New Zealand Country Report

Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests

2003

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Contents

Introduction

THE MONTREAL PROCESS

Forests are home to 70 percent of the world's terrestrial animals and plants, providing the essential components of food, clothing and shelter. Forests are renewable resources and rich, resilient ecosystems which, when managed sustainably, can provide society with essential goods and services – timber, medicines, food, water and jobs – and conserve biodiversity, for generations to come.

The Montreal Process is the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. It was formed in Geneva, Switzerland, in June 1994 to develop and implement internationally agreed criteria and indicators for the conservation and sustainable management of temperate and boreal forests.

Membership of the Working Group is voluntary and currently includes countries from both hemispheres, having a wide range of natural and social conditions. The member countries represent about 90 percent of the world's temperate and boreal forests in the northern and southern hemispheres. This amounts to 60 percent of all of the forests of the world. (Note: Europe's forests are not included – the Helsinki or Pan-European Process is addressing them.)

Criteria and Indicators

Criteria and indicators characterise the essential components of sustainable forest management (SFM), and provide a framework for answering the fundamental question, "What is important about forests?". They recognise forests as ecosystems that provide a wide, complex and dynamic array of environmental and socio-economic benefits and services. Used to monitor and assess national trends in forest conditions and forest management, criteria and indicators provide information essential to the formulation of policies that promote SFM.

The seven criteria identified by the Montreal Process include vital functions and attributes (biodiversity, productivity, forest health, the carbon cycle, and soil and water protection), socio-economic benefits (timber, recreation and cultural values) and the laws and regulations that constitute the forest policy framework.

The Montreal Process indicators are ways to assess or describe the criteria. For example, the "extent of area by forest type relative to total area" and "the number of forest-dependent species" are indicators of biological diversity (Criterion 1) and "forest land available for timber production" and "total growing stock" are indicators of forest productivity (Criterion 2). Many indicators are quantitative, such as the percentage of a country's forest cover. Others are qualitative or descriptive, such as indicators related to forest planning, public participation, and investment or taxation policies. All indicators provide information about present forest conditions and, over time, signal the direction of change in the forests.

Together, the seven criteria and the 67 indicators of the Montreal Process reflect an ecosystem-based approach to SFM and the need to serve human communities. They bring renewed rigour and breadth to forest management and to report planning, monitoring, and policy development. The Montreal Process criteria and indicators are not static; they will be continually reviewed and refined to reflect new research findings, advances in technology and an increased capability to measure indicators.

Why is New Zealand involved in the Montreal Process?

The Montreal Process benefits New Zealand by recognising sustainable forest management at a national level and recognising that New Zealand's planted forests are an integral part of sustainable management.

The Montreal Process represents the prime international arrangement for New Zealand to demonstrate its commitment to sustainable forest management. New Zealand is heavily involved in the Process to ensure our unique position of relying predominantly on planted forests of introduced species for our timber resource is recognised as sustainable forest management.

NEW ZEALAND OVERVIEW

New Zealand, a small, geographically young country comprising two narrow, mountainous islands and a number of small offshore islands, has a total land area of 27 million hectares.

About 80 percent of New Zealand was forested before the first human settlers arrived. Polynesian inhabitants cleared large areas, a process that continued after European settlers arrived in the mid-19th century and into the current century. Forest has been extensively cleared and modified through trade in forest products, expanding agriculture and settlement, and the establishment of human-introduced animals and plants.

Today, forests cover approximately 8.1 million hectares, or 30%, of New Zealand's land area. Of this, 6.3 million hectares (23 percent) are indigenous and 1.8 million hectares (7 percent) are planted forests. These two estates are fundamentally different in terms of their biological characteristics, the management regimes applied to the forests, and their respective roles and national objectives.

THE INDIGENOUS FOREST ESTATE

New Zealand's 6.3 million hectares of indigenous forest are located mainly in the mountain lands, particularly on the West Coast of the South Island. New Zealand has very few remnants of the lowland forests that were once prominent in New Zealand. Indigenous forests have been cleared over the last 200 years to make way for productive farmland.

The Crown is the major indigenous forest owner. Through the Department of Conservation it manages about 77 percent of the estate for conservation, heritage and recreational purposes. There is no timber production from this conservation estate. The vast bulk of this government resource is protected in perpetuity in national parks, scenic reserves and other conservation areas. The Māori people gifted many of these areas to the Government.

Indigenous forests are a key part of New Zealand's environment and help protect the many values of our natural ecosystems. Having a large planted forest resource has provided New Zealand with the opportunity to protect or sustainably manage its remaining Crown and privately owned indigenous forests.

Twenty-one percent of the natural forest estate is in private hands (the 2 percent balance is in miscellaneous reserves, etc). The indigenous forest provisions (part IIIA) of the Forests Act 1949, introduced in 1993, require the sustainable management of privately owned indigenous forests. This means the forests are managed in a way that maintains their ability to provide products and amenities in perpetuity. It is estimated that approximately 250,000 hectares (4 percent) of the indigenous forest estate could be available for sustainable commercial wood production. There is, however, concern from some environmental groups in New Zealand about whether the provisions of the Act will sustain the podocarp forests in these areas.

There are some 18 classifications of forest type in New Zealand. The major indigenous tree species in these complex forests include kauri[1], rimu, matai, and hardwood species including taraire and tawa, and beech. The indigenous forests harbour about 330 species of indigenous birds (some classed as endangered or threatened), two species of bat, reptiles, freshwater fish, amphibians and invertebrates, most notably land snails and giant weta. Their cultural values include spiritual, recreational, scientific, historical and scenic values.

New Zealand's indigenous forests are a key part of the environment and help protect the natural values of the ecosystem. Aside from an increasing demand for access and recreational opportunities, the main threats to New Zealand's forests are from introduced animals and plants. New Zealand has had for many years extensive programmes aimed at controlling or eradicating introduced species such as rats, possum and deer in order to halt the devastating effect these animals have on the indigenous forests.

PLANTED PRODUCTION FORESTS

New Zealand's 1.8 million hectares of planted production forests are:

- dominated by one species – radiata pine (*Pinus radiata*) accounts for 90 percent;
- young, with 60 percent being 15 years old or younger;
- fast growing – the average time to harvest is 27 years;
- intensively tended – 70 percent of the resource has been pruned to produce knot-free timber;
- managed in recognition of ecological, economic and social sustainability principles under an accord between industry and environmental groups, and according to principles for commercial forest management in New Zealand that are based on the accord.

New Zealand's planted forest area is expanding. The provisional estimate of new planting for winter 2001 (May to August 2001) is 30,300 hectares. The average annual area of new planting for the five years from 1997 to 2001 was 59,500 hectares.

In contrast to indigenous forests, the planted forest estate is now mainly owned by the private sector. The New Zealand Government now (as at March 2001) owns or manages only 6 percent of New Zealand's planted forest estate. Management of the Government-owned estate is mainly through:

- Ministry of Agriculture and Forestry managed planted forests on land leased from Māori owners and residual planted forests from the Crown's privatisation process;
- Timberlands West Coast Ltd – a State-owned enterprise, with 3 percent.

Local government owns a further 3 percent, which brings private ownership to 91 percent of the total.

Production from this estate was over 20 million cubic metres in the year to March 2002. By 2010 there will be enough wood available to increase the annual harvest to a sustainable level of almost 30 million cubic metres. The actual harvest will depend on market conditions.

The distinction between New Zealand's productive forests and its protected indigenous forests is a special feature of the New Zealand forest estate. The fundamental difference in the management of forests is also reflected in the availability of data to support the Montreal Process criteria and indicators. Because of its very nature, in most instances more detailed information is available on the planted forest estate than on the indigenous forest.

[1] For a listing of botanical names of species named in this document, see Appendix 1

NEW ZEALAND'S ABILITY TO REPORT ON INDICATORS

This New Zealand Country Report on the Montreal Process Criteria and Indicators includes comment on all 67 indicators. Some of these comments are extensive both qualitatively and quantitatively; others are more descriptive. It is important to note that the data are not necessarily consistent or comparable between indicators. Where data are not available for inclusion in this report, the indicator reports endeavour to describe what information has nevertheless been collected.

Co-ordinating Agency

Reporting on the Montreal Process Criteria and Indicators for New Zealand is not centralised through one agency. However, the Ministry of Agriculture and Forestry has taken responsibility for co-ordinating information gathering and the writing of this report. The Ministry of Agriculture and Forestry took on this responsibility as it was seen, owing to its previous involvement in matters relating to sustainable forest management, as the appropriate government agency to carry out this task.

Process

In gathering the information, the Ministry of Agriculture and Forestry identified potential sources of information in the data collected by a number of other agencies. These agencies were contacted and advised of New Zealand's commitments under the Montreal Process and asked to report on the indicators allocated to their agency.

The first draft has involved a range of organisations, both government and non-government.

Contributors

Other government departments and agencies that contributed information included the Department of Conservation, the Ministry for the Environment, Te Puni Kokiri (Ministry of Māori Development), Statistics New Zealand, the Ministry of Economic Development, the Ministry of Research, Science and Technology and the New Zealand Tourism Board. Information was also obtained from the Crown research institutes – Forest Research, Landcare Research New Zealand Ltd and the National Institute of Water and Atmospheric Research Ltd (NIWA). Other contributors included the National Rural Fire Authority and the Adventure Tourism Council. Comment was also received from a wide range of agencies that did not directly contribute any material for the first draft. The Ministry of Agriculture and Forestry is very grateful for the efforts made by these organisations on their contributions to this report.

Environmental Performance Indicators Programme

The concept of sustainable management of the environment is now well established in New Zealand law and environmental policy. In line with this concept, the Ministry for the Environment will implement an *Environmental Performance Indicators Programme* to establish a core set of nationally standardised environmental indicators. It is envisaged that this programme will help assess the state of the environment[2] and help monitor the outcomes of environmental policies and key legislation, including the Resource Management Act 1991.

The proposed framework of this programme follows the issues-based "pressure-state-response" model developed by the OECD and focuses on developing indicators for major

[2] State of Environment reporting encompasses systematic monitoring, gathering, and analysis of environmental data, and the dissemination of reliable, scientifically based, easily understood information about the condition (state) of the environment, the pressures on it, and the effectiveness of the measures taken to correct any problems.

ecosystems. The issues to be included in the framework are national environmental issues. However, the framework is flexible and can be modified to include issues that are significant at regional, local or community levels and to address emerging issues. It could be expanded to include indicators of sustainable development and environmental accounts. In this regard, the Ministry of Agriculture and Forestry is promoting the inclusion and alignment of international initiatives such as reporting on the Montreal Process criteria and indicators.

Criterion 1: Biological Diversity

DESCRIPTION

Biological diversity includes the elements of the diversity of ecosystems, the diversity between species, and genetic diversity in species.

INTRODUCTION

High proportions of the remaining indigenous forests in New Zealand have been set aside for conservation. A total of 5.1 million hectares of the 6.3 million hectares of indigenous forests are managed by the Department of Conservation primarily for their conservation values, including the maintenance of biological diversity. The planting of forests has allowed both the majority of the remaining indigenous forest to be set aside, and the provision of a sustainable and renewable wood resource.

1.1 Ecosystem Diversity

1.1.a: Extent of Area by Forest Type

DESCRIPTION

Indicator 1.1a: Extent of area by forest type relative to total forest area.

RATIONALE

- Measures current level of forest cover by forest type.
- Demonstrates whether the area is increasing or decreasing.

2003 COUNTRY REPORT

A definition of "forest type" is required which fits the New Zealand situation. Internationally, the definition as proposed in the UN-ECE/FAO Temperate and Boreal Forest Resources Assessment 2000 (TBFRA-2000) is:

"Forest Type: an association of trees and other vegetation typical for a particular site or area and commonly described by the predominant species, e.g. spruce/fir/beech, oak/hickory".

To date, New Zealand has not adopted a formal definition of forest type.

New Zealand has not fully updated its indigenous forest area by forest type in recent years. A forest class schema was produced in 1974/75 that provided for 18 forest classes, collapsed from some 239 mappable virgin and variously modified forest types identified in the National Forest Survey completed in 1955. Areas within each of the 18 major forest classes have been revised in 2002. This revision has involved the intersection of the extent of total indigenous forest area derived from the New Zealand Land Cover Database (LCDB) 1.1 with existing forest class boundaries derived from earlier mapping. This has provided a forest type classification for over 80 percent of indigenous forest by area.

The area in indigenous forest as at 1996 was calculated as being 6.3 million hectares. The reference date is the date at which the remote sensing images were obtained for LCDB 1.1. In addition to this there are an estimated 2.68 million hectares of scrubland.

The planted production forest area as at 1 April 2001 totalled an estimated 1.8 million hectares.

Hence, the total estimated forest area of New Zealand is approximately eight million hectares or 30 percent of the total New Zealand land area. Indigenous forest makes up 78 percent of the total estimated forest area (excluding the 2.68 million hectares of scrubland) with planted production forest making up the balance (22 percent).

Table 1: Total Forest Areas by Class in New Zealand

Forest type	Indigenous forest (000's ha)	Planted forest (000's ha)		Total (000's ha)
		Indigenous	Exotic	
Conifer	124 (1%)		1,799⇑	1,922 (18%) ⇑
Broadleaf	2,684 (30%)			2,684 (25%)
Mixed	3,429 (38%)			3,429 (32%)
Other wooded land (scrubland)	2,679 (30%) ⇑			2,679 (25%) ⇑
Total	**8,916 ⇑**		**1,799 ⇑**	**10,715 ⇑**

Sources: Ministry of Agriculture and Forestry, Ministry for the Environment

Sources of Information

- The area of indigenous forest has been calculated from the LCDB version 1.1, based upon SPOT satellite imagery with 30m pixel resolution acquired 1996/97. The overall mapping accuracy of the LCDB across all land cover classes was estimated as 94 percent. Classification of indigenous forest types is derived from the Forest Service Map Series 6, dated 1957.
- The area in planted production forest is derived from *A National Exotic Forest Description as at 1 April 2001* (Ministry of Agriculture and Forestry, Wellington, 2001). Online at www.maf.govt.nz/forestry/publications/index.htm.
- Eckehard Brockerhoff at Forest Research and David Norton, University of Canterbury, have substantial knowledge on biodiversity issues in New Zealand's planted forests.

Further Reading

- Dunningham A.G., Brownlie R. and Firth, J. *2000 Classification Accuracy of NZLCDB1: Results*. New Zealand Forest Research Ltd.
- LCDB v1.1: www.terralink.co.nz/tech/data/lcdb/lcdb.htm.
- Nicholls, J.L. 1977 *A condensed classification of the indigenous forests of New Zealand* Forestry Handbook, New Zealand Institute of Foresters, Rotorua: 29-34.
- Richardson, B., Barnard, T., Brockerhoff, E. and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

1.1.b: Area by Forest Type & Age Class

DESCRIPTION

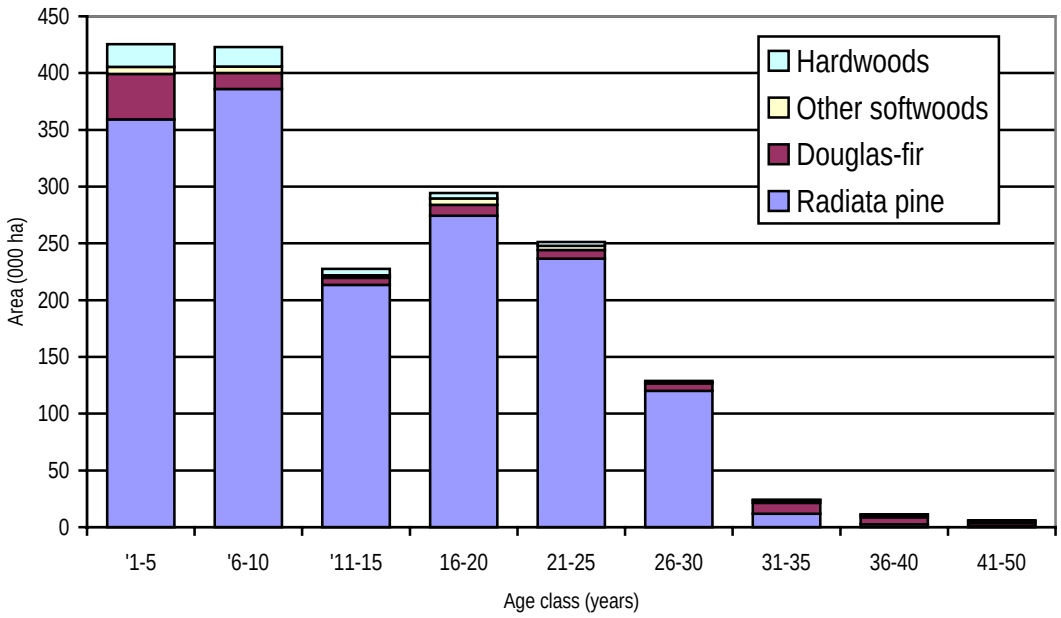
Indicator 1.1.b: Extent of area by forest type and by age class or successional stage.

RATIONALE

Many species are dependent on a particular successional stage and therefore all normally occurring stages should be present with sufficient area to support these species. Ecological processes and the species associated with those processes within a forest ecosystem or forest type are often associated with vegetative structure (species composition, age of the vegetation, its diameter and height, and stratification of the canopy layer). It should be noted that some forest types are uneven-aged.

In addition, in human terms, forest type and forest age are important determinants of timber growth and yield, game animals and other non-timber forest products that can be found, and the forest's aesthetic and recreational value.

Figure 1: Forest Area by Age Class and Species



Source: Ministry of Agriculture and Forestry

Forest type and age class can normally be classified by overstorey vegetation as recommended under indicator 1.1.a. Age class should be determined by knowledge of disturbance history or by ageing individual trees and will have to be done on a sample basis in large area classification and mapping projects. Research is now being undertaken on computer identification of forest age from satellite data. Knowing the type and age of a forest does not suggest that the current mix of forest type and age class is optimum or should be continued.

2003 COUNTRY REPORT

Information on this indicator is only available for the planted production forest area. Age class information is available for the various croptypes recognised in the National Exotic Forest Description (NEFD) database.

An example of the type of information available is shown in Figure 1.

Source of Information

The forest area by age class and species information is from *A National Exotic Forest Description as at 1 April 2001* (Ministry of Agriculture and Forestry, Wellington, 2001).

Further Reading

See Indicator 1.1a.

1.1.c: Protected Areas by Forest Type

DESCRIPTION

Indicator 1.1.c: Extent of area by forest type in protected area categories as defined by IUCN or other classification systems.

RATIONALE

In its broadest sense, the extent of forest ecosystems reserved in some form of protected condition is a measure of the emphasis being placed by a society on the preservation of representative ecosystems as a strategy to conserve biodiversity.

There are also important forest management questions that are addressed by maintaining a comprehensive, adequate and representative sample of forest types within protected areas. Traditionally, protected areas have been set aside for their conservation, scenic and recreational values. The ecosystems they contain may not be representative of the full range of biodiversity in a country. If protected areas are part of the national strategy for conserving ecosystems and species (including rare and endangered species), then some indication of what is protected is required. Over time, forest types will change and this change also needs to be monitored.

Management strategies for forest lands administered for commercial use can be influenced by the amount of land that has been reserved in protected areas. Adequate account of the ecosystems and species in reserved areas may provide more management options in forests under management for timber production or other purposes.

The original intent of this indicator was to measure the extent of ecosystems in legally protected areas. In many countries, however, there may be private forms of protection that are very close to legal protection (for example, areas protected by national trusts and managed by foundations). Many areas may be legally protected by local governments and not inventoried nationally. In addition, there may be "de facto" protected areas, such as stream corridors, that should be inventoried because, although their boundaries are not legally delineated, they are protected by forest codes. Co-operation between national and local government is important to establishing a comprehensive assessment of this indicator.

Information can be provided on the extent of the area of forest types in protected natural areas administered by the Department of Conservation (Table 2),

Forest type by protected area has been defined using a Geographic Information System (GIS) to overlay the tenure layer of Department of Conservation protected natural areas onto a layer of indigenous forest classes (NZFS Map Series 6).

Sources of Information

Table 2 was derived from an overlay of the New Zealand Land Cover Database (LCDB) 1.1 with the boundaries of lands administered by the Department of Conservation and with the forest type information in the Forest Service forest type maps. The results do not include land in private ownership or lands administered by local government.

Further Reading

See Indicator 1.1a.

Table 2 Conservation Estate Forest Area by Type

Vegetation type	Area (ha)	Percent of NZ land area
Beech (single species)	647,485	2.43
Beeches (mixed)	1,261,197	4.72
General Hardwoods	151,866	0.57
General Hardwoods + Beeches	35,283	0.13
Hardwood + Beech	9,226	0.03
Highland Softwoods + Beeches	155,690	0.58
Kauri	2,166	0.01
Kauri + Softwoods + Hardwoods	85,153	0.32
Kauri + Softwoods + Hardwoods + Beeches	5,495	0.02
Lowland Hardwood	1,592	0.01
Lowland Podocarp + Hardwood	11,444	0.04
Lowland Wetland + Highland Softwoods + Hardwoods	103,381	0.39
Podocarp	32,687	0.12
Podocarp + Hardwood + Beech	98,436	0.37
Podocarp + hardwood + Rata/Kamahi	60,228	0.23
Rimu + General Hardwoods	170,645	0.64
Rimu + General Hardwoods + Beeches	449,622	1.68
Rimu + Matai + Hardwoods	68,431	0.26
Rimu + Taraire + Tawa	25,873	0.10
Rimu + Tawa	322,002	1.21
Rimu + Tawa + Beeches	163,405	0.61
Softwoods	54,737	0.21
Taraire + Tawa	5,717	0.02
Tawa	89,931	0.34
Tawa + Beeches	13,143	0.05
Upland Podocarp + Hardwood	585	0.00
Unclassified	660,253	2.47
	4,685,674	**17.55**

1.1.d: Protected Areas by Age Class

DESCRIPTION

Indicator 1.1.d: Extent of area by forest type in protected areas defined by age class or successional stage.

