and discussion of these issues.

»» THE CONTRIBUTION OF THE FORESTRY SECTOR TO ENERGY GENERATION

The forestry sector stands out amongst New Zealand's processing industries in that it generates 50 to 55 percent of its primary energy needs. The sector uses residues from sawmilling and the pulp and paper industry to generate heat and electricity (co-generation). Wood residues produce an estimated 340 Gigawatt hours of electricity and 8700 Gigawatt hours of heat per year.

In 2004, wood provided 6 percent of New Zealand's total energy needs, in the form of heat for industry, firewood in our homes, and a small amount of electricity generation. However, our use of woody biomass has the potential to increase to 8 percent by around 2010 as plantation forests now reaching maturity are harvested and processed, making more wood residue available. (Energy Efficiency and Conservation Authority, 2005: 2)

Attention is also turning to the opportunities for ethanol and methanol production from wood fibre. While there is currently a significant gap between the price of wood-based alcohols and extractive fuel production, the science is evolving progressively, and comparable pricing could be achieved in less than 10 to 15 years. This estimate is based on current fuel pricing projections. With the introduction of climate change policies, this gap may close more rapidly: "As gas price increases and Climate Change policies are introduced the relative economics of bioenergy for heat will improve" (Joint Energy Working Group, 2002: 3).

The industry (in partnership with local and central government) needs to be ready for such developments, with the appropriate infrastructure, technology and human capability for fibre collection and processing.

› ENERGY PRODUCTION FROM PROCESSING SITE RESIDUES

The majority of New Zealand's biomass energy plants are operated as part of sawmilling or timber-processing facilities. The fuel stocks for these plants are drawn from wood residues on the site (bark, sawdust, shavings and off-cuts). Using onsite residues not only generates energy but saves companies the cost of dumping the wood waste. Wood processing companies have moved to use this resource, as energy represents between 5 and 30 percent of total input costs and onsite energy plants provide companies with "the ability to manage for energy price volatility and to access secure supply" (Joint Energy Working Group, 2002: 1). As they are able to internalise a proportion of their energy costs, they are less vulnerable to seasonal and longer-term movements in the price of industrial energy.

Onsite energy plants provide companies with "the ability to manage for energy price volatility and to access secure supply".

The rate of co-generation development has fallen away in recent years. The Bioenergy Association of New Zealand (BANZ) estimates that an additional 12 megawatts of thermal capacity (from woody biomass) was installed in 2004, compared with 79 megawatts in 2001 (East Harbour Management Services, 2005: 52, referring to a BANZ survey). The growth in energy capacity is tied closely to

processing activity (as the feed stock is a by-product of sawmilling and further processing). Processing activity has levelled off in the past four years due to weakness in key export markets and the financial state of the industry. New capital investment will generally be deferred while the industry is under financial pressure.

THE ENERGY POTENTIAL FROM HARVEST AND THINNING RESIDUES

Forest residue as a fuel for energy production has the potential to meet all the wood processing industry's energy needs for heat and electricity. Currently the cost of residue as a fuel source is too expensive but because of its significant potential this is an area where more reliable information is required. (East Harbour Management Services, 2002b: 2)

BANZ (2007: 1) estimates that "at current levels of log production, there are around 4 million tonnes of biomass left in the forests every year". Of this total, approximately 50 percent is readily recoverable. This is a significant, untapped resource for the forestry sector and for New Zealand generally. Just as importantly, it is a renewable source of energy.

The factors limiting the development of this industry are the cost of transportation to heat plants, the cost of storage and the lack of appropriate infrastructure to collect the waste material from harvest sites. The studies completed in recent years have put the cost of landing woody residues at between $40 and $50 per tonne (East Harbour Management Services, 2002a: 93 and 2005: 55). This is for distances of 60 to 80 kilometres from the harvest site. An added issue is that green biomass has a relatively low energy content (7 to 10 megajoules per kilogram). This means the cost of producing a kilowatt hour of electricity from biomass ranges from 15 to 20 cents (Cox, 2006: 4). This compares with an industrial

The forestry sector stands out amongst New Zealand's processing industries in that it generates 50 to 55 percent of its primary energy needs.

electricity purchase price of approximately 8 cents per kilowatt hour.

These high cost structures are likely to reduce over time, as managers gain experience in extracting this resource. Overseas experience (particularly from northern Europe) will help this process. This trend is already being seen in the central North Island:

[W]ith greater experience of waste collection and processing forest residue, costs have been recently decreasing and the economics will thus improve. [The] cost of forest residue in the Kinleith area is reported to be about $31/tonne delivered to a heat plant. (East Harbour Management Services, 2005: 55)

A BIOFUEL FUTURE?

The biofuels industry is a long-term energy option for New Zealand that will require careful consideration by government, research agencies and the forestry sector. It is important, however, to temper the enthusiasm that surrounds this industry with a degree of caution. The biofuels industry is still in its infancy and considerable research is needed to bring the cost of wood-based ethanol and methanol down to a level where it can compete effectively with extractive oil sources. The US Department of Energy estimates that it costs US$2.20 per gallon to produce cellulosic ethanol (Weeks, 2006), or US$92.40 per barrel. However, the energy density of ethanol (compared with crude oil) is just 0.7. This means the per-barrel cost of ethanol will need to be proportionately lower. Methanol has an energy density that is lower than both crude oil and ethanol.

An example of investors laying the groundwork

for this new industry has been the Bio Joule joint venture between Genesis R&D and the Lake Taupo Development Company[28]. In this case, trials have been undertaken on short-rotation crops of willow to determine the viability of producing both ethanol and "natural lignin in a state suitable for production of biodegradable plastics, resins and films, as well as a sugar called xylose that diabetics can safely use" (Snowdon et al, 2006: 25). The development of high-value co-products is critical to the growth of the industry, particularly in its initial stages. In late 2007, the Bio Joule operation was sold to Hong Kong based Pure Global Limited, a renewable energy company that intends to further develop the short-rotation crop technology.

The biofuels industry is a long-term energy option for New Zealand that will require careful consideration by government, research agencies and the forestry sector.

NEW PRODUCTS AND INNOVATIONS

It is a little over 30 years since New Zealand's first MDF was produced at Sefton in North Canterbury. New Zealand was a leader in this innovative technology. When Sefton opened its doors, it had a design capacity of 60 000 cubic metres per annum. In the intervening years, New Zealand production has grown to approximately one million cubic metres, and global production now exceeds 50 million cubic metres annually. This example illustrates that products that were innovative in one generation can quickly become a normal part of life.

The one certainty when looking at the future direction of the wood processing industry is that it will look different from what it is today. Terms such as functional packaging, biomaterial substitution and fibre-based antibacterial surfaces are likely to become part of the industry's day-to-day language. While these new technologies offer new products and markets, it is likely that solid wood manufacturing will continue to be the mainstay of the New Zealand industry. Even in this area, however, there are likely to be changes, with a greater emphasis on engineered timber solutions and work to expand the uses of solid timber (particularly in multi-storey buildings).

NEAR-TERM OPPORTUNITIES (5 TO 10 YEARS)

I. INNOVATIONS IN PACKAGING AND TISSUE MANUFACTURING

European and North American research is producing new forms of wood-fibre packaging that can help extend the shelf life of perishable goods. Low-cost monitoring equipment is also being embedded in the packaging to provide both retailers and consumers with information on the quality of the internal product. This will enhance consumer safety and help retailers manage their inventory.

In the area of tissue manufacturing, "new types of tissue and personal care products will be fashioned with improved properties to retain liquids, and [they will be] produced using less raw materials" (Forest-Based Sector Technology Platform, 2006: 12). It is envisaged that these products will have fibre-based antibacterial surfaces, and may incorporate sensor technology.

II. THE OPPORTUNITIES ASSOCIATED WITH BIOMATERIALS

Biomaterials are engineered products that are manufactured from biological tissue material, such as wood fibre, maize and soy. The range of materials that can be derived from woody biomass includes speciality chemicals, moulded plastics, coatings and composites. The concept of using woody biomass in these forms of production is not new. Manufacturer interest in biomaterials has grown in the past decade, as the cost differential between biological and mineral-based materials has declined.

28 This project is also being supported by the MAF Sustainable Farming Fund.

The range of materials that can be derived from woody biomass includes speciality chemicals, moulded plastics, coatings and composites.

The technology around biomaterials has advanced steadily in recent years. This has brought establishment and production costs down. The result is increasing interest in, and use of, biomaterials. In the US:

> *Wood-fibre reinforced thermoplastic composites (WFRTCs), or wood-plastic composites, are increasingly used in durable applications within the building / construction and furniture industries. Since 1997, this market for WFRTCs has grown at an average annual rate of 38 percent. (US Department of Energy, 2006: 1)*

III. SOLID WOOD BUILDING SOLUTIONS

Within the construction and timber industries, there has been renewed interest in the opportunities for using solid wood design solutions. The New Zealand Government has supported this work by establishing two university chairs in timber design (at the University of Auckland and the University of Canterbury). This investment is aimed at developing competitive design and construction solutions using timber, rather than concrete or steel.

The research to date has shown that buildings with a high proportion of solid timber can be designed to meet (or exceed) the endurance, energy, fire and loading standards of competing materials. This work has also shown that architects, builders and investors are not using timber more readily as there is a lack of knowledge (and ready information) about the ways timber should be used to improve energy efficiency or to reduce fire risks.

> *Because wood is combustible, many building codes discriminate against timber construction. This discrimination is misguided because properly designed timber construction can perform as well as other materials in fires. (Buchanan, 2005)*

This work is aimed not only at increasing the use of solid timber in multi-storey buildings, but at:

- promoting the idea of environmentally sustainable construction;
- extending the use of timber in heavy loading situations (for example, bridges);
- demonstrating the commercial viability of solid wood constructions.

LONG-TERM (BLUE SKY) OPPORTUNITIES (10 YEARS PLUS)

I. TAILORING TREES FOR FUTURE PRODUCTS

As our knowledge of gene sequencing has grown, we have reached the stage where preferred traits can be isolated and commercially developed into a new generation of nursery stock. A recent initiative in this area has been the partnership between Scion (formerly Forest Research) and ArborGen LLC.[29] This partnership is focusing on "the areas of gene discovery and molecular breeding" (Scion, 2007).

Molecular breeding opens the door to developing tree stocks that have a greater resistance to biological risks and an improved tolerance to environmental extremes. This is a critical issue for New Zealand, as the next generation of plantings are likely to be on less-fertile and higher-altitude locations. Breeding tree species with a greater biological resistance to insect and fungal attack would also provide an opportunity to commercialise species that have not previously been seen as viable in New Zealand.

II. EXTENDING THE FUNCTIONAL LIFE OF TIMBER PRODUCTS AND ADHESIVES

A number of research organisations are examining the issue of product life spans and whether there are opportunities to extend the functional working life of products, such as furniture.

29 ArborGen LLC is a US-based company that is involved in the research and commercialisation of genetic technology that improves forest sustainability and productivity. ArborGen is partly owned by New Zealand-based Rubicon.

One part of this research is focusing on how environmental conditions (for example, atmospheric temperature, ultraviolet exposure and relative humidity) affect the physical properties of the timber and the adhesives used in their construction.

This research is resulting in improved design and manufacturing techniques. One example is timber-hardening technologies. Investment over an extended period (10 to 15 years) was required to develop the technology necessary to enable relatively soft species (such as radiata pine) to be used in a wider range of construction, flooring and furniture uses, which were previously the domain of tropical hardwoods. Hardening technology involves the "pressure treatment of wood with a starch mixture that thickens and hardens cell walls. This gives the wood greater stability and provides an even better finished surface" (Forestry Insights, 2005). A number of hardening formulas have been launched in recent years but they are still relatively expensive. As the technology (and investor interest) develops, there will be increasing opportunities for hardened radiata pine to compete against tropical hardwoods.

Molecular breeding opens the door to developing tree stocks that have a greater resistance to biological risks and an improved tolerance to environmental extremes.

PART 3
CURRENT AND FUTURE INFLUENCES

RESEARCH AND INNOVATION

9

OVERVIEW

The future outputs from the forestry sector discussed in Chapter 8 will, in part, be determined by the research direction and innovation activity of the sector over the next few years.

This chapter looks at the importance of research and innovation for the forestry sector. It endeavours to highlight future research priorities, opportunities for gains from research and innovation, and the challenges of turning innovation into profits.

DRIVERS

The direction of innovation and research can be influenced by national and global issues, including:

- society's pressures on environmental issues and desire to see improved environmental outcomes;
- the cost of energy and demand for sustainable alternatives;
- the impacts of climate change and New Zealand's international Kyoto obligations;
- productivity gains and international competitiveness.

THREATS

The New Zealand forestry sector faces a number of challenges resulting from:

- the need to improve New Zealand's competitive advantage, through technical upgrade, against large-scale competitors around the Pacific Rim;
- too many research providers and consortiums, which results in a thin spread of funding and support from industry and government;
- low research funding levels and dependency on the Government contribution;
- the ownership loss of New Zealand's most innovative commercialised scientific breakthroughs;
- the lack of venture capital funding in New Zealand for commercialising research successes.

OPPORTUNITIES

Significant opportunities from research and innovation include:

- A broad and flexible approach to technical learning and knowledge application to the forest growing and processing industries.
- Increased marketing research, as New Zealand faces difficult international competition.
- The potential for bioenergy technology development and biotechnology advances.
- The development of Future Forest Research (FFR), which should provide better focus and co-ordination of some forest research work.
- Research into solid wood processing, focusing on differentiated products and building solutions.
- Research into transport logistics and heavy vehicle configuration.
- A pan-sector organisation that sets the strategic direction and priority of forestry sector-good research and disseminates the research.

BACKGROUND

INNOVATION AND RESEARCH

Innovation is about creating and introducing new ideas and new ways of doing things. These may bring about incremental or major improvements, or radical paradigm shifts. Innovation can be seen as an output, a process, or an integrated system.

The *Innovation in New Zealand 2005* survey report by Statistics New Zealand (2005) showed that 44 percent of New Zealand businesses reported that they had introduced a new product, service

or process over the previous three years, the same rate as the European Union. The innovation survey data suggest that businesses spend the same amount on innovation-related activities as they spend on business research and development (R&D).

Research is defined in the *Concise Oxford Dictionary* (1990) as "The systematic investigation into and study of materials, sources etc., in order to establish facts and reach new conclusions". R&D makes an important contribution to innovation and provides training for the skilled workforce that is necessary for innovation in the business sector. Compared with most OECD countries, New Zealand's research capability is characterised by a large number of publicly funded organisations and dominated by research facilities in Crown Research Institutes (CRIs) and universities.

› CURRENT RESEARCH STRUCTURE

Research in forestry is distributed across CRIs (for example, Scion, Landcare Research, AgResearch, Industrial Research), universities, consulting and research companies and individuals. A number of research consortiums have been established to facilitate and oversee research programmes. These organisations link with industry, as well as prioritise the research programmes.

The number of research providers and consortiums results in a complex structure. While providing the benefits of a competitive environment it can also act against collaboration and integrated ideas.

The development of FFR is an attempt to better focus and co-ordinate forest management research work. FFR does not include wood processing

TABLE 9.1: NEW ZEALAND FORESTRY RESEARCH PROVIDERS

NAME	KEY ROLES	RELATIONSHIPS/PARTNERS
Scion	Dominant forestry Crown Research Institute research and development provider	Research collaboration with Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO)
OTHER CROWN RESEARCH INSTITUTES Landcare Research AgResearch Industrial Research NIWA	Research on forestry and forestry-related topics	Work often in partnership with other Crown Research Institutes and universities
University of Canterbury	Dominant university research provider Professional forestry education	Radi Centre
University of Auckland	Focus on wood processing, pulp and paper	Radi Centre
The Radi Centre	National Centre of Excellence in Wood Manufacturing	A partnership with FITEC (forestry ITO), Waiariki Institute of Technology and University of Auckland
BRANZ	An independent research testing, consulting and information company for the building industry	37% income from building research levy Administered by Building Research

research. Its management structure includes an elected seven-member Board, a Chief Executive and Research Theme leaders. The objective is to invest an annual research fund of $4 to $5 million, including government funding. In 2007 FFR secured from the Foundation for Research Science and Technology (FRST) $3 million per year for six years, which will underpin work in the Radiata Research Theme (New Zealand Farm Forestry Association, 2007). Industry support per year as at May 2007 was $1.06 million (West, 2007).

I. TECHNOLOGICAL LEARNING AND KNOWLEDGE APPLICATIONS

The innovation process of creating and introducing new ideas and new ways of doing things will be influenced in the future by the way technological learning and knowledge is applied within the forestry sector. Given the multiple roles of forests, a broad and flexible approach to technological learning and knowledge application is needed. This will require collaboration between the forestry sector, research providers and government.

Since 1990, New Zealand's science policy has focused on a competitive funding model where research institutions compete for funding and making a profit is a major driver. This has tended to result in the development of organisational capabilities in competitive bidding, output-focused contracts, performance reviews and compliance requirements. However, if not carefully managed, the competitive funding model can also introduce attributes into the science community that act against the inherent benefits of motivation, communication and trust within and between organisations, morale and retention of institutional knowledge.

The *OECD Reviews of Innovation Policy: New Zealand* (OECD, 2007) noted that, in recent years, "the share of truly stable funding has been indeed exceptionally low and that over-reliance on competitive bidding processes for relatively short periods of funding can entail high transaction costs". The review suggested that CRIs be provided with more core funding.

New Zealand's overall research effort by business enterprises is still well below the OECD average.

Some in the scientific community have expressed frustration about the time and resources involved in securing funds and reporting on outcomes at the expense of research activity.

Some of the key influences in technological learning and knowledge application are:

- the importance of two-way learning between users of the research and the research providers;
- the need for a long time horizon (especially for forest growing);
- the impact of funding volatility;
- the barriers to co-operation that can lead to fundamental breakthroughs;
- the presence, or absence, of "strategic thinkers" in the industry.

Over the last few years, there has been an increasing move towards the establishment of research consortiums. This has been largely driven by the sector's desire to have more influence over the management of research programmes, a need to prioritise and the benefits of a strong relationship between research providers and industry.

Consortiums have the potential to ensure there is effective two-way learning between research providers and members of industry consortiums. They may, however, restrict the wider application of knowledge outside their membership.

Consortiums focus on a short-time horizon (four to five years), because of funding constraints and

potential changes in membership.

Given the multiple roles of forests, it is important to take a broad and flexible approach to technical learning and knowledge application. This will require collaboration between the forestry sector, research providers and government.

II. RESEARCH FUNDING

Investments in forestry-related research by FRST between 2000 and 2006 are estimated at NZ$24.1 million to NZ$29.2 million per year. Forestry-related research accounts for 17 to 22 percent of FRST's estimated total research funding for the primary production sector during that period.

TABLE 9.2: NEW ZEALAND FORESTRY RESEARCH CONSORTIUMS

NAME	KEY ROLES	RELATIONSHIPS/PARTNERS
Wood Quality Initiative Ltd (WQI)	Wood quality improvements, including characterisation, appearance, performance, structural properties and stability	13 timber industry companies, CSIRO (Australia) and Canterprise
Structural Timber Innovation Company (STIC) (subject to FRST funding)	Development of engineered structural timber solutions for multi-storey and single-storey buildings	Timber manufacturers, industry associations, universities and an Australian research corporation
Radiata Pine Breeding Company	Tree improvement research to increase yields and reduce production costs through superior germplasm provision	16 New Zealand and Australian timber group interests and Scion
Forest Biosecurity Research Council (FBRC)	Oversee research to protect New Zealand's forests from biosecurity threats	An unincorporated joint venture, including representation from NZFOA, MAF Biosecurity NZ and NZ Forest Health Collaborative
National Centre of Advanced Bio-Protection Technology	Provides some of the research for FBRC	Hosted by Lincoln University
Future Forest Research (FFR)	A trust company replacing industry/Scion research co-ops Forest management research: · species diversification · radiata management · harvesting · environmental and social	Key relationship with Scion Over 50 members from industry, local authorities, University of Canterbury and consultants
Building Research	Industry-good research and knowledge dissemination to building and construction industry	Owned and directed by building and construction industry
Solid Wood Initiative (under consideration)	Research into solid wood technologies, processing systems and identification of market products and consumer needs	New Zealand and Australian processing companies and industry organisations

TABLE 9.3: ESTIMATED BIENNIAL GOVERNMENT FORESTRY RESEARCH FUNDING

	2000/01	2002/03	2004/05	2006/07
Government Vote Research Science and Technology (Treasury, 2005) (millions of dollars, excluding GST)	422.6	445.4	555.0	630.7
Estimated primary sector research funding (millions of dollars, excluding GST) (Broom, 2007 and 2008)	116.9	122.3	137.9	145.1
Estimated FRST forestry research funding[1] (millions of dollars, excluding GST) (Broom, 2007 and 2008)	26.0	27.5	24.1	25.9
Forestry percentage of estimated primary sector research (%)	22	22	17	18
Forestry percentage of Government Vote Research Science and Technology (%)	6	6	4	4

Sources
Treasury, 2005; Broom, 2007 and 2008.
Note
1 The investment includes funds from FRST's Research for Industry, New Economy Research Fund, Environment and Research Consortia output expenses.

In 2006 dollar values, the estimated government research funding for forestry increased from 1994 to 2002 and then decreased from 2002 to 2006. This movement in funding is highlighted in Figure 9.1.

There is concern within industry that forestry-related research funding in real 2006 terms has not shown any significant increase, even though Vote Research Science and Technology (RS&T) increased by 51 percent between 2000/01 and 2006/07. To some extent, the increase in Vote RS&T has not necessarily occurred in the output expenses where forestry would be a major player. It is also important to recognise that forestry has received government funding outside FRST, as highlighted in Table 5.1 in Chapter 5, section entitled "The nature of engagement in the forestry sector".

New Zealand's research effort, measured as the ratio of R&D expenditure to GDP, has been increasing: from 0.95 percent of GDP in 1994 to 1.17 percent in 2006 – an improvement of about 23 percent over the 12-year period. Most of the improvement is also due to increased research effort by the business sector. However, despite the improved level of business research effort, New Zealand's overall research effort by business enterprises is still well below the OECD average; in fact, current levels would need to double before New Zealand's overall research effort as a percentage of GDP began to resemble the OECD average (Ministry of Research, Science and Technology, 2006a). The lack of investment in business enterprise R&D is one of the main weaknesses of New Zealand's innovation system.

The total forestry sector contribution to R&D funding is difficult to calculate due to the numerous research consortiums and research provider/industry arrangements. In many instances, there are also significant in-kind contributions to research programmes.

III. RESEARCH CAPABILITY

Sutton (2006) asks the hard question: "New Zealand is still living on the research of the past. When and how do we address the problem of what research is still required, and how do we attract and retain the necessary scientists?"

It is very difficult to determine the capability

of forestry research when that capability is spread through a number of research providers and consortiums. Capability is determined by knowledge, experience, the required skill mix and numbers of staff. It is therefore difficult, if not impossible, to quantify.

As at June 2006, Scion had a total of 344 full-time equivalent (FTE) employees, which included 268 research scientists. Employees' age classes indicate a reasonable spread of ages for permanent and part-time staff, with 39 percent under 41, 33 percent between 41 and 50, and 28 percent over 50 (Turner, 2007). The number of staff has increased in 2007/08 to 363 (Scion, 2008).

From 1 January 2008, Scion and Australia's CSIRO ceased the joint venture Ensis, which has been replaced with a new collaborative agreement.

In 2007, NZFOA and the Farm Forestry Association decided not to seek a compulsory levy to fund industry-good activities and opted instead to continue with a voluntary approach. Barriers to the adoption of a compulsory levy were identified as:

- the ownership structure of the forestry sector;
- the long-term nature of forestry;
- finding a voting and funding formula that is fair to both large and small-scale forest owners;
- unsuitable legislation.

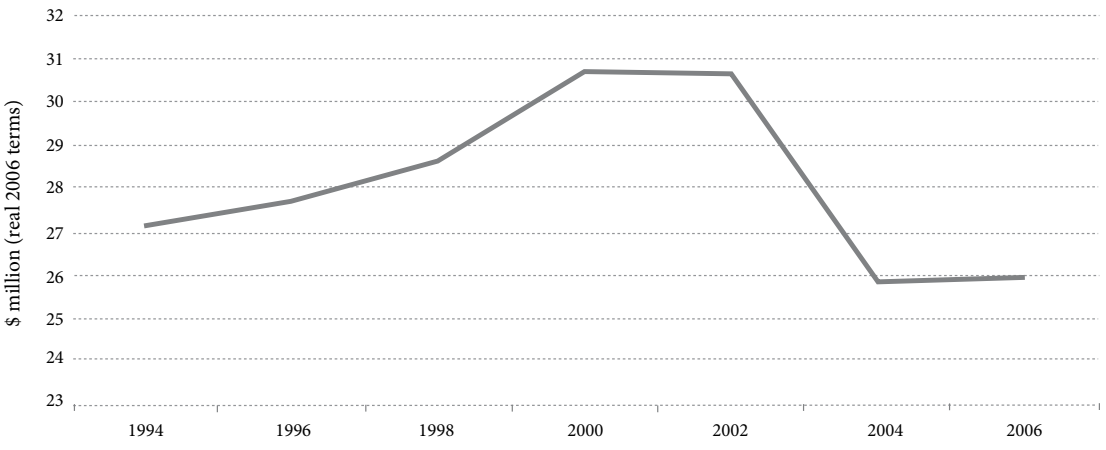
The need for research to cover social and environment forest research, long-term sustainability issues and off-site post-harvest aspects of forestry.

The absence of a levy may be seen as a disadvantage in terms of applied research funding, research extension and advocacy at a national level. A co-ordinated industry approach, and strong research consortiums and industry associations are seen as essential to providing the future direction and focus of forestry research and extension in New Zealand.

RESEARCH GAPS

The forest industry research co-operatives review (Dale, 2005) and a survey of New Zealand stakeholders in sustainable forest management (Fairweather and Hock, 2004) highlighted the need for research to cover social and environment forest research, long-term sustainability issues and off-site post-harvest aspects of forestry. Some of these gaps may be covered in the Environmental and Social Research Theme under FFR.

FIGURE 9.1: GOVERNMENT (FRST) FORESTRY RESEARCH EXPENDITURE



Wood Quality Initiative Ltd has largely completed what it set out to achieve in wood quality improvements, and the development of a "Solid Wood Initiative" (SWI) is being considered. SWI will be a multi-year programme developed by New Zealand and Australian processing companies that will produce better process solutions, products and systems aimed at underpinning the delivery of solid wood with predictable and consistent quality.

SWI is seen as a way to focus solid wood research and, to some extent, fill a research gap caused by the decline of research into primary and secondary processing of radiata pine over the past 10 years.

› INDIGENOUS FORESTRY RESEARCH

MAF Policy (through MAF Operational Research Funding) undertakes research into forest ecology (for example, modelling short and long-term species replacement patterns), forest silviculture (for example, monitoring the impacts of management on stand replacement, structure and growth) and modelling harvest rates. Landcare Research is a major contributor to this work.

In 2007, the Ministerial Advisory Committee on Indigenous Forestry was established as an independent sector group to support and promote indigenous forestry research. The committee successfully secured research funding for timber processing (for example, a Sustainable Farming Fund "beech drying project") and resource and market research (for example, a Sustainable Farming Fund "beech resource description and market research project").

»» INNOVATION AND FORESTRY

The New Zealand forest-growing industry has been characterised by a culture of scientific examination and debate, as have parts of the wood processing industry, particularly the manufacture of MDF and pulp and paper. At all levels of the forestry sector, there has been a willingness to explore new management approaches and to trial innovative technology. This has made the sector a leading player in key areas of research, such as forest genetics (for example, gene mapping and propagation) and crop management.

The overriding objective of New Zealand innovation policy should be to strengthen the basis for sustainable long-term growth.

While the sector has an ethic of innovation, it is important to consider the aims of this research and technology adoption. The *OECD Reviews of Innovation Policy: New Zealand* (OECD, 2007) identifies that:

> *The overriding objective of New Zealand innovation policy should be to strengthen the basis for sustainable long-term growth by fostering market-pulled innovation throughout the economy, focusing basic and mission-oriented research in areas where both critical mass and excellence can be achieved, and creating solid platforms where all types of research could interact in addressing creatively well defined priority socio-economic needs.*

Innovation is therefore important, as ultimately it is about improved productivity, profitability and competitiveness.

Looking back over the past century, the priorities for the industry have remained remarkably consistent.

For L McIntosh Ellis, the first Director General of Forestry in 1920 and the earlier Royal Commission on Forestry (1913), the priorities were centred on the long-term sustainability of the indigenous forest resource, the encouragement of fast-growing exotic species and the opportunities for adding value to New Zealand's timber production, in areas such as pulp and paper production. To illustrate how little thinking has changed, we need only look at how

Ellis recommended research into "the possibilities of securing a cheap motor fuel by distillation of waste wood to produce alcohol" (Ellis, 1920). We could ask, what has changed in 85 years?

While the priorities for R&D remain broadly the same as those expounded by Ellis, the complexities of the sector in the 21st century, and external pressures, have increased several-fold.

The sector faces a number of challenges that require new and innovative science. High on this list is the growing incidence of biological incursions into New Zealand. The national cost of new pests for the primary sector is large.