RATIONALE

In its broadest sense, the extent of forest ecosystems reserved in some form of protected condition is a measure of the emphasis being placed by a society on the preservation of representative ecosystems as a strategy to conserve biodiversity.

There are also important forest management questions that are addressed by maintaining a comprehensive, adequate and representative sample of forest types within protected areas. Traditionally, protected areas have been set aside for their conservation, scenic and

recreational values. The ecosystems they contain may not be representative of the full range of biodiversity in a country. If protected areas are part of the national strategy for conserving ecosystems and species (including rare and endangered species), then some indication of what is protected is required. Over time, forest types will change and this change also needs to be monitored.

Management strategies for forest lands administered for commercial use can be influenced by the amount of land that has been reserved in protected areas. Adequate account of the ecosystems and species in reserved areas may provide more management options in forests under management for timber production or other purposes.

2003 COUNTRY REPORT

New Zealand does not have the data readily available to report on this indicator.

The data for this indicator exists in the Protected Natural Areas Programme, which is an ecological survey for which the Department of Conservation is responsible. Included in the survey is information about age class and successional stage however, this information does not provide full national coverage. To date, approximately one third of the area of New Zealand has been documented.

As for indicator 1.1.c, this information would need to be integrated with existing GIS forest type databases to fully report on this indicator.

Sources of Information

There are only insignificant areas in planted forests and they are not relevant to define by age class. Currently there is a major initiative underway to protect areas of indigenous vegetation within planted production forests, and Forest Research estimates that these areas of indigenous vegetation could account for up to 1 percent of the land area of New Zealand.

Many New Zealand forestry companies are engaged in obtaining Forest Stewardship Council (FSC) certification, and because FSC encourages the protection of areas of indigenous vegetation, it is anticipated that most of this area will be protected in the near future.

In this context it is also important to recognise that most of the forests within New Zealand's conservation estate are at higher altitude, whereas lowland forests are highly underrepresented. By contrast, a large proportion of New Zealand's planted forests, and the indigenous areas within, are located at lower elevations, and because of this, they are very important from a conservation point of view. See Richardson et al 2001, and Norton 1998, Norton and Miller 2000 (see references in Indicator 1.1.a).

1.1.e: Fragmentation of Forest Types

DESCRIPTION

Indicator 1.1.e: Fragmentation of forest types.

RATIONALE

The fragmentation of a forest into small pieces may disrupt ecological processes and reduce the availability of habitat. Decades of research in island biogeography have identified a definite relationship in the ability of forest habitats of various sizes to retain species once

common to that habitat. Some forest fragments are too small to maintain viable breeding populations of some species. Species dependent on the interior regions of extensive forests require an adequate area that is not close to a forest edge. Significant distances between forest patches can interfere with pollination, seed dispersal, wildlife migration and breeding.

2003 COUNTRY REPORT

Spatial continuity of forests is regarded as important for biodiversity conservation. Areas of fragmented forest may not be sufficiently large to provide effective habitat units for many species. In addition, fragmented forest may threaten the viability of the populations living within them, as the gene pool within the fragmented forest may be restricted compared to the fuller population of which the species are members. Fragments of forests are also at the forest-non-forest interface; hence they are the most likely forest areas to have human or other impacts imposed on them.

One measure of fragmentation is to look at the size class distribution of the fragmented areas (Table 3). Another measure is the perimeter to area ratio – with high ratios indicating that there is less likelihood of the forest area having been affected by activities outside it.

Table 3: Area of indigenous forest by size class

Area class (ha)	Hectares
<=10	96,875
>10<=50	271,562
>50<=100	221,024
>100<=500	759,655
>500	4,888,252
Total	**6,237,368**

As community fragmentation can significantly affect viability and survival, it is considered to be an important conceptual variable to quantify.

The area of indigenous forest in New Zealand derived from the Land Cover Database (LCDB) 1.1 has been classified by area to give the results shown in Table 3

Sources of Information

Table 3 is derived from a classification of areas of indigenous forest and mangroves in LCDB 1.1.

Further Reading

See Indicator 1.1a.

1.2 Species Diversity

1.2.a: Forest-Dependent Species

DESCRIPTION

Indicator 1.2.a: The number of forest-dependent species.

RATIONALE

The maintenance of a species list for a given area as a measure of biodiversity is the most basic and easily understood measure. Forest managers use numbers of species as one way of determining biological diversity and species diversity.

An inventory of all forest-dependent species (for example, mammals, plants, fungi, insects) is desirable but probably not feasible. This, however, should not prevent the beginning of such an inventory. Probability sampling using randomly located or stratified transects through forest types is a common approach to data gathering.

2003 COUNTRY REPORT

Species inventories are important because they provide basic information that is relevant to biodiversity assessments. It should be noted, however, that species richness per se is not very informative without information on the origin and the typical habitat of species. Also, high species richness does not necessarily equate with high conservation value; that is, some habitats of high conservation status are not very species rich, and vice versa.

This indicator also needs to be interpreted in a wider sense to better understand the term "dependent". For example, there are probably no species that are entirely dependent on planted forests. It is possible, however, to report on the occurrence of typical forest species.

A national inventory of all taxa known is currently being compiled. Inventories for vertebrates and vascular plants are almost complete, whereas for invertebrates, lower plants and fungi, many more species await description or even discovery.

Recent studies for planted forests have found them to be surprisingly rich in vascular plants, birds and invertebrates. Older stands can provide a forest environment suitable for forest "dependent" species, whereas young stands usually have a higher proportion of species typical of open habitats. However, the value to many such species is limited by the comparatively frequent disturbance caused by harvesting.

New Zealand forests support the following number of indigenous species that either occur in indigenous vegetation or originated from within indigenous vegetation:

- 24 species of birds;
- two species of mammals (bats);
- 21 species of lizards;
- 40,000 species of insects.

Sources of Information

- Department of Conservation, 1994. *Setting Priorities for the Conservation of New Zealand's Threatened Plants and Animals* (2nd Edition).
- Mclaren, P, 1996. *Environmental Effects of Planted forests in New Zealand: the Implications of Continued Afforestation of Pasture*, New Zealand Forest Research Institute.
- Richardson, B., Barnard, T., Brockerhoff, E. and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

1.2.b: Forest Species at Risk

DESCRIPTION

Indicator 1.2.b: The status (threatened, rare, vulnerable, endangered, or extinct) of forest-dependent species at risk of not maintaining viable breeding populations, as determined by legislation or scientific assessment.

RATIONALE

This indicator is a refined measure of the conservation of biodiversity and provides information on the conservation of species that are already of concern.

A clearly defined listing procedure for threatened, rare, vulnerable, endangered or extinct species should be the primary way to maintain this list at the national level.

A list of growing or diminishing species in this category will be of interest for it will tell forest and conservation area managers whether practices are succeeding in maintaining or conserving biological diversity.

2003 COUNTRY REPORT

The Department of Conservation co-ordinates a national collection of data which identifies and prioritises those New Zealand species most in need of conservation. The Department of Conservation is currently reviewing the criteria by which species are ranked. Previous criteria included:

- taxonomic distinctiveness;
- status;
- threats;
- vulnerability;
- cultural values (both Māori and Pakeha).

A legal framework applying to conservation issues on private land is currently being developed as a policy statement under the Resource Management Act. A legal definition of "significantly natural areas", which will be used to determine areas worthy of protection, is under development.

Within planted forests there are insufficient data at present to provide a national overview. Forestry companies are increasingly aware of biodiversity issues and interact in several cases with the Department of Conservation to protect rare or threatened species that occur in planted forests. It is likely that the availability of data will become better in future and it should be possible to report trends in the status of rare and threatened species.

Table 4: Forest-Dependent Species Requiring Conservation Action

	A	B	C	X	1	O
Vascular Plants	6	12	4	1	3	3
Reptiles	1	4	3	1	-	-
Birds	9	20	12	1	-	-
Mammals (Bats)	3	1	-	-	-	-

Source: Department of Conservation 1997

Notes:
Category A: Highest priority species for conservation action
Category B: Second priority species for conservation action
Category C: Third priority species for conservation action
Category X: Species which have not been sighted for a number of years, but which may still exist
Category 1: Species about which little information exists, but which are considered threatened
Category O: Species which are threatened in New Zealand but secure in other parts of their range outside New Zealand

Sources of Information

- Department of Conservation, 1994. *Setting Priorities for the Conservation of New Zealand's Threatened Plants and Animals* (2nd Edition).
- Mclaren, P. 1996 *Environmental Effects of Planted Forests in New Zealand : the Implications of Continued Afforestation of Pasture*, New Zealand Forest Research Institute,.
- Richardson, B., Barnard, T., Brockerhoff, E. and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

1.3 Genetic Diversity

1.3.a: Reduced Range

DESCRIPTION

Indicator 1.3.a: Number of forest-dependent species that occupy a small portion of their former range.

RATIONALE

The geographic ranges of species are continuously responding to phenomena such as glaciation, vegetation migration, climate fluctuation, predation or interspecific competition. Species that currently occupy only a small portion of their former range may have lost some of their genetic variation. This is of concern because a species with a small component of its original genetic material will have less potential for human benefit. The best examples of this are food plants and the constant search for different variations of these species to develop higher-yielding or pest-resistant varieties of the plant.

Survey data are the most appropriate way to monitor the distribution of species. However, survey data regarding the current and original range of most species is not available.

2003 COUNTRY REPORT

The Department of Conservation does not measure this indicator.

Most indigenous species occupy a small proportion of their former range, owing to the large-scale forest clearance New Zealand has experienced over the last 100 years. However, some

species have not experienced a large reduction in their range. For example *Nothofagus* forests in the South Island are still occurring over a large proportion of their former range.

Much of the research in this area has taken place only in restricted parts of New Zealand.

Sources of Information

- Mclaren, P. 1996 *Environmental Effects of Planted Forests in New Zealand : the Implications of Continued Afforestation of Pasture*, New Zealand Forest Research Institute,.
- Richardson, B., Barnard, T., Brockerhoff, E. and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

1.3.b: Representative Species

DESCRIPTION

1.3.b: Population levels of representative species from diverse habitats monitored across their range.

RATIONALE

There are many forest "dependent" species that rely on some particular forest structure (multi-storeyed tree canopies), forest vegetation associations or ecological process. These species are commonly associated with other species that are also dependent on similar conditions. One of these species could be used to represent all species dependent on similar conditions, as it is not feasible to monitor all species. Monitoring population levels of such representative species will indicate the status of the associations of species dependent on specialised conditions. It is important to monitor representative species from diverse habitats to ensure that these habitats and the species dependent on them are protected from threats that may affect species viability.

A representative species refers to a species with habitat dependencies typical of a group of similar species and which is likely to respond to changes in availability of those habitats or resources. Examples include old growth dependent species, air-quality-sensitive species, wetland-dependent species, hollow-tree dependent species and thermoregulation-dependent species.

It is suggested that keystone species (species known to be very important to an ecosystem, for example pollinators, food species for large carnivores and key decomposers) be chosen because of their importance. It is also suggested that species from different taxonomic groups be monitored because different taxa are likely to respond to different threats.

2003 COUNTRY REPORT

With regard to planted forests this indicator has some relevance. Population monitoring in planted forests and indigenous remnants within planted forests is becoming increasingly important because of requirements for environmental certification. However, very few species are being monitored in planted forests for the purpose of obtaining biodiversity information.

Sources of Information

- Mclaren, P. 1996 *Environmental Effects of Planted Forests in New Zealand : the Implications of Continued Afforestation of Pasture*, New Zealand Forest Research Institute.
- Richardson, B., Barnard, T., Brockerhoff, E. and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

Criterion 2: Productive Capacity of Forests

DESCRIPTION

The maintenance of the productive capacity of forest ecosystems.

INTRODUCTION

Timber supply has traditionally been the main concern and focus of forest measurement and reporting work in New Zealand. This has been the case since the early years of last century when it was recognised that the timber supply from the indigenous forests was quickly becoming limited.

The move towards sourcing timber from planted exotic species and the conserving, for primarily non-wood production values, of the remaining indigenous forests have meant that information on the wood supply potential of the planted production forests has been seen as essential for a range of planning functions. Therefore, the traditional emphasis in New Zealand has been on the regular reporting of data related to timber supply on the planted production forests and, conversely, very limited reporting on the indigenous estate because of the constrained wood supply available from it. This has also meant that non-timber products, which are relatively insignificant in comparison with the timber products, have not been accorded the same attention in developing reporting measures for them.

A further issue in forest reporting for New Zealand has been the attempts to adapt New Zealand definitions and concepts to the models used internationally which have been derived in circumstances and conditions far removed from the manner in which New Zealand has evolved with its wood production forestry. This has been compounded further by the fragmentation of responsibilities and the tight resourcing constraints under which the public sector has been operating for the last decade, and the consequent lack of resources and funding available to develop more comprehensive measures and indicators.

Hence most indicators under this criterion are readily available for the New Zealand planted production forests and only a very limited range is available for the indigenous forests and for the non-timber indicators.

2.a: Timber Production

DESCRIPTION

Indicator 2.a: Area of forest land and net area of forest land available for timber production.

RATIONALE

- Shows how much land is available for timber production compared with the total forest area of a country.
- Important for understanding timber productive capacity of forest lands.

2003 COUNTRY REPORT

The planted production forest "area" reported here is that published in the National Exotic Forest Description (NEFD). The NEFD reports the net stocked forest area available for timber production. The NEFD defines net stocked forest area as "the planted production forest area occupied by trees excluding mappable gaps such as landings, roads and other unstocked areas".

The area of indigenous forest available for timber production is strongly influenced by Government policy. As at 1 April 2002, harvesting of all indigenous forest on Crown-managed land ceased.

Timber production from privately owned indigenous forest is subject to the sustainable forest management provisions of the Forests Act 1949. This means that any timber production from privately owned indigenous forests must have an approved sustainable forest management plan or permit.

For historical reasons approximately 20,000 hectares of Māori-owned indigenous forest established under the South Island Landless Natives Act, 1906 (SILNA land) are exempt from the sustainable forest management provisions of the Forests Act 1949. The Government has recently announced a policy to begin negotiations to purchase SILNA forests of high ecological value and provide support to SILNA forest owners who wish to obtain a sustainable forest management plan or permit.

As with planted forests, the area definition used for indigenous forests currently available for timber supply is net stocked forest area. All other indigenous forest areas quoted (including the potential future area for timber production) are gross forest areas and may include some unstocked forest land.

Planted Forests

As at 1 April 2001 the net stocked area of planted production forests available for timber production was 1,799,000 hectares.

Indigenous Forests

As at 31 March 2002 around 95,000 hectares of indigenous forest were available for timber production. Approximately 75,000 hectares of this forest are covered by sustainable forest management plans and permits registered with the Ministry of Agriculture and Forestry. The remaining 20,000 hectares of forest are on SILNA land (as described above).

In future it is likely that the area of indigenous forest available for timber production will increase. There are approximately one million hectares of privately owned indigenous forest, of which 226,000 hectares have protective covenants. The balance of the privately owned indigenous forest (774,000 hectares) sets an upper limit of indigenous forest area potentially available for future timber production. In reality however, it is considered that no more than 250,000 hectares will ever be used for timber production owing to economic and other constraints (Ian Platt, MAF Indigenous Forest Management Unit, pers comm). It is predicted that by 2010 up to 178,000 hectares (inclusive of the already approved 75,000 hectares) of privately owned indigenous forest may be under sustainable forest management (MAF Technical Paper No 01/6, 2002).

Sources of Information

- The area in planted production forest available for timber production is from *A National Exotic Forest Description as at 1 April 2001*, Ministry of Agriculture and Forestry, Wellington, New Zealand, 2002. Online at www.maf.govt.nz/forestry/publications/index.htm.
- The estimated area in indigenous forest available for timber production is compiled from information from the Ministry of Agriculture and Forestry and includes some information from *Indigenous Forestry on Private Land: Present and Future Trends*, Technical Paper No 01/6, Ministry of Agriculture and Forestry, Wellington, New Zealand, 2002. Online at www.maf.govt.nz/forestry/publications/index.htm.

2.b: Total Growing Stock for Timber

DESCRIPTION

Indicator 2.b: Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production.

RATIONALE

Growing stock is a fundamental element of the productive capacity of the area identified under Indicator 2.1.a. Knowledge of growing stock and how it changes is central to considerations of a sustainable wood products industry. In addition, knowledge of the growth rates of forests may assist with the interpretation of this indicator.

A merchantable tree species is defined as one that has known commercial uses for wood products. Merchantability is usually judged with respect to the suitability of a species for pulp, paper, lumber or speciality wood products. Both indigenous and exotic tree species can be considered merchantable tree species.

Growing stock refers to the total standing volume (generally gross bole volume) at a given point in time.

2003 COUNTRY REPORT

Comprehensive information on this indicator is only available for the planted production forest.

Growing stock information on merchantable and non-merchantable tree species in those indigenous forest areas covered by approved sustainable forest management plans or permits under the 1993 provisions of the Forests Act is recorded in the application documentation for these plans or permits. It is not, however, aggregated to cover the growing stock for the total forest areas being managed under these plans or permits.

Planted Forest

The total standing volume as at 1 April 2001 of New Zealand's planted production forest was estimated as 382 million cubic metres. The total standing volume is the total volume of wood contained in stems in cubic metres. It includes approximately 15 percent non-recoverable stem wood volume but excludes bark.

Within the planted forest estate there are areas of indigenous forest, usually in gullies, along streams edges and on steep faces. These forest areas are not considered merchantable. No

stem volume estimates are available for these relatively small areas of indigenous forest contained within planted production forests.

Indigenous Forest

There are no national estimates currently available for the growing stock for merchantable and non-merchantable tree species in indigenous forest areas.

Sources of Information

- The total standing volume for planted production forest estimate is from *A National Exotic Forest Description as at 1 April 2001* (Ministry of Agriculture and Forestry, Wellington, 2002). Online at www.maf.govt.nz/forestry/publications/index.htm.

2.c: Area & Growing Stock

DESCRPITION

Indicator 2.c: The area and growing stock of plantations of indigenous and exotic species.

RATIONALE

The indicator is a measure of the degree to which forest management agencies are establishing planted forests to expand the forest estate in response to increasing demands for forest products. The provision of forest products from intensively managed planted forests may reduce pressures on biodiversity and demands for similar, or other, services from indigenous forests. The use of both indigenous and exotic species in planted forest management enhances the potential range and quantity of goods and services available from the forest sector.

Exotic species are any species growing or living outside their natural range of occurrence. Normally this refers to species purposely or accidentally introduced into countries or regions where they do not historically occur naturally.

2003 COUNTRY REPORT

The area of planted indigenous species grown for production is insignificant and therefore no attempt to estimate the area or growing stock has been made.

The "area" definition used for reporting the planted production forests in the NEFD is the net stocked forest area defined as: "the planted production forest area occupied by trees excluding mappable gaps such as landings, roads and other unstocked areas". The "growing stock" volume for reporting the planted production forests in the NEFD is the total volume of wood contained in stems in cubic metres. It includes some non-recoverable volume but excludes bark.

The area of planted forests of exotic species as recorded in the NEFD as at 1 April 2001 was 1.8 million hectares.

The growing stock of planted forests of exotic species as recorded in the NEFD as at 1 April 2001 was estimated as 382 million cubic metres.

Sources of Information

- The area of planted forests of exotic species and the growing stock of planted forests of exotic species estimates are from *A National Exotic Forest Description as at 1 April 2001* (Ministry of Agriculture and Forestry, Wellington, 2002). Online at www.maf.govt.nz/forestry/publications/index.htm.

2.d: Annual Removal of Wood Products

DESCRIPTION

Indicator 2.d: Annual removal of wood products compared to the volume determined to be sustainable.

RATIONALE

This indicator compares actual harvest level with the sustainable level of harvesting permitted by forest management plans as a measure of the forest's ability to maintain its productive capacity over time.

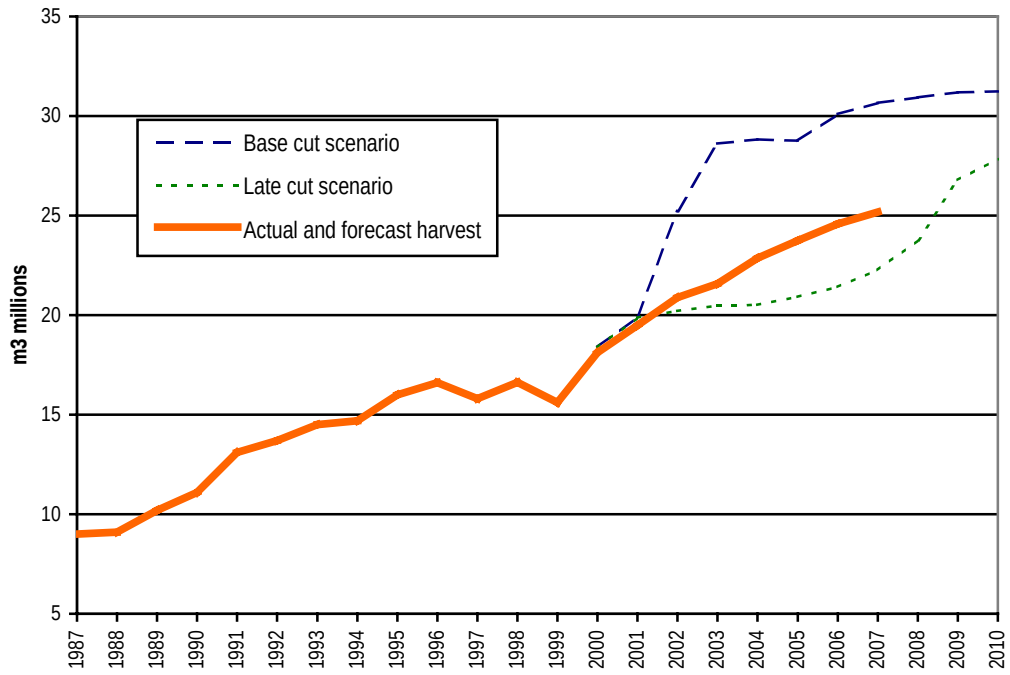
2003 COUNTRY REPORT

The annual removal of roundwood is an estimate of the amount of industrial roundwood removed from New Zealand forests which enters processing plants or is directly exported as unprocessed logs. As it is an estimate based on applying conversion factors to the output of the processing plants, it is not necessarily a direct measure of harvest. It is assumed within the estimate that it provides an "inside bark" volume estimate. Non-industrial roundwood removals are considered to be insignificant in the New Zealand context.

For planted production forests the annual volume that can be removed in a sustainable manner is not directly prescribed by any central agency. Instead, the Ministry of Agriculture and Forestry estimates (by modelling the New Zealand planted production forest estate) the volumes potentially available for harvesting, under a series of scenarios which have assumptions made on yields, areas and harvesting constraints. The most significant "sustainability" constraints within the models are the non-declining yield for radiata pine and that all areas clearfelled are assumed to be replanted in the year following clearfelling.

It needs to be noted that the estimates of available wood that results from the modelling work are essentially resource-based estimates of the level of harvest potentially available,using given assumption on yield, area and harvesting constraints. The estimates are not predictions as to how planted production forest owners will manage the cut from their forests, nor are they prescriptions for how their cut should be managed. The forecasts shown in Figure 2 is based on a Ministry of Agriculture and Forestry forecast of production and exports, based on forecasts of domestic consumption and export volumes.

Figure 2: Planted Forest Harvest and Available Wood



Harvesting from those indigenous forests for which this is a permitted activity (see earlier paragraphs) the forest management permits and plans specify the maximum volumes which may be harvested in a specific period. These maximums are determined on the basis of the volume that may be removed in a sustainable manner over time. Estimates of total industrial roundwood removals from indigenous forests are made but there is no estimate of the total volume that can be removed in a sustainable manner to enable a comparison to be made.

The method used to estimate roundwood removals from New Zealand forest is an indirect method based on applying roundwood conversion factors to the physical output of wood-processing plants (sawmills, panel product plants and the pulp and paper industry) and monitoring exports of unprocessed products (such as logs). As such, the removal estimates are not a direct measure of harvest from the forests.

The method also relies on the conversion factors being reliable. The factors are reviewed each year with data that the Ministry of Agriculture and Forestry collects from processing plants. Over more recent years comparisons have been made with harvest data from the NEFD. This has provided a check on the reasonableness of the estimates and has indicated that they are likely to be accurate to within 5 percent of the actual level of harvest.

Roundwood removals from indigenous forests totalled 53,000 cubic metres in the year ended 31 March 2001. There is no New Zealand national total available on the sustainable level of removals against which to set this estimate.

Roundwood removals from planted production forests totalled 19.4 million cubic metres in the year ended 31 March 2001. This level of removals can be compared with the base cut scenario wood supply forecast of 24.2 million cubic metres per year during the five-year lustrum 2000-2004.

Sources of Information

- The roundwood removal estimates are from the Ministry of Agriculture and Forestry and are regularly published in the Ministry's *Statistical Releases* series. Online at www.maf.govt.nz/forestry/publications/index.htm.
- Estimates of indigenous harvesting are also supplemented by information on approved sustainable forest management plans and permits from the Indigenous Forestry Unit of the Ministry of Agriculture and Forestry.
- The wood supply forecast information can be derived from the *National Exotic Forest Description – National and Regional Wood Supply Forecasts 2000* (Ministry of Agriculture and Forestry, Wellington, 2000). Online at www.maf.govt.nz/forestry/publications/index.htm.

2.e: Non-Timber Forest Products

DESCRIPTION

Indicator 2.e: Annual removal of non-timber forest products (e.g. fur bearers, berries, mushrooms, game), compared to the level determined to be sustainable.

RATIONALE

This indicator compares actual removal of non-timber products with the level of removal permitted by forest management plans as a measure of the forest's ability to maintain its productive capacity over time.

2003 COUNTRY REPORT

The major commodities harvested from the forest estate, other than timber products, are game meat (from feral deer, goats and pigs), pelts (from the Australian brushtailed possum), sphagnum moss and honey. 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). New Zealand researchers are also examining the opportunities to incorporate secondary (non-timber) crops into planted forest blocks. These trials are likely to broaden the range and value of non-timber forest products.

The game animals in New Zealand (red deer, fallow deer, chamois and Himalayan thar), along with the brush tailed possum (*Trichosurus vulpecula*), are not endemic to the country but were introduced by the early European settlers for their meat, hides and fur. They quickly became established in New Zealand's indigenous forests, as they had no natural predators. As their numbers increased their impact upon the forest ecology grew, leading to their classification as noxious pests. A number of control measures are used by the Department of Conservation, the Animal Health Board, forestry companies and private land owners to minimise the environmental (and production) damage caused by these animals. One of the principal control measures is commercial and private hunting.

In the year ended February 2002, a total of 32,452 game animals (excluding possums) were processed in commercial premises for their meat and hides (Ministry of Agriculture and Forestry, Unpublished Series). Of this figure, 87 percent were deer and 8 percent pigs. The number of game animals taken by private hunters, and subsequently consumed for personal and family use are not recorded. The Department of Conservation and the major forestry

companies operate concession systems for commercial hunting operations and they issue hunting permits for private individuals[3].

Generally there are no restrictions on the number of deer that can be taken, except "for popular herds such as Fiordland wapiti and Blue Mountains fallow deer, where systems of ballots and bag limits are in place" (Department of Conservation, 2001, Policy Statement on Deer Control, Section 4). The Department of Conservation periodically monitors deer populations and has generally found that the numbers removed by commercial and recreational hunters are not sufficient to reduce feral deer densities to levels that protect ecosystems from damage[4]. When densities build up (particularly in priority ecological areas), the Department of Conservation supplements hunting with additional control measures. Feral deer numbers are estimated to be in the vicinity of 250,000 (McKinnon, 2001, p. 25).

Commercial hunting and trapping are also important management tools in controlling the possum population in New Zealand, which is estimated at 70 million (Ritchie, 2000, p. 1). Possums consume approximately 21,000 tonnes of foliage each day, which is placing New Zealand's broad-leaved hardwood forests "under threat of major mortality and, in some cases, widespread devastation" (Ritchie, 2000, p. 4). Their diet also includes indigenous invertebrates and birds (particularly eggs and nestlings), which is threatening the survival of certain species.

The major commercial products derived from possums are their fur and skin. The meat is received favourably in South East Asian markets but there are only limited areas of the country where the meat can be sourced, owing to the presence of Tb in a number of the regional possum populations. Pelts have been collected and exported since the early 1920s (Wardle, 1984).

Yearly harvest volumes have been erratic, owing to fluctuations in the price for pelts[5]. When fur has been out of favour as a fashion item, fewer than 500,000 pelts have been collected in a season, as it has been uneconomic for hunters to undertake extensive trapping programmes. In contrast, production has exceeded three million pelts when returns have been strong for fur and skins. The industry struggled in the 1980s and early 90s with low pelt prices but has gradually re-built itself, owing in part to local companies taking more control of processing and with a recent advance in yarn manufacturing which has allowed possum and merino fibre to be blended.

The current level of commercial harvesting makes only a limited impact upon possum numbers. To maintain possums at acceptable levels, the Department of Conservation, the Animal Health Board and the agricultural sector have had to fund extensive control programmes. "Existing control mechanisms for possums cost government and councils more than $60 million[6] a year. This sum does not include the significant amount also spent by private individuals, businesses, and organisations on possum control, estimated at $74.8 million per annum" (Parliamentary Commissioner for the Environment, 2000, p. 11).

New Zealand's forests are also utilised extensively by the beekeeping industry. A significant proportion of New Zealand's 4,539 beekeepers (July 2001) locate hives within forested areas (particularly indigenous forests) or along the bush line. Apiarists take advantage of the nectar and pollen sources available in the bush, particularly the early season nectar flow, which is

[3] The concession and permit system is used to monitor the number of hunters and to control access to blocks where there are high visitor numbers, or where forestry operations are underway.
[4] Even at low densities, deer can prevent the regeneration of key native plant species.
[5] The market for pelts has until recently been dependent upon overseas fashion trends and the requirements of fashion houses.
[6] Unless otherwise stated, the currency used in this document is New Zealand dollars.

critical for building up hive strength and populations. A number of New Zealand's monofloral honeys are derived from the forestry estate (manuka, southern rata and tawari).

In addition to this, bees extract Honeydew nectar from two species of scale insects that inhabit the bark of beech trees, principally black beech and red beech. Total honey production[7] for the July 2000 year amounted to 9,144 tonnes. A significant proportion of this was exported (2,528 tonnes), along with beeswax (65 tonnes) and live bees (21,120 queens and 19,344 kilograms of bulk bees).

The harvesting of honey and honeydew from woodlands has the potential to affect forest eco-systems in terms of the availability of nectar and pollen for indigenous birds and insects. Limited research[8] has been undertaken on this issue and beekeepers have been encouraged to adopt a conservative management approach when assessing stocking rates.

The Department of Conservation monitors the beekeeping concessions on its land and will revoke concessions if there is evidence of pressure on the local ecology[9]. Stocking density and the physical distribution of hives are constrained naturally by climatic conditions and the physical terrain. When determining hive density beekeepers are mindful of the variability of the New Zealand climate (Bourn et al, 1999, 6).

When poor climatic conditions are experienced in autumn, there is a limited supply of protein (in the form of pollen) for the brood[10] over the critical winter and early spring period. The potential for low levels of pollen collection in autumn encourages beekeepers to under-stock. The physical terrain of New Zealand's hill-country and alpine areas is an additional limiting factor. In a 1984 review of the area available for honeydew production Wardle commented that the resource was being "under-utilised because of the lack of suitable sites for the establishment of apiaries and inadequate vehicular access" (Wardle, 1984, p. 368). Limited vehicle access to back country sites curtails the opportunities for commercial beekeeping.

A regionally important non-timber forest product is the gathering of sphagnum moss, principally the variety *Sphagnum cristatum*. It is collected primarily from the forests and bush lands of the West Coast of the South Island. As outlined in Indicator 6.1.b, it is harvested mainly for export to Japan and South East Asia. The annual value of exports during the 1990s ranged from $13 million to $18 million. Sphagnum moss is collected manually from swamplands, by pitchfork, and then air lifted out. There is no draining or undercutting of swamps.

The moss grows in a dense mat (to a height of 0.6 metres) and harvesters generally remove only the material above the water line. This enables the plant to continue to grow. Research trials on the sustainable harvesting of this resource (by the Crown research institute Hort Research) have recommended that companies re-seed blocks to prevent weed intrusion and to stimulate re-growth. Blocks normally return to a stable condition after three to five years. This timeframe ensures that strands reach their maximum length. There is a strong market incentive to allow full re-growth.

New Zealand exporters target the premium orchid market, which requires long strands from mature plants. Market returns would be less if producers harvested early. The Department of

[7] Honey production figures are not broken down by source (i.e. forest and grasslands).
[8] The two major organisations that research hive management and the properties of honey are the Apicultural Research Unit of Hort Research and the Honey Research Unit at the University of Waikato.
[9] The Department of Conservation has produced national guidelines for the location of beehives on conservation land. The guidelines recognise honey production and the wintering over of hives as being generally compatible with conservation land values.
[10] Bee larvae and pupae.

Conservation now manages the majority of the sphagnum moss collection sites. The harvesting operations on conservation land are monitored through the Department's concession system[11], and are assessed for sustainability and environmental impact.

A number of forest plants are utilised by the indigenous Māori population for medicinal remedies. Four of the key species are listed in Indicator 6.1.b. The production of these remedies is undertaken at a local level and generally involves the harvesting of new season leaves. There is minimal disturbance to wood lands as a result of this activity. The Māori population also harvests berries from a number of indigenous trees and shrubs, including the Kotukutuku. The berries are harvested primarily for private use rather than commercial sale. Harvest volumes are limited.

Research trials have been underway for some years on the potential for incorporating secondary crops into the planted forest estate. The emphasis has been upon edible mycorrhizal mushrooms[12] and crops such as ginseng. The intention is to incorporate these crops into the normal planted forest regimes for exotic species[13]. The crops under investigation are high-value, low-volume commodities, which could significantly increase the viability of planted forestry. The scientists involved in these trials are conscious that the management practices for these new crops must be sustainable and in line with those used in commercial forestry.

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[11] Previously, Timberlands West Coast audited the operations to ensure they were consistent with its environmental management principles.
[12] Mycorrhizal mushrooms are those which live in a symbiotic relationship on and in the roots of suitable host plants.
[13] In the case of high-value mycorrhizal mushrooms, such as Périgord black truffle, the returns would justify setting up dedicated plantations for their production (i.e. a truffière), rather than incorporating them into the normal plantation system.

Criterion 3: Forest Ecosystem Health

DESCRIPTION

The maintenance of forest ecosystem health and vitality.

INTRODUCTION

New Zealand is an isolated island nation. Although it is free of many serious pests and diseases present overseas, its biosecurity systems are under pressure because of growth in international trade and travel. A number of species deliberately or unintentionally introduced in the past have subsequently become pests that are costly to manage. To cope with these threats, the government is funding the development of a Biosecurity Strategy. The Strategy's preliminary findings will be presented in late 2002.

The Biosecurity Strategy will:

- set an overall direction for biosecurity;
- identify areas of priority for biosecurity programmes;
- apply to primary production (agriculture, horticulture, forestry), public health, and indigenous terrestrial, marine and freshwater environments;
- provide guidance to all involved in biosecurity;
- raise public awareness and understanding of biosecurity.

3.a: Insects, Disease, Fire etc

DESCRIPTION

Indicator 3.a: Area and percent of forest affected by processes or agents beyond the range of historic variation, e.g. by insects, disease competition from exotic species, fire, storm, land clearance, permanent flooding, salinisation and domestic animals.

RATIONALE

Identifies and monitors the effect that a variety of processes and agents, both natural and human-induced, might have on basic ecological conditions in forests.

2003 COUNTRY REPORT

Summary

Overall, there is reasonable information on many aspects of indicator 3.a. In many cases, historical data are available and trends can be established, although there are occasionally difficulties with the way that data has been recorded. New Zealand's planted forests are relatively healthy, and the few pests that have caused problems have so far been manageable. Despite this, the influx of new pests and diseases will doubtless continue and pose more and new problems. Except for rare catastrophic events, wind and fire have generally not been a large problem, and long-term trends do not indicate any worsening.

Overview

The initiation of the Department of Conservation's BioWeb programme to develop integrated species management databases of distribution and abundance of all species of interest, including pests and protected species, will be useful in reporting against this indicator in the future. The Species project will be completed in 2002 but data collection will take some time.

The Department of Conservation's Measuring Conservation Achievement (MCA) project will measure the disposition and changes in forest condition and indicate the condition of some species populations. The MCA project will be able to provide data but it will take some time (e.g. five years) for sufficient data to accumulate.

Introductions of alien pests have caused some problems in planted forests in the past, and such biosecurity issues could potentially become very important if any of the most destructive pests of radiata pine, for example, would establish in New Zealand. The surveillance effort relating to this threat (and recording of relevant data) undertaken for planted forests is much more comprehensive than that for indigenous forests.

Table 5: New Zealand Rural Fire Statistics for the Period 1986/87-2000/01, showing Percentage of Total Forested Area Burned

Year	Hectares burned	% of total forest area
1986/87	226	0.003%
1987/88	44	0.001%
1988/89	615	0.008%
1989/90	414	0.005%
1990/91	240	0.003%
1991/92	152	0.002%
1992/93	689	0.009%
1993/94	288	0.004%
1994/95	466	0.006%
1995/96	348	0.004%
1996/97	844	0.011%
1997/98	1,296	0.016%
1998/99	213	0.003%
1999/00	141	0.002%
2000/01	412	0.005%

Source: NRFA 2001

Fire

The New Zealand National Rural Fire Authority (NRFA) co-ordinates a Statutory Fire Return, which forms the basis of the statistical data on forest fires. The Return includes information on scrub and forest fires.

These data are based on returns from land owners, and is summarised for three types of land cover: grasslands, scrub, and forest. "Forest" includes indigenous as well as planted forests.

Data for planted forests are available, but are not complete because:

- there is no obligation to report fires to the Rural Fire Authority (RFA);
- there is usually no financial assistance from the Authority for planted forest owners;
- some owners may not find it relevant to report a fire.

The RFA also has regional information and statistics on the causes of fires.

The area of all forest burned in New Zealand from 1986 to 2001 is given in Table 2. It comes from the NRFA annual returns. The reporting year is 1 May to 30 April. These figures are built up from returns from RFAs.

Sources of Information

- Annual fire statistics, Geoff Cameron (National Rural Fire Authority).

Introduced Pest Animals

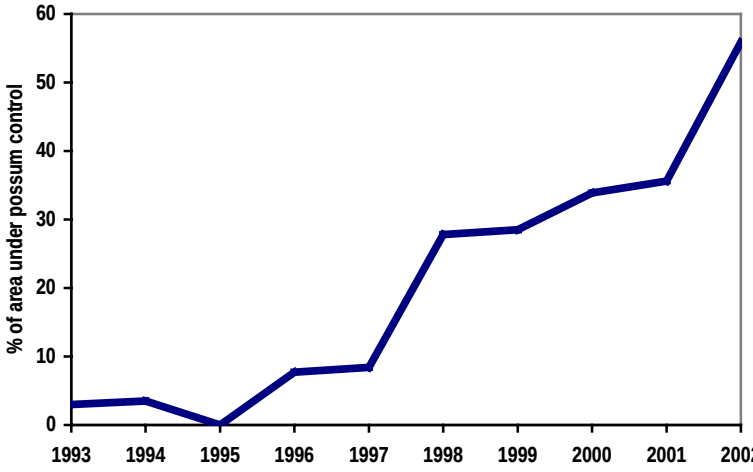
A major forest health problem is the introduced Australian brushtail possum (*Trichosurus vulpecula*), commonly referred to as the "possum".

The possum is a pest because, being an arboreal herbivore, it feasts over 100 species of New Zealand's indigenous flora including rata, rewarewa, kohekohe and kamahi. It especially devours pohutukawa trees. The possum eats the leaves, fruit and flowers of these plants and a single possum will eat about 300g of vegetation per night.

The possum is not entirely herbivorous though. It will prey on the eggs of birds, including the endangered kokako and other invertebrates. The possum also competes with indigenous birds for food, and so lessens the food supply of the birds. Additionally, possums carry the bovine strain of tuberculosis, contributing largely to the spread of tuberculosis to both cattle and deer.

The possum is distributed throughout mainland New Zealand. It has been estimated that there are as many as 70 million possums in New Zealand.

Figure 3: Possum control in Department of Conservation Forest



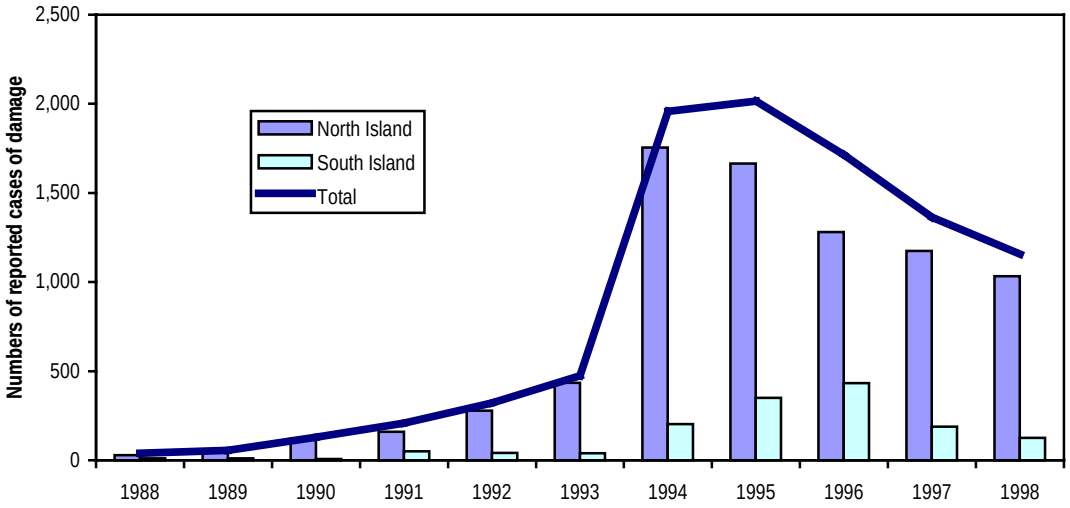
Possum control measures and research are carried out by a variety of agencies, including private companies and consultants. Data collection on possum control is not co-ordinated by any one agency and has not been collated as yet. Possums are, however, a very important issue in the protection of New Zealand's forests.

In the 4.8 million hectares of indigenous forest managed by the Department of Conservation, possums threaten some 1.8 million hectares. There are possum control measures in place on 1.3 million hectares of this estate. There are a further 1.8 million hectares of indigenous forest in private ownership for which there is little data available on the control of possums or other animal pests.

Based on information reviewed by Hosking, leader breakage of younger trees is the most significant damage in planted forests by possums, but only the symptoms, including needle clipping, have been recorded. A secondary problem is infection of damaged trees with the fungal pathogen *Diplodia pinea*.

New Zealand forests, both indigenous and planted, have a variety of other forest browsers and predators on which there is only limited data. Examples of these, which are all introduced to New Zealand, include wasps, mice, rats, mustelids, deer and pigs.

Figure 4: Possum Damage in Plantation Forests



Sources of Information

- Possums: Forest Health Database (Forest Research), Gordon Hosking (Hosking Forestry) and Ian Payton (Landcare Research).
- Animal Health Board manager – Nick Hancox.
- King, Carolyn M. 1990.*Handbook of New Zealand Mammal*s. Oxford University Press,
- Journal of the Royal Society Vol 31, No.1.
- Efford, M. 2000. *The Brushtail Possum. Biology, Impact and Management of an Introduced Marsupial.* Chap 5, pp. 47-61. Manaaki Whenua Press, Lincoln.