> *It's estimated that the annual total cost of new insect pests to the country is around $2 billion. This figure includes the direct costs of eradicating pests, lost opportunity costs to exporters who cannot get market access because of the pests, and costs to the environment and natural estate value of the country. (Trought, 2004)*

To respond to these challenges, the forestry sector needs to continue to work closely with the science providers to develop new monitoring tools, decision-making systems and eradication procedures (including targeted pesticides).

This, however, is only part of the task. While New Zealand has a solid track record in developing innovative technology, it has been less successful in commercialising this research. Converting "grass-roots", basic (or blue sky) research into commercial forestry applications requires significant venture capital (over an extended timeframe – as long as 15 to 20 years). New Zealand's limited pool of venture capital has meant that some of the nation's most innovative research has been directed offshore, in search of funding.

The need for investment does not end with the commercialisation of a product or technology. A company may have the most efficient widget in existence, but this is of little benefit if it lacks the marketing and supply arrangements to build (and meet) customer demand. New Zealand growers and manufacturers are at a particular disadvantage, as the limited size of the domestic market means the principal clients for new products are around the Pacific Rim. Marketing costs will therefore be greater than for manufacturers in Australia or North America, who are selling primarily to a large domestic market.

Innovation policy should avoid an "R&D and high-tech myopia" and should not neglect natural resource-based sectors.

› RESEARCH PRIORITIES FOR THE FORESTRY SECTOR

The *OECD Reviews of Innovation Policy: New Zealand* (OECD, 2007) identifies one of the key guiding principles as:

> *A broad approach to innovation. Innovation policy should avoid an "R&D and high-tech myopia." This means in particular that policy should recognise the importance of "soft" innovation, e.g. as GIF rightly did for design, and should not neglect natural resource based sectors which offer considerable scope for economic growth through the application of advanced science and technology.*

When discussing the forestry sector's research needs, it is always important to recognise that it is not one collective entity, but a composition of parts that range from corporate and private plantation owners through to processing companies, recreational interests and support services (such as transport logistics). Even within one of these subgroups, there can be major differences of opinion as to where research funding should be directed (for example, between the traditional corporate players and the Timber Investment Management Organisations – TIMOs – in the plantation management area).

The section on R&D in the *Forest and Wood Products Industry Strategic Plan* (Wood Council of New Zealand, 2007: 5) recommends:

Sector specific and pan industry investment into industry specific research and development which provides individual sectors with growth opportunities by:

- *developing new products and systems that increase productivity, compete with alternative products and open opportunities for markets for wood based products*
- *successfully competing for and leveraging government funds commensurate with the potential contribution the industry can make to the nation's wealth*
- *increasing industry R&D contribution to at least the OECD average*
- *supporting a solid wood initiative*
- *identifying and promoting of the non-wood values of forests.*

This statement illustrates the focus on R&D that the sector believes will achieve their objective to improve sustainable profitability at all levels of the value chain.

I. FOREST GROWING

The research needs of the forest-growing industry were identified during the 2005 review of forest industry research co-operatives (Dale, 2005). As part of the review, feedback was sought from the members of the five existing co-operatives[30]. The consultation concluded that there are two research areas that are not being adequately addressed at present. These are "harvesting and distribution productivity and long-term sustainability issues including the assessment of the value of non wood forest values" (Dale, 2005: 1). The review also laid out a number of clear messages for research providers:

- "R&D is considered [a] discretionary investment that must rank alongside other investment options in the forest" (Dale, 2005: 4). The industry is prepared to invest, but only where there are clear benefits and "demonstrable" returns for investors.
- The industry needs to lead the research agenda.
- Greater emphasis needs to be placed on the technical transfer and communication of scientific results to the industry and investing community.

The development of FFR should result in a re-prioritisation of the forest growing and management research work in New Zealand.

Priority for forest genetics research is set by the individual research companies. The Radiata Pine Breeding Company (RPBC), whose shareholders include the major forest-growing companies in New Zealand and Australia, has been working to genetically improve radiata pine since the late 1980s. The shareholders set the strategic direction of the annual research programme and the RPBC mission is "to be recognised internationally as the leading provider of radiata pine germplasm through demonstrated value improvements in fitness for purpose" (RPBC, undated).

The opportunities for performance gains in transport and harvesting are very significant for the sector.

ArborGen Australasia is a specialist forest biotechnology business and the largest producer of elite tree stocks in Australasia. Its R&D programme is continuously improving propagation methods in both laboratory and nursery environments.

II. WOOD PROCESSING

The R&D expenditure of the forestry sector has historically "focused on how best to grow and manage plantation forests" (MAF, 2003a: 27). This situation is changing, however, with a greater share of public and corporate R&D expenditure being directed towards "processing and … adding value,

30 Plantation Management Co-operative, Stand Growth Modelling Co-operative, Site Management Co-operative, Douglas Fir Co-operative and the Eucalyptus Co-operative.

including through understanding and enhancing wood quality as it relates to processing options" (MAF, 2003a: 27). To a large extent, the sector relies on importing technology for the downstream processing of the resource. This reliance on overseas technology (and, in some cases, management systems) does not necessarily place New Zealand at a disadvantage in terms of innovation adoption, technology uptake and processing competitiveness. New Zealand needs, however, to be a nimble adaptor of new technology and not rely on the importation of older equipment (particularly second-hand plant) for the development of the processing sector.

> *Innovation must be across all parts of the sector not just production efficiency. Businesses must be highly innovative in market development, product innovation, design, supply chain and distribution management, and human capital. (Sutton, 2004:2)*

Much of the gain from R&D and innovation in wood processing is likely to be incremental, for example, in wood-hardening, wood-drying, laminating and sensing technologies to better determine wood quality and performance (MAF, 2003a: 27).

› OPPORTUNITIES FOR INDUSTRY GAINS

Where are the opportunities in the forestry sector to make substantial gains through science and innovation?

While sawn timber and log exports are likely to remain the mainstays of the forestry sector, forest managers will probably have to harvest an increasingly diverse range of log grades and complementary products. This diversification will be driven by scientific advances in:

- the manufacture of biomaterials;
- the production of biofuels;
- the conversion of residues to bioenergy;
- engineered wood products;
- new construction systems;
- innovation in timber assessment and processing;
- the establishment of secondary crops.

A growing concern about the environmental impacts of alternative building and construction materials (particularly concrete and steel) will also help drive this diversification.

While the focus may be on new products, it is important not to forget that even small, incremental gains in wood quality, lumber conversion rates, harvesting and transport logistics will translate into significant returns on investment for the sector.

The opportunities for performance gains in transport and harvesting are very significant for the sector. Harvesting costs and domestic transport represent about 50 percent of the log value when it arrives at the mill. Any efficiency gains in transport and harvesting will therefore have a significant and immediate impact.

While New Zealand can import new technology, innovation and R&D are needed in order to apply it to the New Zealand situation.

Technical advances are occurring in:

- measuring and sensing technology;
- waste minimisation;
- plant automation;
- load tracking;
- log truck configuration and design.

I. BIOMATERIALS

Scion has developed a vision of "advancing the widespread utilisation of renewable materials and products from plants for economic, environmental and social returns" (Scion, 2005: 7). Scion's vision is built on developing plant-based biomaterials as renewable substitutes for products delivered from non-renewable resources.

As the cost of petroleum-based products rises, researchers are turning their attention to the potential of wood fibre (biomass) for the production of substitutes or replacements for products currently made from oil. In the case of bioplastic materials, Scion is working with its commercial partners to develop "materials that offer controlled degradability in the environment" (Scion, 2006: 13).

The range of biomaterials currently being investigated by researchers in New Zealand includes:

- bioplastics;
- biofoams;
- moulded structures and packaging;
- composites (wood-plastics and wood-steel). (Maplesden and Turner, 2006: 154)

To further build its strengths in biomaterial research, Scion has:

- joined forces with the McDiarmid Institute in Wellington and the Max Planck Institute in Germany – using the skills of others to support its strategies is the key to achieving its vision;
- formed a research programme with AgResearch and the US-based Diversa Corporation to develop improved methods of fermentation for producing bioethanol from trees;
- entered a significant partnership with ArborGen LLC, a leading researcher of plant biotechnology in the US to identify genes that can influence the characteristics and productivity of forest plantations.

While biomaterials have significant potential, it is important to remember that the industry is still in its formative stage. The economics of developing materials based on biomass are still being worked through, and it will be years (if not decades) before the returns from biomaterials add significantly to forestry returns. The option to purchase overseas biomaterials technology should also be considered.

More information on the current state of biomaterial research, and the advances being made in adhesives and packaging, can be found in Chapter 8, in the section entitled "Near-term opportunities (5 to 10 years)".

II. BIOENERGY OPPORTUNITIES

In addition to biomaterials, researchers are once again (for the fourth time in 100 years) investigating the opportunities for converting wood fibre into energy and biofuels. Wood residues are already used extensively for heat and electricity (co-generation) in sawmills and processing plants. In a similar vein, trials are underway to assess the economics of using harvest and thinning residues for energy generation. The widespread use of harvest residues is likely to be some years off, as the energy cost structures are significantly higher than for alternative sources of power (due to transport and storage costs).

Internationally, there is growing interest in bioenergy research, the application of new technology and the exploitation of emerging market opportunities. As costs are imposed on greenhouse gas emissions from coal and natural gas, economic drivers will increasingly favour bioenergy, including solid wood energy such as wood pellets, biomass gasification and ligno-cellulosic ethanol. Oil prices, energy security and climate change concerns are already driving new innovation, such as torrefaction, bioenergy and biochar co-production, and potentially cellulignin.

The use of wood fibre for biofuel production (ethanol, methanol and speciality chemicals) is being looked at seriously in a number of countries, including New Zealand. The costs of production are significantly above those of petroleum, but the pace of research means costs will come down over the next 10 to 15 years.

New Zealand does not have the resources to undertake the fundamental research in this area but the local industry has been establishing strategic

partnerships to ensure the country can use this developing technology. The announcement by AgResearch and Scion[31] that they are teaming up with the United States based Diversa Corporation to study the economics and technologies required for a biofuels industry is a critical step in establishing a viable industry in New Zealand. This research partnership will use Diversa's expertise in enzyme technology to study the suitability of various biomass feedstocks.

New Zealand is in a unique position of being able to investigate the real possibility of transforming from a petrochemical-based to a carbohydrate-based economy … (AgResearch, 2007: 2)

In the short to medium-term, there are opportunities around high-value chemicals and oil extracts.

III. ENGINEERED WOOD PRODUCTS

While the science around biomaterials and bioenergy is still in its formative phase, engineered wood products (EWPs) have been used in the construction industry for decades, and they are gaining increasing market acceptance, particularly in North America. A number of commentators hold the following view:

Engineered wood products [are] the future of wood building materials because they offer the best hope for incorporating technological change (resin technology, flaking machines, press technology, etc.) to ensure that forest products are cost competitive on an installed cost basis with all alternative building materials. (United Nations Economic Commission for Europe/Food and Agriculture Organization – UNECE/FAO, 2000: 146)

EWPs include:

- laminated veneer lumber (LVL) – the adhesive bonding of thin wood veneers in a large block;
- glue-laminated timber (Glulam) – the adhesive bonding of timber strips (of 50 millimetres or less);
- MDF or orientated strand board or lumber (OSB);

The changing focus of building codes, to performance-based standards, has assisted the move towards EWPs.

- finger-jointed lumber;
- I-beams/I-joists;
- Accoya (acetylated) wood – dimensional stability and wood preservative.

EWPs provide opportunities for increased harvest and production efficiencies.

EWPs … enhance forest management options by providing a market for lower quality fibre (both species and diameter). For example, TimberstandTM and some North American LVL is made from trees that previously had limited economic markets. By providing markets for a wider range of species and grades, harvesting costs are often reduced, and additional silvicultural operations become economic. (UNECE/FAO, 2000: 144)

At the sawmilling stage, finger-jointing and laminating provide opportunities to reduce waste and develop higher-value final products.

At the production level, EWPs have superior technical properties in terms of more uniform strength, product stability and durability. LVL and glulam beams can be used in complex building designs and can extend the normal dimensions in which timber is used as a structural roof beam. In the case of "over-sized" roof cavities, EWPs can compete effectively with steel truss-beams.

A new generation of glulam beams with even higher design strengths provide more opportunities in both residential and non-residential markets … Fibre-reinforced polymers can increase glulam strength by 40 percent, which should help wood building construction compete with steel. (UNECE/FAO, 2005b: 102)

31 Formerly Forest Research, a Crown Research Institute.

The changing focus of building codes, to performance-based standards, has assisted the move towards EWPs.

> *Performance-based codes allow builders, architects, [and] specifiers to take full advantage of the performance enhancing properties of EWPs. Due to the worldwide adoption of these codes, demand growth for EWPs escalates. These properties will help EWPs to compete 'head on' with steel and concrete in the large non-residential building construction market. (UNECE/FAO, 2000: 143)*

The principal advantages for the construction industry in adopting EWPs are the predictable quality of the products, reduced waste and savings in construction time. In the case of I-beams, there are also major weight savings, compared with traditional solid beams.

EWPs are gaining an increasing share of the construction market around the Pacific Rim. This trend is projected to continue, as technological advances are increasing the strength and durability of engineered products.

IV. NEW CONSTRUCTION SYSTEMS

The development of new construction systems using a mix of high-value EWPs and lower-grade timber provides a significant opportunity to add value to timber before it goes offshore. This opportunity has been recognised by the Structural Timber Innovation Company (STIC). STIC has been established to create a step change in revenue for New Zealand's wood manufacturing industry through the development of new construction systems.

Scientists have developed new technology that could see wood being used for large-span multi-storey buildings, as well as engineered structural timber solutions for very large-span roof systems for single-storey timber buildings.

There is a market opportunity to develop and export high-value prefabricated timber buildings, as well as facilitate the acceptance of multi-storey wooden buildings in New Zealand. In July 2007, the Government announced that, by July 2008, new government-funded projects for buildings up to four floors (including the ground floor) will have to commission designs and at least consider options for using wood or wood-based products as the main structural materials. (This policy is currently on hold).

V. INNOVATIONS IN TIMBER ASSESSMENT AND PROCESSING

The range of new technologies for harvesting and timber processing coming onto the market will enable incremental gains in harvest site and mill productivity. Maplesden and Turner (2006: 153) have compiled a list of the key developments that are coming on stream:

- improvements in sensing technologies to improve inventory control, particularly control of material quality, for example, GIS[32] and remote-sensing technologies, near-infrared (NIR) and X-ray technologies;
- improvements in waste minimisation;
- tools for measuring in-field wood quality to improve log segregation;
- technology for improving log bucking to match mill demand;
- process automation systems to reduce the labour component;
- just-in-time manufacturing process control to allow rapid product line changes (for example, in planer moulders);
- automated quality control systems to reduce downgrade (for example, online monitoring of density and resin loading in panels);
- energy-saving processing technologies.

VI. SECONDARY CROPS

To date, the New Zealand forest industry has paid limited attention to the opportunities for developing secondary (or complementary) crops in forests.

32 GIS – geographic information system.

Local research providers have worked on a selection of crops that could be managed in conjunction with timber production. They include: mycorrhizal mushrooms, ginseng, goldenseal and a number of berry and nut species. Additional information on secondary crops can be found in Chapter 8, in the section entitled "Opportunities associated with non-timber forest products".

VII. LOGGING AND TRANSPORT LOGISTICS

Forest managers are increasingly looking to reduce supply (and logistical) costs. Two areas where technical advances are enabling this to occur are harvesting and transportation.

a. Innovations in harvesting

Harvesting in New Zealand has traditionally required a high degree of manual input, particularly on steeper hill country terrain. This has limited productivity and the log volumes that can be extracted by a harvesting crew. Internationally, the move over the past two decades has been to mechanise the harvesting and log-handling processes. This has been aided by the development of steep terrain vehicles, with advanced grappling (and sawing) capacities. In the forests of Finland and Sweden, it is now rare to see an individual chainsawing a block of trees. The latest generation of steep terrain felling machines:

> *can cut literally any size tree, directionally fell it and once the cutting disc is retracted it acts like a grapple to make bunches and orient the tree with butt to the road for yarding. The productivity of this unit is around 650 tons in an 8 hour shift and most companies operate double shift, so one machine can cut about 250 000 tons annually. (Olund, 2001: 264)*

These developments are also improving the health and safety of crews. The latest generation of forestry machines have self-levelling and swivelling cabs. This reduces the amount of twisting an operator must endure, improves visibility and reduces jarring motions.

Research into the design and configuration of logging trucks has the potential to enable increased weights and dimensions while still maintaining or improving safety factors.

New Zealand's forestry sector is moving down this mechanised processing track, but it needs to address the issue of labour training and productivity. Investing in the forestry sector's human capital is just as important as investing in technology. This issue is addressed in Chapter 6, section entitled "Human resource challenges facing the sector".

Over the last few years, harvesting research has been absent from the Scion research programme; however, it will be taken up through the Harvesting Theme under FFR, if funding is secured from industry and government.

b. Transport logistics

The forestry sector believes technology and innovation gains could reduce transport costs and improve the sector's competitive advantage. The cost of transporting timber products (whether as a log or in a finished form) is a key component of the overall cost structure of a plantation forest or timber-processing operation. In the case of export logs, freight can absorb up to 50 percent of the c.i.f price (or even more for lower-grade logs), while it can be up to 25 percent of c.i.f price for export sawn timber and 15 percent for pulp and paper.

Technological advances in recent years, such as GPS tracking and electronic docketing, have the potential to increase vehicle optimisation, improve the co-ordination of delivery times to mills, increase crew efficiency, upgrade information recording systems and significantly reduce document handling costs (including reductions in error rates).

Research into the design and configuration of logging trucks has the potential to enable increased

weights and dimensions while still maintaining or improving safety factors. This, combined with the potential introduction of heavy vehicle concessions, could enable significant productivity gains for the forestry sector. Research work is also being undertaken to develop an optimal vehicle configuration for transporting logs and the results could have a major impact on the future design of the logging truck fleet in New Zealand.

The Chapter 6 section entitled "Transport" covers this topic more fully.

TURNING INNOVATION INTO PROFITS

New Zealand's scientific community has an international reputation for undertaking fundamental research, particularly in the primary sectors. However, "Good science alone is not sufficient to take inventions to market" (Scion, 2005: 15), and our breakthroughs are not building the competitive advantage of New Zealand's plantation forest and timber-processing companies to the extent they should.

In the forestry sector, our scientists have been at the forefront of new developments in plant genetics, optimising log-making technology and kiln-control systems. Examples of scientific breakthroughs in the forestry area include:

- wood-hardening technology;
- wood adhesives technology ("Greenweld");
- DNA profiling of forest trees;
- SignaGen™ DNA testing technology;
- Embryogenesis Technology for large-scale production of planting stock;
- production of the world's first genetically engineered (herbicide-resistant) pine;
- Growth and Form GF Plus™ description of tree breeding traits;
- optimising logmaking advanced technology;
- computer forest management decision support systems;
- Dryspec® kiln-control system;
- sapstain control for export logs ("Sentry and Sentry Plus");
- control of the fungus infection *Dothistroma*;
- development of MDF "Lightboard";
- the establishment of a full-scale forest land irrigation system for waste water treatment;
- Spraysafe Manager, a PC-based software package for spray applications;
- wood fibre-cement board replacing asbestos in Scyon™;
- tissue-cultured plant technology;
- cuttings technology for radiata pine.

New Zealand is not taking full advantage of its most promising developments because the local industry lacks the capital, and market, to commercialise them. However, overseas forestry companies and investors are benefiting from New Zealand's scientific breakthroughs. Reversing this trend is one of the challenges for the sector. If the New Zealand forestry sector is to remain competitive on the world scene, it needs to improve its uptake of new technology.

The commercialisation of scientific breakthroughs in New Zealand is a challenge due to a combination of factors:

- The New Zealand domestic market is small, which can limit the commercial testing of scientific breakthroughs.
- New Zealand has a limited pool of venture capital for commercialising scientific breakthroughs. This has limited the speed of commercial development, and in a number of cases it has meant some of our best science has been picked up by overseas backers.
- There has traditionally been a separation between science providers and their commercial clients.

RESEARCH AND TRAINING PARTNERSHIPS WITH THE INDUSTRIES

The previous section focused on the changes occurring within the science community to increase

If the New Zealand forestry sector is to remain competitive on the world scene, it needs to improve its uptake of new technology.

the rate of innovation and technology uptake. It is important to recognise, however, that a number of forestry companies have an internal R&D capacity, which they are using to identify and commercialise new products.

New Zealand has a relatively small pool of resources for forestry research and training (in terms of both capital and skills). This means research and training needs to be tailored to the demands of the local industry, and that innovative approaches are required to maximise the returns from this investment. New Zealand's research and training providers recognise this point, and have been forging new partnerships with the plantation forest and wood processing industries.

These partnerships emphasise:

- the need for ongoing dialogue with the industry to set direction and research priorities;
- the need to draw on both local and overseas resources to progress research and deliver training;
- the need for collaborative efforts between institutions.

This drive to maximise the investment in research and training can be seen, for example, in Scion's collaboration with Australia's CSIRO, RADI initiatives and the Sustainable Land Use Research Initiative.

The National Centre of Excellence in Wood Manufacturing (known as the RADI Centre) was established in 2002 in response to a recognised need for additional tertiary training in wood processing and timber design. The Radi Centre is a partnership between the Waiariki Institute of Technology, the University of Auckland and Forest Industries Training (FITEC). Central government has provided major support. A grant of $2 million was provided to get the initiative off the ground and, in April 2006, a further $5 million (over four years) was committed to develop new facilities and software to support training and innovation in timber design and production. The Radi Centre draws on both New Zealand and overseas resources to support the training curriculum. In addition to training, the Centre is developing partnerships with small to medium-sized businesses in the processing industry to solve design and processing problems.

Another example of targeted investment in the timber industry has been the Government's 2005 announcement that it would financially support the establishment of two wood design professorships, at the Auckland and Canterbury Schools of Engineering. This five-year initiative aims to increase awareness of sustainable building materials (principally timber) within the construction industry. These two positions will also be used to encourage high-class design approaches, using renewable materials.

INVESTING IN MARKETING RESEARCH

Is New Zealand investing its research dollars at the right end of the production chain?

Over the last 30 years, New Zealand companies have focused on growing and processing large volumes of forest products, sometimes at the expense of building the market image of radiata pine and developing long-term customer relationships. There has been an expectation that well-grown and well-manufactured products will find a ready overseas market. The reality is somewhat different. New Zealand is facing an increasingly difficult international market, where buyers can choose from a range of Pacific Rim and Asian suppliers. Where New Zealand companies have committed resources to building long-term relationships (and creating

brand images), the benefits have generally been substantial, through customer loyalty and extended contracts.

Therefore, some re-prioritisation of research funds into targeted marketing initiatives is warranted if New Zealand producers are to grow their export markets and profit margins. The marketing and sales section in the *Forest and Wood Products Industry Strategic Plan* (Wood Council of New Zealand, 2007: 7) identifies two key areas to improve profitability of the industry:

- development of domestic building codes with which the construction sector and the public can easily comply;
- in-market promotion.

The Government has recognised the need for additional support in this area, and has been progressively increasing the resources allocated to market development, building export relationships, and promotional activities (through New Zealand Trade and Enterprise and the Forest Industry Development Agenda). An example of this has been the development of the Wood Innovation Centre in Shanghai (in association with six timber exporters). The Centre showcases New Zealand's timber production range and the opportunities to use radiata pine in Chinese building construction. Maintaining this profile over the long-term is important for market development. The parties involved in this initiative will need to carefully weigh up this issue when considering ongoing funding.

GOVERNMENT'S ROLE IN RESEARCH

Research, and in particular government funded and directed research, will continue to play a critical role in maintaining forestry as a major sector of New Zealand's economy. In the past, government research and investment in plantation forestry has permitted indigenous forests to be conserved and plantation forestry to become the main provider of New Zealand's wood-based products. In the process of bringing about that transformation, government research established for New Zealand an international reputation in genetics and tree breeding, plantation forest management and, in some aspects of wood processing, wood products and pulp and paper research. Building on and extending that research base is critical to achieving any of the major milestones of the sector's vision for the next 20 years.

Research, and in particular government funded and directed research, will continue to play a critical role in maintaining forestry as a major sector of New Zealand's economy.

Ten years ago, the research base in CRIs, universities, research associations and private and public companies was described as giving New Zealand good skills and an effective infrastructure for forestry research (Lancashire and Anderson, 1997). At the time, the bulk of the direct forestry-related research capability was contained in one organisation – Forest Research – and the assessment, while accepting the base as adequate, recognised that there were a number of challenges, particularly in the area of a relatively thin research skill base. Moreover, it was argued that the skill base and type of research required for the future needed to change focus from growing to processing, utilisation and markets. Increased investment was recommended in scientific equipment, with some of the equipment then available to researchers being described as old and in need of replacement.

The last 10 years have seen a great deal of that old equipment replaced and some renewal of the research base. However, that base is still relatively thin. The vast bulk of the forestry research

capability is still contained in one organisation (Scion) and the need to focus on processing and markets is perhaps even more pressing now than it was 10 years ago. However, with the growing concern about the potential implications of land management on big ticket items such as biodiversity, the climate, water quality and water availability, as well as the growing emphasis on sustainability, the need for research into the forest growing side of the sector has also increased in importance.

Currently, around 22 percent of all New Zealand R&D is based in agriculture or forestry. A further 22 percent of the country's research effort is related to industry, 15 percent to development of infrastructure and some 7 percent to care of the environment (Ministry of Research, Science and Technology, 2006a: 22). While not all research in these areas is necessarily relevant to forestry, there is clearly potential for forestry to benefit.

Over the last 10 years, government funding of research has grown at a slower rate than the economy in general, and government research targeted just at the forestry sector has been falling. For the period from 1994 to 2004, funding of the CRIs, the Government's main R&D vehicle, increased by a real 1 percent per year. However, funding fell for Scion, the forestry-based CRI.

As of 2004, New Zealand's ratio of business-based research was only about one-third of the OECD average. Government research (which is much closer to the OECD norms in terms of its overall GDP level) is currently a much greater component of the overall national research effort than is typical for a developed nation. Therefore, government priorities for forest research are going to be of major importance in setting and shaping the research effort of forestry for the foreseeable future.

The Ministry of Research, Science and Technology (2006a: 71) highlights the importance of government funding by comparing the funding situation for CRIs in 2004 with that in 1994:

[there] has been a decrease in R&D funds from government funding and investment agencies, and an increase in funding by the business sector, overseas funding and CRIs' own funds as [follows]:

- *Government funding and investment agencies – from 73 percent to 60 percent;*
- *Business funding – from 13 percent to 20 percent;*
- *Overseas funding – from one percent to five percent;*
- *CRIs' own funds – from four percent to eight percent.*

The ongoing importance of government funding of forestry research is highlighted by a recent MAF estimate of government support for forestry from 2000 to 2007. It is estimated that there was over $307 million of government spending over this period relating to forestry, of which approximately 45 percent was for research (refer to Table 5.1 in Chapter 5, in the section entitled "The nature of engagement in the forestry sector").

Looking out over the next 20 years, there are some exciting prospects for the sector.

THE FUTURE

Looking out over the next 20 years, there are some exciting prospects for the sector. The following list is not exhaustive but it indicates a wide range of areas where significant gains could be made through research and innovation:

- improved prospects for solid wood arising from better recognition of the potential of new wood design solutions and sustainable buildings;
- new markets for wood arising from EWPs;
- ongoing research in biomaterials and bioenergy, including adoption of overseas technologies;
- improved competitiveness through improvements to transport logistics and transport mode design;

› reduced harvest costs and improved harvest safety arising (particularly) from research into the potential for steep terrain mechanical harvesting;
› new returns to forest growers through non-wood services.

This chapter has, however, raised a number of challenges to achieving innovative outcomes from research. Building on the existing research base is absolutely critical to achieving the *Forest and Wood Products Industry Strategic Plan* (Wood Council of New Zealand, 2007). However, the large number of research providers and consortiums represent a very complex structure for forest R&D. This, combined with the lack of a pan-forestry sector body to guide the strategic direction of research, may not help the sector focus on it priorities and make the most productive funding decisions.

Adequate funding of research and venture capital would appear to be critical factors for the future. Of concern is New Zealand's current level of spending on research as a percentage of GDP, which is only about 50 percent of the OECD average.

Government funding for forestry research is a major contribution and therefore obtaining funding through the public research bidding process is essential for its future. The compliance cost of the competitive bidding system, in negotiation, reporting and accountability, is often questioned by science providers.

Improving the domestic commercial uptake of scientific breakthroughs is very important if the country and forestry sector are to gain maximum value from the research effort over the next 20 years.

There is a wide range of research areas in the forestry sector where technical advances could be very significant and, given the multiple roles of forests, it is important that a broad and flexible approach to technical learning and knowledge application is taken.

Photo courtesy of Nelson Pine Industries. Photographer: Nicolas Perez. Nelson Pine Industries warehouse.