Disease

Economic losses owing to exotic forest pathogens are estimated to cost approximately $87 million per annum. *Cyclaneusma minus* and *Dothistroma pini* are the most damaging pathogens, accounting for losses of $51 million per annum and $24 million per annum respectively. Stumpage values, area affected, effect on growth and compensation effects influence the estimate of the economic impact of pests or diseases. Therefore, the loss figure should not be considered exact but should be viewed as providing an indication of the magnitude of the problem. However, the estimates show that exotic forest pathogens are responsible for substantial financial losses.

To provide an overview of the relative importance of tree diseases, a loss ranking is shown in Table 6.

Possibly the most significant pathogen not yet in New Zealand is *Fusarium circinatum* (formerly *Fusarium subglutinans* f.sp. *pini*), the agent that causes the pitch canker disease of pines. In California, this pathogen causes much mortality of radiata pine and other pines, and it has the potential to cause major damage to New Zealand's planted forests if it got here. Many other insects and pathogens occur in North America and Europe.

Table 6: Losses from Exotic Forest Pathogens

Disease	Host	Loss ($ million/annum)
Cyclaneusma minus	*Pinus radiata*	51
Dothistroma pini	*Pinus radiata*	24
Sphaeropsis sapinea	*Pinus radiata*	4
Others	*Pinus radiata*	4
Phaeocryptopus gaeumannii	*Pseudotsuga menziesii*	1
Cypress cankers	*Cupressus* spp	1
Research, diagnosis, and surveillance	All plantation spp	2
Total		**87**

Source: Bulman

Sources of Information

- Forest health surveillance data (Forest Research, Forest Health and Biosecurity/Vigil).
- Forest Health Database (Forest Research, Forest Health and Biosecurity).
- Forest Biosecurity, Ministry of Agriculture and Forestry.
- Bulman, L.S. and Gadgil, P.D. (editors) Cyclaneusma needle-cast in New Zealand. *Forest Research Bulletin No. 222*.
- New, D. 1989. Forest Health – an industry perspective of the risks to New Zealand's plantations. *New Zealand Journal of Forestry Science* 19(2/3): 155-58.
- Dick, M.A. 1999: *Sphaeropsis sapinea diseases of pines. A review from a New Zealand perspective*. Forest Research report to the Forest Health Research Collaborative.

Land Clearance

Before the first Māori settlers arrived in the 13th Century, 75 percent to 80 percent of New Zealand's 27 million hectares were covered in indigenous forest. The rest of the land was unsuitable for forest growth, being too wet, too high or too dry.

Early Māori settlement involved extensive burning-off of forest. Fire was used to encourage growth of bracken fern that was part of the staple diet for Māori. As a result, extensive areas in the drier eastern half of New Zealand had the land cover modified from forest to bracken and tussock grass. Deforestation appears to have ceased after 1600, although large areas of regenerating forest and scrub continued to be burned.

By the time that European settlement had begun to intensify in 1840, the forest cover had fallen to 53 percent (14.3 million hectares). Today, 24 percent of New Zealand remains under indigenous forest. Most of this forest decline occurred between 1880 and 1930, while New Zealand's strong agriculture-based economy was being developed[14].

The total area of occupied land for farming peaked in about 1921. In 1919 the State Forest Service was formed to manage forest resources, and protect four to five million hectares of steepland forest for erosion and flood control. Since then, indigenous timber production has declined to be replaced by yields from exotic planted forests.

[14] Ministry for the Environment website.

In 1987, the majority of indigenous forest in government ownership was allocated to the Department of Conservation to be protected. Many major forest companies are signatories to the New Zealand Forest Accord of 1992, in which they agreed not to replace indigenous forest areas with exotic forest. Also an amendment to the Forests Act in 1993 requires that indigenous wood products only be produced from forests with an approved sustainable forest management plan or permit. The result is that clearfelling of indigenous forest is now at a negligible level.

Reversion of abandoned farm land to scrub and forest is causing a significant increase in forest reversion in New Zealand. The extent of planted exotic forest is currently increasing at about 35,000 hectares per year.

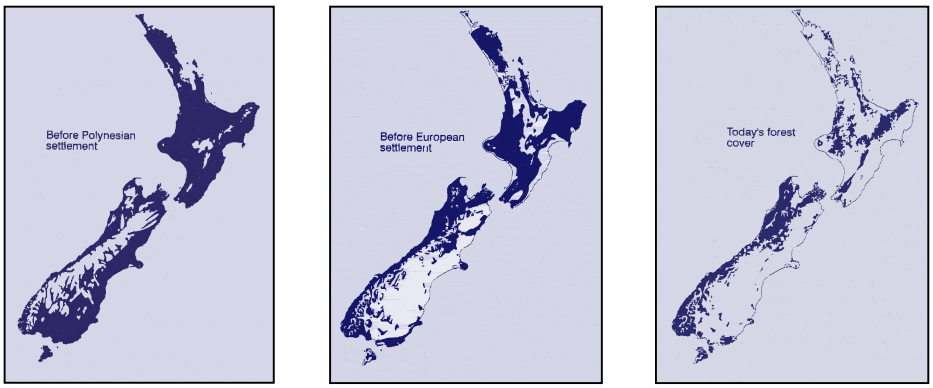


Figure 5: Extent of New Zealand Forest Cover Through Time

Sources of Information

- Mclaren, P. 1996. *Environmental effects of planted forests in New Zealand: the implications of continued afforestation of pasture*, New Zealand Forest Research Institute.
- Taylor, R. and Smith, I. 1997. *The State of New Zealand's Environment.* Ministry for the Environment, Wellington.

Wind

Probably the best general reference for information on wind damage, including risk assessment and calculation of economic impacts, is Somerville et al. 1989. At present there is no formal means of collecting information on wind damage across New Zealand. What statistics are available are compilations by wind researchers using data from a wide range of sources. One such compilation, provided by John Moore, is presented in Table 7.

Table 7: Mean Percentage Net Stocked Planted Forest Area Lost per Year Due to Wind

	Percentage net stocked area lost per annum			
Type of wind damage	**Central North Island**	**Nelson**	**Canterbury**	**Otago**
Catastrophic	0.3%	0.2%	1.7%	0.4%
Attritional	0.2%	0.4%	0.2%	0.2%

As well as catastrophic incidents of wind damage, there is a problem of toppling, particularly in young stands. This reduces stem straightness and value. No national statistics were found on the incidence of toppling, but there are specific experiments that report on this phenomenon (e.g. Mason, 1985).

Sources of Information

- John Moore (Forest Research, Forest Biosecurity and Protection);
- Somerville, A., Wakelin, S. and Whitehouse, L 1989. Workshop on wind damage in New Zealand exotic forests. *FRI Bulletin No. 146*. New Zealand Forest Research Institute Ltd. Rotorua.
- Mason, E.G. 1985. Causes of juvenile instability of radiata pine. *New Zealand Journal of Forestry Science* 15. pp. 263-268

Insect Pests

Forest health surveillance surveys (in New Zealand these are essentially pest detection surveys) are regularly carried out across the planted forest estate. These surveys were initiated in 1956, and today include both ground-based and aerial surveys.

Established insect pests are currently not of great concern to the major planted species (radiata pine and Douglas-fir), but there were outbreaks in the 1940s and 1950s of several species, some of which are referred to below.

Serious outbreaks of the exotic wood wasp *Sirex noctilio* over more than 100,000 hectares caused considerable mortality of affected pines in the 1940's (Rawlings, 1948, Rawlings and Wilson, 1949). Apparently these problems subsided when highly stocked stands became uncommon and also because of a successful biological control project.

Outbreaks of the indigenous looper *Pseudocoremia suavis* occurred in the 1950s in planted pine forests in Canterbury, and in the early 1970s in Douglas-fir stands in Kaingaroa Forest (Alma 1977)**.** Apparently, these outbreaks occurred because trees were more susceptible than usual because of drought stress.

Eucalypts and acacias are generally more affected by insect pests, primarily because of the proximity to Australia, where species in these genera originate. However, the area of eucalypts and acacias in New Zealand is relatively small, and insect problems are not of major importance.

Biosecurity is of major significance to New Zealand planted forests. A number of potentially extremely harmful insects and pathogens occur overseas. Chile's pine forests suffer from widespread damage from the European pine shoot moth, causing major economic losses.

The Biosecurity Authority in the Ministry of Agriculture and Forestry manages border control and other biosecurity processes. In the 1990s, nearly 10 insects and fungi that affect trees were newly recorded each year (Ridley et al, 2000). New Zealand has an excellent track record of eradication of such pests, for example the white-spotted tussock moth, however, eradication will not always be possible or feasible.

Sources of Information

- Information on wood and bark boring insects that have been intercepted at ports since 1948 (and were sent to Forest Research for identification) is recorded in the quarantine

database (BUGS). The Forest Health Database contains comprehensive records of occurrence and incidence of all key pests.

- Alma, P.J., 1977. Heliothis armigera Hübner (Lepidoptera: Noctudiae). *Forest andTimber insects in New Zealand No. 9*. Government Printer, Wellington
- **Carter, P.S. 1989. Risk assessment and pest detection surveys for exotic pests and diseases which threaten commercial forestry in New Zealand. New Zealand Journal of Forestry Science 19, 353-374.**
- **Kershaw, D.J. 1989. History of forest health surveillance in New Zealand. New Zealand Journal of Forestry Science 19, 375-377.**
- **Rawlings, G.B. 1948. Recent observations on the** *Sirex noctilio* **population in** *Pinus radiata* **forests in New Zealand. N.Z. J. For. 5, 411-421.**
- **Rawlings, G.B., and Wilson, N.M. 1949.** *Sirex noctilio* **as a beneficial and destructive insect to** *Pinus radiata* **New Zealand. N.Z. J. For. 6, 20-29.**
- **Ridley, G.S., Bain, J., Bulman, L.S., Dick, M.A. and Kay, M.K. 2000. Threats to New Zealand's indigenous forests from exotic pathogens and pests. Science for Conservation No. 142. Dept. of Conservation, Wellington. 67 pp.**
- **Sweet, G.B. 1989. Keynote address. Maintaining health in plantation forests. N.Z. J. For. 19, 143-54.**

Weeds

There is little publicly available information on the amount, types and spread of weeds within planted forests. Furthermore, what are perceived as problem species can change over time, between regions, and with different managers. With difficulty, it might be possible to obtain estimates of the amount of herbicide used per year in planted forests or total area per year treated with herbicide. However, this is not a meaningful indicator because use rates and the intensity of use are also dictated by cost-benefit analyses (which changes with economic factors), management regimes, types of herbicide products available, and herbicide formulations. To obtain useful information for reporting on this factor, either an industry survey or a more formal sampling approach would be required.

Domestic Animals

Domestic animals are currently of no real concern to planted forests. While there is occasional damage to planted forests from grazing animals, particularly in agroforestry situations, this of no practical significance. Feral cats and other domestic animals can cause problems by hunting indigenous fauna.

Sources of Information

- **Maclaren, J.P. 1988. Proceedings of the Agroforestry Symposium, Rotorua, 24-27 November 1986.** *FRI Bulletin No. 139***. New Zealand Forest Research Institute Ltd, Rotorua.**

3.b: Air Pollutants

DESCRIPTION

Indicator 3.b: Area and percent of forest land subjected to levels of specific air pollutants (e.g. sulphates, nitrate, ozone) or ultraviolet B that may cause negative impacts on the forest ecosystem.

RATIONALE

Air pollutants are suspected to have a significant cumulative impact on forest ecosystems by affecting regeneration, productivity and species composition. Correlating forest health measures with information on the deposition or concentrations of these substances may provide more information on the effects of pollutants on forests. Increased ultraviolet radiation, caused by changes in the earth's atmosphere, also has been shown to damage plants.

2003 COUNTRY REPORT

New Zealand generally has very clean air. Industrial activity is low, the population base small, and the country is well exposed to the prevailing mid-latitude westerly winds. There are very few instances of forest ecosystems being affected by air pollution in New Zealand. In the two documented circumstances below, the total area of trees affected is of the order of a few hectares:

- effects from atmospheric fluoride in pine trees immediately adjacent to industrial dischargers (one aluminium smelter and three fertilizer works);
- very slight sulphur dioxide damage in trees on a hillside with direct plume impingement from a refinery.

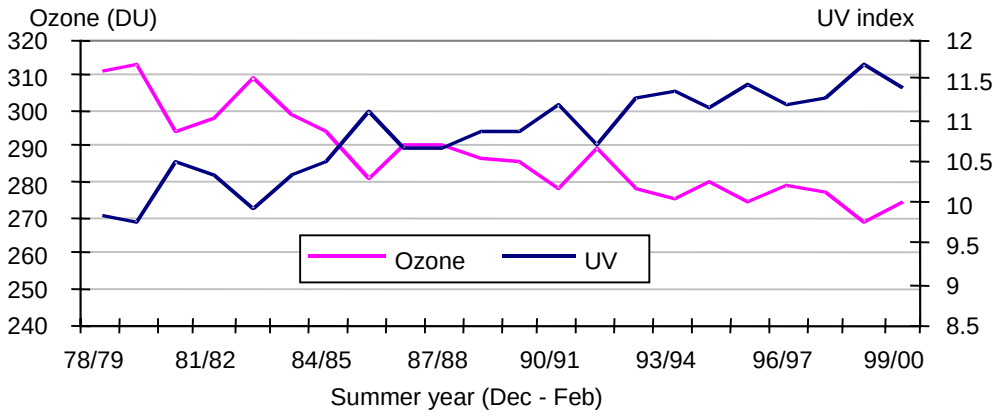
Sulphates: the air in New Zealand contains very low concentrations of sulphates. New Zealand's thermal electricity generation uses natural gas, with coal burning restricted to a few small processes and domestic heating. Sulphur concentrations in cities have been increasing slightly owing to increased use of diesel fuel, but remain below 5-10 microgrammes per cubic metre as an annual average. Concentrations in most of the forest areas, outside the cities, are negligible (<1).

Nitrates: concentrations of oxides of nitrogen can exceed international health-based guidelines in the three or four major cities. Outside the immediate urban areas however, annual average concentrations above five microgrammes per cubic metre are rare. Nitrogen deposition effects on forests and other agricultural systems are negligible.

Ozone: New Zealand does not suffer from any significant instances of ozone or photochemical smog pollution. Slightly elevated concentrations are sometimes observed at 20 to 80 kilometres downwind of the major city of Auckland, but these have not exceeded the relevant guidelines and occur at most a few hours per year.

Ultraviolet B (UVB): New Zealand has experienced greater UVB levels since the advent of the ozone hole. General background levels have increased by 10 percent to 15 percent over the last 20 years. Research has shown that exposure to increasing UVB can affect trees and plants by stunting growth. UVB also increases with altitude in clean atmospheres by about 7 percent per 1,000 metres, and may be one of the causes limiting tree growth at high altitudes.

Figure 6: Mean Summer Ozone & Estimated UV Index



Sources of Information

- NIWA:
  - www.katipo.niwa.cri.nz;
  - gfisher@niwa.cri.nz (Auckland);
  - gbodeker@niwa.cri.nz (Lauder).
- Official New Zealand Year Book 2000.
- Ministry for the Environment, *Environmental Performance Indicators Programme* on line at www.mfe.govt.nz/monitoring/report.htm.
- Stevenson C. and Noonan, M. "Ecosystem Effects of Air Pollution: Acidification and Eutrophication of Terrestrial Ecosystems" in *15th Clean Air and Environment Conference*, Sydney, Australia, Vol.1.
- Ministry for the Environment, 2000. Effects of air contaminants on ecosystems and recommended critical levels and critical loads. *Air quality technical report no.15.*

3.c: Diminished Biological Components

DESCRIPTION

Indicator 3.c: Area and percentage of forest land with diminished biological components indicative of changes in fundamental ecological processes (e.g. soil nutrient cycling, seed dispersion, pollination) and/or ecological continuity (monitoring of functionally important species such as fungi, arboreal epiphytes, nematodes, beetles, wasps, etc).

RATIONALE

The indicator has the potential to provide a measure of the status of fundamental ecological processes that underpin the maintenance of ecosystem health and vitality. The indicator should be used as an integrated measure of component influences and should not rely on only one component. The indicator demands a fairly high level of understanding about the linkages among individual components of ecosystems that is often lacking and research may be required to fill knowledge gaps.

2003 COUNTRY REPORT

Planted Forest

This indicator is appropriate for New Zealand's planted forests. In a sense this indicator aims to measure the process directly. The difficulties and cost of obtaining this information could lead to the use of surrogates for this process. For example if adequate levels of soil and foliage chemistry are reported (e.g. as part of Indicator 4.d) it is likely that nutrient recycling processes are also functioning well.

Another difficulty is how to determine what "diminished biological components" means for animal, plant and fungal species. A comparison with a reference area is suggested and may be applicable, but has not yet been established. To date, apart from some site-specific data being collected as part of research programmes, there has been no integrated, nation wide measurements undertaken for this indicator. Case study data are available for only a limited number of sites. However, biodiversity indicators are being developed within the *Environmental Performance Indicators Programme*.

Conservation Forest

No detailed data are available. However, scientists are proposing a composite indicator that will allow integration across a range of data sources, and interpretation of some components will be possible through geographic information systems. A survey of the indigenous estate is presently being initiated which will address some topics, such as forest condition

Sources of Information

- Ministry for the Environment, *Environmental Performance Indicators Programme* on line at www.mfe.govt.nz/monitoring/report.htm.
- Research Report 2001, Landcare Research on line at www.landcareresearch.co.nz/publications/ResearchReport01.pdf.
- Froude, V. August 2001. *Potential Contribution of the New Zealand Environmental Performance Indicators Programme to Montreal Process Reporting - Prepared for Ministry of Agriculture and Forestry.* Pacific Eco-Logic Ltd, Porirua, Wellington.
- Richardson, B., Barnard, T., Brockerhoff, E., and Dunningham, A. 2002. *Defining Montreal Process…* Forest Research, Rotorua.

Criterion 4: Soil & Water Resources

DESCRIPTION

The conservation and maintenance of soil and water resources. This criterion encompasses the conservation of soil and water resources and the protective and productive functions of forests.

INTRODUCTION

New Zealand has traditionally been very strong in the area of addressing soil and water issues. This strength is largely derived from the legislative framework, particularly at local government level. Currently, any proposals which will result in disturbances or changes to soils or areas of water must meet the requirements of the Resource Management Act 1991. Proposals of this nature will often require a resource consent granted by local authorities.

As a consequence of the Resource Management Act requirements, there is a large amount of soil and water information collected and held at local government level by regional councils. The extent of this information has not been assessed for this report; however, it is likely this may be a substantial data resource for future research and reporting.

Research information is collected by two main government agencies (Crown research institutes) which collect information on soil and water resources: Landcare Research and the National Institute of Water and Atmospheric Research (NIWA). Some of their research is referred to in the indicators below.

4.a: Soil Erosion

DESCRIPTION

Indicator 4.a: Area and percent of forest land with significant soil erosion.

RATIONALE

This indicator aims to measure the extent of soil erosion in forest areas that is of sufficient magnitude to lower soil fertility or cause significant sediment delivery to streams.

2003 COUNTRY REPORT

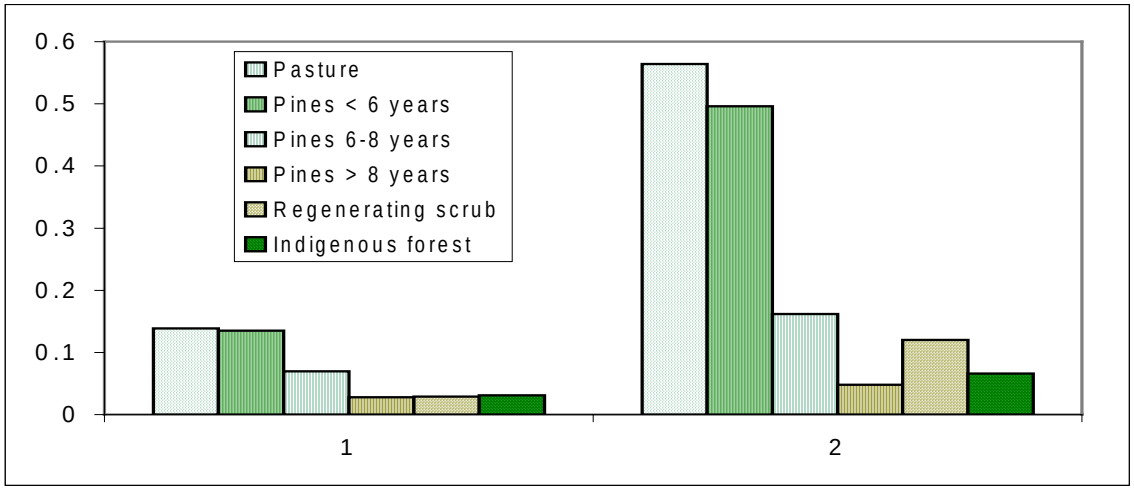
Quantifying soil erosion is technically difficult over large regions. Studies have identified the difficulty of measuring past erosion owing to revegetation obscuring erosion scars. Also it may be difficult to distinguish between erosion caused by naturally unstable terrain owing to New Zealand being a geologically young country, or by unsustainable forestry operations. For example, some of the highest rates of soil loss occur in relatively undisturbed catchments such as in Fiordland (Maclaren 1996).

Planted exotic forest is considered to provide similar levels of erosion protection to indigenous forest, once the trees are over eight years of age (Marden and Rowan, 1993, Hicks, 1993). This is evident in Fig. 7, indicating landslide densities before and after a major cyclonic storm event. Land under planted exotic pine forests showed similar landslide densities to indigenous forest. Fig. 7 shows mean landslides per hectare for different

vegetation types before (1 left) and after (2 right) Cyclone Bola on 30,570 hectares of land on the North Island's East Coast.

Estimates of the extent of severely eroded land can be derived from the New Zealand Land Resource Inventory (NZLRI) database. The NZLRI is a national physical resource inventory designed for the promotion of sustainable land use and managed by Landcare Research. Information contained in the database on erosion is derived from air photos and fieldwork.

Figure 7: Graph of Landslide Densities



Source: Marden and Rowan 1993

Two methods are presented here for providing estimates of the extent of eroded land within New Zealand. The first uses the extent of mapping units that showed severe erosion, rather than the areas of the erosion scars themselves (Table 8). This is similar to the approach of Eyles (1983). The minimum mapping unit in the NZLRI is 25 hectares. There is no indication given here of the type of erosion; for example, surface erosion predominates in the South Island whereas mass movement is more common in the North Island.

Table 8: Land with Severe or Worse Erosion

Location	Forest class	Area (hectares)	Percentage of the total
North Island	Indigenous	71,462	18.6
North Island	Planted	74,413	19.4
South Island	Indigenous	227,159	59.1
South Island	Planted	11,271	2.9
NZ Total	**All**	**384,305**	

The second method uses the extent of bare ground in forested regions, as determined by satellite data analysis. This provides a smaller extent estimate, giving only the actual extent of erosion scars, with a minimum mapping unit of one hectare.

The land area classified as having severe or worse erosion (NZLRI erosion classes 3 to 5) was intersected with the extent of forested land as defined by the New Zealand Land Cover Database ver 1.1 (LCDB 1.1) using a GIS. Table 8 shows the calculated land areas.

An alternative method of estimating significant soil erosion in forested areas is to determine the extent of bare ground in these areas. This has been achieved by the following method using a GIS:

1. The extent of bare land was obtained from the LCDB 1.1 GIS dataset.

2. The bare ground adjacent to or enclosed by forest was obtained by analysing the adjacency of bare ground polygons to forest area polygons from LCDB 1.1.
3. The forest area polygons were buffered with 300-metre buffer zones to inflate their extent.
4. The buffered forest area polygons from (3) were intersected with the bare ground areas adjacent to forest.
5. Finally the remaining bare ground areas from (4) were clipped to be less than 1,300 metres' elevation (the approximate tree-line in South Island) and braided river channel polygons were selectively removed by interpretation.

This method provides a good approximation of the extent of bare eroded soils within forest in New Zealand. These areas are typically scree (talus) slopes and landslide scars. Some may be naturally occurring when close to the natural tree-line; others are the result of forest deterioration following grazing of forest by feral animals such as deer and possums. In certain areas such as the East Coast of the North Island, forest clearance on younger erosion-prone rock types has caused extensive erosion, which affects adjacent forest areas.

Table 9 lists the areas of bare ground in forested areas in New Zealand.

Table 9: Areas of Bare Ground in Forested Areas in New Zealand

Location	Area (hectares)	Percentage of the total
North Island	19,945	20.5
South Island	77,125	79.5
NZ Total	**97,070**	

Sources of Information

- Eyles, G.O. 1983. The Distribution and Severity of Present Soil Erosion in New Zealand. *New Zealand Geographer 39*(1):2-28.
- Hicks, D.L. et al. 1993. Erosion of Hill Country in the Manuwatu-Wanganui Region 1992: Impacts and Options for Sustainable Land Use. *Landcare Research Contract Report LC 9394/51*, prepared for Federated Farmers, Palmerston North
- Landcare Research: New Zealand Land Resource Inventory
- Maclaren, P. 1996 Environmental Effects of Planted Forests in New Zealand. *Forest Research.*
- Marden, M. and Rowan, D. 1993. Protective value of vegetation on tertiary terrain before and during Cyclone Bola, East Coast Region, North Island, *New Zealand. New Zealand Journal of Forestry Science 23*(3): 255-263

4.b: Protection Forestry

DESCRIPTION

Indicator 4.b: Area and percent of forest land managed primarily for protective functions, e.g. watersheds, flood protection, avalanche protection, riparian zones.

2003 COUNTRY REPORT

There are insufficient data currently available for reporting on this indicator.

4.c: Streams in Forested Catchments

DESCRIPTION

Indicator 4.c: Percent of stream kilometres in forested catchments in which stream flow and timing have significantly deviated from the historic range of variation.

RATIONALE

This indicator is useful in evaluating the integrated effects of land use change and forest management. Changes to stream flows may also occur as a result of land uses outside the forested portion of the watershed. In assessing flow patterns, it is important to consider streams in a watershed or catchment context.

2003 COUNTRY REPORT

Forestry generally results in reduced stream flow owing to the greater interception capacity of trees compared with other land uses. Consequently, as large areas of New Zealand's indigenous forests have been cleared in the past, stream flow would have increased. The extent to which stream flow decreases with afforestation is not currently measured, nor is it considered a priority.

New Zealand has a good national archive of stream flow data that is managed by the National Institute of Water and Atmospheric Research (NIWA). From this dataset a good understanding is available of the specific water yield associated with different land uses and the variations in such yield associated with different stages of the forestry cycle.

Future work in this area could potentially involve developing models that, combined with GIS information, would enable predictions to be made of the reductions in stream flow associated with forestry land uses. This information, combined with further data on the age structure of forests, would provide for future predictions of variations in stream flow.

As most of New Zealand was forested at some stage, most regions have a reliable rainfall. Researching the impacts of afforestation on stream flow is not currently considered a priority for New Zealand.

The New Zealand National Rivers Quality Network (NRWQN) monitors selected aspects of water quality and periphyton (attached algae) cover monthly, and benthic invertebrates annually at 77 sites within New Zealand's major rivers. This shows a general lack of historic variability and will not be discussed further here. River flows are measured at a network of recorder sites throughout New Zealand run by NIWA and the regional councils (see Walter, 2000).

Whereas no data exists to describe the historic variation of stream flows in forested areas, data sources exist for the following areas, which are discussed below:

- studies of the effects of land use change on stream flow and timing;
- studies on the effects of forest management at monitored sites.

Studies of the effects of land use change on stream flow and timing

Land use change in recent times in New Zealand can be summarised as expansion of pasture by indigenous forest clearance until c. 1920, followed by a general contraction in the area under pasture since. Areas of abandoned pasture have either reverted to scrub and indigenous forest, or have been planted under exotic forest, principally radiata pine. Some conversion of

indigenous forest and scrub to pasture continued into the 1980s, but has now effectively ceased.

The three main types of land use change of interest here as affecting forested catchments are thus:
1. Clearance of indigenous forest to pasture.
2. Planting of pasture with exotic forest.
3. Reversion of abandoned pasture to indigenous scrub and forest.

The effects of different land uses on catchments have been studied by comparing adjacent catchments under different cover types (Dons, 1987), and by changing land use types in adjacent catchments. The effects can be summarised as in Table 10.

Table 10: Estimated annual water balance (mm) under different land use types at Purukohukohu study area, Central North Island, 1981-1984

	Pasture	Exotic (pine)	Indigenous forest
Gross rainfall	1,427	1,398	1,484
Stormflow	74	31	8
Delayed flow	469	223	331
Total flow	543	254	339
Evapotranspiration	784	1,044	1,045
Groundwater loss	100	100	100

The greatest contrasts are between pasture on the one hand, and forested (indigenous or exotic) and scrub land on the other. Tussock grassland has intermediate characteristics between forest and pasture, having a similar aerodynamic resistance to forest but lower transpiration than pasture (Fahey and Rowe, 1992). Land cleared to pasture creates higher stream flows, on average 2.1 and 1.6 those of pine forest and indigenous forest. Peak flows (stormflows or quickflows) were highest from pasture and lowest from indigenous forest; low flows (baseflows) were highest from indigenous forest and lowest from planted exotic forest. Stock trampling which lowers the soil permeability and enhances surface runoff, may increase peak flow rates in pasture.

The reduction in stormflow can be maintained even in extreme events, e.g. Duncan (1980) found that even 50-year flood events would only produce half as much stormflow as before following afforestation of a catchment under pines near Nelson. However, the potential for flood reduction from the impact of stormflow reduction under forest is only believed to apply to smaller catchment areas owing to other hydrological factors, e.g. channel storage capacity, coming into play in larger catchments (Maclaren, 1996).

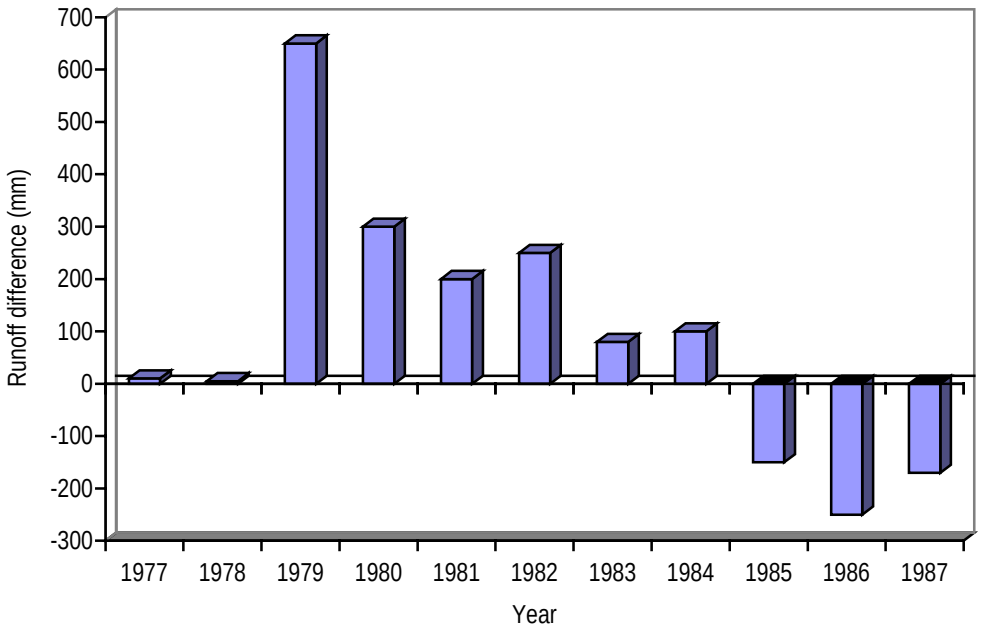
Total sediment discharges were ranked with maximum values from pasture and minimum values from pines, except for a short time during harvesting. The role of forests in causing increased rainfall is believed to be negligible in a New Zealand context (Maclaren, 1996).

In larger catchments, different hydrologic factors must be taken into account compared with studies of smaller areas. However, total water yield tends to decrease with an increase in the area of forest. For example, Dons (1987) calculated that 4.5 cubic metres per second (41 percent) of the 13 percent total reduction in flow from the 906 square kilometres Tarawera River catchment between 1964 and 1981 could be accounted for by catchment afforestation in 250 square kilometres of pines.

In summary, total water yield from catchments where the forest area is increasing will drop, as will sediment yield and stormflow levels. Baseflows will be sustained or even increase

with any increase in areas of indigenous forest reversion, but will decrease in areas of planted exotic forest.

Figure 8: Difference in Annual Water Yield



Studies on the effects of forest management at monitored sites

Various studies have monitored the effects of forest management on stream flow in New Zealand. The effects of most interest relate to clearance and stocking of areas with planted forest. Management effects on indigenous forest are mostly negligible, as clearfelling of indigenous forests for timber extraction has ceased. Any timber extraction from indigenous forests is now performed in a sustainable fashion with low impacts.

The immediate impact of any forest or scrub clearance is a large increase in water yield as evaporative losses decrease and quick-flow runoff increases. In New Zealand, annual water yield can increase by up to 650 millimetres in the first year after clearance (Pearce et al 1980). Following replanting in exotic forest species (principally radiata pine), it will take 8 to 10 years before the water yield declines to its original level. Figure 8 demonstrates this by showing the difference between adjacent catchments at Maimai (Westland), with one catchment in undisturbed indigenous forest and the other being clearfelled, herbicide sprayed and planted in radiata pine in 1978. In the following year, there was much more water yield from the cleared and planted catchment and by 1984 this had reduced significantly. In 1985 onwards, there was less runoff from the pine forest than from the indigenous catchment.

Other forest management activities can influence water yield. For example, simulation studies have shown that minor changes to the timing of thinning and pruning operations on a pine plantation near Rotorua could have increased water yield from 42 percent to 53 percent of annual rainfall (Whitehead and Kelleher, 1991).

Sources of Information

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4.d: Soil Organic Matter & Chemical Properties

DESCRIPTION

Indicator 4.d: Area and percent of forest land with significantly diminished soil organic matter and/or changes in other soil chemical properties.

RATIONALE

The level of soil organic matter is a characteristic of each forest ecosystem and should be maintained because of its links to nutrient and carbon storage, effect on soil physical and hydrological properties and role in providing substrates for soil biota. Changes in soil organic matter following natural disturbance may be used as a benchmark. In some ecosystems it should be noted that organic matter accretion is cyclical and maintenance of ecosystem health may require occasional forest fires or other disturbances to reduce the accumulation of organic material, for example in boreal black spruce forests.

2003 COUNTRY REPORT

A general calculation of the areas of different forest soils classified by percentage of organic matter can be derived from the Carbon Monitoring System (CMS) (Ministry for the Environment, 2001). This provides an estimate of soil carbon (tonnes/hectare) in the 0 to 30 centimetre profile of New Zealand soils (table 11). It is derived from a Generalised Linear Model analysis using soil, climate and land cover data from within a GIS.

Table 11: Soil carbon (tonnes/hectare) for up to 30cm of soil under indigenous and exotic forest areas in New Zealand

Carbon (t/ha)	Indigenous forest (ha)	Indigenous forest (%)	Exotic forest (ha)	Indigenous forest (%)
0 to 25	622	0.0	970	0.1
25 to 50	1,522,872	25.0	683,030	43.7
50 to 75	3,075,471	50.6	550,551	35.2
75 to 100	1,412,848	23.2	325,895	20.9
100 to 125	60,235	1.0	0	0.0
>125	5,016	0.1	2,066	0.1
Total	**6,077,064***	**100.0**	**1,562,512***	**100.0**

Source: Carbon Monitoring System, Ministry for the Environment, 1996.

Note: correction factors for soil carbon have been applied of -36t/ha and -53t/ha for indigenous and exotic forest respectively.

* : these totals differ from those expressed in Table 1 as a small percentage of forest soils are unclassified in the Carbon Monitoring System.

The data derived from the CMS gives a general indication of the amount of soil organic matter as carbon, based on 18 soil classes from the New Zealand Land Resource Inventory (NZLRI) and seven major climate classes. It is not intended as an indicator of specific areas of loss of soil organic matter.

It can be assumed that areas classified as suffering from "severe" or worse erosion in the NZLRI will have suffered significant losses of soil organic matter. However there are no data available to indicate the quantities of carbon loss. It can be assumed that areas of primary indigenous forest in New Zealand will not have suffered from any significant diminution of soil organic matter in recent times except where exceptional erosion has occurred (e.g. from feral animal browsing). Indigenous forest in New Zealand does not require fire as an agent of regeneration.

Indigenous forest regenerating on abandoned pasture, and planted exotic forest will generally be established on soils which have suffered historic loss of organic matter. Soil organic matter will have been lost on original clearance of indigenous forest, but is likely to have been maintained whilst under pasture.

No data exists for direct comparison of first- with second-rotation productivity for New Zealand planted forests. It is considered that there are no grounds for concern provided that appropriate site preparation and fertiliser treatments are used (Maclaren, 1996). Planted pine forestry is known to cause acidification of soils, with a fall in the surface levels of calcium, magnesium and potassium. (Davis and Nordmeyer, 1999). However, the availability of nitrogen, sulphur and phosphorus is usually enhanced in the top 10 centimetres of soil following afforestation with exotic tree species. Exchangeable and soil solution aluminium tends to increase under exotic forest.

Substantial research is being conducted on site quality, nutrient cycling, soil fertility and tree nutrition. For example, Forest Research is evaluating nutrition and productivity in six long-term intensive harvesting trials that cover a range of soil and climatic types. In addition, nutrient cycling models which predict the effects of organic matter management practices on the productivity of radiata pine are being developed and calibrated at two sites.

In order to better predict forest nutrition and the sustainability of soil fertility in second- and third-rotation planted forests, systems to measure the effects of harvesting on organic matter transformations and cycling of predicting soil carbon and nitrogen dynamics in these ecosystems are being developed and calibrated. In addition, the national network of fertiliser trials is being maintained and the National Forestry Soil and Foliage database is being maintained and enhanced. Further foliage and soil diagnostic tools are being developed and

implemented. A Nutritional Atlas is available from Forest Research as a tool to predict nutrient deficiencies and responses.

Sources of Information

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4.e: Soil Compaction

DESCRIPTION

Indicator 4.e: Area and percent of forest land with significant compaction or change in soil physical properties resulting from human activities.

RATIONALE

This indicator measures the extent of physical soil change induced by human activities that might affect soil productivity and hydrology and other ecosystem processes. Soil compaction from the use of heavy equipment in the harvesting of forest products, or from vehicle access, is a major cause of changes in soil bulk density. Management practices that control and limit compaction are desirable.

2003 COUNTRY REPORT

It is unlikely that any significant compaction of soil has resulted from human activities in New Zealand's indigenous forests. The limited logging of these forests is undertaken on a sustainable basis, involving minimal impact methods including helicopter extraction.

Studies into the effects of compaction during harvesting operations on site productivity in exotic planted forests are being undertaken. These investigations are also addressing the effectiveness of a variety of techniques for ameliorating the effects of compaction, specifically on the effects of different levels of soil disturbance and amelioration treatments on soil physical properties, root growth and individual tree and stand growth in planted forests. Also, studies are underway to develop a laboratory test that simulates the field response of a soil to harvesting traffic.

Soil penetration resistance increases noticeably under repeated traffic during harvesting operations. For example, cone penetration resistance of soil below 18 centimetres in Kinleith Forest increased from 2Mpa to3-4 Mpa for 20 to 50 machine passes.

Example studies show that soil compaction owing to harvesting activities persists for many years. In Esk Forest, bulk density of allophanic soils increased from approximately 0.7 tonnes/m^3 to 1.05 t/m^3 under severe disturbance during harvesting. Fifteen years later the bulk density of these disturbed soils had barely changed.

The area under skids in three sample planted forests during harvesting was 3.8%, 5.3%, and 5.9 percent. The cost per hectare of ripping and returning soil to the skid was $340, $370 and $270 respectively. If we take the average area under skids as being 5%, and assume that the same areas are used in each successive harvesting operation, then the approximate area in New Zealand suffering from harvesting compaction would be (1,800,000 x 0.05) or 90,000 hectares. Studies in Kaingaroa Forest show that skid rehabilitation using ripping and soil/debris restoration is effective in giving similar tree growth rates to cutover areas.

Sources of Information

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4.f: Biological Diversity in Water

DESCRIPTION

Indicator 4.f: Percent of water bodies in forest areas (e.g. stream kilometres, lake hectares) with significant variance of biological diversity from the historic range of variability.

RATIONALE

This indicator measures the diversity of a sample of in-stream flora and fauna as a reflection of the quality of habitat and water.

2003 COUNTRY REPORT

The National Institute of Water and Atmospheric Research (NIWA) has some research data from its national water quality monitoring network and some historical information is available from which there is a good understanding of biological diversity in single land use catchments, including planted forests. This information is also supplemented by a number of studies undertaken by NIWA for individual forestry companies as part of their requirements under the Resource Management Act. NIWA is involved in studies to measure invertebrate species richness in streams in indigenous forest and pine forests before and after harvesting (e.g., Harding et al, 2000). Some studies have also addressed indigenous fish species (e.g., Rowe et al, 2002).

Further clarification is required on what is meant by "historic range of variability". New Zealand's situation with its history of changing land use and short-rotation planted forests has not allowed for the collection of data from a stable forested environment.

Nationwide data on variation of stream biodiversity in forest areas are not available. Instead some summary points from research at selected sites are presented below.

Effects of land use change on stream biodiversity

Studies of the effects of different types of land use on hill country stream habitat and invertebrates were summarised by Quinn et al (1997). Woody debris volume was higher in exotic planted forest than in indigenous forest. Overall pollution/enrichment tolerance did not differ between forest types, as measured by the "Quantitative Macroinvertebrate Community Index" (QMCI). Invertebrate community types were fairly similar between forest types. Streams under exotic planted forest were classified as "slightly impaired" to "non-impaired" according to the "Index of Biotic Integrity" (IBI), whereas streams under indigenous forest

were classified as "non-impaired". Use of riparian strips in exotic forest was found to increase IBI values.

Mean photosynthesis/mean respiration ratios were 0.6 under indigenous forest, and 1.2 under planted pine forest, indicating an increased proportion of periphyton to heterotrophic bacterial and fungal biofilm under the exotic pines.

Land use changes affecting forest in New Zealand are now predominantly the conversion of pasture or scrub to exotic planted forest. The IBI of streams in pasture had been found to be "moderately impaired" relative to an indigenous forest reference. Results of the study above imply that an increase in the IBI and QMCI indicators in streams will occur in these areas of afforestation, although total invertebrate abundance will fall markedly. This indicates a reversion of stream conditions towards those that would have occurred under the original indigenous forest cover.

Hicks and McCaughan (1997) and Rowe et al (1999) found little or no difference in fish community structure between streams in indigenous and exotic forest in the North Island. There was a significant difference in fish community structure between forest and pastoral land. Total fish biomass was also much higher in pastoral land, owing mainly to increases in shortfinned eels (*Anguilla australis*). However, Jowett and Richardson (1996) found no strong relationship between distribution and abundance of fish and land use in New Zealand.

The decline in whitebait (*galaxiid*) fisheries in New Zealand streams in the last century is attributed to loss of habitat in indigenous forest streams owing to forest clearance to pasture. Reforestation of pasture under planted pines may be expected to reverse this decline.

Long-term trends in water-body biodiversity in New Zealand

Long-term trends in macroinvertebrate communities have been monitored as part of the National River Water Quality Network (NRWQN) since 1989. Although none of this monitoring is directed specifically towards forested sites, general trends reported for the period to 1996 are of interest (Scarsbrook et al, 2000).

Overall 27 positive and 42 negative trends in macroinvertebrate community measures were recorded nationally. The Macroinvertebrate Community Index (MCI) showed generally positive trends, with a median of 103 and range of 44 to 145. MCI values were especially good for "baseline" sites that are upstream of most point pollution sources and areas of changing land use and agricultural development.