CLIMATE CHANGE AND FORESTRY

10

OVERVIEW

The roles forests can play in responding to climate change offer many opportunities and challenges for New Zealand forestry and may generate major changes to forest management. The previous government enacted an emissions trading scheme (ETS) in late 2008 and forestry is the first sector to be involved, effective retrospectively from 1 January 2008. The scheme is currently under review but the forestry provisions of the scheme remain operative.

DRIVERS

These potential opportunities and threats will be driven by:

- international climate change agreements;
- global carbon trading (through international and domestic mechanisms);
- the price of carbon;
- international perceptions of forestry's role regarding climate change;
- public perceptions and consumer demands of forestry.

THREATS

The following obstacles may prevent the forestry sector from taking advantage of potential opportunities:

- uncertainty about future international climate change agreements and how they may be translated into domestic policy;
- a lack of international acceptance and/or knowledge of carbon credits generated from New Zealand forests;
- the price risks associated with carbon;
- the high cost of land acting as a barrier to new carbon forestry;
- enhanced risks from wind, fire and pests.

OPPORTUNITIES

Although there is uncertainty surrounding future policies and mechanisms addressing climate change, opportunities should arise from the:

- generation of carbon credits from forests under an ETS, with likely effects flowing on to species choice, management practices and regime length;
- greater demand for wood as a sustainable substitute to materials that produce intensive greenhouse gases;
- enhanced viability for using woody biomass as an energy source arising from increasing demand for sustainable sources of energy and the implementation of an ETS;
- encouragement of new forest investment (for example, through the Afforestation Grant Scheme) and the mitigation of risks affecting sustainable catchment management.

The forestry sector has a positive story it can sell to consumers and communities that are becoming increasingly concerned about climate change.

INTRODUCTION

The forestry sector has a positive story it can sell to consumers and communities that are becoming increasingly concerned about climate change. In addition to forests sequestering and storing carbon:

- wood products can meet demand for low carbon-intensity products;
- new forests can assist with adapting to the expected impacts of climate change on land management;
- a changing climate may provide opportunities for new species or enhanced growth potential for

existing forests due to changes in temperature, rainfall and increases in atmospheric carbon dioxide;
- carbon credits can be generated;
- woody biomass can be used as a sustainable energy source in wood processing and, in some cases, electricity can be sold back into the national grid.

However, forest owners may also have to manage increased vulnerability to adverse climatic events, weeds, insects and fire.

AN EMISSIONS TRADING SCHEME AND FORESTRY[33]

An ETS will have significant implications for the forestry sector. The currently enacted, but being reviewed, ETS is the first internationally linked domestic emissions trading scheme where forest sinks can be used by emitters to meet obligations to surrender units.[34]

An ETS follows the Kyoto Protocol and treats forests differently depending on when they were first established. Under New Zealand's implementation of the Kyoto Protocol, forests first established before 1990 (called pre-1990 forests) do not earn carbon credits as a result of their growth but they do incur liabilities if deforested. The previous government recognised the impact this has on land-use flexibility and proposed to help affected owners through the free allocation of New Zealand Units (NZUs).

Currently owners of post-1989 forest land can choose to enter the ETS. Owners who enter the scheme receive all of the credits and associated liabilities linked with this forest land: they receive NZUs if their forests' carbon stocks increase as a result of tree growth and they must surrender NZUs if those stocks decrease (for example, due to harvesting or fire). Where the owners opt not to enter the ETS, the Crown takes responsibility for changes in the carbon stocks and for the associated credits and liabilities.

The forestry sector will also be affected if an ETS is rolled out over other sectors, particularly liquid fossil fuels (transport), stationary energy and alternative land uses such as sheep and beef farming.

FACTORS INFLUENCING NEW FOREST ESTABLISHMENT

An ETS will influence new forest investment in a number of ways.

Larger-scale landowners, including Māori, may be able to lessen the risk from the unknown future price path of carbon by having a number of forests at different ages. Thus, the new trees in one forest will offset, at least partially, the harvest at another. This may result in different investment and planting strategies to the present.

In addition, the financial sector may promote a range of schemes for managing potential liabilities, such as transferring harvest liabilities to buyers or holders of carbon credits. Such parties may be in a better position to manage the associated risk within a wider portfolio of carbon instruments.

Risk will remain a prime consideration.

The other potential obstacle to new forest investment is that forestry profits have been squeezed by the increasing costs of land (the single largest input) and returns that are static to falling. The price of typical hill country forest land (according to Quotable Value's Grazing Land Price Index) has increased in real terms by 100 percent, or doubled, in the past four years and by 150 percent in the past 10 years. During the same time, log prices have fallen by 5 percent and 25 percent respectively.

33 The following commentary is based on the Climate Change (Emissions Trading and Renewable Preference) Bill, as referred to the Finance and Expenditure Select Committee in December 2007.
34 A unit is equal to one tonne of carbon dioxide.

Analysis shows that even at relatively low carbon prices participation in the ETS will have a demonstrable positive effect on internal rates of return, while high carbon prices will have significant positive effects. However, any net gain is likely to find its way to land values, which will exacerbate the already high costs of land.

Land value may not be so important if a potential forest investor already owns land (for example, a farmer). However, risk will remain a prime consideration. Risk is considerably reduced where the forest investor opts for "carbon farming" with no intention to completely harvest the forest. Under a suitable growing regime, future carbon liabilities (for example, from partial harvest or from thinning) are more than covered by future carbon credits. Such regimes will involve long-lived species that can grow wood and sequester carbon over a long period of time – probably in excess of 100 years. These carbon farming regimes may suit the Permanent Forest Sink Initiative (PFSI) – see section on "Other climate change policy inititatives".

There is potential under an ETS for new forest investment, particularly by existing landowners, perhaps in conjunction with outside investors. At this early point in the currently enacted ETS, the amount of new activity cannot be gauged.

The cost of land will be very important in these investment decisions. It is the single largest input cost and, in present value terms, represents approximately 30 percent of total costs for an average North Island hill country location. For a non-harvested Douglas-fir regime, analysis suggests that net present values of $500 to $1000 per hectare can be achieved at a constant carbon price of $30 per carbon dioxide-equivalent tonne, excluding the land cost.

With traditional forest growing, returns from the sale of logs for lumber and other products depend on location and harvest costs. However, areas that have been historically unattractive for "traditional" rotational-harvest forests (due to high harvest costs) may pass investment hurdle rates when carbon is factored into the investment profile, either as an adjunct to traditional returns or as stand-alone carbon farming.

»» SILVICULTURAL MANAGEMENT AND POST-1989 FORESTS IN AN ETS

This section applies to post-1989 forest owners who participate in the currently enacted ETS, which is being reviewed.

› CHOICE OF SPECIES

Where the investment objective is focused on long-term carbon sequestration, there could be a shift from radiata pine to long-lived high-volume species such as Douglas-fir, redwoods and eucalypts. In addition, an ETS will improve the economics of establishing indigenous forests, as returns from carbon provide a much earlier income stream compared with a timber-only investment.

Rotation ages are likely to become more variable as a result of an ETS.

› INITIAL STOCKING

Most establishment regimes are currently designed to gain full site occupancy quickly. For post-1989 forests under the currently enacted ETS, it is unlikely that there will be a significant shift in stocking rates where timber production is still a core objective. However, if carbon is the primary objective, then stocking rates may fall to facilitate a "plant and leave" regime to minimise tending costs and maximise carbon profitability.

› PRUNING AND THINNING

It is conceivable that mainstream forestry will shift to regimes that produce more wood (and capture

more carbon) per hectare. Such volume-maximising regimes will probably not include pruning, as they do not tend to recognise the benefits.

Production thinning does not provide much profit but it reduces silviculture costs and/or produces wood for use. Parts of the sector still undertake thinning but it may become less common as post-1989 forest owner participants in an ETS factor in the impacts of thinning on the forests' carbon stocks.

ROTATION AGE

Rotation ages are likely to become more variable as a result of an ETS. For post-1989 forest land, owners will consider not only log prices, but also the carbon balance in the forest (whether it is better to continue to accrue units or meet liabilities) and the price of carbon, which will be a significant new factor that comes into the felling decision. If anything, rotation lengths are likely to increase.

DEFORESTATION OF PRE-1990 FOREST

The commentary in this section applies to owners of pre-1990 forest land that is subject to the currently enacted ETS, which is being reviewed.

Economic analysis has been used to determine the key drivers influencing the decision to deforest. The analysis covered scenarios with different species (radiata pine and Douglas-fir), growth rates, present ages of the trees, values of the deforested land and carbon prices and some variations of carbon price paths.

The analysis determined that the key influences on deforestation will be the:

- price of carbon;
- carbon content of the forest;
- age of the forest.

However, a number of forest owners are likely to behave differently from that indicated by the economic analysis due to:

- non-economic factors that are important to them;
- broader economic factors (for example, owners partway through a large deforestation programme will base their decisions on enterprise economics rather than the single-hectare approach in the analysis).

In the short to medium-term, deforestation activity is expected to slow down. Deforestation that continues after the introduction of the current ETS will be from either exempt areas, where the forests are more likely to be mature, or non-exempt areas, where forests are likely to be younger and to hold less carbon (and thus incur fewer liabilities).

WOOD FLOWS AND THE ETS

Wood flows from the pre-1990 forest estate will be largely unaffected by an ETS because the vast majority of pre-1990 forest owners are expected to continue to harvest and replant their forests. Any effect on wood flows will therefore result from the harvesting decisions of those post-1989 forest owners who choose to participate in the ETS.

As rotation ages are likely to become more variable as a result of an ETS, it is not possible to gauge the effect that carbon will have on wood flows from post-1989 forests – it will depend on the price of carbon at the time of decision making and future carbon price expectations:

- In periods of low log prices, the ongoing accrual of carbon may mean the owner delays harvesting until log prices improve.
- In times of static log prices but low carbon prices, the owner may harvest to try to mitigate the cost of the liability of reduced carbon stocks as a result of harvest.

On sites that are marginally profitable in pure-forestry terms, an ETS could result in post-1989 forest owners adopting a no-harvest or long-rotation regime to capitalise on carbon returns.

The degree to which the above considerations will impact on an owner's harvest profile (and therefore wood flow) will also depend on the size and age distribution of their forest holding. Large estates with a wide spread of age classes will be more able to balance their carbon profile, and harvest management could be undertaken largely irrespective of the price of carbon.

Single or narrow-age class estates will be more influenced by their carbon profile and the price of carbon, as there is less ability to spread activity over market fluctuations. Wood flows from these estates will be affected by carbon factors.

Douglas-fir is New Zealand's second most important wood production species after radiata pine, although at a much lower share of the national harvest. Compared with radiata pine, Douglas-fir is a long-lived species amenable to multiple production thinnings.

It is conceivable that some post-1989 owners of Douglas-fir stands may change from the present clearfell regime to a long-rotation multiple thinning regime (or even a non-harvest regime). However, the shifts in the wood flow from this species will not be significant to the overall national wood flow.

OTHER CLIMATE CHANGE POLICY INITIATIVES

THE AFFORESTATION GRANT SCHEME

The Afforestation Grant Scheme (AGS) was first flagged in the discussion document *Sustainable Land Management and Climate Change: Options for a Plan of Action* (MAF, 2006b), released in December 2006. The Scheme is administered by MAF and has been allocated $50m over five years.

Under the AGS, a government grant is available for planting new forests on Kyoto-compliant land (that is, land that was not forested as at 31 December 1989). Grant recipients will own the new forests and earn income from the timber, while the Crown will retain the carbon credits generated under the Kyoto Protocol and take responsibility for meeting all Kyoto harvesting and deforestation liabilities.

A government grant is available for planting new forests on Kyoto-compliant land.

The AGS offers an alternative to the ETS to encourage greater levels of greenhouse gas absorption by increasing the area of new Kyoto-compliant forest in New Zealand.

Another objective of the AGS is to establish this new Kyoto-compliant forest in areas where it will help reduce the likely impacts of climate change and generate other environmental benefits, for example, where it will reduce soil erosion, nutrient leaching and flood peaks.

THE PERMANENT FOREST SINK INITIATIVE

The PFSI is a government programme, also administered by MAF, which enables private landowners to receive Kyoto-compliant carbon credits (AAUs[35]) when they establish new permanent forests. These forests may be of exotic or indigenous species. The PFSI operates through a covenant mechanism.

The PFSI may enable landowners to make better economic use of their land, particularly isolated and erosion-prone land that is currently marginal for uses such as agriculture or conventional production forestry.

The PFSI remains an option for post-1989 forest landowners wishing to differentiate their forestry practices from normal clearfell forestry. Some believe that there is an opportunity in the carbon

35 An Assigned Amount Unit (AAU) is a tradeable unit of 1 tonne of carbon dioxide-equivalent greenhouse gases allocated to Annex 1 (Developed countries) based on their emissions at 1990.

market to receive a premium for units generated under the PFSI compared with units from normal clearfell forestry. Such PFSI forests may be marketed as having greater environmental credentials.

Perceptions of market demand and the price of units generated from New Zealand forests in the post-2012 period will have a significant influence on investments in new carbon forestry.

»» THE CARBON MARKET AND FORESTRY

The currently enacted New Zealand ETS is the first internationally linked domestic emissions trading scheme where emitters can use forest sinks to meet obligations to surrender units. Because this ETS is the only scheme to include forestry, it is unclear how units generated from New Zealand forests will be perceived internationally in the carbon market. There will need to be a degree of learning internationally as carbon market participants understand how a New Zealand ETS deals with issues such as permanence.

Perceptions of market demand and the price of units generated from New Zealand forests in the post-2012 period will have a significant influence on investments in new carbon forestry, as much of the carbon uptake occurs in this period. Market demand and price will be influenced by factors such as:

- post-2012 demand in a New Zealand ETS;
- acceptance of New Zealand forestry units into foreign emission trading schemes and the costs of potential alternative sources of supply of offsets in these markets;
- the nature of any post-2012 international climate change agreement(s).

However, existing post-1989 growers must decide whether or not to join an ETS. As previously mentioned, economic analysis shows an ETS will add positively to the rates of return (over time and subject to risks) for an existing post-1989 plantation. The decision will largely be based on the expected price of carbon.

If the expected price increases at more than about 7.5 percent per year, there is likely to be less incentive to join as the cost of meeting the liability on harvest becomes greater than the value obtained from the sale of units in the near term.

› CARBON PRICES AND INTERNATIONAL EMISSIONS TRADING

In 2007, the carbon market was worth about €40 billion, which represents a trading volume of 2.7 gigatonnes of carbon. The market was dominated by trading in the European Union Emission Trading Scheme (EUETS). While the voluntary market grew significantly in 2007, it was small compared with the compliance market (with a trading volume of 75 megatonnes of carbon).

Units generated from forestry activities are explicitly excluded from the EUETS.

The EUETS is a "permit-based" system that also allows for limited use of units generated from developing countries under the Clean Development Mechanism. Units generated from forestry activities are explicitly excluded from the EUETS, and current proposals for Phase III of the EUETS continue to exclude forestry until at least 2020.

International prices for carbon are likely to be based on the expected supply of, and demand for, units. The Kyoto carbon market has the potential to be oversupplied if AAUs from Russia and Eastern Europe enter the market. However, these parties may decide to bank their units. Demand for these particular units is also uncertain and is likely to be

driven by market acceptance of greened AAUs generated from Green Investment Schemes.

Pricing within a New Zealand ETS will largely be set by international markets. European Union Allowances (EUAs[36]) are the primary units of trade in the EUETS. They have tended to trade at the greatest price in the global carbon market. Certified Emission Reductions (CERs[37]) that are stripped of delivery risk (which Project/Primary CERs contain) are also known as Secondary CERs and can be used to meet EUETS obligations.

The cap on the use of CERs in the EUETS, problems with registry systems (the International Transaction Log in particular) and more attractive settlement terms for EUAs have seen CERs trade at a discount of 10 to 25 percent to EUAs. As emitters in a New Zealand scheme can surrender either Secondary CERs or NZUs in the absence of a deluge of AAUs, the Secondary CER is what the NZU is most likely to trade against.

THE VOLUNTARY CARBON MARKET

A small but growing part of the world carbon market is in the voluntary sector. The voluntary sector operates beyond the compliance obligations and its market is driven by factors such as the desire to demonstrate greater social responsibility through carbon neutrality.

The US, which has an underdeveloped compliance market, is a major voluntary market. This market in particular has shown much more willingness to accept forestry credits than Europe, where they are not allowed into the EUETS despite being valid under the Kyoto Protocol.

36 An EUA equals 1 tonne of carbon dioxide.
37 CERs are permits generated through the Clean Development Mechanism (CDM), a mechanism for project-based emission reduction activities in developing countries. Certificates will be generated through the CDM from projects that lead to certifiable emissions reductions that would otherwise not occur.

The US, which has an underdeveloped compliance market, is a major voluntary market.

Like the CER market, the voluntary market focuses on three things:

- additionality (put simply, proving that an emission-reducing project would not have occurred without the credits being issued);
- permanence (proving that the emissions reduction is robust through time);
- measurement (being able to measure it).

Existing post-1989 forests may be able to sell offsets into the voluntary market for the carbon sequestration that occurred in the period up to the end of 2007. The forest management practices that increase carbon sequestration in pre-1990 forests may also generate offsets for the voluntary market.

A key development in the voluntary market is the amalgamation of standards for estimating emissions and for the creation of offsets. Already, inventory standards focus on The Greenhouse Gas Protocol (http://www.ghgprotocol.org/) and the International Organisation for Standardization (ISO) (http://www.iso.org/iso/home.htm). These define how an entity estimates its emissions and therefore the offset required.

In the project space, which defines the supply side of the voluntary market, increasing attention is focusing on ISO 14-064-02 and The Voluntary Carbon Standard (VCS) which in its most recent release contains updated guidelines for the Agriculture, Forestry and Land Use projects. Four types of activities are eligible under the VCS:

- Afforestation, Reforestation and Revegetation (ARR);
- Agricultural Land Management (ALM);
- Improved Forest Management (IFM);
- Reducing Emissions from Deforestation (RED).

There are numerous voluntary standards available. A thorough comparison of carbon offset standards is available in the report *Making Sense of the Voluntary Carbon Market: A Comparison of Carbon Offset Standards (*Kollmus et al, 2008) at http://assets.panda.org/downloads/vcm_report_final.pdf).

Since voluntary standards are particularly sensitive to double counting, opportunities to generate offsets are unlikely where a sector is already covered under New Zealand's Kyoto Protocol accounting.

Photo courtesy of Red Stag Photography.

INTERNATIONAL INFLUENCES

11

OVERVIEW

The international timber trade and the globalisation of forest-related environmental, social and cultural issues will continue to shape the future of New Zealand forestry. This chapter describes the international influences on New Zealand forestry and discusses how these will shape the sector and how the sector needs to respond.

The New Zealand forestry sector depends on exports, and New Zealand has well-recognised advantages. Despite its small size, the New Zealand forestry sector has generated a significant international reputation, especially for plantation forest management and research. However, there are considerable risks if we fail to take advantage of global trends.

DRIVERS

There are a number of international influences on the New Zealand forestry sector:

- All of New Zealand's increase in wood production will have to be exported and there is a need to understand and meet these export markets.
- Globally, communities are demanding more from forests, including wood production and environmental and recreation services.
- The international forest products market is focused increasingly on plantation forests.
- Proximity to "regional" markets in the Pacific Rim and Asia means that New Zealand's trade and competition in forestry will continue to be focused in these regions.
- Future timber supply, increasingly from small-scale growers with forests dominated by radiata pine, will influence how the domestic industry can and needs to respond to the changing shape of international forestry.

New Zealand is a top 20 global forest products supplier.

THREATS

There are a number of threats that may influence how New Zealand responds to these drivers, including:

- The predominantly foreign ownership of New Zealand's larger forests and fragmented ownership of other plantation forests reducing our ability to strategically focus domestically and to co-operate in growing and processing.
- The dominance of one species reducing future flexibility in global markets where species choice may be important or where monocultures are perceived negatively.
- Changes in international practices for management requirements, such as clearfelling, chemical use and timber treatment, possibly leading to future restrictions on the ability to grow radiata pine.
- Tariff and non-tariff barriers and high transportation costs possibly leading to the exclusion of and competition against New Zealand forest products.

OPPORTUNITIES

There are also a number of opportunities:

- New Zealand's resources and industry are well positioned to take advantage of global trends for greater roles for plantation forests.
- New Zealand society and policies are well attuned to sustainability principles, and New Zealand has an excellent international reputation for this.
- There is the potential to enhance the existing research and innovation capability.
- There is the potential to develop niche and engineered wood products.

INTRODUCTION

While New Zealand has 0.05 percent of the world's forest resources, it is a top 20 global forest products supplier. It supplies 1.1 percent of the world's forest products trade and 8.8 percent in the Asia-Pacific region. Approximately 70 percent of New Zealand's harvested volume is exported. Therefore, it is important to consider international factors that impact, or have the potential to impact, on the New Zealand forestry sector.

This chapter broadly considers those international factors and forces. It begins with a discussion of the forestry sector's driving forces at the macro level. It then considers the particular effects of globalisation.

The third and fourth sections of the chapter provide a snapshot of the practical realities of the elements discussed in the first two sections. The third section is an overview of the global trading environment for the forestry sector and New Zealand's place in it. The fourth section considers how changing paradigms and tools have influenced policy and the operational management of forests.

DRIVING FORCES OF THE FORESTRY SECTOR – THE MACRO STORY

There are three major forces that drive the dynamics of the global forestry sector:

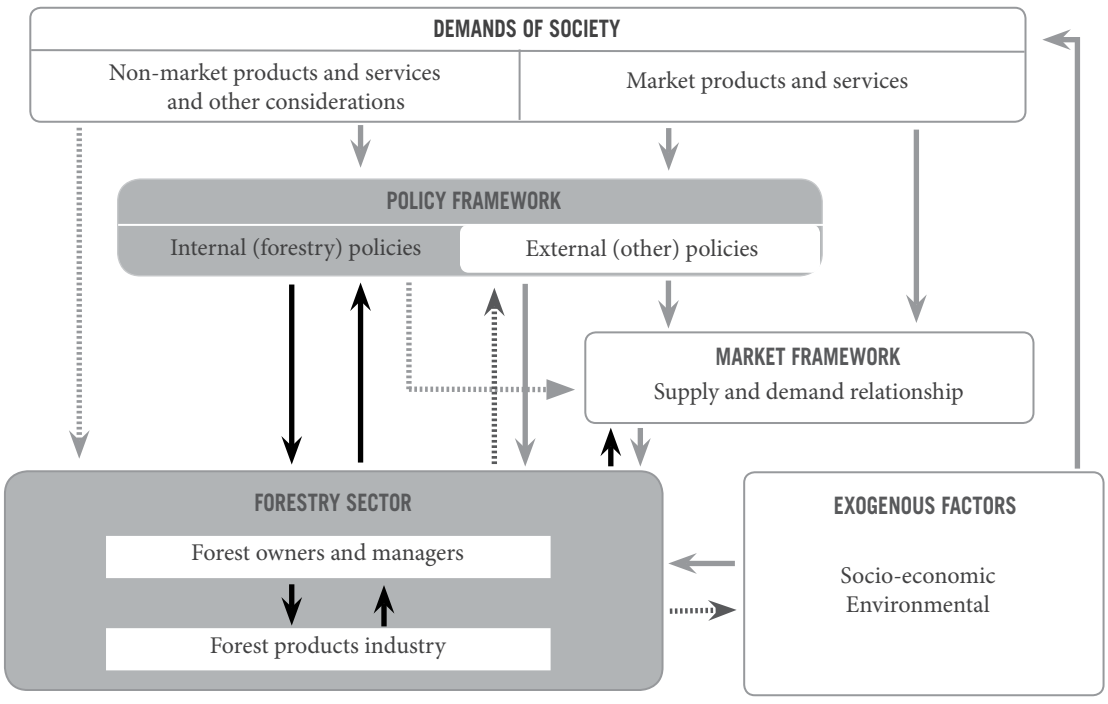
- external factors;
- society's demands on the forestry sector;
- policy and market frameworks.

Figure 11.1 shows the complex and interrelated interactions between these forces.

EXTERNAL FACTORS

The main external factors affecting the forestry sector are socio-economic developments (changes in population, urbanisation, accessibility, economics) and changes in environmental factors.

FIGURE 11.1: FORCES DRIVING THE DYNAMICS OF THE GLOBAL FORESTRY SECTOR



Source
UNECE/FAO, 2005a.

I. POPULATION[38]

The global population is expected to reach 9.2 billion by 2050. However, virtually all of this growth will occur in the less developed regions. The population in the developed regions is expected to remain steady but will age markedly.

Population growth will expand the market for forest products and services but will result in greater competition for land, particularly through urbanisation. The changes in the age structure of the population are expected to affect demand for particular types of forest products by altering income levels and consumer preferences.

II. URBANISATION[39]

It is estimated that, by 2030, 60 percent of the global population (an estimated 4.9 billion people) will live in cities. The pattern of increasing urbanisation is radically different between the developed and developing worlds, with higher rates of urbanisation in the developed world.

A significant development in both developed and developing countries has been the rise of the "megacity" (such as Sao Paulo, Tokyo and Mumbai). This type of urbanisation requires construction products suitable for concentrated development and may affect demand for timber products that have traditionally not been suitable for this purpose. This urbanisation will place additional pressure on land resources and may lead to a greater "disconnect" with forests or to different demands being placed on them.

III. ACCESSIBILITY OF AND TO FORESTS

As incomes and socio-economic levels have increased, the ability and desire of people to access forests for a variety of purposes has also increased. This increase has occurred due to a combination of factors, such as increased leisure time, improved rural infrastructure, increased car ownership and

Population growth will expand the market for forest products and services but will result in greater competition for land, particularly through urbanisation.

increased opportunity to travel[40] and is expected to continue.

What is not clear is the type of forests that will be accessed, for example, urban-remnant or plantation forest parks, forests in the peri-urban catchment or more remote conservation lands. However, it is likely that the increase in using forests for recreational purposes will reinforce the shift towards greater demand for non-wood forestry products and services and also increase public interest in forest and/or environmental issues.

There is also an increasing trend towards private ownership, although 84 percent of the world's forests are still publicly owned. An increase in accessibility demands may put additional pressure on public forests and may increase demands for legal rights of access to more forests.

It is also likely that increased population growth in forested areas, particularly in developing countries, will increase the number of people seeking to access forest resources for basic daily living resources, such as firewood and food.

IV. ECONOMICS

Economic growth is arguably the most important factor that influences the outlook for the forestry sector. It may lead to increased trade, investment and personal incomes, resulting in stronger growth in demand for all forest products and services. However, it may have a detrimental effect on forest resources if those demands exceed the biological capacity of forests to meet them or if rapid economic growth results in factors, such as increased air pollution, that harm forests.

38 This section is largely based on a report by the United Nations (2006).
39 This section is largely based on two reports by the United Nations (2004 and 2005).
40 See FAO, 2005: Chapter 7.

Analysis of likely future world economic events (completed prior to the 2008 global financial crisis) reveals the following.

a. Global economic growth

› The good levels of economic growth that have taken place globally over the past decade should continue, with estimates of 5 percent growth per year.
› Economic growth will be geographically variable: the US slowing, Europe and Japan picking up, Latin America continuing to do well and Asia continuing to have the highest levels of economic growth.

New technologies and innovation are likely to increase.

b. Global integration

› Global economic integration is likely to intensify further, as international trade and investment continue to expand.
› It is likely that global production processes will be more dispersed and more specialised.
› Technologically advanced goods are likely to continue to have the highest levels of growth in manufacturing exports.
› However, the risks of geopolitical imbalance will continue.

c. Adoption of new technologies and innovation

› The rates of adoption of new technologies and innovation are likely to increase further. The increasing returns to high-tech and innovative goods will provide further incentives for more R&D by both firms and the public sector.
› The adoption of new technologies will require more advanced skills in the workforces of the world's economies.

Economic growth is arguably the most important factor that influences the outlook for the forestry sector.

d. Pressures

› High levels of population and economic growth in countries such as China will increase the demand for, and prices of, raw materials.
› High levels of population and economic growth will also result in added pressures on the environment and climate change.
› Governments will therefore continue to be pressured to respond to these challenges and focus attention on the environmental impacts of non-biological materials and increase demand for sustainably sourced materials.

V. ENVIRONMENTAL FACTORS

Policy and management priorities for forests are influenced in part by the geographical, biological, biophysical and climatic factors that shape the diversity, character and extent of forests within regions and countries.

a. Biophysical risks

The total area affected by all types of biophysical risk in 2000 was at least 3.2 percent of the forest area of those countries who reported.[41] The risks from biological pests and diseases and invasive alien species will continue to increase as a consequence of global integration.

b. Changes to the resource base

The main changes to the forestry resource base are the age structure and growth rates of forest resources. Climate change (discussed below) is also likely to have an impact on the resource base.