The percentage of baseline sites with MCI scores indicative of clean water increased from 3 percent in 1989 to 46 percent in 1996, although this may be owing to climatic conditions. Total invertebrate abundance showed a large amount of inter-annual variability, with an approximately three-fold difference in median and maximum total numbers between years (all sites combined).

Effects of forest harvesting on stream biodiversity

Log harvesting operations in exotic planted forests will have a marked effect on species abundance and some effect on stream biodiversity. These harvesting operations typically occur at about 28-year intervals. The density of aquatic invertebrates was found to decline for a few months after harvesting, followed by a significant rise thereafter in a study conducted by Collier et al in 1997. There were indications that leaving post-harvest woody debris in the stream channels where it had accumulated may lead to an increased density of stream

invertebrates in the longer term; decaying wood debris was found to be persistent 20 years after harvesting.

Mechanical disturbance of stream channels or significant catchment erosion following clearfelling was found to have very significant detrimental effects on stream invertebrate biodiversity by Quinn and Halliday (2000).

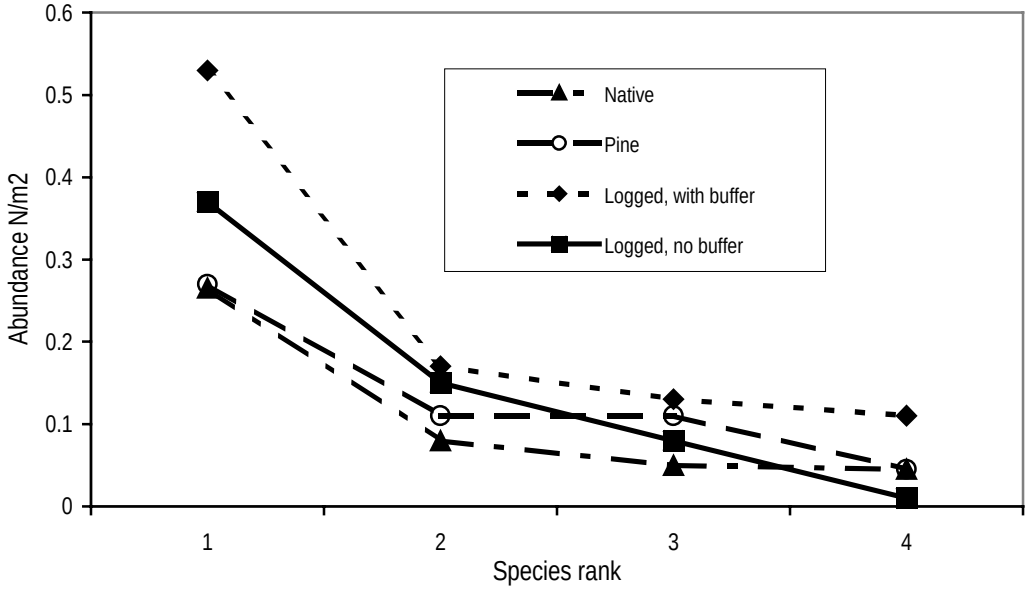
In one sample stream in this study, the IBI value fell from 80 to 15 after clearfelling followed by a major storm which caused siltation of the streambed. Careful forest management including use of riparian strips and avoidance of streambed disturbance can minimise damage to stream invertebrate biodiversity.

Comparative studies of indigenous fish abundance in a variety of forested stream environments to determine the effects of logging have been made by Rowe et al (2002) in the Coromandel Peninsula, North Island. They found that logging generally increased the abundance of indigenous fish, and that use of riparian buffer strips of indigenous forest along the stream banks increased the numbers of fish in all species ranks after logging compared with unbuffered streams. Rank-abundance curves were used to illustrate characteristics such as species richness, diversity and equitability (see Figure 9). The higher curve for logging with riparian strips indicates a more diverse and equitable fish community.

Four dominant indigenous fish species were used as the basis for comparative data, as they were present in all sites monitored. These species were *Anguilla dieffenbachii, Gobiomorphus huttoni, Anguilla australis* and *Galaxias fasciatus*.

Figure 9 shows the fish community was more diverse in streams within logged forest, and most diverse and abundant where a riparian strip was present.

Figure 9: Species Rank Abundance Curves of Native Fish for Four Types of Forest Stream in Coromandel



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- Rowe, D. K.; Smith, J.; Quinn, J.; Boothroyd, I. 2002. *Effects of logging with and without riparian strips on fish species abundance, mean size, and the structure of indigenous fish aeeamblages in Coromandel, New Zealand, streams*. N Z J Mar Freshwater Res 36: 67-79.
- New Zealand Journal of Marine and Freshwater Research, 2002, 36(1), 67-79
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4.g: Variations in Water Chemical Properties

DESCRIPTION

Indicator 4.g: Percent of water bodies in forest areas (e.g. stream kilometres, lake hectares) with significant variation from the historic range of variability in pH, dissolved oxygen, levels of chemicals (electrical conductivity), sedimentation or temperature change.

RATIONALE

The purpose of this indicator is to relate water quality to the rate and extent of forest management activities by measuring a number of key physical and chemical variables. Monitoring and analysis of these variables will assess the impact of forest operations on water quality. Management practices can then be adjusted to maintain or improve water quality.

2003 COUNTRY REPORT

General national trends in water quality

The National River Water Quality Network (NRWQN) monitors 77 river sites on a monthly basis. Although none of this monitoring is directed specifically towards forested sites, general trends are of interest. They indicate a general improvement in water quality for the period 1989-1993. Downward trends were found for water temperature, BOD5, NH4-N, NOx-N and TP. Upward trends were found for dissolved oxygen, visual clarity and conductivity.

The trends reflect those found in macroinvertebrate community measures for the NRWQN noted under Indicator 4.f. They may be related to climatic factors.

Effects of land use change on stream water properties

Studies of the effects of different types of land use on hill country stream habitat were summarised by Quinn et al (1997) and Quinn et al (2002) available online at www.rsnz.govt.nz/publish/nzjmfr/2002/032.php

Streams in areas of planted pine forests had three-fold higher suspended solids and fine sediment in the stream bed than streams in indigenous forest, resulting in much higher turbidity under the pine forest. Dissolved organic carbon and dissolved inorganic nitrogen were higher under the pine forest than under indigenous forest. Collier et al (1997) found a strong relationship between pH and time since afforestation under exotic pines, indicating increased stream acidification owing to catchment land use change.

Conversion of pasture land to planted forest will generally result in diminished nitrogen and phosphorus loadings of watercourses (Quinn et al 2000). However, evidence from monitored catchments suggests that riparian shade and reduction of sedimentation are more important to stream health than nutrient loading. Stream temperatures are reduced and diurnal temperature variability is reduced in forest streams compared with streams in pasture.

Another key study is Cooper et al, 1998.

Effects of forest harvesting on stream water properties

Studies of the effects of forest harvesting operations in exotic planted forests indicate a drop in dissolved oxygen levels in stream waters of the catchment. The pre-harvest values were restored 20 weeks after harvest for moderate amounts of wood debris in the stream channel, but continued to be suppressed (from $10g/m^3$ to $7.5g/m^3$) after 20 weeks for high amounts of wood debris (Franson et al, 1999).

Sources of Information

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4.h: Toxic Substances

DESCRIPTION

Indicator 4.h: Area and percent of forest land experiencing an accumulation of persistent toxic substances.

RATIONALE

This indicator measures the degree to which pollutants and environmentally damaging chemicals might be affecting forest land. Toxic substances have adversely affected extensive areas of some forests.

2003 COUNTRY REPORT

Specific definition of "persistent toxic substances" is necessary. As it is, it does not distinguish between naturally occurring toxic compounds (e.g. soil Al and Mn, resin acids in pine) and anthropogenic sources (e.g. pesticides, wood preservatives, air pollutants). Monitoring for even a limited number of compounds is expensive over large tracts of forest.

As a general comment the existing indicators may be adequate for describing the state of soil resources on some defined spatial and temporal scales, but are not adequate for enabling quantitative inferences about ecosystem health or productivity unless locally calibrated via research trials.

Currently no national register exists of contaminated sites. The Ministry for the Environment intends to identify all sites on the Hazardous Activities and Industry List by 2008 and to have performed a rapid screening of 50 percent of them.

Organochlorine Contamination

The Ministry for the Environment established the Organochlorines Programme in 1995 to carry out research into contamination by these chemicals. A 1998 report presented the findings of the research programme, including analyses from seven indigenous forest sites (no exotic planted forest soils were analysed). The purpose of the programme was to establish background concentrations in the environment; it was not intended to identify or characterise environmental hot spots, such as contaminated sites.

Data was presented on concentrations of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), organochlorine pesticides and chlorophenols quantified in New Zealand soils. Releases of PCDDs and PCDFs are thought to have resulted from use of the herbicide 2,4,5-T, use of PCP in the timber industry for control of fungi on cut timber, from accidental spillages and from a small number of pulp mills, kilns and incinerators. PCBs were used in industrial applications such as electrical insulating fluids. Organochlorine pesticides were used from the mid-1940s to 1970s in agriculture, horticulture, forestry and public health.

Organochlorine pesticide concentrations in forest soils were found to be lower than for comparable environments reported overseas. The more highly chlorinated PCDDs were the most abundantly and frequently detected congeners. For all samples the soil I-TEQ concentrations are generally well below the New Zealand and overseas guidelines for agricultural and other land uses. The most frequently detected pesticides were HCB and dieldrin, along with DDT residues. HCB, dieldrin, DDT and DDE were found at all forest sites, but at low levels.

Contamination Due to Mining Activities

Mining activities are known to have caused significant concentrations of heavy metals in mine water discharges, tailing ponds and sluices, which have affected forest catchment streams. Mining which has affected forested areas has principally been of coal and gold, in Westland and the Coromandel Peninsula. Impacts include polluted runoff, acidification of streams, iron-floc development and heavy-metal toxicity.

Significant impacts on stream biota have been demonstrated at many sites as a result of mining activities. However, the presence of multiple stressors such as pH reduction, iron-floc formation, and heavy-metal contamination may preclude identification of specific causes of the impacts. Some Coromandel streams adjacent to gold mines studied by Hickey and Clements (1998) showed a strong relationship between cumulative criterion units (CCUs) of the heavy metals Cd, Cu, Pb and Zn in streamwaters with abundance, species richness and taxonomic richness of macroinvertebrates. (CCUs represent the sum of heavy metal concentrations divided by chronic US EPA criteria).

Table 12: Concentrations of organochlorines in indigenous forest soils in New Zealand (seven sites)

	Median	Mean	Min	Max
PCDDs and PCDFs (ng/kg dry wt)				
Sum of PCDD/Fs	111	152	17.1	306
Total I-TEQ	1.26	1.06	0.17	1.99
PCBs (µg/Kg dry wt)				
Sum of PCBs	0.24	0.42	0.14	1.20
Total PCB TEQ	0.10	0.11	0.065	0.16
Pesticides (µg/kg dry wt)				
Alpha-HCH	<0.02	nc	<0.01	<0.03
Beta-HCH	<0.01	nc	<0.01	<0.02
Gamma-HCH	<0.02	nc	<0.02	<0.04
HCB	0.15	0.16	0.085	0.28
Aldrin	<0.01	nc	<0.01	<0.02
Dieldrin	0.24	nc	<0.03	0.83
Heptachlor	<0.03	nc	<0.01	<0.04
Heptachlor Epoxide	<0.01	nc	<0.01	<0.06
Alpha-Chlordane	<0.03	nc	<0.02	<0.06
Gamma-Chlordane	<0.02	nc	<0.02	<0.06
pp-DDE	1.20	1.14	0.048	2.69
pp-TDE	0.087	nc	<0.01	0.13
Op-DDT	0.11	0.14	<0.01	0.37
Pp-DDT	0.83	1.18	0.034	2.70
Chlorophenols				
PCP (µg/kg dry wt)	<1	nc	<1	<2

Use of Herbicides in Forestry

Herbicides are extensively used in the planted forest industry in New Zealand, mostly in site preparation and for spot release after planting. The range of herbicides used has been reduced nowadays to about 12 basic products. These include triazines ("Gardoprim"), hexazinone ("Velpar"), triclopyr ("Grazon"), picloram ("Tordon"), clopyralid ("Radiate"), sulfonyl urea ("Escort"), metsulfuron ("Escort") and glyphosate ("Roundup").

The herbicide 2,4,5-T was formerly extensively used for releasing pine trees from woody weeds after planting, but has now been withdrawn. No data are available as to any residues left from herbicide use in planted forests.

Sources of Information

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- Hickey, C.W. and Clements, W.H. 1998 *Effects of heavy metals on benthic macroinvertebrate communities in New Zealand streams* Environmental toxicology and chemistry, 17 : 2338-2346.

Criterion 5: Carbon

DESCRIPTION

The maintenance of forest contributions to the global carbon cycle.

INTRODUCTION

Much of the data used for reporting on the following three indicators is collected as part of the New Zealand greenhouse gas inventory under the Framework Convention on Climate Change (FCCC). The inventory, which is an inventory of emissions and sinks of the most significant greenhouse gases, is 1990-based and updated annually to monitor trends in emissions and sinks, and develop and evaluate the effectiveness of policy measures. Data are prepared using International Panel on Climate Change (IPCC) guidelines.

Estimates are available for planted forests, and New Zealand is working towards having a complete set of data available. Work is underway to address reporting on the carbon contributions of indigenous forests, soils and wood products.

5.a: Biomass & Carbon Pool

DESCRIPTION

Indicator 5.a: Total ecosystem biomass and carbon pool, and if appropriate, by forest type, age class, and successional stages.

RATIONALE

Globally, forest ecosystems are one of the largest reservoirs of both biomass and carbon. Reports on trends in this indicator are important for assessing national strategies to help stabilise global climate.

2003 COUNTRY REPORT

Planted Forests

Detailed calculations of the carbon pool in planted forests are undertaken annually. Net stocked areas and stem volume by age class are obtained from the National Exotic Forest Description (NEFD). Stem volume is converted to dry matter and carbon using the biomass allocation model C_Change[15]. A national forest estate model (FOLPI[16]) is then used to model carbon stock changes over time. The carbon stock estimates provided are based on total planted forest biomass (above and below ground) but do not include soil carbon.

Indigenous Forests

A preliminary attempt to estimate carbon stored in indigenous forests as at 1990 was undertaken in 1998 based upon available data at that time. A national carbon monitoring system for indigenous forests and scrublands commenced operation in early 2002 and will provide future estimates of carbon stocks and carbon stock changes. The carbon stock

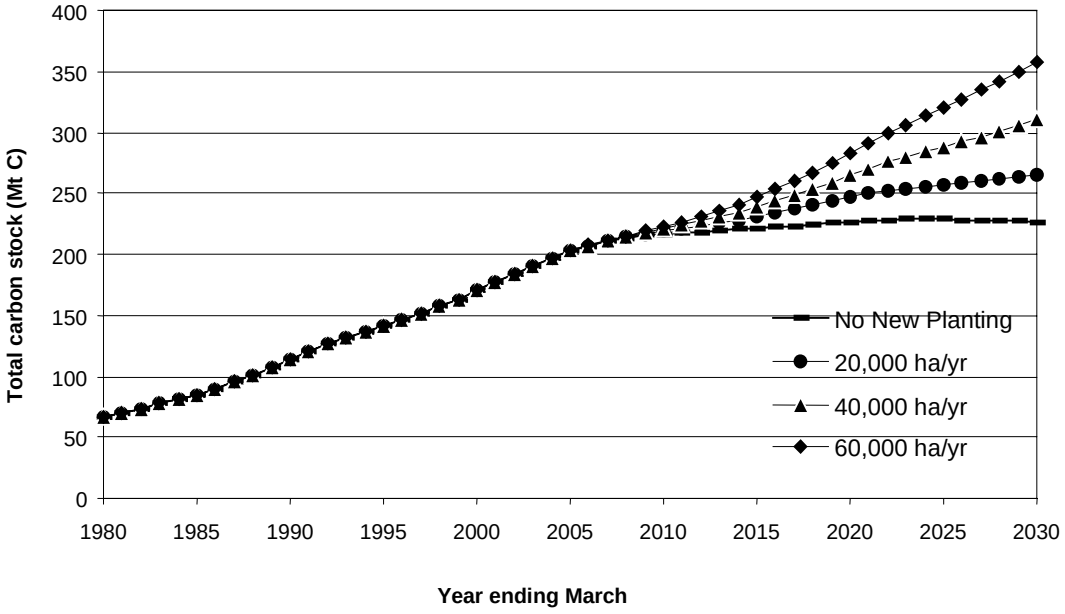
[15] C_Change is a dry matter allocation model (Beets et al, 1999).
[16] FOLPI (Garcia, 1984) stands for Forestry-Oriented Linear Programming Interpreter. FOLPI is a forest estate optimisation model that is routinely used in New Zealand forest management (Manley et al, 1991) and is also used for national and regional wood supply modelling (Ministry of Agriculture and Forestry, 2000).

estimates provided are based on total forest biomass (above and below ground). They do not include forest floor litter, coarse woody debris or soil carbon.

Planted Forests

As at 1 April 2001 planted forests were estimated to contain 177 million tonnes of carbon, an increase of 64 million tonnes since 1990 (see figure 10).

Figure 10: Total planted forest carbon stocks (new planting scenarios)



Indigenous Forests

A preliminary national estimate of carbon stored in indigenous forests as at 1990 was 933 million tonnes of carbon. Of the national forest biomass carbon reservoir 60 percent is stored in beech trees, 26.7 percent in other hardwoods, 13.2 percent in conifers and 0.1 percent in other (e.g. tree ferns) taxa. A further 527 million tonnes of carbon is estimated to be stored in scrub and other woody mixtures of indigenous vegetation (Hall et al, 1998).

Sources of Information

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Table 13: Carbon Stocks by Forest Type (million tonnes carbon)

Predominant forest type	Indigenous [1] forest ecosystem carbon	Planted forest ecosystem carbon		Forest ecosystem carbon	Soil carbon [4]
		Indigenous [2]	Exotic [3]		
Conifer	123	0	177	300	
Broadleaf	809	0	na	809	
Mixed	na	0	0	na	
Palm/Bamboo	0	0	0	0	
Other Wooded Land (e.g. scrubland)	528	0	0	528	
Total	**1,460**	**0**	**177**	**1,637**	

Source: Ministry of Agriculture and Forestry and Ministry for the Environment

Notes:
(1) Much of New Zealand's indigenous forests are mixed hardwood and softwood forests. The subdivision of the carbon stored in these forest types is based upon the predominance of either hardwoods or softwoods.
(2) The area in indigenous planted forest is insignificant.
(3) 97 % of the planted forest area in New Zealand are conifers. Because no breakdown of the carbon stored in broadleaf exotic forests is available all carbon has been assumed to be stored in conifer forests for the purposes of this table.
(4) Not currently available.

5.b: Forest Contribution to the Carbon Budget

DESCRIPTION

Indicator 5.b: Contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon (standing biomass, woody debris, peat and soil carbon).

RATIONALE

This indicator seeks to assess the change in total forest ecosystem carbon stocks with time and to quantify, at the national level, whether forest ecosystems are sinks or sources of carbon.

2003 COUNTRY REPORT

What is Measured

Planted Forests

Under IPCC guidelines, this category covers total emissions and removals from changes in forest and other woody biomass stocks, forest and grassland conversion, and the abandonment of managed lands. In New Zealand, because the area of planted forest is increasing and the planted forest estate contains a large number of trees that have yet to reach maturity, the national planted forest estate is absorbing carbon from the atmosphere and so is a carbon sink. On-site burning and forest and grassland conversion result in some emissions of carbon dioxide, but these are small in magnitude compared with the sinks, and are netted into the "land use change and forestry" sink figure, reported as negative emissions in Table 14.

Table 14: Carbon dioxide (CO_2) and other greenhouse gas removals and emissions from land use changes and forests (Gg)

	1990	1995	1996	1997	1998	1999	2000
CO_2 removals[1, 2]	-22,199	-17,916	-18,460	-19,902	-21,669	-23,245	-25,126
CO_2 emissions[3]	669	1,753	1,930	1,732	773	1,127	1,611
Total CO_2 removals[1]	-21,530	-16,163	-16,530	-18,170	-20,896	-22,118	-23,515
CH_4 emissions	4.23	6.12	6.92	7.52	6.03	5.68	4.61
N_2O emissions	0.03	0.04	0.04	0.05	0.04	0.04	0.03
NO_x emissions	1.05	1.52	1.71	1.87	1.50	1.41	1.15
CO emissions	37	54	60	66	53	50	40

Source: Ministry for the Environment

Notes:
1. As per IPCC guidelines, removals are reported as a negative emission.
2. Based on gross growth in planted forests less harvest from planted and indigenous forests.
3. Includes emissions from scrub clearance, wildfires and prescribed burning of forest and scrub.

Currently the IPCC methodology assumes that emissions of CO_2 occur at the time of harvest. This is an obvious simplification. Although a large proportion of carbon is emitted shortly after harvest from on-site slash and short-lived products, where harvested wood ends up in long-lived wood products the carbon may remain in storage for long periods of time. Therefore, New Zealand's inventory of CO_2 removals by planted forests includes the potential emissions from harvest, as opposed to actual emissions in New Zealand

Major planting of exotic forests began in the 1920s. The area of annual planting has fluctuated widely since then. New Zealand has good records of commercial forest planting. Planting is 90 percent one species (radiata pine). Research in forestry (particularly by the government body, the Forest Research) has been well developed, over many years. Using this research New Zealand has developed methodology (Hollinger et al, 1993, Wakelin and Te Morenga, 1996) to quantify carbon sequestration by planted forests based on calculating a "carbon inventory" at two points in time and identifying the difference. This difference represents the net sequestration or emission of carbon for this period.