Key findings on global forestry resources (FAO, 2005) indicate:

41 Although such disturbances are strongly underreported.

- The total world area of plantation forest was estimated to be just over 141 million hectares (Del Lungo et al, 2006: 9) and is unevenly distributed.
- The 10 most forest-rich countries account for two-thirds of the total forest area.
- Relatively few species account for most of the standing wood volume.
- Total forest area continues to decrease, although the rate of decrease is slowing.
- Primary forests are still being lost or modified, partly as a result of a shift to other land uses, including biofuel production.
- The area of plantation forests is increasing, although they still account for less than 5 percent of the total forest area. There was rapid growth in the area of plantation forests, especially between 1990 and 2000 in the Americas and Oceania, and between 2000 and 2005 in Asia. Much of the growth in Asia has been in China. China accounted for nearly three-quarters of the Asian regional total in 2005 (Del Lungo et al, 2006: 9). The expansion has predominantly been fuelled through various government subsidies and incentives.

c. Global climate change

The impacts of climate change on forests will be mixed. Sea level rise and/or changing rainfall patterns will have different impacts in different regions. Initial assessments have indicated that, in some parts of the world, increases in temperature and associated decreases in soil water will lead to the gradual replacement of tropical forests with savannah.

Global commercial timber production will rise modestly in the short to medium-term (although with large regional variation) as a result of new, poleward locations and carbon dioxide "fertilisation" effects. In addition, associated disturbances from climate change and other change drivers (for example, land-use change, pollution, over-exploitation and urbanisation) are likely to increase

The area of plantation forests is increasing, although they still account for less than 5 percent of the total forest area.

the vulnerability of forest ecosystems and reduce their adaptive capacity. There are also considerable uncertainties associated with the effects of increased pests and diseases, and extreme weather and fire events.

d. Water issues

The link between forests and water is complex and differs considerably depending on factors such as precipitation, slope, soil conditions, vegetation and the scale and intensity of land use.

Climate change will increase uncertainty, with its altering patterns of storm events and rainfall affecting groundwater and the changing risk of forest fire. Restricted water supply, water quality issues and cross-boundary issues are all likely to affect forest outputs.

The Fourth Assessment Report by the Intergovernmental Panel on Climate Change (2007) states that there is "high confidence" that, by mid-century, annual river runoff and water availability will increase at high latitudes (and in some tropical wet areas) and decrease in some dry regions in the mid-latitudes and tropics. There is also "high confidence" that many semi-arid areas (for example, Mediterranean basin, western US, southern Africa and northeast Brazil) will suffer a decrease in water resources due to climate change. However, there are no precise indications of how the overall supply and demand of water may affect global timber supply.

› DEMANDS OF SOCIETY

The demand for wood and timber products is probably still the most important demand placed on forests and it is certainly the most important demand in terms of income for the forest owner.

There are a number of policy trends at a global level that are likely to impact on the global forestry sector in the medium to long-term.

This demand is the basis for future projections for forest products markets.

However, there is also increasing demand for forests' non-wood products and forest services that have previously only exerted a minor influence on the forestry sector. These range from the traditional removal of plant products for food and medical uses to the use of forests for recreational activities and the provision of environmental services for both national and global purposes. There are strong indications that the non-wood demands on forests, especially international pressure to retain forests to mitigate the impacts of climate change, will become more prominent in the future. The mechanisms that will quantify such environmental and societal values of forests are likely to be clearer when timber values, opportunity costs on forest land and the non-timber values are all considered within a similar "economic frame".

I. CHANGES IN SOCIETY'S NEEDS AND PERCEPTIONS

Approximately 40 percent of global wood removals are for local subsistence – fuel wood. There are no reliable estimates of non-wood forest product removals from forests, but the bulk of such removals is known to be for food. Approximately 80 percent of plant product removals are in Asia.

As noted, increases in population and personal income are likely to increase the demand for a broad range of goods and services, including environmental services such as conservation, recreation and environmental management. It is also likely that consumers will have a greater interest in the environmental credentials of forest products.

II. CHANGES IN INDUSTRIAL DEMAND FOR FOREST PRODUCTS

Labour costs will rise with the ageing population and a reduction in workforce size proportional to total population. These changes may have an impact on forest supplies to the construction sector, which is traditionally labour intensive and currently accounts for a significant share of sawnwood consumption (over 50 percent in most countries).

One result may be pressure to substitute labour at the construction site for technology in the wood processing facility, increasing the demand for EWPs and modular and panelised construction. Such wood products would have the added advantage of reducing construction waste and the costs of handling and recycling such waste.

Promotional campaigns by manufacturers of timber substitutes (such as steel, concrete and engineered products) have had a tangible impact on how builders, engineers and buyers perceive the suitability, effectiveness and sustainability of timber products in a wide range of applications. As discussions about the non-wood values of forests gain prominence and mechanisms are developed to quantify such values, it is likely that the wood processors will be able to challenge the non-wood substitutes on sustainability grounds.

At the same time, new technologies and the growth of markets for various forms of wood-based composite products will enable greater use of small-dimension and residue wood in the production of high value-added products. This (and the emerging interest in wood as a bioenergy source) may increase the potential for the economic harvest and use of small trees and increase pressure for unsustainable harvest levels.

› POLICY AND MARKET FRAMEWORKS

Developments in the forestry sector are strongly affected by changes in government policies and

market frameworks. Even policies that are not specifically related to the forestry sector can have unexpected consequences. There is growing recognition that these cross-sector impacts are a major driving force in the forestry sector.

There are a number of policy trends at a global level that are likely to impact on the global forestry sector in the medium to long-term. These include:

- increasing conflict among demands for land for agriculture, biofuel and forestry, which is exacerbated by the effects of agricultural policy reforms in developed countries;[42]
- the effects of transition from centrally planned economies to market-based economies on ownership, institutions and economic growth;
- changes in the balance between tariffs and non-tariff measures;
- greater emphasis on the environmental services of forests, including carbon sinks, and biodiversity and nature conservation, and an increased pressure for governments to pay for such services;
- increased demand for certification of forest management and wood products for both sustainability and legal purposes;
- increased demand for energy and environmental improvement (including biofuel production), and linkages between these issues.

IMPLICATIONS OF EXTERNAL FACTORS FOR THE NEW ZEALAND FORESTRY SECTOR

The pressures on global forests from population and urbanisation changes, non-wood demands on forests and changing perspectives of environmental values will be increasingly evident in New Zealand. As New Zealand is likely to be part of the growing global economic integration affecting forests and forestry, domestic demands on forests will need to be balanced with their role as part of the global forest resource.

New Zealand's forests are well placed to accommodate the influence of changing global environmental factors. New Zealand already depends on plantation forests for commercial timber supply and therefore is well placed to take advantage of a growing international reliance on plantation forests for timber and biofuels. Policies in New Zealand regulate unsustainable forestry practices, and indigenous forest cover is stable, although biodiversity and habitat quality issues remain. There is also a growing strategic importance of the multiple-uses of plantation forests in New Zealand.

The pressures on global forests from population and urbanisation changes, non-wood demands on forests and changing perspectives of environmental values will be increasingly evident in New Zealand.

Although different sets of policies apply to indigenous and plantation forests in New Zealand, these may blur as indigenous and plantation forests play an increasingly more aligned role in environmental services and climate change mitigation.

New Zealand's relatively small forest resource will continue to be an actor in the highly mobile global interconnection of forest labour, investment, raw material supply and processing. Due to its size, the forestry sector will need to capitalise on New Zealand's good forest-growing attributes and well-established environmental policies, while looking to innovations in multi-use forest management, reduced energy use, eco-verification and processing technology.

42 Land use was a theme in the early forestry debates but has been largely forgotten in forestry forums (although the FAO has undertaken a lot of cross-sectoral work in this area).

GLOBALISATION

ASPECTS OF GLOBALISATION

Globalisation is the intensification of interconnections among societies, institutions, cultures and individuals on a worldwide basis. It includes flows and trade in goods and services, such as ideas, capital, people, foreign direct investment and products.

The speed and extent of globalisation has increased significantly over the past two decades as a result of:

- the end of the Cold War and the integration of former Communist states into the global system;
- technological developments, particularly in information and communications technology (ICT) and transportation;
- global income and technological convergence;
- increased dispersion of production processes around the world;
- development of more sophisticated financial markets and greater trade and investment flows.

CHALLENGES AND OPPORTUNITIES OF GLOBALISATION FOR NEW ZEALAND[43]

The mass of global activity is moving closer to New Zealand as a result of the growth in Asia. However, distance from markets, isolation from major shipping routes, the volume of product and sea transport costs still put New Zealand products at a disadvantage.

There are also increasing amounts of trade within industries and firms located all over the world. Countries that are most linked to these international industry and firm value chains will be major beneficiaries of globalisation.

Finally, people mobility is an increasing feature of globalisation and there are now global markets for skilled labour. This, combined with a declining labour pool as the developed world's population

Global activity is moving closer to New Zealand as a result of the growth in Asia.

ages, will put additional pressure on wages for skilled labour.

Globalisation will also present challenging issues for New Zealand's national identity. At one level, the global reach of New Zealand's brand is a positive development. At another level, our brand image will need to be managed and protected.

I. FOCUSING ON THE FORESTRY SECTOR

A common reaction to the challenges of globalisation is a call for New Zealand to move away from producing and exporting commodities, and towards higher value-added products and services. However, New Zealand's best tactic may be to focus on its natural advantages while remaining alert to opportunities that arise.

This approach is very similar to the development paths of a number of economies, such as Finland and the other Nordic countries[44], as well as Australia and Canada. In these countries, new and sophisticated industries have emerged from traditional primary production sectors. While these countries do possess high-tech industries, the economies have developed on, and continue to rest on, major low and medium-tech activities. In these countries, such industries are not stagnant or declining but are characterised by innovation and growth and offer long-term development potential.

If this approach is taken in New Zealand, the forestry sector will need to create new higher value-added goods and services that are branded and marketed in more complex and sophisticated ways. New Zealand's agricultural sector has the crucial attributes required to do this – including cost and quality competitiveness, international scale, an

43 This section is based largely on a speech by John Whitehead of The Treasury in July 2006 (Whitehead, 2006). Note that the focus was predominantly on agriculture, with some forestry.

44 For example, the forestry sector (wood, pulp and paper) remains one of the largest industries in Finland – in recent years, the forestry sector has accounted for around 25 percent of Finnish exports, a higher share than Nokia's.

extensive science base and established channels to market. Indeed, as a sector, it has produced some of the best productivity records over the last 20 years (Hall and Scobie, 2006). The same cannot be said of the forestry sector.

In addition to lacking these attributes, the New Zealand forestry sector also faces increasing competition from developing nations such as China, Chile and Brazil. These countries are already adding value and rapidly moving up the supply chain and technological spectrum. With low labour costs, fewer environmental protections, cheap land and low exchange rates, they can beat New Zealand on price. Combined with the rapid growth of other economies such as India, their growth may also make it more difficult for New Zealand to secure the shipping needed for export (and to import essential inputs), further affecting New Zealand's ability to compete on price.

There is also increasing pressure on natural resources, such as water and soil, in some parts of the country. The effects of climate change will exacerbate this. Foreign markets and international instruments are likely to increasingly seek to penalise all producers for not producing forest products sustainably (see the section on "Trade restrictions").

Meeting the globalisation challenge will require strategic and sustained change across the entire sector and investment in innovation in high-value products and markets. It will also require a renewed focus on governance and performance. New Zealand firms will need to take ownership of the issue and make a commitment to keep pace, including how to think differently and constructively about collaboration and co-ordination.

Recent policy work[45] on New Zealand's global connectedness and response to the challenges and risks of globalisation identified a need to focus on:

- boosting levels of innovation;
- improving infrastructure;
- creating a more competitive environment for capital investment;
- ensuring that the education system provides a well-trained and internationally recognised skilled workforce;
- ensuring that domestic regulation achieves a balance between economic development (and international competitiveness) and environmental sustainability;
- advancing trade negotiations and trade promotion initiatives.

The forestry sector will need to create new higher value-added goods and services that are branded and marketed in more complex and sophisticated ways.

THE CHANGING FACE OF THE GLOBAL FORESTRY SECTOR

The global forestry sector has faced considerable pressure over the past decade and has changed significantly. There has been a shift in comparative advantage from regions that are abundant in indigenous forest resources to those that have a competitive processing industry and more favourable conditions for intensively managed plantation forests. Forestry in traditional producing regions has struggled to remain profitable in the face of lower-cost "new forest economies" that are emerging as major exporters and importers of forest products.[46]

In the past decade, the traditional value chain model for the forestry sector has transformed, causing the break-up of vertically integrated providers. This, in turn, has fuelled merger and acquisition activity in the global forestry sector. There are indications that

45 For example, the Government's Growth and Innovation Framework and Economic Transformation processes.

46 Sande (2002) notes that the Boston Group has concluded that, as an investment, the forestry sector has performed worse than the average stock market during the 1990s.

the forest companies are responding to consolidating markets and supply chains either by identifying new market niches and developing value-added and consumer-specific products or through consolidation strategies (Sande, 2002: 20).

While companies have sought to adjust, cost pressures in the supply chain have remained relentless, and are likely to continue to be so. The ending of cheap energy prices (affecting both production and transport costs) and the cost of carbon regulation have been identified as two key issues for the global forestry sector (PricewaterhouseCoopers, 2007b).

A survey of international forestry sector Chief Executive Officers (CEOs) in mid-2006 (PricewaterhouseCoopers, 2007a) identified four key observations regarding the current state of the global forestry sector, the key issues it faces and its future direction.

OBSERVATION 1: The cost structure of the sector is under intense pressure in the short-term, despite optimism (particularly in emerging markets) about the growing demand for and the long-term viability of the sector's products. As a result of these pressures, sector executives identified that they needed to make tough decisions to improve return on capital and shareholder value. One CEO expressed concern that low rates of return are simply expected from the sector throughout the supply chain, creating a vicious circle. They stated that "Leaders in the industry need to force higher return expectations to break this cycle" (PricewaterhouseCoopers, 2007a: 5).

OBSERVATION 2: The forest, paper and packaging supply chain needs to be optimised, including industry consolidation. Globally, forest companies need to work on all aspects of the supply chain and be open to innovative solutions, such as new types of supply agreements. The fragmented sector also needs substantial consolidation in order to optimise the supply chain. However, there was also a view that there would always be room for a number of smaller players, who will be able to find niche markets under the umbrellas of bigger companies.

OBSERVATION 3: There is a need to know the customer and understand the markets – established and emerging. Retaining customers and defending strong market share were seen as key priorities in order to survive and thrive in a fragmented industry. The measures identified to do this included: tailoring product mix in order to improve value to customers, designing R&D activities around meeting customer needs and researching different processes of growing trees that better meet customers' needs for specific types of pulp.

OBSERVATION 4: Sustainability is a critical factor to ensure long-term success. Collectively, the CEOs felt that good forest management practices will be needed to ensure the long-term viability of the available resource and to respond to the views of social interest groups. Certification garnered mixed views – some believed it contributed substantially to competitiveness and some believed it was necessary due to customer demand, while some believed that certification was not worth the high cost of obtaining it (PricewaterhouseCoopers, 2007a: 3).

Many of the changes described have also been seen in the New Zealand forestry sector. These global changes are likely to continue and the structures and organisation that the New Zealand forestry sector adopts in response will have a major impact on its viability and competitiveness.

› GLOBALISATION OF CONCERN

The late 20th century saw global concern grow about the state of and outlook for the environment, and consolidate into an active focus on environmental issues.[47] This resulted from increased awareness of the effects of population pressure, environmental

47 The latest Pew Centre's Global Attitudes Survey (Kohut et al, 2007) found that concerns about environmental degradation are regarded as a top global threat in 20 of 35 countries for which trends are available, and that these concerns had risen sharply since the last survey in 2002.

degradation and rising incomes and attendant development pressures.

It is interesting to look at how the impetus for that concern has changed over time. At first, the concern was about how much growth was possible. Then this shifted to specific and immediate environmental concerns, such as acid rain, in part fuelled by the oil crisis. The mid-1980s saw the green movement gather pace in developed countries, driven by concern over a multitude of environmental accidents and by recognition that pristine environmental areas were in danger of being destroyed for economic development.

The notion of respect for the "existence value of biodiversity" became increasingly influential and the emergence of better data and trend information started to impact on both public views and NGO activity. At the same time, the science of climate change was starting to develop and gain recognition.

The notion of sustainable development emerged in 1987 as the new mantra to shape discussions about environmental issues. Forestry became an important sector as it bore the dual impact of population expansion and economic growth. There was also increasing concern about the condition of temperate and boreal forests. Forests, however, were recognised as only part of the sustainable development equation.

It is only in more recent times, though, that attention has focused specifically and directly on forests: firstly through the lens of sustainable forest management, and more recently through forest degradation, illegal logging and avoided deforestation.

I. THE RISE OF MULTILATERAL ENVIRONMENTAL AGREEMENTS (MEAS)

There are over 500 international treaties and other agreements related to the environment. Nearly 60 percent have been negotiated since 1972. The first agreement specifically for forests was the Non-Legally Binding Authoritative Statement of Principles For a Global Consensus On The Management, Conservation And Sustainable Development Of All Types Of Forests, agreed at the 1992 UNCED.[48]

II. NO SINGLE GLOBAL APPROACH TO FORESTRY

The years after the 1992 Rio Earth Summit saw a range of initiatives to review key issues facing forests and to re-establish a spirit of co-operation.
A plethora of international bodies became involved in forestry issues, for example:

- United Nations Commission on Sustainable Development;
- FAO – appointed as task master for Chapter 11 of Agenda 21 on combating deforestation;
- International Tropical Timber Agreement – this was renegotiated and its scope was widened to reflect the Forest Principles and Agenda 21;
- Intergovernmental Panel on Forests;
- Intergovernmental Forum on Forests.

The United Nations Forum on Forests (UNFF) was set up in 2000 to help implement the 270 proposals for action to fulfil the Forest Principles agreed to by countries between 1995 and 1999. The UNFF had few tools with which to "implement" anything, but it was instrumental in setting up the Collaborative Forum on Forests through which international organisations involved in forests could co-ordinate and collaborate.

Consequently, there is no single global approach to forests but rather a multitude of different approaches for different issues, for example:

- forests and the international policy and political arena – UNFF, Group of Eight (G8) and regional processes (Ministerial Conference on the Protection of Forests in Europe, Association of Southeast Asian Nations, Central Africa

48 A forestry convention was not negotiated at the Rio Earth Summit in 1992 because there was no agreement on a related forestry fund.

Forests Commission – COMIFAC, Amazonian Cooperation Treaty Organization – OTCA), Montreal Process; Helsinki Process;
- forests and development – Millennium Development Goals 1 and 7 and the poverty-forest link;
- forests and global change – climate, soil, water, energy;
- forests and biological diversity – Convention on Biological Diversity, Global Environment Facility, International Convention on Wetlands (Ramsar), Convention on International Trade in Endangered Species;
- forests and economic growth – WTO, financial institutions, private sector investments;
- forests, the culture and the "public opinion" dimension – multinational, national, local interests and environmental NGOs;
- Commodity agreement – International Tropical Timber Organisation.

This is a challenging context in which to advance international forestry policy.

III. CIVIL SOCIETY AND ENVIRONMENTAL NGOS

There has been a rise in the number of NGOs and civil societies involved in environmental, development and forestry issues, as well as an increase in the extent of their involvement. Globalisation has created both cross-border issues that NGOs address and cross-border communities of interest that NGOs represent. Although most NGOs operate within a single country and at a local level, the number of international NGOs has risen sharply – one estimate is that about 25 000 now exist.

A great deal of NGO activity is directed not at states but at other civil society actors and NGOs, and at the private sector. The relationship between all parties with an interest in the forestry sector has evolved over time; the focus is now on jointly finding and implementing solutions. One example is the diversity of involvement in non-government forest certification schemes.

NGOs can sometimes command greater legitimacy from the public than national authorities in shaping and directing public opinion. NGOs also have an emerging influence on the international policy arena (despite little formal power) and the global marketplace.[49] This influence has been attributed in part to their effective use of the internet to rapidly mobilise global constituencies.

The sheer number and diversity of NGOs has meant that there are many, often conflicting, messages about the nature of a problem, who is at fault and what the solution should be. Because of this, NGOs have been most effective when they have worked together in coalitions, pooling resources and co-ordinating their engagement with Government.

There are important NGO networks on the environment and on international economic policy that allow NGOs to co-ordinate their actions in many countries and at international conferences and negotiations. In particular, new forums have emerged for the conservation and sustainable management of forests, environmental issues and climate change. One example is the World Bank/WWF Alliance for Forest Conservation at a global level. Another is Yale University's "The Forest Dialogue", which is a multi-stakeholder standing forum on issues of sustainable forest management.

› THE GLOBAL MARKETPLACE AND SUSTAINABLE DEVELOPMENT

The rise in global concern about the environment has led to a rapidly increasing awareness of the benefits of environmentally (and labour) friendly production practices, with notions such as "carbon foot-printing" and life cycle analysis gaining prominence.[50] This is leading to a growing

49 Illegal logging in Papua New Guinea is one example.

50 However, this awareness is not yet matched by changes in overall consumption habits or a willingness to pay higher prices for environmentally friendly products.

"gatekeeper" interest in sustainable products (and associated practices).

As a result:

- Environmentally motivated non-tariff measures have been growing in prominence, although there is debate about the extent to which these technically constitute trade impediments.
- Third-party audited certification schemes are being supported by the buyers' groups. For the forestry sector, sustainable product certification and labelling have been particularly important. The two main objectives of certification are to improve forest management and ensure market access for certified timber.
- Forest resource restrictions through country-based regulation to protect indigenous forests from logging have been applied.
- There is growing concern globally about the impacts of illegal logging and unsustainable practices, and associated forest products trade.
- There continues to be opposition to establishing plantation forests as a substitute for indigenous forests, especially where these are on previously naturally occurring forested lands.

It is expected that, over time, these types of responses will increase as the general public's awareness of sustainability increases.

To date, environmentally motivated non-tariff measures and other environmental measures are not having a significant impact on trade in forest products. However, the uncertainty they have created remains a threat to the global trading system because the interface between trade, development and the environment will continue to be contentious. New Zealand's forestry sector should be well positioned to capitalise on this situation because the sector is based on sustainably managed plantation forests, a significant portion of which are already certified.

The New Zealand sector will need to remain a nimble participant in the globalisation game.

IMPLICATIONS OF GLOBALISATION FOR THE NEW ZEALAND FORESTRY SECTOR

Globalisation will have a significant and continuing impact on the New Zealand forestry sector. Even with shifts between unrestricted globalisation and constraints through national barriers to trade, the globalisation of environmental/social concerns promises to exert as much external influence on New Zealand as the effects of trade.

Increased globalisation will affect New Zealand on several fronts: the environmental issues, multiple-use forestry and the raft of labour, investment, forest ownership, corporate structure and products flows that accompany the trade dimension of globalisation.

Global shifts in forest ownership are already strongly evident in New Zealand, where ownership involving international corporate and pension funds dominates the plantation forest resource. The only wholly New Zealand-owned commercial forests are largely those of private small growers or partnerships.

Globalisation will mean that international influences will increasingly control the forestry sector's direction. The New Zealand sector will need to remain a nimble participant in the globalisation game. It will need to agree and set an agenda that trades on the best attributes of radiata pine, New Zealand's forest-growing advantages, the skill and ability to adapt and to balance commodity production with innovation, and its reputation for sound environmental and sustainability policies.

THE GLOBAL TRADING ENVIRONMENT

The factors identified in the section on driving forces provide the dynamics for the global trading environment, although aspects of globalisation are also influential. The aim of this section is to provide an insight into some of the changes and issues that are affecting the global trade of forest products and explore New Zealand's place in the global trading environment.

World trade in forest products is valued at more than US$200 billion per annum, and has quadrupled over the last three decades.

OVERVIEW

The forest products industry is one of the world's largest industrial sectors, with total annual sales of around US$950 billion. Forest products also supply the base material for a significant number of other key industries, and are derived from one of the world's few renewable resources.

World trade in forest products is valued at more than US$200 billion per annum, and has quadrupled over the last three decades. During this period, the growth in trade exceeded the growth in production. By 2005, the global percentage of production exported ranged from about 11 percent for industrial roundwood to nearly 31 percent for processed wood products such as wood-based panels.

The trade has been dominated by developed countries. Developing countries, however, have been increasing their added-value product exports. Forest products were historically traded in unprocessed form. Today, in general more wood processing takes place. Additionally, forest products (both as a group and as different products) are increasingly competitive with substitutes such as steel, concrete and plastics.

KEY FEATURES OF THE GLOBAL TRADING ENVIRONMENT

I. GLOBAL CONSUMPTION

The global consumption of all wood products has increased during the last 40 years, with the fastest growth in wood-based panels and paper products. This increase is predicted to continue.

North America accounts for just over one-third of current global forest products consumption, Europe and Asia each account for about one-quarter and all developed countries account for 70 to 75 percent of forest products consumption. China's forest products consumption is estimated to account for over one-third of Asia's consumption (and is growing very rapidly), while Japan and the Republic of Korea account for a further 30 percent.

II. GLOBAL PRODUCTION

In 2000, world production of roundwood was estimated to be 3.35 billion cubic metres. Fuel wood accounted for 51 percent of total production and industrial roundwood 49 percent. The largest producers of industrial roundwood were North America, Europe, Canada and South America. However, production in tropical countries has grown faster than in non-tropical countries and their share of global total production increased from 8.1 percent in 1961 to 18 percent in 2004.

III. CHANGING SOURCES

Most traded wood originates from natural and semi-natural managed forests. However, as noted, plantation forests are becoming an increasingly important source of supply.[51] The rise of plantation forests has allowed some forest-poor countries (in terms of industrial wood resources) to become forest-rich (for example, South Africa). In 2000, plantation forests were estimated to supply 35 percent of global industrial roundwood. This share

51 Currently, 62 percent of plantations are in Asia-Oceania, 17 percent in Europe and 9 percent in North and Central America (quoted in Katila and Simula, 2005).

is expected to increase to 44 percent by 2020 (Katila and Simula, 2005).[52]

Given the changes in source, it is interesting to consider how the changing quality of the raw materials (from indigenous forests to plantation forests) will affect production costs for wood processors in different regions. Two studies commissioned by the FAO suggest that processors in some regions of the world have adapted better than others by intensifying the use of technology to boost utilisation.

IV. PRODUCTION VOLUME TRADED

International trade in the forest products sector as a whole has increased slowly and steadily over recent decades, based increasingly on plantation and managed second-growth natural forests. The international trade in forest products has grown faster than global production. However, in some cases, the trade in individual product classes has decreased.

a. Industrial roundwood

Until recently, industrial roundwood as a percentage of total forest products traded globally was stable (at 7 to 8 percent), despite a 38 percent increase in the volume of industrial roundwood entering international trade since 1980. This roundwood proportion, however, has risen slightly and it is predicted to rise further.

b. Processed products

There has been a high level of trade for processed forest products in both relative and absolute terms because government policies have emphasised domestic processing. In absolute terms, export volumes have increased significantly since 1980: sawnwood and wood pulp have doubled, paper and paperboard have trebled and wood-based panels have increased almost four-fold.

c. Trade patterns

The number of countries exporting and importing has grown, but five countries account for more than 50 percent of the global trade. Most of the main importers are also significant exporters.

Canada is the world's largest exporter of forest products, accounting for approximately 17 percent of global forest products exports by volume, followed by the Russian Federation and the US. Exports from tropical countries have remained relatively static as a whole but the composition has changed from raw materials to processed products.

The global pattern of trade remains largely regionally based, given the generally unfavourable economics of transporting forest products to distant

52 Quoting ABARE and Jaakko Poyry, 1999.

TABLE 11.1: PERCENTAGE OF GLOBAL PRODUCTION TRADED ACROSS BORDERS

	1980 %	1997 %	2005 %	2030[1] %
Industrial roundwood	7.9	7.9	10.6	12.4
Sawnwood and sleepers	17.6	25.7	29.4	34.4
Wood-based panels	16.1	32.1	30.6	23.8
Wood pulp	16.8	21.7	10.0	8.5
Paper and paperboard	20.6	29.4	30.0	22.1

Source
FAO, 2007 – FAOSTAT; 2002–2030 Global Forest Products Model.
Note
1 Forecast by FAO, 2007.

markets. Intra-regional trade is increasing in all continents. About 85 percent of Europe's trade is between European countries, around 70 percent of North America's trade is within the region and 85 percent of the exports from Asian countries are to other Asian countries.

V. TRADE FLOWS ARE DOMINATED BY THREE REGIONS

Three regions dominate the global trade in forest products and account for 87 percent of global trade by value. Europe, the largest region (including the former USSR), controls 53 percent of the global forestry export trade by value (an increase from 1980), followed by North and Central America with 25 percent (a decrease from 1980) and Asia with 12 percent (stable).

The largest trade flows are between Canada and the US, from North America to various parts of Asia and from Europe to various parts of Asia. The Pacific Rim is the main area where developing countries export their forest products to developed countries.

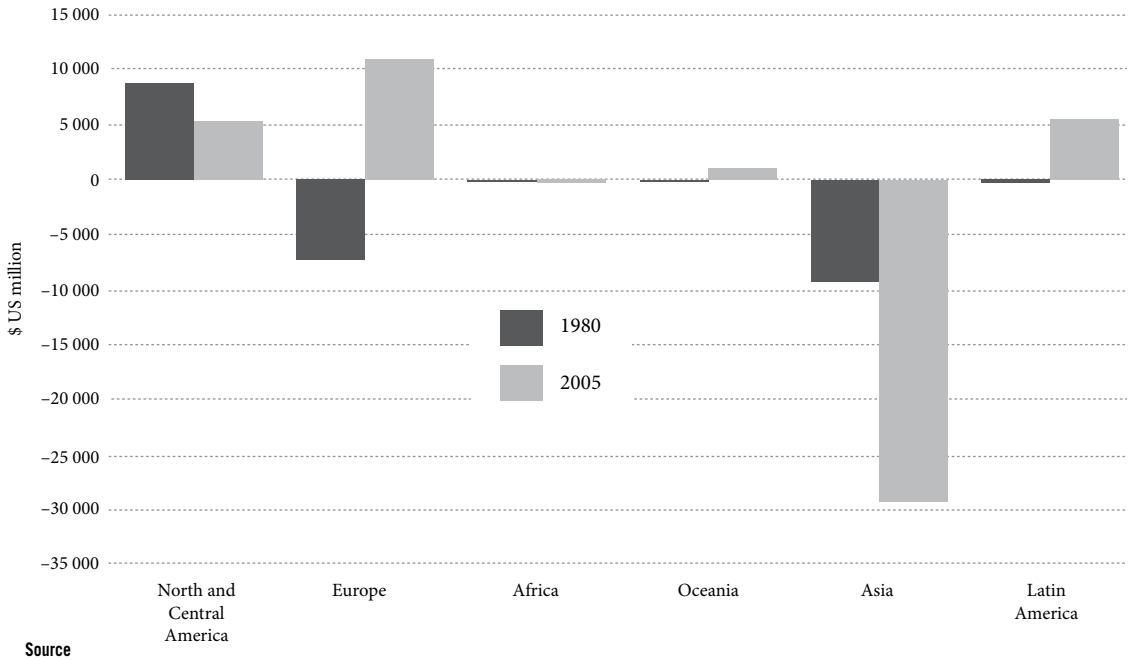
The level of the Asian region's imports varies markedly by country and with the products involved, although a large proportion is accounted for by imports into Japan and China. The large consuming nations in Asia are not always large importers because some of these countries (such as Indonesia) are also significant producers of forest products.

› CHANGING DIRECTION OF TRADE

In recent years, there has been increasing trade between developing countries. China, the Republic of Korea, Thailand and the Philippines have all increased their imports from other developing countries and China is now the second largest importer in Asia. Japan has changed some of its sources and some of the products it imports. It is now importing from new suppliers outside the region, including Africa and Scandinavia, as well as from newer sources from within the region.

These trends are likely to continue. Presently, most of the imports consist of logs and semi-finished

FIGURE 11.2: GLOBAL NET TRADE BALANCE, 1980 AND 2005



Source
FAO, 2007.

wood products. While it would be expected that this import mix would change as the economies grow and incomes increase, the presence of trade barriers and the growing forest industry in these countries are likely to mean that the types of products they import will not change.

I. FOREST PRODUCT TRADE

At the global level, there has been a noticeable decline in the importance of unprocessed forest products and an increase in the prominence of trade in processed products. Although global statistics are not available, trade in wooden furniture and componentry has reportedly increased sharply.

In some parts of the world, new products are driving export growth. In Japan, glue-laminated beams now comprise over 60 percent of the posts and beams used in traditional housing construction. Similar products are beginning to find wider acceptance in Europe. Wood-plastic composite materials are now gaining a market share in North America, with 700 000 tonnes used in exterior decking in 2005.

There has been a noticeable decline in the importance of unprocessed forest products and an increase in the prominence of trade in processed products.

Within these regional trade patterns, there are also quite distinct patterns in the type of product flowing between regions.

II. DOMINANCE OF SOME COUNTRIES

Traditionally, developed countries have been major producers and exporters within the global forest products industry. However, global exports in forest

TABLE 11.2: MAIN WOOD PRODUCT TRADE FLOWS

PRODUCT CATEGORY	MAIN TRADE FLOWS (BASED ON VOLUME)
Industrial roundwood	Intra-Europe Former USSR to Europe Former USSR to East and South Asia Increasing intra-regional trade from other Asian countries to China
Sawnwood	Intra-North America (90% of trade) Intra-Europe Intra-East and South Asia
Panels	Intra-East and South Asia Intra-Europe Intra-North America
Paper	North America to East and South Asia Intra-Europe Intra-North America

Source
Katila and Simula, 2005.

TABLE 11.3: PRODUCT DOMINANCE BY COUNTRY

PRODUCT CATEGORY	DOMINATING COUNTRY
Sawnwood	Canada has 30% of global exports
Panels	Brazil, Indonesia, Malaysia and China are the top four
Paper	Europe and North America account for 80% of the globally traded volume, with increasing capacity in Asia
Millwork and mouldings	Brazil is the largest exporter, followed by Indonesia
Plywood	China, Indonesia and Malaysia account for over 50% of global trade

products from developed countries decreased by almost US$1 billion each year from 1999 to 2001. Meanwhile, developing countries have been increasing their position in the global trade of forest products: developing countries represent 12 of the world's top 20 exporters of forest products.

› NATIONAL POLICIES AFFECTING TRADE

I. INCENTIVES FOR DOMESTIC PROCESSING IN DEVELOPING COUNTRIES

In many developing countries, particularly in Asia, the logging of indigenous forests has been banned and economic development has focused on the domestic processing industry. This focus has been supported by a range of government initiatives, incentives and subsidies.

II. SUBSIDISATION OF PLANTATION FORESTRY

Surveys of countries experiencing large expansions of plantation forest area show that the growth, in almost all cases, is associated with either government policies offering generous incentives in one form or another or governments actively involved in the planting. In Europe, the attractive incentive schemes for afforestation can make it economically rewarding for farmers to convert surplus arable land into forestry, although there are regulatory constraints on land-use change.

This issue is likely to become increasingly contentious because of the distortionary effects on trade and, in some cases, impacts on environmental values, especially where there is direct conversion of indigenous forests. From a commercial perspective, such measures shift the margin of relative profitability and encourage more conversions to plantation forests. Subsidies tilt trade in favour of the exporting countries that offer planting subsidies: the subsidies make it easier for them to capture market share because they are able to compete at lower prices.

III. PROMOTION OF THE SOUND USE OF WOOD

Wood industries in Europe, North America and Australasia are promoting the use of wood in building design and construction. This has included specific promotion of the carbon dioxide reductions that can be achieved by building with wood rather than other materials. Green building rating systems are gaining prominence in the promotion of "sustainable buildings" but they rarely recognise the full-life sustainability and/or embodied energy attributes (positive or negative) of construction materials.

There has also been a relatively recent trend in Europe and North America to reuse construction timbers, although logistics for collecting, sorting and cleaning need to be improved and more needs to be known about the strength properties of recovered woods and the detection of chemical compounds that may be present.

› TRADE RESTRICTIONS

I. CURRENT TARIFFS ON FOREST PRODUCTS

"Tariff escalation," where tariff rates increase proportionately to manufactured content, is an issue in a number of export markets.

The tariff rates faced by exporters of forest products at a global level are relatively low, largely as a result of the WTO multinational trade negotiation rounds, including the "zero for zero" paper and pulp agreement signed by eight WTO members during the Uruguay Round and another 10 in their WTO accession packages. The current applied tariff rate[53] in forest products for WTO members is 11 percent. The average bound rate[54] is 30 percent. Some exporting countries have also gained preferential

53 That is, the tariff rate actually imposed by customs at the border. These rates are sometimes considerably lower than the WTO-bound rates listed in national tariff schedules.

54 That is, the specified tariff rate agreed in WTO negotiations above which countries cannot raise their tariffs at the border.

access under schemes and regional trade agreements that are part of the Generalised System of Preferences (GSP). The overall level of applied tariffs is higher in developing countries than in developed countries. South Asia, North Africa and the Middle East have the highest bound tariff rates.

While tariffs have generally been reduced globally, "tariff escalation", where tariff rates increase proportionately to manufactured content, is an issue in a number of export markets. For example, many countries have no or very low tariff rates for raw logs and/or pulp, but significantly higher rates on manufactured wood products, such as paper or furniture, to protect domestic manufacturing. Tariff escalation is a particularly common feature of tariff schedules in both developed and developing countries. It is estimated that the removal of tariff escalation would have the greatest positive impact on trade between developing countries.

II. NON-TARIFF MEASURES INFLUENCING TRADE IN FOREST PRODUCTS

Non-tariff measures are "government laws, regulations, policies and or practices which either protect domestically produced products from the full weight of foreign competition or artificially stimulate exports of particular domestic products" (New Zealand Forest Research Institute, 1999). They vary by country, by product and even over time, and their application is not always transparent and consistent.

An APEC report produced by the New Zealand Forest Research Institute (1999) found that non-tariff measures have increased in parallel with the decline in tariff barriers and have therefore become relatively more influential in impacting trade.

A report commissioned by the International Centre for Trade and Sustainable Development (Alavi, 2007) suggests that standards for sustainable forest management and international certification of forest products may further restrict trade. The report notes "The cost for operating sustainable forest management schemes and obtaining certification for timber is extremely high and time consuming … Anecdotal evidence also confirms that certification schemes have also been used as a protectionist measure in some countries".

› COMPETITOR ANALYSIS

The relative competitiveness of major wood

TABLE 11.4: WOOD PROCESSING INDUSTRY COMPETITIVENESS RANKINGS, 2004

	WORLD COMPETITIVENESS INDEX 2004		WEIGHTED SCORE WITH WOOD PROCESSING FACTORS	FINAL COMPETITIVENESS RANKING
	SCORE	RANKING		
US	10.0	1	8.1	1
Sweden	8.0	11	7.4	2
Australia	8.6	4	7.3	3
Chile	7.0	24	7.3	3
New Zealand	7.4	18	7.0	5
China	7.1	22	7.0	5
Brazil	4.8	44	6.3	7
Russia	5.2	41	5.8	8
India	6.3	30	5.5	9

processing countries is essentially a summation of the factors already considered above.

Ortiz (2004) assessed the competitiveness of the wood processing industries in eight countries against that of the New Zealand industry.[55] This was done using a combination of the general competitiveness of the business environment (as measured by the World Competitiveness Index[56]) and specific factors particular to the wood processing industry.

Table 11.4 shows the relative ranking of those countries assessed. Note that there have been some major changes in the world competitiveness rankings since 2004: Australia has dropped from 4th to 12th place and China has moved from 22nd to 15th place. These two changes in particular are likely to have altered Australia and China's final competitiveness ratings.

TRENDS IN NEW ZEALAND FOREST PRODUCTS EXPORTS

The value of New Zealand forest products exports for the year ended March 2008 decreased by 3 percent on the previous year to NZ$3.5 billion. Nevertheless, this equalled about 10 percent of total exports receipts.

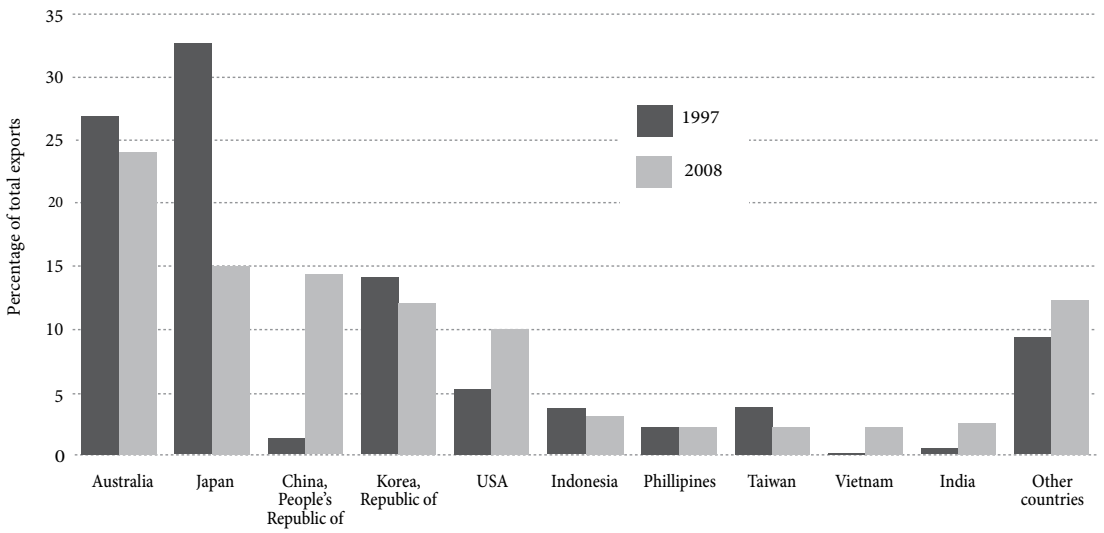
Australia, North Asia and the US have remained New Zealand's major wood product markets in the last decade. However, as shown in Figure 11.3, the percentage of exports going to China, the US, Vietnam and India significantly increased, while exports going to Japan decreased.

The increased export value to China comprises a significant increase in unprocessed logs but also increases across the range of processed categories. Most of the increase for India is from log exports, while that for Vietnam is mostly sawn timber and some fibreboard, pulp and logs. Trade with the US over the decade shows fewer logs and less pulp and a strong increase in sawn timber, fibreboard and other processed products.

ISSUES FACED BY NEW ZEALAND EXPORTERS

New Zealand exporters are faced with maintaining existing markets and establishing new markets. New Zealand pine is well accepted as a fine

FIGURE 11.3: EXPORTS TO KEY DESTINATIONS OF FOREST PRODUCTS, 1997 AND 2008



55 Ortiz's report followed on from a previous report prepared in 2001 for MAF.
56 The World Competitiveness Index assesses a country's economic performance, government efficiency, business efficiency and infrastructure.

remanufacturing and engineered wood product, but tariff and non-tariff barriers, various competitive elements and changing market access are constant threats. These issues are not easily addressed, except through multilateral action at the WTO or through bilateral agreements such as free trade agreements (MAF, 2002).

The benefits from removing or reducing barriers are considerable. Based on 2001 wood products exports, improved New Zealand export earnings from the removal of tariffs have been estimated at just over $40 million annually, while the potential earnings from reduced non-tariff barriers is estimated at $175 million annually (MAF, 2002).

TABLE 11.5: EXAMPLES OF ISSUES FACED BY NEW ZEALAND EXPORTERS

ISSUE	MARKET WHERE FACED
TARIFF	
Eroding conditions of access[1]	Australia, Japan, US
Escalating tariffs	China, Indonesia, Japan, Korea, Philippines, Taiwan, Vietnam
Differential tariffs based on wood or product type	China, India, Japan, Taiwan, US
STANDARDS	
Unique standards and sizes	Japan
Fire codes	China
OTHER	
Lack of transparent trade practices, predictability and consistency	China

Note
1 From loss of the benefits of preferential access; and trade diversion, from free trade agreements where NZ is not a party.

New Zealand will have to be especially vigilant and co-ordinated to extol the virtues of radiata pine products.

New Zealand will have to be especially vigilant and co-ordinated to extol the virtues of radiata pine products, given our single-species dependence. We will also need to ensure that New Zealand pine products can meet technical barriers, such as prescriptive building codes and standards, and specification on dimensions and species, an increasing feature of timber product use in Asia. The *2002 Wood Processing Strategy, Trade Access Group Strategy Report* (MAF, 2002) notes that New Zealand faces increasing competition from Australian-grown pine. This remains an issue for New Zealand, together with other pine-growing countries such as Chile.

› IMPLICATIONS OF GLOBAL TRADING ENVIRONMENT FOR THE NEW ZEALAND FORESTRY SECTOR

New Zealand is well placed to take advantage of the growing importance of plantation forest as a timber source and to meet increasingly stringent environmental standards related to sustainable forest management and certification. New Zealand radiata pine is generally well regarded as a technically good timber that offers good scope for remanufacturing and engineered products.

The sector is attuned to the current market and emerging changes in the regional market. However, there is an increasing challenge from other plantation forest developments, particularly in South America, China and Australia. These countries look to locally sourced timber to meet growing domestic demand, including locally processed timber products. Such plantation forest development is often actively supported through various government incentives. However, the rate of change is influenced by the location, extent and

age of existing stands and by the transition from indigenous forest to plantation forest supply.

With its proximity to Asia, New Zealand is well placed to continue to supply unprocessed logs as part of the export product mix, although this will be affected by the eventual supply from maturing plantation forests, such as in China, uncertainties over shipping costs and exchange rate variations, and the impact of various trade measures, especially affecting processed timber.

»» CHANGING PARADIGMS AND CHANGING TOOLS

This section explores how and in what ways underlying paradigms about forests have changed, some of the tensions that have driven these changes and the different tools that have been used to address forestry issues. These paradigms and tools will continue to influence the economics of the forestry sector and the policy and market frameworks that have been used by governments.

The discussion follows on from the earlier one in the globalisation section on the rise of global concern about the environment and forests, including the more recent interest in sustainability in the marketplace. It also draws on ideas raised in the first section on the demands of society.

› CHANGING PARADIGMS

Over the past few centuries, there has been a transition in attitudes to and philosophy about forests. These have ranged from relatively benign use to exploitation, to conservation plus sustainable management, then sustainable use. This transition occurred earlier in developed countries and is in the process of happening in developing countries. The transition and the underlying paradigms will continue to shape forest policy at a national and global level.

I. FROM BENIGN USE TO EXPLOITATION

Forests have always been used for an array of goods and services, particularly food and energy. They have also been seen as a strategic resource, such as during the age of the great maritime empires when they were used for shipbuilding and iron production.

However, forests came under increasing pressure as a result of the industrial revolution and the demands of colonial empires for cash crops. Although there was a great deal of forest destruction, it was still limited because of low technology and lack of population pressure.

At the beginning of the 20th century, the pressure on forests in developed countries abated as a result of various factors, such as the increased use of oil and electricity, the development of alternative materials for wood, increased efficiency in wood utilisation and improved forest management techniques. Forests (particularly in mountainous terrain) were some of the earliest areas that were conserved and protected, particularly through the establishment of national parks.

The sector is attuned to the current market and emerging changes in the regional market.

As deforestation in temperate countries peaked and decreased, deforestation in the tropics had barely begun. Population pressures meant that tropical forests were being cleared for food and fuel wood production, and increasingly for export cash crops. By mid-century, additional pressure came to bear as development started to occur in tropical countries.

In the early 1980s (as the first International Tropical Timber Agreement was being negotiated), researchers were seeing the connection between industrial production and sustainable capacity. Two

issues were identified: bad land-use policies and bad forest management.

II. RISE OF SUSTAINABLE MANAGEMENT

At Rio, the policy objective for forests was agreed – "to work towards the management, conservation and sustainable development of all types of forests" (Forest Principles and Chapter 11 of Agenda 21 in United Nations Conference on Environment and Development, 1992). The Forest Principles covered the spectrum of economic, environmental and social issues but they were political, very high level and subsequently opaque and full of ambiguity. However, the new phrase in forest politics – "all types of forests" – was a crucial development.

The concept of sustainable forest management continued to evolve following Rio through a series of international meetings sponsored by the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF). Some thematic issues that have been discussed in these forums are:

- elaboration of criteria and indicators for sustainable forest management;
- enhanced recognition and use of traditional forest-related knowledge;
- appropriate assessment and valuation of forest resources, products and services;
- enhanced trade in forest products and services in an environmentally sustainable way;
- promotion and enforcement of appropriate codes of conduct in forest enterprises.

The United Nations Forum on Forests (UNFF), which succeeded the IPF and IFF in 2002, assumed the task of promoting sustainable forest management and the outcomes of the dialogue. Subsequent meetings of the UNFF culminated in the Non-Legally Binding Instrument agreement in April 2007 on all types of forests. This agreement set out a purpose, principles, scope and objectives for further commitment on the sustainable management of forests. The years of dialogue illustrate the complexity of the concept and especially the difficulty in agreeing how this might apply to the array of global forests.

Sustainable forest management has developed in New Zealand over a similar timeframe to increasingly accommodate environmental and social values, together with timber management values such as sustained yield. New Zealand has adopted the concept into statute, for some indigenous forests, under the sustainable forest management provisions of the Forests Act 1949 as inserted by amendment in 1993.

III. FORESTRY AT THE CROSSROADS

In many ways, forests are at the crossroads of any number of issues and concerns. This is because forests provide multiple benefits and service many constituencies, have conflicting demands placed on them at individual, national and global levels and have multiple links with other sectors (agriculture, energy, water and tourism). Forests are also closely associated with a number of issues (meeting human needs, economic development, poverty reduction, environmental concerns) and have multiple dimensions (local, national, trans-border and global) and are multi-generational.

Policy makers have been trying to address and/or balance these issues and concerns. At a national level this process can be challenging, it becomes considerably more so at the multilateral level.

Another way of trying to reconcile all of these issues and concerns has been to use certification as a market-based mechanism that captures the value of non-wood services. However, experience has shown that consumers are not always willing to pay the full value of these services.

There are strong indications, though, that the non-wood demands on forests will gain prominence,

especially international pressure to retain forests (avoided deforestation) to mitigate the impacts of climate change. The mechanisms that will quantify such environmental and societal values of forests are likely to be clearer when timber values, opportunity costs on forest land and the non-timber values are all within a "similar economic frame".

IV. UNDERLYING TENSIONS

This brief history of changing attitudes to the use and exploitation of the forestry resource hides a set of underlying tensions that have driven global and national forestry policy.

a. Developed versus developing countries

The tension between developed and developing countries has been a continual theme in the evolution of global environmental and forestry policy.

At its simplest, developed countries have been concerned that developing countries do not make the same mistakes that they did, and developed countries have seen conservation of the environment as a necessity, not a luxury. While agreeing that environmental considerations were important, developing countries have seen economic growth, poverty alleviation, health and development as more important priorities.

This tension between developed and developing countries has extended to issues of sovereignty and allegations of interference in domestic matters, debates about who should take responsibility for past environmental degradation and allegations of self-interest on the part of developed countries.

Arguably, much of the current politics in forestry arose from the 1970s and 1980s debates over forest exploitation and deforestation. If this is the case, it would explain why recent "demands" from developed countries have been met with so much resistance. Developing countries largely recognise the need for tailored solutions, co-operation and cross-sectoral work but they tend to oppose such generalised solutions as a forestry convention, quantitative targets or specific commitments to sustainable forest management.

b. Global commons versus national environmental interests

Another related tension has been around issues of "global good" or "global commons" versus national interest and control.

Forestry can be regarded as an international issue. The high rates of deforestation and forest degradation are threatening livelihoods, and have economic, social and cultural impacts and environmental consequences. All of these aspects have been the subject of international discussion and goal setting.[57]

Developing countries tend to oppose such generalised solutions as a forestry convention, quantitative targets or specific commitments to sustainable forest management.

It is common in multilateral environmental agreements to have "common but differentiated responsibility" towards the implementation of the provisions of agreement to address a global concern. However, for forests, developing countries have continuously stressed the sovereign right to use and/or remove forests for development purposes and, if they are to be conserved, to receive adequate compensation for that global service.

c. Indigenous versus exotic plantation forests

The 20th century has seen the rise of plantation forests, both as a means of conserving indigenous forests and as a way to achieve a more cost-effective resource.

57 For example, the Millennium Development Goals.

There have been underlying concerns about the environmental "legitimacy" of plantation forests – whether inappropriate land is being used for plantation forests, whether plantation forests are replacing indigenous forests and whether plantation forests have negative environmental and social consequences. Less concern has been expressed about the way in which the shift to plantation forests has seen significant shifts in investment and ownership from the public into the private sector.

As noted above, the proportion of industrial roundwood coming from plantation forests is expected to rise over the next few decades. In particular, as developing countries increasingly seek to limit or ban extraction from their indigenous forests while at the same time increasing their processing capacity, demand will only be able to be met from plantation forests.

There is a question as to whether there will be greater demand for environmental-type services from plantation forests, in addition to their role as an extractive resource. In the United Nations Framework Convention on Climate Change and the Kyoto Protocol at least, no distinction is made between indigenous and plantation forests.

d. Legality versus illegality

Over the past few decades, most countries have adopted the idea of sustainable forest management and many have developed national forest policies and frameworks to guide decision making. At the same time, demand and cost pressures have led to a rise in illegal logging and trade in illegally harvested products. Deforestation and illegal logging are closely linked, and illegal logging is often a catalyst for forest land conversion to other uses. While deforestation has environmental and social impacts, illegal logging also adds governance and economic impacts.

There is a lack of definitive data on the extent of illegal logging, although all studies indicate it is a pervasive problem. Analysis of the impact of illegal logging and associated trade on volumes and prices of New Zealand wood products (Turner et al, 2007) suggests that:

- The supply of illegal wood in world markets depresses all wood product prices, distorting global production and trade – average log prices are 3.8 percent lower (for New Zealand, 10.6 percent lower) and the global wood supply is 1.5 percent higher than would otherwise be the case.
- Trade distortions due to illegal logging cost the New Zealand forestry sector $266 million per year in lost revenue.

The issue of illegal logging has increasingly been the focus of international discussion over the past few years and there are a range of international initiatives underway to address various aspects of the issue. As the OECD (2007) reports, although there are multiple efforts, there is no global vision or objective and there is insufficient co-operation among countries and agencies on a global or even a regional scale. Information gaps are not defined and there is no co-ordinated action taken to address them.

e. Public versus private interests

There has always been a tension between public and private interests in forestry. Globally, there has been a long history of public land being sold into private ownership and then cleared for agricultural purposes. The state has traditionally retained public ownership of residual forests or forests of conservation significance. In many parts of the world, property and tenure rights to forests (especially for indigenous peoples) are issues, particularly where governments offer cutting rights to indigenous forests to commercial companies. In contrast, most plantation forests are privately owned.

Commercial forestry used to be primarily a public sector activity in many countries, and many governments maintain an active involvement in the management of forests today, if not in commercial harvest and production. This is in contrast with agriculture, where government involvement has been limited for some time to providing support and/or sectoral mechanisms for the marketing of products.

The multiple benefits of forests have long been recognised, although not always properly valued. In many countries, regulatory frameworks for the management of natural resources and forestry are focused on trying to balance these competing benefits. Many of these benefits are in fact public goods, and the private sector has not had a strong interest in providing these goods unless they extract some value in return. To date, market mechanisms such as certification have provided this incentive.

TABLE 11.6: TOOLS FOR ACHIEVING NATIONAL OR GLOBAL FORESTRY POLICY OBJECTIVES

OBJECTIVE	TOOL
Management of forests	Conservation and protection regimes Various codes of practice Sustainable forest management frameworks
Monitoring and assessment	Criteria and indicators
Trade	Commodity agreements, e.g. the International Tropical Timber Organisation Chain of custody Suppliers' declarations Certification
Economic valuation	Clean Development Mechanism in Kyoto Protocol Avoided deforestation mechanisms

› CHANGING TOOLS

As attitudes to forest use and exploitation have changed, a wide range of tools have been developed and used to achieve forestry policy objectives at either a national or global level. The main ones are shown in Table 11.6.

Conditions are now emerging in some developing countries that suggest they are making the transition to more affluence and less pressure on forests and land, and are placing more importance on environmental and social outcomes. It is also clear that voluntary mechanisms such as national forest plans, codes of practice, and criteria and indicators are beginning to work.

With an increased focus on the links between forestry and other environmental issues, forests continue to be singled out internationally. The solutions proposed are often aimed at "strengthening" the range of available tools. Such strengthening often increases the cost of forest management compared with other land uses. This has the perverse effect of encouraging land conversion or illegal logging.

Despite the progress that has been made, deforestation and degradation continue. The causes are complex, and vary between and even within countries. This suggests that tailored solutions are needed for individual countries, as well as support from the international community.

One of the key issues may relate to the level at which action has occurred in the past and the implications of this. If governments have wanted to deliver certain public goods related to forests, then they have used regulation to achieve this, including in some instances

transition mechanisms and compensation. If such regulation has under-delivered, then governments have also made targeted payments for certain activities. There has also been action at the market/consumer level through the use of procurement policies, certification and suppliers' declarations of conformity. All of this has led to a wide and flexible implementation agenda for national sustainable forest management, and tensions with other national goals (such as poverty alleviation) that countries consider more important or pressing.

All this has not given incentives to countries to provide what could be described as "global commons" environmental services. In as much as countries contribute to the global commons, it is incidental to national efforts and because countries aspire to be "good global citizens". To fill this gap, the international community has tried to "regulate" for sustainable forest management by adopting sustainable forest management principles and the UNFF Non-Legally Binding Instrument. However, these lack the necessary economic incentives.

WHAT NEXT?

Perhaps the most important international forestry issue is how to address the economic incentives underlying deforestation. There are three key components emerging in the international forestry agenda that, if acted on together, have the potential to make a significant difference to the status and viability of forests. These are:

- avoided deforestation (and also afforestation/reforestation);
- trade in illegal timber and wood products;
- capacity building and technology transfer for sustainable forest management in developing countries.

A critical component in this nexus will be how market mechanisms can be developed so as to acknowledge an economic valuation for all forest services. The most promising avenue would appear to be the Bali Action Plan (UNFCCC, 2007: 2), which will consider in the context of enhanced action on climate change:

> *policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.*

There is a clear sense that forests and sustainable forest management issues are gaining a higher political profile and that the next couple of years are likely to see more attention given to the three components identified above.