The estimation of the total amount of carbon dioxide sequestered by New Zealand forests in any one year takes into account:

- the amount of carbon sequestered by planted forests;
- the amount of carbon lost through the harvesting of planted forests;
- carbon lost through the logging of indigenous forests;
- carbon lost through the clearance of scrublands for forest planting;
- carbon lost through forest and scrubland wildfires and prescribed burning.

Indigenous Forests

Government funding has been made available for monitoring carbon stocks in indigenous forests, scrublands and soils. The monitoring system makes use of satellite imagery and a national network of forest and scrub plots as outlined in the introduction to Criterion 5.

Soil Carbon

No reliable estimates are currently available for changes in soil carbon owing to land use changes. Work is underway to develop and implement a carbon monitoring system for New Zealand soils, and a component of this programme is the soil sampling undertaken in the indigenous forest and scrub carbon monitoring plots.

Factual Information

Planted Forests

Annual sequestration net of harvesting fluctuates owing to the uneven age structure of the forests and year-to-year fluctuations in the rate of harvesting. Using a three-year rolling average, it was estimated that 6.3 million tonnes of carbon were sequestered in 1990. This has

remained reasonably static since 1990. In the year ending March 2002 6.5 million tonnes of carbon were sequestered (three-year rolling average).

Across the entire planted forest estate annual sequestration is expected to decline over the next decade owing to forecast increases in harvesting as larger areas of the planted forest estate reach maturity. By 2010, annual sequestration (net of harvesting) is projected to decline to three million tonnes of carbon. However, the total carbon stock in the planted forest estate is projected to continue to increase from 114 million tonnes of carbon in 1990 to 221 million tonnes of carbon by 2010.

As at 2002 New Zealand had 620,000 hectares of forests planted after 1 January 1990. Over the 12-year period 1990 to 2002 new planting has averaged a little more than 50,000 hectares per year. Using an assumed future new planting range of between 20,000 and 40,000 hectares per annum it is projected that the post-1990 forests (Kyoto forests) will sequester between 103 million and 124 million tonnes of carbon dioxide in the period 2008 to 2012 (the "first commitment" period).

Carbon dioxide and other greenhouse gas emissions as reported in the Land Use Change and Forestry section of the FCCC annual Greenhouse Gas Inventory are provided in Table 14. The figures given include removals through sequestration by planted forests, emissions at harvest from planted forests and harvest emissions from indigenous forests. Non carbon dioxide greenhouse gas emissions are also reported for wildfires and the burning of scrub for new forest planting.

No estimates are available of the net level of vegetation clearance for land uses other than for planted forest. Reversion to scrubland of marginally economic hill farm land, mainly in the North Island, has been particularly evident since the restructuring of the New Zealand economy in the mid-1980s. During this period the removal of agricultural assistance to farmers fell from an average 25 percent of the value of agricultural production in the period 1979-1986, to 3 percent in 1992. Anecdotal evidence indicates that significantly more land is reverting to scrubland cover than is being cleared of such vegetation.

Indigenous Forests

Estimates of carbon flux from New Zealand's indigenous forests are not available. As reported in Indicator 5.a, a monitoring system is being established to measure carbon stocks in indigenous forests. Successive measurements of carbon stocks will provide the information needed to calculate changes in carbon stocks for New Zealand's indigenous forests. New Zealand's current greenhouse gas inventory does, however, include carbon dioxide and other greenhouse gas emissions from harvesting and wildfires in indigenous forests.

At this stage there is uncertainty as to whether the carbon reservoir in indigenous forests is increasing (i.e. the forest is a sink) or decreasing (i.e. it is a net source of emissions).

It is also possible that the regeneration of vegetation on abandoned agricultural land outweighs losses of carbon in other parts of indigenous forests.

Sources of Information

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5.c: Global Carbon Budget

DESCRIPTION

Indicator 5.c: Contribution of forest products to the global carbon budget.

RATIONALE

Harvested wood releases its carbon at rates dependent upon its method of processing and its end use. Waste wood is usually burned immediately or within a couple of years, paper usually decays in up to five years (although landfilling of paper can result in longer-term storage of the carbon and eventual release as methane or carbon dioxide), and lumber decays in up to 100 or more years. Because of this latter fact, forest harvest (with other forms of forest management) could result in a net uptake of carbon if the stock of wood products increases. This indicator seeks to quantify the contribution that forest products make to a nation's carbon budget.

2003 COUNTRY REPORT

What are we Measuring?

Attempts have been made to measure the contribution of forest products to the global carbon budget, with some limited success. Currently there is no agreed methodology for calculating the carbon pool stored in harvested wood products. New Zealand, through the climate change programme co-ordinated by the Ministry for the Environment, is working internationally on methodology development generally. New Zealand experts are participating in the preparation of the Intergovernmental Panel on Climate Change's *Good Practice Guidance for Land Use, Land Use Change and Forestry.* This will ensure that New Zealand contributes to the development of any international methodology for reporting the changes to the carbon pools stored in harvested wood products.

Good annual statistics on harvest volumes and the production of forest products are available in New Zealand. This information, at a national level, allows New Zealand to calculate a net carbon balance for harvested forest products derived from New Zealand's planted production forests. Limited information is available on the expected lifetime of wood products and on statistics about wood waste that could be used to estimate the contribution to the global carbon budget at any one time. While no data on the carbon status of these products are presently available, a project aimed at assessing the stocks and flows of carbon in forest

products has been worked on by staff from the Forest Research in conjunction with the Ministry for the Environment.

Factual Information

No robust estimate of the carbon stock in harvested wood products is currently available. Several studies on this topic have been undertaken in New Zealand over the last four years. A report commissioned by the New Zealand Forest Industries Council (Ford-Robertson, 1998) estimated the stock of all harvested wood products in New Zealand in 1990 was 16 million tonnes of carbon. This report also projected carbon stored in harvested wood products would rise to 26 million tonnes in 2008 and to 30 million tonnes in 2012. A report commissioned by the Ministry of the Environment (Ford-Robertson, 2001) estimated that carbon stored in harvested wood products was 9.6 million tonnes of carbon in 1990 and 10.8 million tonnes of carbon in 2000.

The differences between the estimates from these two studies are due to the different methodology and assumptions used. When set against the carbon stock stored in planted forests (estimated as 184 million tonnes as at 2002) the carbon stock in harvested wood products is relatively small in size. However, this carbon stock is significant for New Zealand given the high per capita use of wood products.

Sources of Information

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Criterion 6: Socio-Economic Benefits

DESCRIPTION

The maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies.

INTRODUCTION

New Zealand's ability to report on the indicators relating to the socio-economic benefits of forests gained by society is varied. In part, this is reflected in the distinction between the planted forest and indigenous forest estates. Generally, good information is available for production and consumption, and investment in the forestry sector – information derived predominantly from the planted forest estates. Information on recreation and tourism is also available; however, this mainly relates to activities in indigenous forest areas.

Collecting information on the indicators relating to cultural, social and spiritual needs and values is more difficult, with the exception of data on employment, injury statistics and, to a lesser degree, average wage rates. Other social and cultural factors tend to impact regionally and data are less readily available. In addition, there has been less research in these areas undertaken in recent years.

6.1 Production & Consumption

6.1.a: Value & Volume of Wood & Wood Products

DESCRIPTION

Indicator 6.1.a: Value and volume of wood and wood products production, including value added through downstream processing.

RATIONALE

This indicator enables socio-economic benefits to be monitored by identifying trends in value and volume of wood and wood products' production against management objectives.

FOB – Free on Board – refers to the point to which the seller will deliver goods without charge to the buyer; additional freight or other charges connected with transporting or handling the product become the responsibility of the buyer.

2003 COUNTRY REPORT

New Zealand is able to estimate the contribution in terms of value to the economy or to New Zealand's gross domestic product (GDP) through the New Zealand System of National Accounts (NZSNA) production groups: Forestry and Logging; and Wood and Paper Products. The units of value are New Zealand dollars in dollar values of the year concerned or in constant 1995/96 prices. The value added through downstream processing is estimated as the contribution to GDP of production groups Wood and Wood Products, and part (two-thirds) of the value of the Paper, Printing and Publishing group.

For volumes, this indicator measures the physical quantities of output from the forests (roundwood removals); the sawmilling and panel products industries; and the pulp and paper production industries.

Table 15 illustrates the type of data that are available for value estimates. Note that the estimate for the "forestry sector" is made up of the contributions to GDP from the production groups Forestry and Logging; and Wood and Paper Products. Note that Table 15 is in constant 1995/96 prices. This means that changes in the values shown reflect changes in the volume of output rather than price level changes.

A similar table in dollars of the year would reflect the value changes due to both price changes and output quantity changes.

Table 15: GDP Expressed in 1995/96 prices ($ million)

Industry goup	1996	1997	1998	1999	2000	2001
Forestry and Logging	1,201	1,169	1,212	1,188	1,322	1,382
Wood and Paper Products	1,953	2,028	2,043	1,967	2,326	2,317
Total GDP	92,680	95,516	97,284	97,682	102,251	104,975

Source: Statistics New Zealand

For volume estimates several tables can be provided. An example for roundwood removals from New Zealand forests is shown in Table 16.

Table 16: Estimated Roundwood Removals from New Zealand Forests

Year ended 31 March	Natural forest	Planted production forests (units: 000 cubic metres of roundwood)					Total removals
	Total	Saw logs	Pulp logs	Export logs	Other	Total	
1995	**205**	5,310	4,060	4,762	1,846	**15,978**	**16,183**
1996	**130**	5,271	3,757	5,608	1,926	**16,562**	**16,692**
1997	**110**	5,459	3,142	5,469	1,894	**15,964**	**16,074**
1998	**75**	5,810	3,152	5,594	2,074	**16,630**	**16,705**
1999	**125**	5,865	2,971	4,803	2,050	**15,689**	**15,814**
2000	**76**	6,985	3,049	5,806	2,280	**18,120**	**18,196**
2001	**55**	7,220	3,566	6,149	2,483	**19,418**	**19,473**

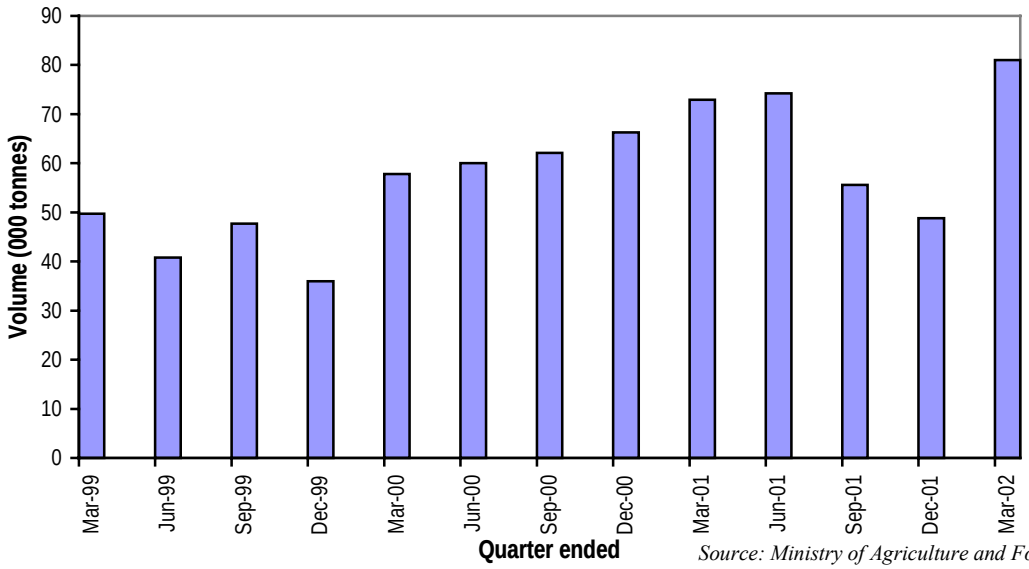
Source: Forestry Statistics Section, Policy Information Group, Ministry of Agriculture and Forestry

Data for annual and quarterly production of various major downstream forestry products are available in the Ministry of Agriculture and Forestry's series of statistical releases. Figure 11 is an example of a graph from this data.

Sources of Information

- The value information (in terms of GDP estimates) is sourced from Statistics New Zealand. Other information is from the Ministry of Agriculture and Forestry.
- The physical volume information is obtained by means of regular statistical surveys undertaken by the Forestry Statistics section of the Ministry of Agriculture and Forestry. The results of these surveys are published in *Statistical Releases* or the *New Zealand Forestry Statistics* publication.

Figure 11: Stocks of Paper and Paperboard



Source: Ministry of Agriculture and Forestry

6.1.b: Non-Wood Forest Products

DESCRIPTION

Indicator 6.1.b: Value and quantities of production of non-wood forest products.

RATIONALE

This indicator monitors socio-economic benefits by determining trends in value and quantities of non-wood products against management objectives. It may include a range of products important to indigenous people, but not those which are better described as cultural, social or spiritual and which are monitored under other indicators.

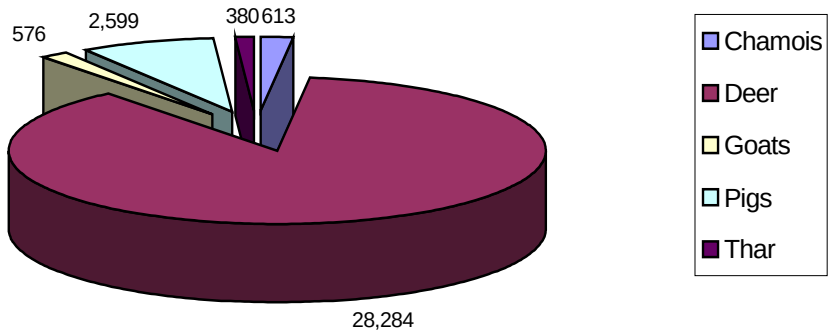
2003 COUNTRY REPORT

New Zealand's indigenous and planted forests are utilised for a range of productive activities that are not directly related to timber extraction or recreational tourism. These non-wood forest products include: feral meat production (goat, pork and venison); the trapping of possums for fur; the gathering of sphagnum moss; honey collection (including honeydew); and trophy hunting. Local researchers are also investigating the opportunities for incorporating secondary (non-timber) crops into the forest environment.

For more than a century, commercial and private hunters have sourced game meat from New Zealand's forested areas. All of the species hunted were introduced to the New Zealand environment, in the decades following European settlement. Red and fallow deer were introduced in the 1860s, while chamois and Himalayan thar were released at the beginning of the 20th century. The Australian possum was introduced in the 1830s as a source of fur pelts but there is now limited processing of its meat, primarily for export. All of these species have become established in New Zealand's forests, and in the case of deer and possums are seen as environmental threats, therefore sustainable management of this resource is not a national objective.

Commercial hunting of these species rose sharply in the 1950s and 60s when the Forest Service established an extensive network of back country tracks and huts, in both

Figure 12: Number of Feral Animals Processed in the February 2002 year



conservation and production forests. This was also the period when export markets for game products (particularly to Western Europe) were being developed. In addition to the game meat market, lucrative markets have been established for the hides and the by-products of deer, such as tails, antlers and sinews. These by-products are generally exported to Asia for traditional medicines and health foods (Wardle, 1984).

The Ministry of Agriculture and Forestry records the number of feral animals that are processed for commercial sale (these figures exclude animals killed for private consumption). The latest figures (February 2002) record that 32,452 feral animals were processed, of which 87 percent were deer. The volume of feral deer processed in recent years has ranged from 800 tonnes (June 2000 year) to 1,500 tonnes (1997). Figures are not published on the number of feral possums processed for human consumption, as there is a single meat works involved in this activity[17]. The company (New Zealand Exotic Game Meats) reports that there is strong demand for possum meat (marketed as Kiwi Bear) throughout Asia, as it is a low-cholesterol product.

A market is also being developed for possum pet food (branded as Poss Yum). The initial shipments to Singapore and South Korea have been favourably received. All the possum meat for these markets is sourced from the forestry estate.

Possums were traditionally farmed but as a result of escapes are now regarded as pests and are hunted for their pelts. The returns from this commodity have fluctuated over time, owing to changes in fashion trends. As a consequence of this, harvest levels have also varied from year to year. In peak years, the harvest has exceeded three million skins[18] while in low return years, it has fallen below 500,000. After a depressed period in the late 1980s and early 90s, harvest levels are again rising. The current rise in demand partially reflects a move to further processing within New Zealand and a recent advance in yarn manufacturing that enables possum and merino fibre to be blended. The blended product is a light, warm yarn that is gaining wide market acceptance.

Local entrepreneurs have used New Zealand's image as a hunting destination to develop a sizeable game estate and trophy industry. Forest and hill country blocks have been fenced off

[17] The Ministry of Agriculture and Forestry is not permitted to release production figures, where they can identify individual companies.
[18] The feral possum population is estimated at between 70 and 80 million.

and feral deer numbers allowed to increase. The developing game estate industry is estimated to be worth $15 million annually (Earl, 2001), and in the June 2000 year, 2,280 international visitors were estimated to have participated in hunting and shooting activities (Tourism New Zealand, 2000).

In addition to feral game, New Zealand's forests play an important role in the domestic honey and beekeeping industry. New Zealand's beekeepers utilise a range of flowering indigenous and introduced tree species as sources of pollen and nectar. Three of the principal monofloral honeys are manuka (*Leptospermum scoparium*), southern rata (*Metrosideros umbellata*) and tawari (*Ixerba brexiodes*). Manuka honey is particularly favoured as it contains a number of natural compounds with strong antibacterial properties.

Beekeepers also extract honeydew nectar from two species of scale insects that inhabit the bark of beech trees, principally black beech (*Nothofagus solandri*) and red beech (*Nothofagus fusca*). Honeydew is a premium export honey, which is sold primarily to Europe, with the main market being Germany. Total honey production[19] for the July 2000 year was 9,144 tonnes, of which 2,528 tonnes were exported. In addition to honey, there are significant exports of beeswax and live bees.

Apiarists frequently move their hives into forested areas or locate them on the bush line in early spring, so they can access nutrients from the bush. Indigenous forests provide the hives with an early season nectar flow that is critical for building up bee populations. Without this ability to build up hive strength, apiarists would have difficulty in supplying the number of hives required for horticultural pollination.

Another significant activity, in economic terms, has been the collection of sphagnum moss. The moss is collected primarily from the wetlands within forests and bush lands of the West Coast of the South Island. This commodity is collected under licence from lands administered by the Department of Conservation, as well as from private forest holdings. The main variety of moss collected has been *Sphagnum cristatum*. This variety is utilised as it is highly absorbent (holds more than 20 times its own weight in water) and is a naturally sterile substance. Local companies have developed strong export markets for this product in Japan and South East Asia, where the principal users are orchid growers. Upwards of 80 percent of the harvest is exported. Exports during the 1990s have varied between $13 million and $18 million per annum.

The indigenous Māori population has traditionally utilised a number of forest plant species for medicinal purposes. These species include:

- karamu – The leaves are boiled down for an extract that is good for the urinary system.
- koromiko – The leaf ends are boiled down as a tonic for dysentery and diarrhoea.
- makomako/wineberry – The leaves make a tea that is soothing and cleansing for sore and dusty eyes.
- manuka/tea tree – Used to soothe burns (a sedative) and treat fevers and colds.

In recent years there has been increasing scientific research on these species to determine whether they have commercial applications. Manuka is currently being studied to assess its anti-bacterial properties, while research is underway at Massey University on the seeds and berries of 46 indigenous plants, to determine whether the lipids and fatty acids contained in these plants have benefits as supplements for human food and nutrition.

[19] Honey production figures are not broken down by source (i.e. forest and grasslands).

Research efforts are also underway to extend the range of secondary crops that can be grown within the forest estate. The focus to date has been on edible mycorrhizal mushrooms[20] but research is also underway on crops such as ginseng (*Panax ginseng and P. quinquefolium*). This is a new area of research in New Zealand as indigenous fungi "growing on wood are not generally eaten in this country" (Hood, 1992, p.26), apart from harore (*Armillaria novae-zelandiae*). This work has been led by a Crown research institute (Crop and Food Research) which has had success in inoculating a range of exotic tree species (oaks, hazels and pines) with mycorrhizal mushrooms. Successful inoculations have occurred with Périgord black truffle, Italian white truffle, porcini and saffron milk cap. Initial crops are proving economic and there are opportunities to develop edible mushrooms as a complementary crop in future plantation developments.

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6.1.c: Supply & Consumption of Wood

DESCRIPTION

Indicator 6.1.c: Supply and consumption of wood and wood products, including consumption per capita.

RATIONALE

This indicator provides a measure of the extent to which the supply of wood and wood products meets the needs for domestic consumption**.** A measure of consumption per capita

[20] Mycorrhizal mushrooms are those which live in a symbiotic relationship on and in the roots of suitable host plants.

may reflect the cultural affinity to wood products, the level of disposable income, the price or availability of wood products or the efficacy of conservation, recycling and reuse measures.

2003 COUNTRY REPORT

This indicator can be interpreted as apparent domestic consumption of various wood and wood products. For New Zealand the interpretation is:

Apparent domestic consumption = Production + Imports – Exports (no allowance is made for stock changes).

Consumption per capita = Apparent domestic consumption in the reference period ÷ estimated mean population in the reference period.

Apparent domestic consumption data are available for a range of wood and wood products. This includes roundwood removals; sawn timber; wood pulp; paper and paperboard; and fibreboard.

Likewise, estimated consumption per capita for a range of wood and wood products is also available.

An example of the time series that is available for this indicator is shown in Table 17.