BIOLOGICAL RISKS AND THEIR MANAGEMENT

12

OVERVIEW

New Zealand's isolation has meant that indigenous flora and fauna and the plantation forest estate are free from many of the pests and diseases that affect other countries. However, increasing trade and travel, and climate change, are elevating the risks of pests and diseases entering New Zealand and becoming established. This chapter examines the nature of the risks and how forestry biosecurity is managed in New Zealand.

DRIVERS

Isolation has given New Zealand some natural advantages in protecting its biodiversity. However:

- the constantly increasing levels of international trade and travel are resulting in more ways that pests and diseases can enter New Zealand and become established;
- the species and genetic diversity of the plantation forest estate are set for the foreseeable future, as, barring a biological disaster, any change in composition will occur only gradually.

THREATS

Although the levels of risk to flora and fauna and the plantation forestry sector may be low, there are potential threats from:

- the impacts on trade of domestic and international biosecurity strategies, restrictions on New Zealand trade arising from domestic pest and disease status, and challenges by importing countries over the effectiveness of control programmes;
- monoculture plantation forests being more vulnerable to pests and disease epidemics than mixed-species forests;
- the limited preparation for the use of alternative species should replacements for radiata pine be required;
- lack of clarity around the roles of central government, regional councils, industries and landowners for the long-term management of pests that become established in New Zealand;
- lack of public awareness around the importance of biosecurity and opposition to response measures.

OPPORTUNITIES

The principal opportunities for mitigating biosecurity risks are:

- an ability to build on an existing collaborative capability that involves government, industries and research agencies;
- gaining funding by recognising the increasing commercial and non-wood values of the resource being protected;
- increasing biodiversity associated with plantation forests at stand, forest and landscape levels without necessarily planting mixed-species stands or forests;
- progressing research on the biological and commercial merits of likely alternatives to radiata pine;
- increasing public understanding of the importance of biosecurity and the high standards required for protection, and increasing government agencies' understanding of community concerns.

PESTS AND DISEASES

Internationally, there are a large number of pests and diseases that could affect the forestry sector, and some will arrive in New Zealand. There have been over 750 pests and diseases identified with the potential to attack radiata pine (Ormsby, 2007).

Forestry pests and diseases currently in New Zealand are estimated to result in an annual

Forestry pests and diseases currently in New Zealand are estimated to result in an annual economic loss of about $200 million.

economic loss of about $200 million. The major plantation forest pests and diseases are:

- *Cyclaneusma* needle-cast (*Cyclaneusma minus*);
- *Dothistroma* needle blight (*Dothistroma septosporum*);
- *Armillaria* root rot;
- flute canker (*Nectria fuckeliana*);
- *Diplodia* whorl canker (*Diplodia pinea*);
- physiological needle blight;
- *Hylastes* bark beetle (*Hylastes ater*);
- *Essigella* aphid (*Essigella californica*);
- Sapstain fungi;
- Cypress cankers;
- pests of *Eucalyptus*.

(MAF/NZFOA, 2006)

Wilding tree spread must also be regarded as a notable, existing and costly pest problem. It has probably arisen because land managers did not realise that introduced trees might disperse seed and out-compete existing local vegetation, so they did not amend their management practices (Ledgard and Langer, 1999). The problem mainly relates to lodgepole pine, Douglas-fir and Corsican pine, which have greater spreading vigour than radiata pine.

Predicting the impacts of a new pest or disease is difficult. Key considerations include how quickly the population can grow, what parts of New Zealand it may spread to and how fast, and the presence of potential predators that may limit the impacts or spread. The pest or disease may have a narrow or wide range of hosts, and its impact will depend on the importance of those hosts to the economy, the environment and society.

In North America, the costs to the forestry sectors from invasive species have been substantial. The overall projected economic impact to Canada's forestry sector as a result of bio-invasions has been estimated at between CDN$7.7 billion and CDN$20.1 billion per year (Coluatti et al, 2006). Pimentel et al (1999) estimated that losses to the US forestry sector from invasive forest plant pathogens and insects, as a result of reduced timber yields and increased costs of control and management, were US$4.2 billion per year.

CHANGING NATURE OF THREATS

New Zealand's biological assets are under greater threat than ever before, as the volumes, sources and speed of movements of imported goods and international passengers increase the chances of exotic pests arriving. Over a recent 10-year period, trade volumes increased by 76 percent and international passengers by 93 percent (Biosecurity Council, 2003). These trends are predicted to continue.

Changing climatic conditions mean the ranges for pests are steadily extending, and invasive pests are threatening biodiversity as they evolve and adapt. It is expected that pests and diseases will be carried along new and different pathways, and some may become resistant to current treatments.

MONOCULTURES AND DIVERSITY

The debate over the vulnerability of so-called forest monocultures[58] to pests and diseases has been alive for decades, both within New Zealand and overseas. De Gryse (1955) reported to the New Zealand Forest Service that growing radiata pine in extensive monocultures was "tantamount to challenging all the laws of nature". Popovich (1980) wrote in the *(American) Journal of Forestry* on the influence of tree improvement programmes leading to the planting of fast-growing species, describing it as a widespread mistake: "Monterey pine was heavily planted in New Zealand and Australia, often to

58 Most references to forest "monocultures" use the term in the context of the cultivation of even-aged plantations of a single species.

the exclusion of other species with greater disease resistance. Now these stands are vulnerable to severe disease attacks".

MONOCULTURE FORESTS OCCUR NATURALLY

Monocultures are often criticised as being unnatural, in the belief that the ideal environment is the natural forest. However, pure stands, or stands in which a single species is dominant, occur frequently in nature, especially in temperate regions, and can be highly stable. Examples include pine forests in the eastern US, coniferous forests in Canada and beech forests in the South Island of New Zealand (Burdon, 1982).

Even-aged, single-species stands also occur naturally, often as a result of regeneration processes such as fire. Examples include Douglas-fir forest in North America and, notably, much of the radiata pine growing in its native California (Burdon, 1982).

DIVERSITY CAN INCREASE RESILIENCE

In the 1980s and 1990s, there was no evidence that confirmed or refuted the theory that complex ecosystems contained checks or balances that limited damage by pests and diseases (Maclaren, 1996) compared with single-species forests. Monoclonal plantings were certainly regarded as potentially more vulnerable, but New Zealand's plantation forests have never been monoclonal.

Recent research on the role of biodiversity in plantation forests has concluded that diverse forests can be healthier than monocultures. Carnus and others (2003) concluded that meta-analysis of more than 50 field experiments comparing pure stands with mixed stands of the same tree species demonstrated a significant increase in insect pest damage in single-tree species forests.

GENETIC DIVERSITY

Radiata pine plantings in New Zealand have retained considerable genetic variation, so the abilities of pests to exploit the forests and reach epidemic levels are reduced (Walsh, 1995).

New Zealand's biological assets are under greater threat than ever before.

A radiata pine breeding strategy has been in place since 1987 under the auspices of the various forest research and industry co-operatives. The strategy's objectives focus on both the delivery of genetically improved planting stock and the maintenance of long-term genetic variability.

In the seed production population, genetic diversity is assured by including a number of unrelated parent clones, with the seedlings containing almost infinite combinations of their genes (Burdon, 1995). Genetic variability even results from seedlings with the same parents (Burdon, 2001).

This seed production population is underpinned by a larger and more genetically diverse breeding population, which in turn is underpinned by a larger and more genetically diverse collection of native population material (Burdon, 2001). This ensures that a wide pool of genotypes exists for tree breeders to draw on in the future.

CLONAL FORESTRY

Clonal forestry involves the use of planting stock that is vegetatively replicated from a seedling or immature seed, and is therefore genetically identical. The advantages of clonal forestry arise from the:

- reduction in variability among logs;
- high genetic gain in multiple traits;
- specific clone selection for a forest owner's requirements.

(Sorensson and Shelbourne, 2005)

Clonal planting stock accounts for about 9 percent of tree stock sales, but sales are expected to increase in the future (Sorensson and Shelbourne, 2005).

Clonal forestry is likely to be limited to more uniform, higher-quality sites (Burdon and Aimers-Halliday, 2003), as site variability restricts the primary advantage of a uniform and predictable product.

The risk from clonal forestry is in the reduction in genetic diversity. However, there is little evidence that forests using several different clones planted in monoclonal blocks are at risk of failure, provided a number of clones are planted each year (Sorensson and Shelbourne, 2005).

LOOKING FORWARD

The key advance since the 1980s in our knowledge about the risks of forest monocultures is the recent evidence confirming that insect pest outbreaks occur more frequently in single-species forests than in species-diverse forests. In response to this situation, Carnus and others (2003) suggest that:

> *A critical issue for the future of plantation forests is how to combine biodiversity maintenance and wood production at various spatial scales (i.e., stand, forest, landscape). One way to achieve a balance between biodiversity and productivity/profitability is through improved practices at the stand level or alternative silvicultural regimes (species mixture at different scales from individual trees to compartments of different sizes, age and clone mosaic) combined with biodiversity management at landscape level. This would include, for example, modification of extensive clear-felling practices to reduce coup sizes (i.e., plan for smaller compartments of same-aged stands that are dispersed within the plantation landscape) to achieve a better balance between economic and environmental objectives. Thus it may be possible to achieve a degree of biodiversity at the landscape scale through diversification of plantation landscapes to create mosaics of different plantation forest and natural vegetation habitats, even if each of the individual plantation stands within that landscape are established as simple monocultures. In many parts of the world, this will require a reorientation of current practices and, in particular, a shift from a stand-level to a forest- or landscape-level approach to the planning of all aspects of plantation management.*

The large-scale use of alternative species is a fall-back position if these systems were to substantially fail, but preparation for this is an area of strategic weakness in New Zealand.

Another way of increasing the functional benefits of diversity might involve increasing plant diversity in the plantation forest understorey, although the effectiveness of this approach is yet to be tested (Carnus et al, 2003).

Maintaining genetic diversity in the radiata pine breeding population seems assured by the management strategies of the Radiata Pine Breeding Company. The risk of inadequate genetic diversity though monoclonal plantings appears to be recognised by the forestry corporates, but may not be appreciated by the smaller-scale growers. The possible introduction of a code of practice to ensure plantations are established using effective numbers of clones or effective numbers of orchard parents has been raised by Burdon (2001) and by Burdon and Aimers-Halliday (2003). The latter suggest, as a guideline for a major forest estate unit, at least 20 clones in a five-year age cohort, or at least 16 unrelated seedling parents.

There are lines of defence in forest management that are focused on maintaining forest health and genetic diversity, and in biosecurity systems that are focused on risk reduction, readiness, response and recovery. The large-scale use of alternative species is a fall-back position if these systems were to substantially fail, but preparation for this is an area of strategic weakness in New Zealand.

In a review of realistic alternatives to radiata pine, Maclaren (2005) concluded that the only proven alternative that could be planted at a profit and on a large scale was Douglas-fir. Certain cypresses, certain eucalypts and redwoods were identified as "likely contenders". However, Douglas-fir aside, weaknesses exist in terms of matching species to sites, securing good seed sources and developing technology for mass propagation (Burdon, 2001).

While a biological disaster to New Zealand's plantation forests seems unlikely, the risk is always present. The current mountain pine beetle epidemic in British Columbia (see next section) provides a dramatic example of what can happen, be it in an indigenous or plantation forest. More likely outcomes are tree malformation and growth loss. Walsh (1995) considered that the real threat in New Zealand lies with "unmanaged" indigenous forest, where monitoring is difficult.

While a biological disaster to New Zealand's plantation forests seems unlikely, the risk is always present.

A CLIMATE CHANGE-INDUCED BIOLOGICAL DISASTER?

By 2013, it is projected that 80 percent of the merchantable pine in British Columbia's central and southern interior could be dead. The forest health epidemic, facilitated by relatively mild autumns and winters since 2000, is described as a catastrophic natural disaster, and no longer just a forestry issue. The economic, social and cultural well-being of the province is at stake (Government of British Columbia, undated).

The culprit is the mountain pine beetle that has always co-existed with lodgepole pine as a natural part of the province's interior forest ecosystems. Lodgepole pine accounts for over 50 percent of the growing stock in British Columbia's interior (Minister of Forests, 2001). The mountain pine beetle also affects the less abundant ponderosa pine. Beetles lay eggs under the bark and, when the larvae hatch, they mine the phloem area and cut off the tree's supply of nutrients (Government of British Columbia, 2007).

The mountain pine beetle epidemic has now affected over 8 million hectares of forests, killed over 400 million cubic metres of merchantable timber and continues to kill mature pine trees. The Government has developed an action plan to mitigate the disaster, involving provincial ministries, industries and stakeholders, but the epidemic will only be stopped by a period of extremely cold weather throughout the affected area of about –20 degrees centigrade in the autumn or –40 degrees centigrade in the winter (Government of British Columbia, undated).

(The implications of climate change on forests in New Zealand are addressed in Chapter 13 in the section called "Impacts of climate change".)

MANAGING NEW ZEALAND'S BIOSECURITY

Biosecurity is the exclusion, eradication or effective management of risks posed by pests and diseases to the economy, environment and human health (Biosecurity Council, 2003).

NEW ZEALAND'S APPROACH TO INVASIVE SPECIES MANAGEMENT

New Zealand's geographical isolation means the forest industries and indigenous flora and fauna have been protected from many of the world's pests and diseases. This is being threatened by the increase in new pathways by which serious pests and diseases can arrive and become established. A good biosecurity system is crucial to protect the environment, the economy and human health.

New Zealand's biosecurity system is based on the

Biosecurity Act 1993. In 2002, the Biosecurity Council reviewed the biosecurity system and outlined a future direction through the Biosecurity Strategy, released in 2003.

THE "4R"S OF EMERGENCY MANAGEMENT

There are four basic steps in reducing the potential or actual impacts of a new and unwanted organism:

- Risk reduction involves identifying, analysing and eliminating or mitigating risks (pre-border and border biosecurity measures).
- Readiness is about preparedness for future events (surveillance/resources/policies).
- Response involves actions taken after an incursion event.
- Recovery is the co-ordinated mid and long-term efforts to restore the social, economic, natural and built environments.

RISK REDUCTION

I. INTEGRATED RISK MANAGEMENT FRAMEWORK

The strategy for delivering the key biosecurity outcomes is to successively treat the biosecurity risks along the entry and establishment pathways to reduce the risk to an acceptable level. With effective intervention and detection, the residual risk of pest establishment diminishes at each intervention step from the pre-border to the forests.

Risk reduction processes involve:

- pre-border – international agreements, import risk analysis, import health standards, pest risk analysis, permits;
- border – pathway risk analysis, clearance standards, sniffer dogs, mail inspection, passenger inspection;
- High Risk Site Surveillance (HRSS) – see the section on "Readiness";
- forests – see the section on "Readiness".

Inanimates (sea containers, imported vehicles and machinery) pose the greatest ongoing biosecurity threats to forests, as there are now widespread entry pathways and multiple risks that are hard to manage.

II. IMPORT HEALTH STANDARDS

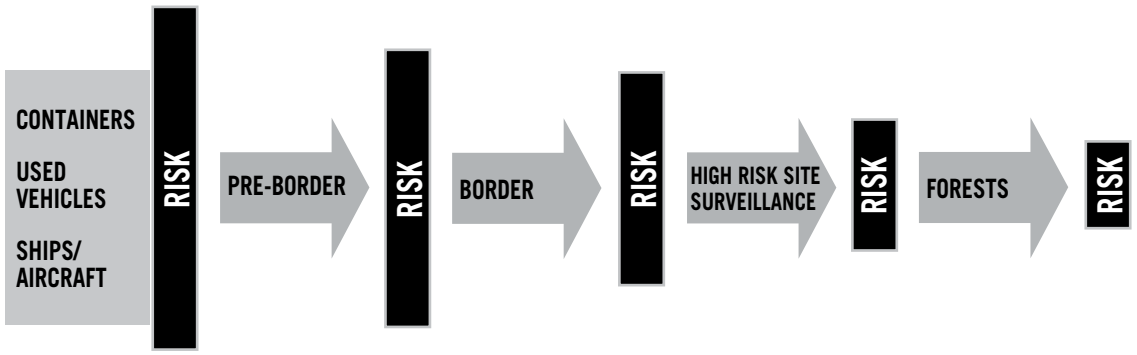
Import Health Standards (IHSs) state the requirements that must be met before risk goods can be imported into New Zealand. Forestry-related IHSs include those for used vehicles and containers, new wood and nursery stock. IHSs are developed according to the requirements of section 22 of the Biosecurity Act 1993 and are based on risk analyses.

III. BORDER MANAGEMENT

New Zealand's economy depends on the export and import of traded products. All forest produce must receive biosecurity clearance before entering New Zealand. Clearance requires that:

- the product complies with appropriate IHSs;
- there are no discrepancies in documentation;

FIGURE 12.1: SUCCESSIVE BIOSECURITY RISKS



› there are no signs that produce is harbouring unwanted organisms;
› there has been no change in circumstances or knowledge that makes it unwise to issue a clearance.
(Ormsby and Self, 2005)

For the export of forest products, New Zealand also needs to provide assurances to trading partners that the goods comply with their phytosanitary (quarantine) requirements. This requires New Zealand to:
› identify biosecurity risks that exported goods pose to other countries;
› ensure phytosanitary rules imposed by other countries comply with international agreements;
› manage existing pests and disease risks so that overseas countries consider exported goods to be safe from a biosecurity perspective.
(Ormsby and Self, 2005)

IV. INTERNATIONAL AGREEMENTS AND CONVENTIONS

International agreements and conventions to which New Zealand is a formal party set out principles, guidelines, criteria or rules, and influence biosecurity systems. These agreements and conventions include the:
› Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) – WTO;
› International Plant Protection Convention (IPPC) – Food and Agriculture Organization of the United Nations;
› outcomes from the United Nations Conference on Environment and Development (UNCED);
› International Tropical Timber Organisation (ITTO) Objective 2000;
› the plant protection agreement for Asia and the Pacific;
› Convention on Biological Diversity (CBD);
› Montréal Protocol;
› Convention on International Trade in Endangered Species (CITES).

The IPPC is an international treaty that is designed to prevent the spread and introduction of pests of plants and plant products throughout the world. It also promotes the establishment of appropriate measures to control plant pests.

V. KEY PATHWAYS FOR FORESTRY RISKS

Increased trade and tourism from a broader range of countries have increased the risk of new pests and diseases arriving in New Zealand. The number of sea containers imported into New Zealand increased from about 350 000 in 2000/01 to about 550 000 in 2004/05 (Office of the Auditor General, 2006), the volume of used vehicle imports doubled between 1995 and 2005 (New Zealand Customs, 2005) and the number of international air passengers arriving in the country grew by 30 percent over the past five years (Whyte, 2006).

Inanimates (sea containers, imported vehicles and machinery) pose the greatest ongoing biosecurity threats to forests.

a. Sea containers

More than 60 percent of the world's general sea cargo is carried by sea containers (Ministry of Transport, 2007). In New Zealand, approximately 99 percent of imports and exports (by volume) are moved by sea (Ministry of Transport, 2002). An unintended consequence of this growth is that sea containers carry exotic organisms to new places, and represent a significant pathway for the potential entry of unwanted organisms into New Zealand. Import Health Standards require all containers to go to approved transitional facilities, either on or off the wharf, for biosecurity clearance.

Borders have also become more diffuse and are no longer only at the point of entry. Containers offloaded at ports may be opened and inspected at hundreds of regional and local transitional facilities around the country. Suitable responses must be

considered carefully, such as targeted surveillance around sites where containers are opened.

b. Imported vehicles and machinery

Pests and diseases can arrive on imported vehicles and machinery. Although these come from about 80 countries, at least 95 percent of the 176 000 used and 112 000 new vehicles imported in 2005 came from Japan (New Zealand Customs, 2005).

Risk management for vehicles and machinery is currently under review, and measures such as routine fumigation and heat treatment are being considered.

Three Import Health Standards currently provide for all vehicles to have the interior and exterior inspected, and cleaned or treated if contamination is found, either offshore or on arrival at the border. About 55 percent of imported used vehicles are currently inspected and decontaminated offshore in Japan (MAF Biosecurity New Zealand, 2007a). Non-visible biosecurity contamination is an issue that is not currently being adequately addressed for both offshore- and onshore-inspected vehicles.

The risk from high-impact, low-frequency contaminants is a concern given the high volume of vehicles and machinery imported. The risk factors for many of these hazards relate to the use and storage conditions of the vehicle/machine and are difficult to profile.

c. Wood packaging

Wood packaging can be found in approximately 50 percent of all loaded shipping containers entering New Zealand (Sathyapala, 2004). It is often made from the less valuable or off-cut wood that may be infested at the time of manufacture.

Under the IPPC, a series of international standards for phytosanitary measures (ISPMs) has been developed. In 2002, ISPM No. 15 "Phytosanitary requirements for wood packaging in international trade" was the first commodity standard developed under the IPPC. A recent survey found that around 70 percent of all wood packaging now entering New Zealand was marked as treated in compliance with ISPM No. 15, but in the European Union and North America the compliance rates are up to 95 percent. New Zealand needs to lift its compliance rate. Any wood packaging found entering New Zealand that does not comply with the standard is sent for treatment.

Increased trade and tourism from a broader range of countries have increased the risk of new pests and diseases arriving in New Zealand.

d. Germplasm

Plant germplasm enters New Zealand as seeds, nursery stock or tissue cultures (plants in-vitro). Nursery stock includes material such as whole plants, cuttings and budwood. As a commodity, nursery stock in particular and germplasm in general carries a higher biosecurity risk per item than most other commodities. This is mainly because any infesting pests can become established in New Zealand on the imported germplasm itself, thus avoiding the need to find a suitable host after arrival.

New Zealand has traditionally either prohibited or limited the volume of the higher-risk forestry germplasm that is able to enter the country. This prohibition or restriction has played a significant role in limiting impacts from forestry-specific pests and diseases in other countries. Forestry pests and diseases can sometimes be carried into New Zealand on non-forestry germplasm, such as horticultural or nursery/amenity trees or plants. Many of these commodities are controlled less stringently and pose a greater risk to the forestry sector.

VI. EXPORT CERTIFICATION AND MARKET ACCESS

Part of New Zealand's commitment to the IPPC is to provide export phytosanitary certification to ensure that the international trading of plants and plant products does not spread unwanted plant pests. MAF is designated as the National Plant Protection Organisation to ensure that New Zealand is meeting the requirements of the IPPC.

The International Plant Protection Convention's ISPMs impact on, and provide guidelines for, export certification.

The impact of phytosanitary standards imposed by trading partners following a pest's establishment may have more immediate economic consequences to forest owners than the impacts on wood quantity and quality (Self, 2004). For example, Pine Pitch canker may not cause widespread destruction in New Zealand's plantation forests, but emergency measures can be imposed by the IPPC. This could mean that only kiln-sterilised or fumigated lumber could be exported and would have an immediate and serious impact on New Zealand exports.

VII. KEY INITIATIVES

a. Merging policy and regulatory services with delivery services

Within the general structure of biosecurity, the incorporation of the MAF Quarantine Service in 2007 within Biosecurity New Zealand (to form MAF Biosecurity New Zealand) has increased the capacity to co-ordinate and more effectively manage biosecurity risk across all sectors.

b. Segmentation strategy

MAF Biosecurity New Zealand is considering "border segmentation" to better align and manage business operations. The segments would be groups of like-goods based on biological risks and stakeholders. Specific intervention strategies would be developed to target these characteristics, set out rationales and objectives for protection, and prioritise resource allocation. These would be linked to service delivery plans that detail how the objectives are to be met.

Early detection of pests and diseases that evade border control is the key to effective control and eradication.

c. Collaboration with the sector

Forest biosecurity has been strengthened through collaboration by MAF Biosecurity New Zealand, the forestry sector and other stakeholders. This is reflected in the establishment and composition of the Forest Biosecurity Consultative Committee, Surveillance Incursion Response Working Group and the Forest Research Biosecurity Council.

d. New research programme – Better Border Biosecurity (B3)

Better Border Biosecurity (B3) is a large co-operative science programme that is researching ways to reduce the rate at which new unwanted organisms are becoming established in New Zealand. The programme is led by Crop & Food Research in a collaborative arrangement with Hort Research, Scion and AgResearch.

› READINESS

New Zealand's state of "readiness" for future events is based around surveillance systems and tested response methods. New response policy and online response procedures will ensure consistent decision making and implementation of responses. Greater ownership of risks affecting plantation forests by the forest industries is needed through the development of agreements between the Government and industry on joint decision making and resourcing for readiness and incursion responses. The forest industries are represented on a working group with this aim.

I. INDUSTRY AGREEMENTS – SURVEILLANCE INCURSION RESPONSE WORKING GROUP (SIRWG)

SIRWG is a MAF–industries working group that has proposed a new framework where government and industries share decision making and resourcing for incursion management when responding to pests and diseases that directly impact on the primary production sectors. Industries and MAF would jointly make high-level decisions about responses led by MAF, and would share the costs of readiness and responses according to the proportion of public to private benefits to be realised.

II. SURVEILLANCE

Early detection of pests and diseases that evade border control is the key to effective control and eradication. Effective surveillance provides the best chance of early detection.

An independent review in 2002 highlighted the over-reliance on air and sea pathway surveillance, and the inadequate attention to the increasing number of transitional facilities around the country.

Recent changes in import processes have resulted in goods being rapidly cleared from ports to about 7500 inland "transitional facilities" for unpacking or redistribution. Surveillance is now targeted at "high-risk sites" where clusters of high-use transitional facilities are located near high numbers of potential hosts for pests and diseases. There are about 480 of these high-risk sites in New Zealand. An additional 68 high-risk sites associated with adventure tourism have also been identified (Baddeley, 2007a).

The New Zealand Forest Owners Association undertakes its own forest surveillance programme.

III. FUNDING AND INCREASED CAPABILITY

Biosecurity funding has increased significantly over the last decade, with about $340 million now annually spent on co-ordinated biosecurity programmes (Baddeley, 2007b). About one-quarter of this is spent on prevention, one-quarter on surveillance, preparedness and major and minor responses, and about half on managing established pests and diseases.

Of the total, approximately 70 percent is funded by central government, 20 percent comes through industry charges and contributions and 10 percent is from local government. In addition, individual landowners spend significant sums managing existing pests and diseases, and many groups face costs for complying with biosecurity requirements.

As entry pathways expand with increasing trade, additional funding will be required to maintain or enhance biosecurity systems.

Biosecurity has a particular emphasis on engaging with the public.

IV. PUBLIC AWARENESS

Biosecurity has a particular emphasis on engaging with the public, as their behaviour can contribute to, or reduce, the likelihood that new pests and diseases are introduced and spread. Informed groups can also contribute to the early detection and reporting of new pests and diseases. A supportive public is needed to facilitate biosecurity responses.

V. MAINTAINING EXISTING TOOLS

The broad-scale use of some key compounds to control pests is an area of controversy among some sectors of the public. Aerial application of 1080 poison (sodium monofluoroacetate) to control possums is effective and relatively cheap, but has been criticised for its toxicity to other wildlife and livestock, and with respect to potential contamination of waterways. ERMA New Zealand (the Environmental Risk Management Authority) has recently reassessed 1080 poison and provided for its continued use.

Btk (*Bacillus thuringiensis* var. *kurstaki*) is the insecticide that has been used in aerial operations to eradicate white-spotted tussock moth, Painted apple moth and Asian gypsy moth. It specifically targets caterpillars, but local community opposition has arisen to Btk on the basis of health risks.

About 16 percent of New Zealand's export earnings from the forestry sector depend on the use of methyl bromide fumigation, either before leaving New Zealand or on arrival in the country of origin (Glassey, 2007). The Montreal Protocol originally excluded methyl bromide use for phytosanitary purposes. While it is not now excluded, many countries have begun to limit its use; in New Zealand, some regions are restricting its use due to public pressure.

If 1080, methyl bromide and Btk are unable to be used for the broad-scale control of target pests, there would be challenges finding replacement compounds that provide similar cost-effective control but do not raise greater community concerns. The Forestry Industry Development Agenda's (FIDA) Trade Access Group is trying to find acceptable alternatives to methyl bromide.

› RESPONSE

New Zealand has effectively responded to a number of significant forestry pest and disease incursions, but the costs have been high. MAF Biosecurity New Zealand leads or co-ordinates responses to national interest organisms. It maintains core competencies and resources but relies on the ability to upscale resources rapidly to meet the requirements of a response, through reassignment of resources from other activities following reprioritisation, contracting out services to other parties or partnerships with other agencies.

Regional councils may choose to respond to organisms that impose risks within their regional boundaries, with the primary mechanism being regional pest management strategies. Industries may also manage their own biosecurity risks.

The broad-scale use of some key compounds to control pests is an area of controversy among some sectors of the public.

Response plans have been prepared for major threats, such as Asian gypsy moth. The full range of threats to New Zealand forestry is too broad to be covered by specific plans, but generic programmes cover most threats.

Incursion response decisions are based on a consideration of technical and economic feasibility, and priority for action.

I. FORESTRY RESPONSE METHODS

Response methods to manage or eradicate a forestry pest or disease incursion traditionally involve silviculture, breeding, chemical intervention, biocontrol, site matching and/or maintaining biodiversity. Examples include:

- silvicultural responses to manage stocking rates and maintain healthy stands as a (part) response in the control of *Sirex noctilio,* and pruning and thinning to remove inoculum as a (part) response in the control of *Dothistroma septostorum;*
- breeding for radiata pine resistance as a (part) response to the control of *Dothistroma septostorum;*
- chemical intervention using the Btk-based insecticide Foray 48B in the control of the white-spotted tussock moth and Painted apple moth, and the use of copper spray in the control of *Dothistroma septostorum;*
- biocontrol of *Sirex noctilio* through the introduction of parasites and a sterilising nematode, and in the introduction of parasites to control *Paropsis charybdis;* (Dick, undated)
- site matching to help avoid problems with *Sirex,*

the common forest looper and the brown-headed leaf rollers (Ridley et al, 2005);
› maintaining biodiversity to reduce insect pest damage (Carnus et al, 2003), although this has received little attention in New Zealand to date.

II. RECENT RESPONSES TO FORESTRY PESTS AND DISEASES

A number of recent forest and tree pest and disease incursions have resulted in high-profile, and often expensive, eradication or control operations. The most prominent have been:
› the white-spotted tussock moth (*Orgyia thyellina*) from 1996 to 1998;
› the Painted apple moth (*Teia anartoides*) from 1999 to 2006;
› Dutch elm disease (*Ophiostoma novo-ulmi*) from 1989, but no longer funded under a national management programme;
› subterranean termites (since the 1950s);
› fall webworm (*Hyphantria cunea*) found in 2003 and not seen since;
› Asian gypsy moth (*Lymantria dispar*) from 2004 to 2006;
› gum leaf skeletoniser (*Uraba lugens*) first found in 1992 and now under pest management.

III. LONG-TERM MANAGEMENT

The Biosecurity Act 1993 provides a number of pest management options, ranging from direct use of the Act's powers by government departments through to the development of legally binding pest management strategies by any group. The Biosecurity Act does not require any party to manage a particular organism.

The Government takes the lead for a number of national interest pests (for a list, see MAF Biosecurity New Zealand, 2007b). Further work on clarifying roles and responsibilities for the long-term management of endemic pests needs to be undertaken by MAF Biosecurity New Zealand and regional councils.

Further work on clarifying roles and responsibilities for the long-term management of endemic pests needs to be undertaken.

› RECOVERY

The New Zealand forestry sector has experienced few serious pest or disease incursions where "recovery" strategies have been required.

Sirex outbreaks between 1948 and 1951 killed one-third of trees over 120 000 hectares (Dick, undated), but these tended to be less thrifty trees that would normally be removed under the thinning regimes that applied at the time. Lower stocking rates and biocontrols have effectively addressed the problem.

Dothistroma spread rapidly after its identification in 1964 in the central North Island, and is now controlled by silviculture, copper-based sprays and breeding for radiata pine resistance. However, it did play a major part in Corsican and Ponderosa pines, which are particularly susceptible, being replaced by radiata pine in most parts of the country.

While a major pest or disease could strike at any time, the probability is that new incursions are unlikely to result in widespread forest mortality over a short period of time. More likely are reductions in growth rates, tree malformation and the gradual spread to neighbouring areas if immediate response methods are less than completely successful.

This would enable the forestry sector to adapt to the situation. The development and implementation of "recovery" strategies might include the use of mature and near-mature stands, enhanced forest health, breeding for tree resistance, the introduction of biocontrols and the replacement of young and harvested stands with resistant species if necessary (and assuming such species are commercially proven and available).

Recovery methods are, in effect, likely to involve the extension of response methods.

An issue that could frustrate a recovery strategy arising from the establishment of a significant pest or disease would be any restrictions on the export of forest products from New Zealand, particularly export logs if an enhanced level of harvesting was necessary.

FUTURE DIRECTIONS

MAF and NZFOA convened their sixth Annual Forest Health Workshop in March 2007. The workshop identified a number of opportunities and actions for progressing the biosecurity system as it relates to the forestry sector. These opportunities included:

- identifying replacement technologies, for example, phosphine instead of methyl bromide as a fumigant;
- drawing on other sectors and countries, as new technology and even old technology can be expensive and not always accepted by the public;
- encouraging greater use of diagnostic tools for biosecurity and conducting an inventory of what we already have;
- looking outside traditional pathology and genetics research areas for solutions (for example, soil micro-organisms and endophytic fungi) and encouraging research collaboration;
- using more skills outside traditional forestry areas of research, such as from the grape and olive industries;
- considering the reliance on radiata pine and the poor preparation for replacing it should biosecurity issues (or climate change) make it uneconomic in parts of New Zealand;
- preparing a strategic plan for biosecurity database development and integration that would enable better use of data and help identify the origin of species;
- encouraging better integration of databases for biosecurity purposes and making better use of existing data;
- considering the Terrestrial and Freshwater Biodiversity Information System (TIFBIS) as an umbrella scheme, under which information related to biodiversity is linked together. (MAF/NZFOA, 2007)

Other areas for potential advancement include:

- seeking new ways to fund biosecurity research from all participants, perhaps recognising the non-wood benefits from forests;
- researching genetic modification to enhance resistance to pests and diseases;
- evaluating whether risk management in different border pathways aligns with the level of risks in those pathways so that available resources are used most efficiently;
- providing greater phytosanitary assurances that products meet the standards of the importing country in a fair and equitable way, which depend on an international rules-based trading environment;
- ensuring surveillance is good enough to demonstrate freedom from particular pests should trade restrictions be applied at a future date;
- government–industry agreements of readiness and response;
- improving industry and public awareness of biosecurity issues;
- engaging in international agreements to ensure the appropriate balance between protection and market access;
- more effectively managing offshore risks through international agreements and standard setting under the IPPC.

PHYSICAL RISKS TO NEW ZEALAND'S FORESTS

13

OVERVIEW

This chapter continues with the theme of risks to the forestry sector, and in particular those that arise from the physical environment within which New Zealand's forests grow. Fire is the physical risk that we hear most about, but is it the most important? The influences of climate change on the nature of physical risks to forests are also examined.

DRIVER

The forestry sector forms a significant part of the national economy, and many regional and local economies, but the potential for physical risks to result in significant forest loss or damage is expected to increase in some regions as a result of climate change.

THREATS

The major physical threats to the forestry sector, exacerbated by climate change, are:

- the increased risk of forest damage from wind in areas expected to be exposed to ex-tropical cyclones and more frequent and severe westerly winds;
- the increased risk of forest fire in the east of both islands and in the Bay of Plenty, Wellington and Nelson;
- the increased vulnerability of beech forests in the eastern parts of the South Island to attack by the pinhole beetle.

OPPORTUNITIES

There are opportunities to address these risks through:

- the re-instatement of a wind research programme to address both physical damage and impacts on wood properties;
- enhanced public promotion of the risks of fire;
- regionally specific research into the likely effects of climate change and its implications for forest management, species selection, tree breeding, forest infrastructure and, more broadly, sustainable land management.

THE NATURE OF PHYSICAL RISKS

Moore (2005) discussed the physical risks to forests and notes:

While the physical factors of climate and soils generally provide a good growing environment for many tree species in New Zealand, certain climatic conditions can also result in damage to forests. The most notable of these conditions are wind, snow and frost. Fire is also considered to be a climatic risk as its behaviour is highly dependent on weather and climate.

WIND

Wind can damage individual trees, stands of trees, entire forests and regional forest resources, and affect wood properties. In indigenous forests, stem breakage and windthrow occur during storms and influence regeneration.

I. PLANTATION FORESTS

Wind is regarded as the greatest (physical) risk factor to investment in plantation forestry in New Zealand (Somerville, 1989 and 1995). Most of New Zealand is windy and some northern parts are affected by ex-tropical cyclones. On a national scale, records show that wind damage is many times more significant than fire damage (Maclaren, 1993). Salvage logging after wind events is difficult, expensive and dangerous.

Available data (see Moore, 2005) highlight that individual wind storms can cause extensive damage,

and that the regions that have suffered most are the central North Island (including the East Coast), through ex-tropical cyclones, and Canterbury, through topographically enhanced winds. However, these losses of up to 19 000 hectares for a single storm are relatively minor in an international context. In January 2005, the Gudrun storm in Sweden devastated 140 000 hectares of forest (Ek, 2005).

Factors that contribute to wind damage are both manageable and unmanageable:

- Manageable factors include the selection of tree species, nursery practices, site preparation, planting techniques, thinning regimes, rotation lengths and harvesting patterns (Ainsworth, 1989). These factors mean that forest managers can take steps to reduce the risk and damage to forests associated with wind.
- Unmanageable factors are storm intensity and frequency, topography and soil type (Ainsworth, 1989).

Wind damage can take various forms:

- toppling of young trees (particularly on fertile ex-farm sites);
- windthrow of trees;
- stem breakage;
- negative impacts on stem form and wood properties that can result even from mild wind.

A study in the mid-1990s of historical wind damage in stands over five years old (catastrophic damage) and stands over 14 years old (attritional damage) concluded that "data correspond to an average 12 percent of the forest area lost over a 28-year rotation. While the least affected forests would lose only 5-6 percent over one rotation, the worst would lose most of its stocked area" (Somerville, 1995). With storm events expected to be exacerbated by climate change, and a trend towards longer rotations, wind damage is likely to increase.

Wind is regarded as the greatest (physical) risk factor to investment in plantation forestry in New Zealand.

Wind also has negative influences on stem form and wood properties, including increases in microfibril angle, quantity of reaction wood, reduction in the modulus of elasticity, and possibly the formation of resin pockets, although this is still the subject of debate (Moore, 2005).

II. INDIGENOUS FORESTS

Windthrow is relatively common in beech forests, with small areas occurring regularly. More extreme storms can cause a pattern of individual windthrown areas of many hectares repeated over hundreds of kilometres (Wardle, 1991). In mixed forests, the damage varies among species and is usually caused by wind gusts striking normally sheltered stands (Wardle, 1991). Large rimu are relatively wind-firm (Shaw, 1983), but areas as large as 100 hectares of the shallow-rooted rimu stands on Westland terraces can be windthrown (Ministry of Forestry/New Zealand Farm Forestry Association, 1998). Kauri are also frequently windthrown (Wardle, 1991).

› SNOW

Many South Island and higher-elevation North Island forestry sites experience snow. The weight of accumulated snow can sometimes topple young trees or break stems in older stands.

Radiata pine is susceptible to snow damage as a result of its heavy branching, and alternative species such as Douglas-fir are recommended in areas with histories of heavy snow (Maclaren, 1993). While stand losses from snow have been relatively low, damage is often followed by insect and fungal attacks (Pearce et al, 2001).

Snow can also cause stem breakage and uproot trees

in indigenous forests, and considerable damage can arise in beech forests in the South Island's eastern and southern regions (Ministry of Forestry/ New Zealand Farm Forestry Association, 1998).

FROST

Frost occurs on most forest sites from autumn to spring, and some inland sites can have frost at any time of the year. Radiata pine does not form a true dormant bud and does not tolerate winter frosts as well as species that become fully dormant, for example, Douglas-fir. However, it is more tolerant of out-of-season frosts than Douglas-fir (Moore, 2005). Young radiata pine can be killed by temperatures of –7 degrees centigrade in summer or –13 degrees centigrade at any time (Maclaren, 1993).

DROUGHT

Radiata pine is drought hardy, although young seedlings planted in drier parts of the country will be at risk and trees will not grow with inadequate soil moisture (Maclaren, 1993).

Extensive mortality in indigenous beech forest has sometimes been attributed to drought. However, rather than being directly caused by moisture deficits, death may have resulted from stress in trees caused by drought predisposing them to attack by pinhole beetles (Wardle, 1984).

FIRE

The risk of fire to forests in New Zealand is said to be overrated in the public mind, possibly as a response to its widespread and disastrous occurrences in Australia and North America (Maclaren, 1996). Each year, New Zealand experiences an average of around 2000 vegetation fires that burn about 7000 hectares (Pearce et al, 2001). In comparison, the 2006/07 fires in Victoria (Australia) burnt a total area of over one million hectares of bush, raged over 59 days, involved 14 500 volunteers and destroyed 37 homes.

Most vegetation fires in New Zealand result from human activities, with only 1 to 2 percent arising from natural causes (Pearce et al, 2001). Burn-offs getting out of control have been major causes. Burning-off has decreased in recent years, but this has been offset by an increase in fires caused by arsonists, and overseas trends indicate that the number of fires caused by arson will continue to rise. Other main causes of forest fires are sparks from engines, overheated machinery, welding or abrasive wheel cutting, roadside mowing and cigarettes (Geddes, 2005).

New Zealand plantation forests are typically exposed to major loss from fire two to three times per rotation (Geddes, 2005). However, fire has destroyed less than 0.1 percent of the forest area per year and there is a 98 percent chance that a stand will not be burnt before harvesting, although this varies with location and management regime (Maclaren, 1993). Areas of plantation forest damage from major fire events since 1940 are provided by Pearce and others (2001).

Most vegetation fires in New Zealand result from human activities.

Indigenous forests are generally considered to be less flammable than exotic forests, although there have been major indigenous forest fires, particularly in beech forests (Pearce et al, 2001).

IMPACTS OF CLIMATE CHANGE

The Intergovernmental Panel on Climate Change (2007) states that:

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

Climate change is expected to affect the frequency and severity of natural hazards (floods, storms and drought) in New Zealand, and the costs of these events. Impacts are expected to vary across the country, but on average:

- A 30 to 50 centimetre rise in sea level is likely by 2100, which will exacerbate coastal erosion, coastal flooding and saltwater entering freshwater.
- Temperatures are projected to increase by 1 degree centigrade by the 2030s, and about 2 to 3 degrees centigrade by the 2080s.
- More rain is likely to fall in the west of the country and less in the east.
- Westerly winds are likely to become more prevalent.
- Natural weather cycles such as El Nino are likely to be amplified.

(Ministry for the Environment, 2004)

The effects of climate change may not be simply reflected in changes to mean conditions. The pattern of variability about the mean may also be affected through the increasing frequency of extreme events, an increased probability of strings of extremes occurring, and the increasing magnitudes of variations (Campbell and Ericksen, 1990).

The major risks for the forestry sector from projected climate change are likely to include:

- more droughts, high winds and localised flooding;
- increasing water shortages in eastern areas;
- increasing pest and disease problems;
- costs of changing land-use activities to suit the new climate.

(Ministry for the Environment, 2001)

The risk of fires and their intensities are also expected to increase. Chapter 10 has more information on climate change and forestry.

EFFECTS ON FORESTS

Climate change is expected to affect tree growth rates and forest biomass, geographical range and species composition, and fire frequency (Hollinger, 1990). Other likely effects concern the impacts of ex-tropical cyclones and the establishment of pests and diseases.

Research originally suggested that the primary production response to doubling carbon dioxide may lead to a 30 to 40 percent increase in biomass. More recent research suggests that a saturation response and decline in biomass production will occur with this level of change, and that biomass increases by only about 14 percent (Canadell, 1999).

The effects of climate change may not be simply reflected in changes to mean conditions.

Vegetation patterns are also expected to change with the temperature increase. A 1 degree centigrade increase in New Zealand's mean temperature might result in:

- expansion southwards of the crop range by about 200 kilometres;
- expansion of the crop range upwards in altitude by about 200 metres;
- at least 40 more frost-free days in the North Island and 20 to 30 more frost-free days in the South Island;
- a decrease in winter "chilling" (affecting the dormancy period), ranging from 30 percent in Northland to 5 percent in Canterbury.

(Salinger, 1991)

WIND

Predictions are for westerly winds to become more prevalent, with a greater risk of severe winds and storms (Ministry for the Environment, 2006b). This

is particularly relevant for Canterbury. In addition, ex-tropical cyclones are expected to increase in intensity (Ministry for the Environment, 2006a), with affected regions most likely to be the northern North Island, the eastern Bay of Plenty and the East Coast.

FIRE

The risk of rural fires is predicted to increase with climate change over the rest of the century. The Bay of Plenty, Wellington, Nelson and the east of both islands from Gisborne to Wairarapa and Marlborough to Canterbury will be particularly affected (NIWA, 2005).

Drier and windier weather is likely to result in:

- easier ignition, faster fire spread and greater areas burned;
- longer fire seasons, greater fuel availability, increased fire intensities and more difficult fire suppression;
- increased fire suppression costs and damage. (NIWA, 2005)

OTHER EXPECTED IMPACTS

New Zealand can expect more extreme events in the future, including more droughts in already drought-prone areas and more floods in regions already vulnerable to flooding (Ministry for the Environment, 2006a). In addition, increased snowfalls in the higher-altitude areas of the central North Island, Taranaki, Canterbury and Otago are possible (Ministry for the Environment, 2006b).

CLIMATE CHANGE AND BEECH FORESTS

Extensive dieback from pathogen attack has been reported in New Zealand's beech forests (Wardle, 1984), mostly arising from attack from the pinhole beetle and its associated fungus *Sporothrix*. The amount of damage depends on the concentration of beetles, which is influenced by forest damage and stress from wind, snow or drought (Wardle, 1991).

The combination of more frequent and stronger westerly winds, possibly increased snowfalls and more droughts in the eastern parts of the country as a result of climate change may greatly enhance the conditions for the pinhole beetle. If this happens, the potential for damage to beech forests in the eastern South Island could be considerable.

Physical risks to forests will always exist and are generally well recognised by forest managers and the industry.

MANAGING PHYSICAL RISKS

Physical risks to forests will always exist and are generally well recognised by forest managers and the industry through risk-mitigation measures (site and species selection, genetic diversity, silvicultural practices, fire plans, insurance), risk spread (geographic dispersal of forests, genetic diversity, scale of forest-growing operation compared with the total business) and response preparation (maintaining a wide breeding population, maintaining a fire response capability, ensuring salvage logging capability).

Physical risk management should be based around understanding the regional and/or local profiles for different types of risk. Good quantitative information exists on forest damage from wind and fire from which risk profiles can be developed.

Based on historical records and information, the actual levels of risk from physical factors must be regarded as generally low. The possible exception is wind, where the risk might be described as significant in those parts of the North Island subject to ex-tropical cyclones and in Canterbury. Levels of risk are likely to increase in these regions as a result of climate change. This is a concern for the key forestry areas of the northern North Island, eastern Bay of Plenty and East Coast regions.

In New Zealand, a considerable amount of work has been carried out on wind toppling of forests, but currently there is no wind research programme. In contrast, a research programme exists for fire, generally regarded as a lower risk to New Zealand forestry.

The levels of risk associated with fire in eastern parts of the country are also expected to increase as a result of climate change. However, in New Zealand, nearly all rural and forest fires have been started by human activity. In theory, therefore, the risk is controllable. In practice, of course, complete control is unrealistic. A cause for concern is the increasing number of reports from overseas countries, for example, Australia, of forest fires resulting from arson.

There are many ways individual forest owners can mitigate, spread and respond to physical risks so the overall risk level is not excessive.

Insurance is available for fire and wind damage, although there are generally restrictions on the latter, for example, relating to age and maximum cover. Over the last 10 years, forestry insurance premiums have not changed significantly.

Globally, economic losses for all sectors of the economy through weather-related catastrophes have been doubling every 10 years, and insurance losses have increased accordingly (Insurance Australia Group – New Zealand, 2006). It is reasonable to assume that the global trends and increased domestic wind and fire risks will drive insurance premiums upwards in New Zealand. For wind in particular, insurance premiums may become expensive in vulnerable regions, perhaps prohibitively so, or the option may be withdrawn.

The New Zealand climate is highly variable and is expected to become more so. While radiata pine is successfully planted over a wide range of conditions, New Zealand is not well prepared with other proven species that can be grown over a variety of climatic situations.

There are many ways individual forest owners can mitigate, spread and respond to physical risks so the overall risk level is not excessive in terms of their total business interests. Local and regional wood processing industries, and supporting services such as harvesting and transport companies, may have limited room to manoeuvre in spreading their exposures to risk from significant forest loss at the local or regional levels. Similarly, some community economies are highly dependent, directly and indirectly, on the local forestry sector. Any major loss to these local forest resources would significantly affect the local economy and the welfare of the community. Losses that were relatively modest for individual forest owners but widespread across a region or the country could also have significant impacts on the regional or national economy.

It is important that all stakeholders in the forestry sector understand the nature and level of risks they are exposed to and how these may change over time, and develop appropriate mitigation and response strategies.

FORESTRY IN THE EYES OF SOCIETY 14

OVERVIEW

This chapter completes the consideration of matters that influence both the setting within which the forestry sector operates and what it delivers to society. Ultimately, the management of any resource and the production of goods and services from that resource serve the well-being of local, regional, national and/or international communities. It is critical that forest managers and producers of goods and services understand the values, perceptions and attitudes of the societies they serve, and that societies understand the true nature of the forestry sector. Failure to establish this mutual understanding inevitably leads to conflict.

DRIVERS

The values, perceptions and attitudes of New Zealand society towards the forestry sector are driven by the:

- historical destruction of our indigenous forest resource;
- views of the urban majority;
- many positive environmental, social and economic values of forests and forestry;
- lack of awareness of the "environmental services" that the forestry sector is providing.

THREATS

New Zealand's plantation forests continue to be undervalued by society because of the:

- limited interaction between the forest industries and the New Zealand public;
- limited resourcing for forest industries advocacy;
- generic criticisms of plantation forestry in international forums, many of which do not apply to current plantation forest management in New Zealand;
- poor international image of radiata pine and the poor domestic image of forestry and wood products;
- poor image of the forest industries as places of employment.

OPPORTUNITIES

Significant opportunities to lift the understanding between society and the forestry sector arise from the:

- widespread public interest in the management of forests;
- environmental, social and economic values of forests, forestry and wood products and their contributions to sustainable development;
- certification and other environmentally focused processes (life cycle analysis, carbon foot-printing) that are pushing the forest industries towards a more serious approach to social acceptability of forest management;
- ability to promote and position wood as a renewable and environmentally benign product compared with alternatives.

VALUES, PERCEPTIONS AND ATTITUDES HELD BY NEW ZEALAND SOCIETY

Social acceptability of forest management has to become increasingly important to ensure decisions are durable. Ford and others (2005) suggest that understanding the way people think and act is as important as understanding the way plants, soils and water function.

HISTORICAL VALUES, PERCEPTIONS AND ATTITUDES

The original Māori settlers spiritually revered the indigenous trees and forests, and had a lifestyle closely allied to their many products. However, about one-third of New Zealand's original indigenous forest area (including large areas of

forest in the lowlands and drier eastern regions of both islands of New Zealand) was destroyed by Māori fires, particularly in the earlier moa-hunting period. Early shifting agriculture, renewed by the introduction of the potato in the 18th century, also resulted in the burning and clearance of indigenous forest (Department of Scientific and Industrial Research, 1980).

European settlers regarded indigenous forests as obstacles to the development of pastoral agriculture and as an inexhaustible source of timber. In a "frontier expansion" period of about 60 years to 1920, another one-third of the original indigenous forest was cleared, with very little use made of the timber. By the early 1900s, it was realised that the remaining indigenous forests may not be able to provide for New Zealand's future timber needs, but planting forests was usually only considered appropriate on land not suitable for agriculture – commonly referred to as "wasteland". This attitude was widely held among the agricultural community through to the 1980s. The Federated Farmers' 1981 draft policy on forestry (Storey, 1981) stated:

We will oppose the expansion of commercial forestry on developed farmland, or that with potential for development.

We support the development of forestry on wasteland unsuitable for pastoral production.

The Social and Regional Implications Working Party (1981) identified some of the social issues the forestry sector must envisage as part of the challenge before it. These included:

- concerns over the loss of people and declining levels of services in rural areas, for example, declining school rolls, decreasing hospital services, changes to sports and social clubs;
- debates over levels of employment in forestry compared with agriculture;
- a clear preference for state forestry rather than private forestry because it created more employment, was located mainly on marginal land and involved local input to decision making;
- boom-type demands for services during the development of processing facilities that then drop away.

Social acceptability of forest management has to become increasingly important to ensure decisions are durable.

Debates from the 1950s over the protection of Waipoua Forest and areas of the Ureweras started to put the natural values of indigenous trees and forests more firmly in the public light. There were campaigns in the 1970s to protect the North Westland beech forest, centring on the Maruia Declaration petition, which set the course for the conservation movement. There were major campaigns in the 1970s and 1980s to protect the forests at Pureora and Whirinaki, and eventually to sustain all indigenous forests.

At the same time, there were vigorous debates in the statutory planning arena over the place of plantation forests in a rural environment dominated by agriculture.

CURRENT VALUES, PERCEPTIONS AND ATTITUDES

I. THE FOREST ENVIRONMENT

As part of a review of the Montreal Process criteria and indicators, workshops with forest users and interest groups were convened to identify forest values. A wide range of similar values for both exotic and indigenous forests were identified, but some participants emphasised particular values for certain forest types (Barnard et al, 2006).

The report by Barnard and others (2006) concluded that forest management practices across public and private tenures account for these values inconsistently, and that development of practices that incorporate the values of the local community

may provide a range of benefits to landowners and forest users. The Canadian Model Forest Programme is identified as an initiative that could accommodate stakeholders' desires to engage in forest management and decision making.

The range of forest values identified by Barnard and others (2006) included:

- biodiversity at the species and ecosystem levels, and the ability of these to function in a healthy state;
- the productive capacity of forests for timber, employment and economic contributions, largely, but not entirely, related to plantation forestry;
- wild animal recovery and the cultural harvest of plant species;
- access to non-polluted drinking water catchments and waterways;
- the contributions forests make to soil conservation and carbon sinks;
- intrinsic values and their contributions to people's health and well-being;
- freedom of access for a wide range of passive and active recreational pursuits;
- landscape features and their contributions to the identity of areas;
- opportunities to be involved in managing local forests.

The workshop convenors endeavoured to consult with the forest industries as a stakeholder group, but no representatives attended the first workshop series so industry meetings were cut from the second phase of workshops.

An investigation of the relative importance of forest values by different stakeholder groupings in Tasmania concluded that most values were not shared, and that non-affiliated participants had forest values more aligned to those of conservation affiliates than of industry affiliates (Ford et al, 2005).

Community issues identified in the early 1980s are mostly still relevant today.

II. INDIGENOUS SPECIES AND LAND MANAGEMENT

The Parliamentary Commissioner for the Environment's 2002 report *Weaving Resilience into our Working Lands* is about the clash of values over what New Zealand should do with native vegetation growing, or planted, on privately owned land:

> *At the core of the debate regarding the future roles of native plants on private land is a fundamental difference of view concerning the ability of New Zealanders to interact with indigenous ecosystems in ecologically sustainable ways. There is an inherent tension in human efforts to manage natural resources. This tension is most immediately evident in the conflicts between values of utilisation and protection, between monetary returns and ecological constraints. The inability of New Zealanders to reconcile these conflicts has created a significant split in the purposes for which we manage land …*
>
> *As illustrated, land management in New Zealand can be characterised by a dichotomy between:*
> *Nature and culture (society)*
> *Public and private*
> *Indigenous and exotic*
> *Conservation and production*
> *Protection and exploitation.*

The situation reflects failures in the not too distant past to recognise the values of indigenous vegetation, and of the well-intentioned, but destructive, approaches to indigenous forest management. New Zealand society is divided on how well the values are appreciated today, and whether the nation has yet developed the ability to manage indigenous resources for productive purposes while protecting their inherent values.

III. PLANTATION FORESTS AND COMMUNITY PERSPECTIVES AND ISSUES

A 1994 public opinion survey on plantation forestry (NZFOA, 1995) concluded that it rated fairly well for its economic contribution and support of local communities, but negatively for its environmental impacts and export of logs. About half the respondents viewed the forestry sector positively overall, and those who did not held a neutral, rather than negative, view. However, the public held a poor perception of the sector as an employer.

Recent research reveals that community issues identified in the early 1980s are mostly still relevant today. Barnard and others (2006) identify community concerns as the:

- loss of farmland and decline in rural population and services;
- employment of outsiders and the working conditions;
- visual impacts;
- recreational use and access;
- transportation impacts;
- perceptions, real or imagined, of environmental effects;
- water quality and water yield issues;
- external ownership versus local accountability.

A survey of attitudes to plantation forestry in the Gisborne/East Coast region in 1999/2000 found that 21 percent of respondents viewed forestry as a preferred industry, compared with 32 percent for tourism, 25 percent for farming, 14 percent for electronics and 9 percent for fishing. Reasons for preferring forestry related to job opportunities, having a partner or family member working in the industry, because it was a lasting investment, and because there was a demand for wood. Surprisingly, control of soil erosion was not a common reason, yet more than half of the region's planting was primarily for this purpose (Langer and Barnard, 2003).

In contrast, 17 percent selected forestry as the least preferred industry compared with 43 percent for electronics, 21 percent for fishing, 11 percent for tourism and 8 percent for farming. Reasons given included:

- lack of employment for locals;
- tree planting on good arable land;
- problems relating to marijuana use by forestry employees and the growing of marijuana within plantation forests;
- environmental damage;
- ownership by large corporations taking profits out of the region.

(Langer and Barnard, 2003)

The same study compared similar survey data from 1994 and found that, after six years, the percentage of people who considered there were problems associated with forestry development had decreased from 72 percent to 41 percent. While there were still deep-seated concerns about forestry, it was suggested that increasing familiarity with forestry benefits may have softened attitudes (Langer and Barnard, 2003).

Increasing familiarity with forestry benefits may have softened attitudes.

Forest management and surveillance reports prepared for FSC certification also identify community perspectives associated with plantation forestry. Issues reported, favourably or negatively, include:

- consultation with communities, and business relationships with local community service providers and with community activities;
- maintenance of access to forests for local recreational and school groups;
- consultation with Māori, and awareness of Māori rights and special sites;
- adverse effects associated with landscape values, riparian management, water quantity, the application of biosolid material to neighbouring

forest land, dust from harvesting affecting lifestyles, damage to rural roads from heavy traffic, and noise and safety issues from logging trucks travelling through urban areas. (See, for example, Smartwood, 2003, 2004a and 2004b; SGS QUALIFOR, 2005a and 2005b.)

Some of the initial forest management reports prepared by Smartwood and SGS QUALIFOR comment on the need for forest owners to develop processes for social impact assessments and monitoring. Subsequent surveillance reports indicate that these are beginning to be introduced.

Research undertaken for the *NZ Wood* initiative suggests that the large majority of New Zealanders believe that plantation forests are sustainable and are part of the country's landscape. However, the surveyed audiences did not believe that forestry was a growth industry, had doubts about whether forests were responsibly managed and had particular concerns over impacts on soils and about clearfelling (NZ Wood Project Team, 2007).

IV. THE WOOD PROCESSING INDUSTRY

Some concerns of community groups regarding wood processing proposals come to the fore through resource consent applications under the RMA. Environment Court decisions on Blue Mountain Lumber's application to construct a sawmill in the Coromandel and City Forests' application for a sawmill in North Taieri (Environment Court, 2004 and 2005) reveal key community group concerns relating to adverse effects on:

- landscape values and the natural character of the rural environment;
- amenity and cultural values;
- odour and noise;
- transport.

It is difficult to know the degree to which these matters are genuine community concerns as opposed to areas of perceived vulnerability in the proponents' proposals that can be exploited in the RMA arena.

Surveyed audiences did not believe that forestry was a growth industry, had doubts about whether forests were responsibly managed and had particular concerns over impacts on soils and about clearfelling.

Complicating the picture further are the issues of context and the "not in my backyard" (NIMBY) syndrome. In another location, the expressed community concerns to these proposals may not be relevant. Attitudes can also reflect a community's familiarity with forestry and wood processing.

V. THE FORESTRY WORKPLACE

The forestry sector is not well regarded as a workplace. Public perceptions of forestry as a low-level career choice have not helped the industries to recruit skilled labour (Skill New Zealand Pukenga Aotearoa, 2001). Better remuneration and working conditions in other industries, and disillusionment through mill closures and redundancies, have seen experienced machinists lost to the industry (Brown and Ortiz, 2001).

The preference of some members of the wood processing industries to train new staff to avoid inheriting bad habits, rather than seeking to retain experienced labour (Brown and Ortiz, 2001) seems to reinforce public perceptions about working conditions, remuneration and low-level career choice, and highlights what should be a major issue for the forestry sector to redress.

Forestry contractors have also expressed their displeasure at what they see as the "unconscionable conduct" (Forest Industry Contractors Association, 2006) of major forest owners who refused to discuss compensation for increasing fuel costs and for rapid layoffs when log prices fall. When Huaguang

Forests went into receivership, about $4 million was owed to local logging contractors, truck operators and infrastructure providers (*New Zealand Herald*, 2004). These sorts of events create a negative image of employment in the forestry sector.

A major part of the problem is that the forest industries have not kept the New Zealand public (and their potential workforce) up to date with the changes that have occurred. Students (and their parents) have had to draw on outdated historical images of the industry when deciding whether forestry is a career path.

Those considering forestry careers need to be aware that:

- the industries can offer workers a long-term career, with opportunities to advance in forest management, sawmilling and further processing;
- the industries require a wide range of skills, from operational staff through to marketing, logistics, accounting and management;
- advances in technology have reduced the labour-intensive nature of forestry and increased the technical sophistication of the industries (although adoption of technology has been slow);
- steady progress is being made in improving safety and workplace management standards;
- there are opportunities to attain high-paying positions, or to branch out as self-employed contractors.

A number of regional initiatives are currently underway in areas such as Northland, the East Cape and Otago/Southland that mainly involve industry players, with some public sector input. The focus is to shift public opinion towards forestry and encourage greater student interest. Efforts are being made to create working relationships with high schools and to provide educational resources for field days, career days and the like (including video material). These regional initiatives are making some headway with individual communities and schools, but it is proving difficult to turn around broader public opinion. The work to date demonstrates that there is a need for collective, national action in fostering a more positive attitude to forestry as a career.

VI A FORESTER'S VIEW OF THE PUBLIC'S PERCEPTIONS

Perley (1996) provided a forester's view of the public's perception of forestry that is probably shared to varying degrees among many of his professional colleagues. It highlights the disconnect between the profession and the public. It may have been coloured by what was often seen as a frustrating lack of justification and equity in the development of controls on forestry in plans being prepared under the RMA. Perley comments:

> *The public's 'perceptions' are a pole apart from foresters' sense of 'reality.' Examples are commonplace. Forestry harvesting is lambasted as representing irreparable destruction causing massive erosion, only comparable to the detonation of a small nuclear device, while ploughing and grazing are generally considered benign and almost natural. The spraying of chemicals within our forests is accused of causing foetal malformations, while apple and nectarine orchards are driven past without a qualm. Planting forests are (sic) admonished for causing serious reductions in water yields, which are perceived to threaten our very existence as a community, while there is no conscious association between higher flows and other land uses and either increasing soil erosion, decreasing water quality or increasing natural flood hazards. Forestry processing plants are all considered polluters, almost by definition, while the urban and rural communities around it do not appear to have any major problems. We witness the absurdity of dairy farmers complaining about the water-polluting effects of MDF plants. I could go on. The principles of NIMBY and 'thinking locally – acting locally' are the predominant creed.*

VII. MĀORI PERCEPTIONS

Māori have strong cultural, spiritual and commercial connections to forests and forestry. Māori are connected spiritually and culturally with indigenous forests as a resource for food, medicines, building materials, shelter, clothing, implements and handicrafts. Plantation forestry provides an option for the protection of remaining lands, employment and economic benefits (Miller et al, 2005).

Some 238 000 hectares of plantation forest are on Māori-owned land under long-term forestry leases. Asher (2003) notes that Māori have historically adhered strongly to the basic customary principles and beliefs that form Māori customary law. In the management of the Lake Taupo and Lake Rotoaira Māori lease plantation forests, the first three objectives of each lease require the:

- maintenance of soil stability and the prevention of erosion to protect the streams, rivers and lakes;
- protection of wildlife and fish habitat;
- protection of wāhi tapu (prohibited and sacred sites) on the lands.

(Asher, 2003)

Barnard and others (2006) recommend research to better understand Māori perspectives on forest values.

VIII. ENVIRONMENTAL NGO PERSPECTIVES

The introduction of Part IIIA of the Forests Act 1949 addressing sustainable indigenous forest management on privately owned land, and the cessation of harvesting on Crown-owned indigenous forest land, removed much of the animosity between NGOs and the forestry sector. The 1991 New Zealand Forest Accord, signed by many NGOs and forestry sector representatives, saw NGO support for plantation forestry in return for agreement to cease converting indigenous forests to plantation forests.

Key environmental concerns held by NGOs are:

- pesticide use;
- genetically modified organisations (GMOs);
- timber preservation treatment;
- indigenous people's rights;
- natural ecosystem reserve set-aside requirements and restoration;
- habitat for rare, threatened and endangered species;
- landscape ecology issues of monocultures versus mosaics;
- the production/conservation matrix;
- the clearcut size.

(Rosoman, 2003)

Deforestation, the clearance of tropical forests and the establishment of plantation forests are "flashpoints" for debate that generate negative perceptions of forestry.

»» VALUES, PERCEPTIONS AND ATTITUDES HELD BY GLOBAL SOCIETY

› DEVELOPED COUNTRIES

The principal values associated with forests in developed countries relate to biodiversity and habitat. Consequently, deforestation, the clearance of tropical forests and the establishment of plantation forests are "flashpoints" for debate that generate negative perceptions of forestry.

Global deforestation is predominantly an agricultural issue; that is, most of the land is cleared for agricultural use. However, the criticisms and negativity that it produces seem to attach themselves to the forest industries.

Tropical forests have high levels of biodiversity (as well as important roles in soil conservation), and their loss is a magnet for international attention. In contrast, plantation forests are viewed by some international environmental NGOs and European countries as biological deserts, particularly when they replace indigenous forests, and the plantation

forestry concept is attacked accordingly.

Murray and Nelson (2005) examined public perceptions of forestry in the northwest US and the implications for converting forests to non-forest uses. They concluded that clean water and protection of fish and wildlife habitat ranked as the first and second most important uses of forestland, with aesthetics playing a strong role in perceptions of forest management practices. Opposition to clearcutting and lack of trust in foresters were also revealed.

Surveys of perceptions and attitudes to forestry and afforestation in Ireland (Irish Forest Industry Chain, 1997; Clinche, 1999) highlighted the contributions of forests to the national and local economies, landscape and environment, their use for leisure purposes, and that young people were more favourably disposed to forestry than older generations. Support for government incentives for afforestation and more farmland being available for forestry were also identified.

Values, perceptions and uses of forests in developing countries are linked to relative levels of poverty and differ hugely from country to country.

› DEVELOPING COUNTRIES

Values, perceptions and uses of forests in developing countries are linked to relative levels of poverty and differ hugely from country to country. They are driven by factors varying from basic needs for fuel wood and/or land for food production to sustainable economic development opportunities.

The extent of deforestation (gross area of about 13 million hectares per year) and forest degradation suggests forests are often viewed as dispensable (as they were historically in now developed countries). But the problems are complex and arise primarily from the expansion of agriculture, for example, oil palm, and conversion of forests to non-forest uses as a result of population growth. Clearance to support pulp and paper production, and illegal logging, are other significant causes of deforestation.

These are the direct causes of deforestation and forest degradation, but they "obscure the underlying causes, which include poverty, inequitable resource tenure, population pressures, greed, corruption, misguided policies and institutional failures" (Asia Pacific Forestry Commission, 2003).

In such environments, society's perceptions of forests will be based on values that are different from those held in developed countries. Initiatives such as reduced-impact logging, codes of practice and restrictions or bans on harvesting indigenous forests indicate that the natural and economic values of forests are gaining recognition.

Many developing countries have established plantation forest programmes for timber production and income opportunities for the rural population, for fuel wood, to address soil erosion and desertification, to provide shelter and to rehabilitate degraded indigenous forests.

› ARGUMENTS AGAINST PLANTATION FORESTS

Magginis and Pollard (2006) suggest that:

There's nothing quite like plantations for stirring up a heated debate in forestry circles. Some see forestry plantations as the answer not only to the growing demand for timber and wood fibre, but also to the problem of natural forest loss. Plantations, they say, lessen the need to log natural forests and thus contribute to the conservation of forest biodiversity. Others, however, see forest plantations as biological deserts, water guzzlers, livelihood saboteurs and carbuncles on the landscape. Plantations, they say, actually increase pressure on natural forests by replacing diversity with monocultural monotony

and flooding the market with cheap fibre that can either make natural forest management uncompetitive or, somewhat to the contrary, help raise consumer demand for wood products from plantation and natural forests alike.

The international debates about the merits of plantation forests are focused both on plantations generally and on a specific category known as "fast-wood" forests. The public probably do not distinguish between the two.

I. PLANTATION FORESTS

Most of the criticisms of plantation forests come from environmental organisations and some European countries. They focus on what is considered "monoculture forestry", characterised by uniformity. Specific criticisms (see, for example, Baltodano, 2000) revolve around the:

- perceived lower levels of biodiversity and complexity compared with indigenous forests;
- conversion of indigenous forests to, or reforestation with, plantation forests;
- high inputs of energy, fertiliser and pesticides;
- impoverishment of resources, particularly the quality of water and structure and fertility of the soil;
- transformation of land tenure to foreign ownership and the displacement of communities;
- large-scale of many forest nursery and plantation forest operations;
- use of plantation forests as carbon sinks, particularly if subsidies are involved, rather than addressing emissions directly.

Many of the negative issues are not relevant to current plantation forestry in New Zealand, for example, conversion of indigenous forests, impoverishment of resources, displacement of communities, high inputs of energy, fertiliser and pesticides. However, criticisms in international forums and media are commonly generic and do not distinguish between countries. The potential for negative outcomes for New Zealand is significant, as few countries take stands to correct misrepresentations.

International debates about the merits of plantation forests are focused both on plantations generally and on a specific category known as "fast-wood" forests.

The opportunities to develop plantation forests, particularly those of a large scale, are constrained in many countries by land availability and land tenure patterns dominated by small-scale ownership.

II. FAST-WOOD PLANTATION FORESTS

Fast-wood forests are intensively managed commercial plantation forests that are set in blocks of a single species that produce industrial roundwood at high growth rates, and are harvested in less than 20 years (Cossalter and Pye-Smith, 2003). They are commonly associated with pulp wood production, an industry criticised by environmental groups. Fast-wood forests are the main form of hardwood production in Asia and an important component of its regional wood supply.

Much of the opposition to fast-wood forests is based on the belief that they damage the environment. They are seen as threats to biodiversity, water resources and soil fertility (Cossalter and Pye-Smith, 2003). Other concerns that have been attached to fast-wood forests (and, to varying degrees, to plantation forests generally) include:

- land tenure conflicts and the large scale of some of the plantings;
- the replacement of indigenous forests;
- the use of genetically modified tree crops;
- the spread of pests and diseases;
- the use of incentives and subsidies for establishment;
- levels of employment;

› use as carbon sinks, rather than reducing carbon emissions at source.

Environmentalists may have exaggerated the negative impacts of fast-wood forests, but these forests have caused environmental and social problems in some situations (Cossalter and Pye-Smith, 2003).

Fast-wood forests can be an efficient form of wood fibre production. New Zealand has a small area of forests that fit the fast-wood definition.

»» PERCEPTIONS OF, AND FACTS ABOUT, RADIATA PINE

Radiata pine is perceived in some overseas markets, and particularly in Asia, as a cheap, weak wood only useful for low-value end uses, such as packaging. This perception continues to be an international weakness for New Zealand's forest industries. Domestically, also, the public perception of radiata pine products has suffered recently through the leaky building syndrome, concerns around the safety of some timber preservatives, inconsistent quality and insufficient regard to countering campaigns to promote alternatives to wood as a building material. Nevertheless, research for the *NZ Wood* initiative suggests that people still hold positive attitudes about wood, its performance in use, fashionableness and future (NZ Wood Project Team, 2007).

The reality is that wood is a variable material, with differences in structure and physical properties between cells, tree rings, individual trees, sites and geographic regions (Cown et al, 1991). The position within the stem, tree age and silviculture also affect radiata pine wood properties. Any evaluation of the properties of radiata pine must be viewed in this context of variability.

Wood basic density is regarded as the most useful physical property to evaluate because it is correlated with strength properties, yields and quality of pulp, and a range of other attributes such as calorific value, thermal conductivity, machinability and glueability (Kininmonth and Whitehouse, 1991). Radiata pine is described as a medium-density softwood, but regional differences in New Zealand can be large and are primarily related to mean annual temperature (Cown et al, 1991).

Radiata pine is regarded by the New Zealand forest industries as a versatile timber with a wide range of uses … but as a structural timber it is seen as inferior to major species available on the global market, such as Douglas-fir.

Average earlywood and latewood basic densities of radiata pine (350 and 550 kilograms per cubic metre), compared with ponderosa pine (313 and 578 kilograms per cubic metre) (Kininmonth and Whitehouse, 1991), are not dissimilar. Density variations within annual growth rings are small in radiata pine compared with many other pines, and very small compared with Douglas-fir, giving it a comparatively even texture. This makes for easy machining, peeling and slicing for veneers, nailing, gluing, painting and varnishing. However, for its density, radiata pine has limited stiffness, a constraint for more exacting structural uses. For mechanical pulping, it is superior to most other pine species, but in chemical pulping it cannot produce the short-fibred pulps required for surface properties of some high-quality papers (Burdon and Miller, 1992).

As a consequence of these properties, radiata pine is regarded by the New Zealand forest industries as a versatile timber with a wide range of uses. Internationally, it is well regarded for MDF (colour advantage), newsprint and paperboard production (strength advantages), but as a structural timber it is seen as inferior to major species available on the

global market, such as Douglas-fir.

Radiata pine is not naturally durable for exterior uses, but is readily treated with timber preservatives. The use of timber preservatives, particularly CCA (copper, chromium and arsenic), has generated some public concern, and could emerge (or re-emerge with respect to CCA) as an issue for the forestry sector. While the use of CCA has not been restricted in New Zealand, it has been in a number of overseas countries.

Aesthetically, radiata pine is not well regarded in New Zealand, probably because of its widespread use and the often "blanket planting" that covers extensive areas. A monotonous forestry landscape emerges. A more species-diverse landscape would no doubt find greater favour among the New Zealand public.

The perceptions of timber generally by the architectural profession in New Zealand are also important. Howe (2006) discusses discrepancies between the perceptions of architects and the realities with respect to limited uses of timber, reduced durability and high-maintenance requirements compared with steel and masonry construction, damage to the environment from production processes, and the trend towards ecologically sustainable design being unlikely to be widely embraced.

The perception of architects that the timber industry has not moved with the times and lacks innovation may be true, with the exception of some engineered products (Howe, 2006).

SOCIAL ACCEPTABILITY

WHAT SHAPES PEOPLE'S VIEWS?

People's perceptions of the characteristics, desirability, equitability and feasibility of alternatives shape their decisions on acceptability (Murray and Nelson, 2005, referring to Brunson, 1993 and 1996). Perceptions are influenced by:

- science;
- experience and knowledge;
- values and ethics;
- beliefs and attitudes;
- familiarity with the environment. (Murray and Nelson, 2005)

Geographical and social contexts also influence people's assessment of acceptability. An action that directly affects someone is more likely to be opposed than an action that does not affect them – the NIMBY syndrome (Murray and Nelson, 2005). The judgements of key groups are also likely to influence individual judgements (Murray and Nelson, 2005, referring to Brunson, 1996).

People may interpret information in different ways and draw different conclusions.

The variety of factors that may influence perceptions and acceptability means that judgements "cannot be expected to change solely in response to changes in the level of technical understanding" (Stankey, 1996, in Murray and Nelson, 2005).

THE ROLE OF COMMUNICATION

A common assumption is that providing people with information about natural resource issues will influence their views on such issues. However, the process is more complicated than a simple cause-and-effect scenario (Murray and Nelson, 2005), and people may interpret information in different ways and draw different conclusions (Murray and Nelson, 2005, referring to Brunson, 1993). The credibility and timing of information, and the links with science and other forms of knowledge, may also influence the outcomes, with the weight of each factor varying among individuals and contexts (Murray and Nelson, 2005, referring to Stankey 1996).

THE MESSENGER

Without trust and credibility in the messenger, information will be disregarded. The use of a credible third party is one way to overcome these problems, although the appropriate messenger may not be the same person or agency for each target audience (Murray and Nelson, 2005).

THE MEDIA

The media probably has the most influence on how New Zealand society perceives forestry. Unfortunately, most media coverage of forestry sector events in the last decade has been negative, for example:

- the disaggregation of Fletcher Challenge;
- the poor financial performances of Carter Holt Harvey Ltd and other forestry corporates;
- the high-profile receiverships of the Central North Island Forest Partnership and Huaguang Forestry;
- price fixing by a timber preservation cartel;
- framing timber sold by Carter Holt Harvey not meeting strength standards;
- redundancies in the workforce and contractors being laid off;
- workplace deaths, primarily associated with logging;
- community reactions against aerial spraying of white-spotted tussock moth, Painted apple moth and Asian gypsy moth;
- logging truck rollovers;
- the export of unprocessed logs;
- the use of methyl bromide as a fumigant;
- concern over the use of CCA-treated timber;
- wilding tree spread;
- the illegal harvesting of indigenous forests.

It is difficult to recall positive coverage of the forest industries, yet forests and forestry contribute so much to society's well-being. There is a substantial opportunity to build an image based on positive values, and raise the public's perception of the forestry sector to one of being a key contributor to economic and environmental well-being.

There is a substantial opportunity to build an image based on positive values, and raise the public's perception of the forestry sector.

DO THE PERCEPTIONS REFLECT REALITY?

Perceptions of forest management reflect personal values, and "the acceptability judgements of people with one set of values are no more legitimate or rational than those of people with another set of values, they simply reflect different ideas about what is good or important in the world" (Ford et al, 2005).

Forests are recognised for a wide range of values, many of which are "public" values, for example, biodiversity, landscape and water quality. Forest management is consequently a magnet for public attention. Perceptions are formed around how well forest managers embrace these public values in the management of forest resources. In New Zealand, forest management practices across the public and private sectors account for values inconsistently (Barnard et al, 2006).

A range of environmental values comes to the fore in society's eyes, reflecting the fact that forest ecosystems are probably most highly valued by society for biodiversity, habitat and aesthetics. Wood production is just one of many values, and its importance varies with environmental, economic and social contexts.

With respect to wood processing, the issues pursued by community groups in the Environment Court cases considered above (in the section entitled "The wood processing industry") have been found to be sufficiently relevant by the Court for them to decline some of the resource consent applications. The Environment Court clearly gives considerable weight to the views of local community groups, and in these cases those views must be said to reflect reality, at least in the context of the RMA.

Fundamental public perception issues for New Zealand forestry were highlighted by the Parliamentary Commissioner for the Environment (2002), who suggested that land management can be characterised by:

- conservation and protection of things natural, indigenous and publicly owned;
- production and exploitation of things cultural, exotic and privately owned.

These are the realities of forest and land management. However, natural or cultural, indigenous or exotic, and public or private ownership by themselves do not determine the values that management of a resource should embrace.

A major concern for New Zealand lies in the international arena and the perceptions, attitudes and generalised criticisms of plantation forestry by some environmental groups and European countries. The generalisations may be relevant in some situations, but most are not applicable in the current New Zealand context. There is a risk that such perceptions and associated generalisations will "stick" to plantation forestry, if left unchecked.

THREATS AND OPPORTUNITIES ARISING FROM VALUES, PERCEPTIONS AND ATTITUDES OF SOCIETY

The forestry sector in New Zealand has struggled to connect with society. The modern approach of viewing local offices, "front desks", advisory services and public field days as intrusions on efficiency has severed what connections there were. Mass media on its own is not an adequate replacement for person to person engagement.

The values that society attaches to forests and forestry will continue to present both threats and opportunities to the development of the sector. At issue is whether or not society perceives forest management to be giving due recognition and priority to the values it holds uppermost. A report for the Southern Wood Council (BERL, 2005) suggests that future sustainability and growth in the Otago and Southland regions depend on positive perceptions of the sector by various stakeholders.

Society recognises multiple values associated with forests. Because many of these are associated with the conservation of "public" values (for example, biodiversity and water), society considers itself a stakeholder in the management of forests, even when in private ownership. It is this recognition of multiple "public" values and their importance in sustainable resource management that attracts society's interest to forests and their management, and leads to castigation when public values are considered to be given inadequate attention. In contrast, agriculture is probably perceived by society as a more single-purpose land use focused on economic productivity, and has attracted less attention, although this is changing.

When management of forests is at odds with the values and priorities, or perceptions, of society, the repercussions can be substantial. The New Zealand Forest Service lost touch with society over the management of indigenous forests, and this contributed to its disestablishment. Public perceptions on government's management of indigenous forests for wood production endured in many quarters, and state-owned indigenous production forest management activities ended with cessation of logging on the Timberland's West Coast Ltd's indigenous forest estate.

The views of small community groups have led to the rejection of resource consent applications for multi-million dollar wood processing proposals. National logging bans have been introduced in some countries as a last resort to halt what local and global societies considered unacceptable management practices.

A major concern for New Zealand lies in the international arena and the perceptions, attitudes and generalised criticisms of plantation forestry.

Equally, when society's views are favourable, forestry can be swept along in a tide of enthusiasm. Witness the illogical money-focused intrigue with long-term commercial forestry investment arising from the short-term 1993/94 international log price spike that was arguably one factor in motivating new planting to record levels.

The values, perceptions and attitudes of society to forestry must be taken seriously, but the forestry sector has traditionally viewed the high public interest in forests as largely uninformed and a threat to their management intentions. There have been few initiatives by the sector to improve its understanding of public attitudes towards forestry, or to improve the public's understanding of forestry. These are major failings that will continue to constrain the development of the forestry sector if not addressed.

The New Zealand Forest Accord, signed in 1991, was a remarkable achievement in developing a common understanding between major plantation forest owners and prominent environmental groups. Forestry Insights, published in 1994 and promoted by school teachers, was a notable initiative focused on school children. There have been no significant public initiatives launched by the sector since that time. The Forests of Life programme recently developed by Scion is a science and education programme, rather than a forestry programme. In general, the sector struggles to reconcile the desire of civil society to have greater opportunities to express their views and interest in forest management.

Society's widespread interest could provide considerable potential to drive the forestry sector forwards. The challenge is harnessing that interest in a way that provides positive support. That can only be achieved by embracing society's interests and demonstrating how public values such as biodiversity, soil conservation and water quality are incorporated into sustainable management, and how forestry produces renewable and environmentally benign wood products. It may not be an easy task. Third-party certification is a good start, but public understanding of certification is likely to be limited.

Failure to do this means that society will keep challenging the forestry sector by opposing investment proposals, tying it down in RMA-based controls, regarding it as a low-level career opportunity, highlighting the failures and not the successes, and internationally challenging the New Zealand commercial plantation forestry model.

The New Zealand forest industries (like large businesses generally), often struggle to be convincing in connecting with the public at large, who probably see them as protecting their (commercial) interests. The New Zealand Institute of Forestry has always been restricted in its ability to connect beyond the forestry profession. The smaller-scale farm foresters possibly connect more readily with society, but limited resources constrain their ability to embark on significant initiatives. The still-common references to the Ministry of Agriculture and Forestry as the Ministry of Agriculture and Fisheries suggest that it is yet to cement a position as the universally recognised government forestry agency.

There is a fundamental dilemma over the lack of a recognised, convincing and resourced body that can "put" the forestry case to New Zealand society and build understanding and trust.

Photo Courtesy of NZ Wood.

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LIST OF ACRONYMS 16

AGS	Afforestation Grant Scheme
AAU	Assigned Amount Unit
ALM	Agricultural Land Management
ARR	Afforestation, Reforestation and Revegetation
B3	Better Border Biosecurity
BERL	Business and Economic Research Ltd
Btk	*Bacillus thuringiensis* var. kurstaki insecticide
CBD	Convention on Biological Diversity
CER	Certified Emission Reduction
c.i.f.	Cost including insurance and freight
CITES	Convention on International Trade in Endangered Species
COMIFAC	Central Africa Forests Commission (English translation)
CRI	Crown Research Institute
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
ECFP	East Coast Forestry Project
Ensis	Former joint venture partnership between Scion and Australia's CSIRO
ETS	Emissions Trading Scheme
EUA	European Union Allowance
EUETS	European Union Emission Trading Scheme
EWPs	Egineered wood products
FAO	Food and Agriculture Organization (of the United Nations)
FBRC	Forest Biosecurity Research Council
FFA	Farm Forestry Association
FFR	Future Forest Research
FIDA	Forest Industry Development Agenda
FITEC	Forest Industries Training and Education Council
FSC	Forest Stewardship Council
G8	Group of Eight wealthy countries
GDP	Gross Domestic Product
GIF	Growth and Innovation Framework
IFM	Improved Forest Management
IPPC	International Plant Protection Convention
ISO	International Standard Organisation
ITO	Industry Training Organisation

ITTO International Tropical Timber Organisation

LIRO Logging Industry Research Organisation (New Zealand)

MAF Ministry of Agriculture and Forestry

NEFD National Exotic Forest Description

NIWA National Institute of Water and Atmospheric Research

NGO non-government organisation

NTFP non-timber forest product

NZFIC New Zealand Forest Industries Council

NZFOA New Zealand Forest Owners Association

NZU New Zealand Unit

OECD Organisation for Economic Co-operation and Development

OTCA Amazon Cooperation Treaty Organization (English translation)

PFSI Permanent Forest Sink Initiative

PMA Pine Manufacturers' Association

RADI Centre
The National Centre of Excellence in Wood Manufacturing

Ramsar International Convention on Wetlands

RED Reducing Emissions from Deforestation

Scion formerly Forest Research, a Crown Research Institute in Rotorua

SILNA South Island Landless Natives Act 1906

SIRWG Surveillance Incursion Response Working Group

SPS Agreement
Agreement on the Application of Sanitary and Phytosanitary Measures

STIC Structural Timber Innovation Company Ltd

TIMO Timber Investment Management Organisation

UNCED
United Nations Conference on Environment and Development

UNECE
United Nations Economic Commission for Europe

WQI Wood Quality Initiative Ltd

UNFCCC
United Nations Framework Convention on Climate Change

UNFF United Nations Forum on Forests

US United States of America

VCS Voluntary Carbon Standard

WPA Wood Processors Association

WTO World Trade Organization