Table 17: Estimated Production, Imports, Exports and Consumption of Roundwood[1]

Year ended 31 March	Mean NZ population (000 capita)	Production	Imports[2,3]	Exports[2,4]	Total apparent consumption	Apparent consumption per 000 capita ($(m^3)r$)
1981	3,147	10,245	272	4,904	**5,613**	1,784
1982	3,161	9,753	348	4,178	**5,923**	1,874
1983	3,190	9,358	351	3,880	**5,829**	1,828
1984	3,231	9,266	422	4,318	**5,370**	1,662
1985	3,259	9,626	568	3,911	**6,283**	1,928
1986	3,273	10,195	656	3,881	**6,970**	2,129
1987	3,282	9,613	766	3,670	**6,709**	2,044
1988	3,310	9,688	566	4,638	**5,616**	1,697
1989	3,318	10,619	557	5,619	**5,557**	1,675
1990	3,337	11,486	625	6,000	**6,111**	1,831
1991	3,373	13,454	642	7,876	**6,220**	1,844
1992	3,488	13,903	691	9,069	**5,525**	1,584
1993	3,524	14,690	1,060	9,816	**5,934**	1,684
1994	3,567	14,871	841	9,016	**6,696**	1,877
1995	3,617	16,183	981	10,332	**6,832**	1,889
1996	3 673	16 692	939	10,673	**6,958**	1,894
1997	3,729	16,074	1,251	11,169	**6,156**	1,651
1998	3,771	16,705	1,320	10,228	**7,797**	2,068
1999	3,799	15,814	1,620	11,074	**6,360**	1,674
2000	3,818	18,196	1,737	12,482	**7,451**	1,952
2001	3 837	19 473	1,608	13,314	**7,767**	2,024

Source: Ministry of Agriculture and Forestry

Notes:
1. No account is taken of changes in stock levels.
2. Imports and exports are for years ended 30 June.
3. Imports do not take account of the use of sawmill residues in the country of origin.
4. Exports are adjusted to net roundwood to account for the use of sawmill residues.
5. This table updates Table D8 of *New Zealand Forestry Statistics 2000*, Ministry of Agriculture and Forestry (Wellington).

Sources of Information

Information compiled by the Forestry Statistics section, Ministry of Forestry, and published in *Statistical Releases* and in *New Zealand Forestry Statistics*.

6.1.d: Value of Wood & Non-Wood Products

DESCRIPTION

Indicator 6.1.d: Value of wood and non-wood products' production as a percentage of GDP.

RATIONALE

This indicator is a measure of the contribution and importance of the forest sector to the national economy.

2003 COUNTRY REPORT

This indicator can be interpreted as the contribution to GDP of the Wood and Wood Products group in the New Zealand System of National Accounts (NZSNA).

It is not possible to isolate out within the NZSNA the contribution to GDP of non-wood products production.

An example of the type of information that is available is in Table 18.

On this basis the contribution to GDP in the year ended 31 March 2001 of the Forestry and Logging group was estimated as 1.3 percent and the Wood and Paper Products group 2.2 percent.

Table 18: Gross Domestic Product by Industry Expressed in 1995/96 Prices

	Year ended 31 March ($ million)						
Production group	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Agriculture	4,550	4,947	5,547	5,526	5,479	5,767	6,019
Fishing	255	281	275	271	273	263	239
Forestry and Logging	1,187	1,201	1,169	1,212	1,188	1,322	1,382
Mining and Quarrying	1,078	1,089	1,398	1,409	1,318	1,241	1,236
Food, Beverage and Tobacco Manufacturing	4,674	4,869	4,932	5,170	4,998	5,096	5,268
Textiles and Apparel Manufacturing	988	945	944	875	857	896	899
Wood and Paper Products Manufacturing	1,983	1,953	2,028	2,043	1,967	2,326	2,317
Printing, Publishing and Recorded Media	1,341	1,404	1,407	1,417	1,335	1,238	1,257
Petroleum, Chemical, Plastics and Rubber Products	1,781	1,776	1,819	1,753	1,766	1,839	2,029
Non-Metallic Mineral Products Manufacturing	586	613	633	679	678	701	657
Metal Product Manufacturing	1,587	1,639	1,666	1,646	1,490	1,614	1,698
Machinery and Equipment Manufacturing	2,165	2,230	2,304	2,334	2,053	2,117	2,181
Furniture and Other Manufacturing	540	512	500	528	499	539	456
Electricity, Gas and Water Supply	2,248	2,367	2,164	2,119	2,152	2,084	2,192
Construction	3,509	3,698	4,030	4,059	3,702	4,160	3,776
Wholesale Trade	7,125	7,316	7,247	7,388	7,519	8,309	8,531
Retail Trade (including motor vehicle repairs)	5,182	5,319	5,364	5,459	5,515	5,809	5,934
Accommodation, Cafes and Restaurants	1,487	1,546	1,589	1,587	1,572	1,656	1,689
Transport and Storage	4,143	4,588	4,652	4,695	4,785	5,056	5,275
Communication Services	2,555	2,940	3,249	3,554	3,977	4,631	5,190
Finance, Insurance	4,590	4,875	5,214	5,476	5,650	5,825	6,004
Property Services	4,580	4,765	4,796	4,806	4,736	4,709	4,644
Ownership of Owner Occupied Dwellings	7,030	7,124	7,147	7,231	7,335	7,464	7,615
Business Services	5,918	6,174	6,510	6,934	7,411	7,371	7,635
Central Govt Admin and Defence	2,985	3,035	3,067	3,028	3,006	2,978	3,058
Local Government Administration	1,196	1,239	1,197	1,196	1,194	1,159	1,117
Education	3,465	3,524	3,604	3,642	3,669	3,726	3,772
Health and Community Services	4,010	4,228	4,417	4,695	4,974	5,261	5,542
Cultural and Recreational Services	1,486	1,548	1,733	1,741	1,763	1,890	2,095
Personal and Other Community Services	968	1,019	1,035	1,050	1,068	1,128	1,162
Unallocated	3,856	3,917	3,880	3,746	3,716	4,194	4,271
Total GDP	**89,000**	**92,680**	**95,516**	**97,284**	**97,682**	**102,251**	**104,975**

Source: Statistics New Zealand

Sources of Information

GDP information is sourced from Statistics New Zealand. The table above also appears in *New Zealand Forestry Statistics 2000* (Ministry of Agriculture and Forestry, Wellington, 2001).

6.1.e: Recycling of Forest Products

DESCRIPTION

Indicator 6.1.e: Degree of recycling of forest products.

RATIONALE

As global demands for forest products increase, there is a growing awareness of the opportunity and need to extend the use of forest products through recycling. This indicator identifies the extent to which recycling and reuse of forest products are occurring and can be linked to conservation of forest resources and reduction in solid waste.

2003 COUNTRY REPORT

There is very limited information available on recycling within the forest sector in New Zealand. The information that is available relates to wastepaper used in pulp and paper production. For example, in the year to March 2001, 191,000 tonnes of wastepaper were used in paper and paperboard production. Some 79,000 tonnes of wastepaper were exported. Based on these figures an estimate of wastepaper recovered in New Zealand in 2001 was 270,000 tonnes.

An increasingly important aspect of recycling is the recycling of wood waste to create bioenergy.

Bioenergy is the conversion of biomass (i.e. plant material) to useful forms of energy, such as the combustion of wood for space heating. It offers significant economic, environmental and social benefits. These include:

- reduced dependence on imported fossil fuels
- reduced energy supply risks
- reduced greenhouse gas emissions
- enhanced opportunity for wealth creation through new industries and enterprises.

Bioenergy already contributes over 6 percent to New Zealand's current primary energy supply in wood processing (25PJ) and domestic space heating (4PJ). Estimates of the technical potential for woody biomass for New Zealand indicate that by 2005 an additional 50PJ/year could be available from increasing volumes of forest residues. In the industrial, commercial and domestic sectors, an additional 50PJ of heat demand is available, which could be based on heat or co-generation solutions. This would represent a total contribution of over 10 percent of consumer energy.

Sources of Information

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6.1.f: Supply & Consumption of Non-Wood Products

DESCRIPTION

6.1.f: The supply and consumption/use of non-wood products.

RATIONALE

This indicator is a measure of the socio-economic benefits derived from supply and consumption of non-wood products.

2003 COUNTRY REPORT

The non-wood forest products harvested from New Zealand's woodlands have been bulk, primary commodities e.g. honey, game meat hides, and possum pelts. Other than honey, these commodities are considered "by-products" of pest control activities. They are generally destined for export markets, rather than the domestic economy[21]. This reliance on the international market has meant that producers have been subject to overseas price conditions and to the consumer trends in key markets, such as the United States and Japan.

This has led to a degree of price volatility for these commodities. In the case of fur and hide production, the returns to commercial operators have varied substantially (even over short timeframes), reflecting changes in international fashion trends (Wardle, 1984, p. 360). This volatility has flowed through to harvesting patterns.

To counter these fluctuating prices, New Zealand companies are moving to differentiate their products, in an effort to create niche export markets. This has included product branding, identifying the unique features of a commodity (i.e. the anti-bacterial properties of manuka honey) and promoting the sustainability of local production, as in the case of sphagnum moss. There has also been an effort to increase local processing of commodities, so that production can be sold as a final product rather than as a raw material.

The commercial harvesting of non-timber forest products has a history dating back more than 80 years[22] in New Zealand. The initial commodities harvested were possum pelts, game hides and honey. The first recorded shipment of possum pelts occurred in 1921. By this stage, the Australian brushtailed possum had been resident in the country for more than 80 years and there were sufficient numbers to justify commercial trapping. The market for pelts has been a highly variable one, as it has depended upon overseas trends in the fashion industry, the public view of fur products (which has generally been negative in recent decades) and the preference of international buyers[23].

This variability in demand has flowed through to harvest volumes. During periods of depressed pelt prices, the quantity of skins exported has fallen below 500,000, while in peak years (when returns are sufficient to provide a reasonable living for trappers) it has exceeded three million. The volumes exported over recent decades are only a fraction of the potential harvest volume. The brushtailed possum population is estimated at 70 million (Ritchie, 2000) and is classified as a noxious pest. The Department of Conservation, the Animal Health Board and the agricultural sector fund extensive control programmes to manage their numbers.

The nature of the fur industry is changing with increased local processing of pelts and a recent advance in yarn manufacturing that has enabled possum and merino fibre to be blended. This new fibre is being used in a range of high-quality fashion garments and is gaining wide market acceptance. These domestic developments are taking a small but increasing proportion of possum pelts. In addition to their pelts, there have been recent initiatives to utilise the meat

[21] The majority of New Zealand's honey production is sold upon the domestic market, although overseas markets have been developed for a number of speciality honeys (including honeydew).
[22] The forest estate was utilised prior to this as a food gathering source, by the Maori and early settler populations.
[23] The principal markets for possum fur and skins have been the United States, the United Kingdom and the European Union.

of the possum, as discussed in Indicator 6.1.b[24]. Possum meat is branded as Kiwi Bear and is well received in Asian markets, owing to its low cholesterol content.

Another longstanding use of New Zealand's forests has been as a source of nectar, honeydew and pollen for the country's commercial beekeepers. Forested areas are used both in the production of honey and in the wintering over of hives, as described in Indicator 2.1.e. The majority of New Zealand's honey production (which has varied between 7,086 and 11,819 tonnes in the last decade) is consumed within the country, with exports over this period ranging from 20 percent to 35 percent of the total crop.

The New Zealand beekeeping industry has attempted to differentiate its product by marketing a range of mono-floral honeys. A number of these branded honeys are derived from the forest estate (manuka, southern rata and tawari). The industry is marketing the distinctive flavours of these honeys; and in the case of manuka, its natural antibacterial properties. Demand (both domestically and overseas) is building for these branded honeys, in particular manuka. The supply of manuka honey is increasing but there are difficulties in accessing remoter sites (which makes expansion marginal) and there are also concerns about how increased hive densities could affect the pollen sources for indigenous fauna.

An important element of the export honey trade is honeydew nectar[25]. The principal markets for this product are Germany and United Kingdom, which take the majority of domestic production. Honeydew is viewed as a premium honey product in Europe (owing to its sugar profile) and there is strengthening demand for this commodity. There is potential to increase the supply of honeydew from New Zealand's beech forests but apiarists are constrained by the factors outlined in the previous paragraph.

The hunting of game animals developed as a commercial industry in the 1930s[26], with the removal of the legal protections on deer. Initially, they were hunted for their hides, which were mainly exported to the United States and Unite Kingdom for use in boot, shoe and bag manufacturing. Feral meat exports (principally venison) were slower to develop, with regular shipments only commencing in the late 1950s. The principal markets for feral meat have been Germany, the Netherlands and the United States. The volume of feral venison exported rose sharply during the 1960s and peaked in the 1971/72 season at 4,387 tonnes (Wardle, 1984). The volume has since declined, owing to a substantial reduction in the wild deer population and the shift to farm-raised venison.

Feral venison production in recent years has varied between 800 tonnes (June 2000 year) and 1,515 tonnes (June 1997 year). These figures exclude the feral meat taken for private consumption. The increasing demand in Europe and North America for New Zealand venison is being met by farmed rather than feral venison. The Ministry of Agriculture and Forestry forecasts that 32,150 tonnes of farmed venison will be processed in the June 2002 year. A number of by-products from game animals are also sold commercially, mainly for medicinal remedies and health foods (tails, velvet and sinews). The markets for these products are mainly in Asia and the returns have been volatile (particularly for velvet), as the markets are limited and can be over-supplied.

An important commodity from the forests and bush lands of the West Coast of the South Island is sphagnum moss, primarily the variety *Sphagnum cristatum*. This industry is export focused, with more than 80 percent of the harvest supplied to overseas customers. The

[24] There are only limited areas of the country where the meat can be sourced, owing to the presence of tuberculosis in a number of the regional possum populations.
[25] Honeydew nectar is derived from two species of scale insects that inhabit beech trees.
[26] The Department of Internal Affairs lifted the protections on deer in 1930 and in the following year, it established a Deer Control Section.

premium grade moss is supplied to orchid growers in Japan and South East Asia, while the lower grades are used in hanging baskets. Sphagnum moss is also finding a market in sanitary products, as it is a naturally sterile substance. The yearly exports of sphagnum moss ranged from $13 million to $18 million during the 1990s.

The market for moss products is a competitive one and local producers have worked to create a distinctive image for New Zealand's production. This has been based upon the sustainable management techniques they use during harvesting and the rejuvenation of the resource (these techniques are discussed in Indicator 2.1.e). There is limited potential for bringing new areas into production, as the remaining resource sites are generally within the conservation estate.

Looking to the future, research trials are underway on integrating secondary (non-timber) crops into exotic plantations. The focus of this research is on edible mycorrhizal mushrooms. The varieties under examination are high value crops with developed markets. The researchers involved in these trials believe that New Zealand has the potential to become an important supplier in the international mushroom trade. New Zealand has the advantage that it can supply mushrooms in the traditional off-season for the major varieties.

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6.2 Recreation & Tourism

6.2.a: Areas for Recreation & Tourism

DESCRIPTION

Indicator 6.2.a: Area and percentage of forestry land managed for general recreation and tourism, in relation to the total area of forest land.

RATIONALE

This indicator provides information on potential public access to recreational and tourism uses of forests. It also provides a measure of the extent to which forest management programmes recognise the recreational needs of the community.

2003 COUNTRY REPORT

"The opportunity to freely visit forests and coastlines, mountains and rivers, historic sites and attractive landscapes, is a deeply cherished part of the New Zealand way of life" (Department of Conservation, Visitor Strategy, 2000, p. 3).

Public access to the forestry estate, for recreational purposes, is a strongly ingrained notion within New Zealand thinking. Recreational groups have campaigned vigorously to safeguard and enhance the public "right of access" to forested areas. This has traditionally meant the indigenous forestry estate, but in recent decades has come to include planted forests, which are important for passive and active recreation including hunting, mountain biking and educational purposes.

The area of forestry land formally managed for recreation and tourism has grown with the evolution of New Zealand's parks and reserves system. New Zealand's first national park was formed in 1887 (Tongariro National Park – 79,598 hectares) and the latest addition to the estate was made in March 2002 (Rakiura National Park on Steward Island – 157,000 hectares). New Zealand currently has 14 national parks, which cover a combined area of 2.65 million hectares, the majority of which is in indigenous bush and forestry. New Zealand's national parks are managed with the dual roles of preserving natural features and ecosystems and promoting public access to wilderness areas (National Parks Act, 1980, section 4).

National parks are just one component of the parks and reserves system that is managed by the Department of Conservation. The Department maintains 20 conservation parks (formerly known as forest parks) and 3,500 ecological and scientific reserves. Conservation parks cover 1.8 million hectares and reserve areas an additional 1.3 million hectares. In managing this estate, the Department of Conservation is mandated to foster tourism and recreation (Conservation Act, 1987, section 6), as long as there is no degradation of the physical resource.

The Department spends close to 30 percent of its annual budget on recreational facilities and public information. This funding maintains 12,569 kilometres of tracks and walkways, along with 1,725 huts, campsites and amenity areas. In total, the Department manages just over eight million hectares of land, of which 5.2 million hectares comprises indigenous forested areas. The Department has been increasing its forestry estate, with 130,000 hectares added in the 2001/02 year. The latest addition included several ecologically important forests on the West Coast of the South Island.

With these latest additions to the conservation estate, the Department now manages over 80 percent of the indigenous resource (of 6.3 million hectares), and 63 percent of the combined indigenous and exotic forestry resource (of 8.2 million hectares). Nearly all of the Conservation Department estate is managed with the twin goals of preservation and recreation. In addition to this, over 200,000 hectares of privately owned indigenous forest have been voluntarily protected by land owners (through covenants). The covenant system often allows a degree of public access, mainly for educational purposes.

New Zealand's planted forests are not formally managed for recreational purposes but there has been a tradition of allowing public access where it does not impinge upon harvesting

operations or create occupational safety issues. For more than half a century, planted forests have been used by recreational hunters, mainly in search of wild deer and pigs. Most commercial forestry companies now 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).

In New Zealand's larger planted forests tourists will usually find walking, horse riding and mountain biking tracks. There are generally more of these facilities in the former Government-owned forests than in the privately developed planted forests. The companies that have purchased forests planted by the government have normally maintained the facilities and in certain cases shown a commitment to enhancing the facilities. Major forestry companies, such as Carter Holt Harvey, 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.

Planted forests play an important role in regional or local recreational provision, owing to their relatively close proximity to urban and large population centres, e.g. Bottle Lake Forest Park (Christchurch), Whakarewarewa Forest (Rotorua) and forests near Auckland.

Sources of Information

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6.2.b: Tourist Facilities

DESCRIPTION

Indicator 6.2.b: Number and type of facilities available for general recreation and tourism, in relation to population and forest area.

RATIONALE

This indicator provides an assessment of the availability of specific facilities for forest-based recreation. It can infer changes in public recreational preferences, the cost-benefit relationship

of various recreational developments or the priority placed on providing recreational facilities in a country.

2003 COUNTRY REPORT

New Zealand's indigenous forests and alpine areas have been a major drawcard for domestic and international tourists for more than a century. As visitor numbers have grown an extensive system of facilities have been developed to meet their recreational needs. This investment in facilities have been driven largely by government agencies (both central and local government). In recent decades however, the private sector has shown an increasing interest in the development of services.

Two early examples of this investment in forestry-related facilities were the establishment of the Hermitage Hotel, near Mount Cook (1884), to provide a base for guided alpine walks, and the creation of the Milford Track in 1890 (now an internationally renowned walking experience). Successive New Zealand governments have encouraged the creation of walking tracks and related facilities, to enable public access to the conservation estate and to important ecological areas. This philosophy is enshrined in the New Zealand Walkways Act (1990) and the New Zealand Walkways Policy (April 1995), which encourage the development of a national system of walkways, involving both public and private lands. The 1995 Policy also emphasises the need for ancillary services to encourage the public use of walkways.

New Zealand's system of walkways, tracks and camping facilities was progressively developed during the course of the 20th century. The system was given a major boost in the 1950s and 60s, when the Forest Service established an extensive network of back country tracks and huts, in both conservation and production forests. These tracks opened up the backcountry for recreational and commercial hunters, who were drawn by the burgeoning number of feral deer. This was followed in the 1970s and early 80s by a range of government schemes to upgrade tracks and amenities to encourage greater domestic and overseas visitor use of the conservation resource.

The Department of Conservation manages the network of tracks and walkways in the conservation estate, along with the majority of the back country huts and ancillary services. In the year to November 2001, the Department recorded 28 million visitor trips[27] to national parks, forest parks, world heritage areas and reserves. The majority of these visitors were short stop or day visitors, although 3.1 million were recorded as back country comfort seekers and back country adventurers[28]. These numbers indicate that there is a high usage rate of the conservation estate by the New Zealand population, which currently stands at 3,737,277 (March 2001). The infrastructure to support these visitors includes:

- 12,569 kilometres of tracks and walkways, along with 2,131 kilometres of formed roads (the track figure includes 150 walkways on private land)
- 13,690 structures (bridges, boardwalks, platforms and wharves)
- in excess of 13,000 information signs and boards
- over 5,000 historic sites (i.e. early sites of settlement, redoubts from the New Zealand wars, remains of early extractive industries and historic bridges)
- 1,041 back country huts
- 309 campsites (including 74 backcountry sites)
- 375 amenity areas
- 29 visitor information centres.

[27] This figure includes repeat visits (i.e. visitors who have visited a site or range of sites more than once).
[28] Back country comfort seekers are those who utilise the major tracks and seek a low-risk outdoors experience, while back country adventurers are those who want to experience the traditional high country experience (including hunting and fishing).

These facilities are spread throughout the conservation estate of eight million hectares (roughly 30 percent of New Zealand's land area), with a high proportion in the 5.2 million hectares of indigenous forest. The Department has sought to open as much of the estate to recreational users as is practical, and is continuing to explore the development of further tracks and huts.

In addition to these facilities, the Department of Conservation has authorised a considerable number of private operators to undertake tourism activities within the conservation estate. In the June 2001 year, the Department managed 1,134 recreation and tourism concessions. These concessions range from seasonal wilderness tours through to permanent operations, such as lodges and ski fields. The number of concessions has risen sharply in recent years (from 689 concessions in the 1998/99 year) and this interest from the private sector is continuing to grow.

Applications for concessions are judged on how they can enhance the visitor experience to the conservation estate, in particular, whether they will provide facilities that would not otherwise be available. The Department assesses whether the project is in keeping with conservation principles and whether it would compromise the intrinsic natural and heritage values of the area. The Department is also conscious of the accumulative effects of visitor numbers on the conservation resource and on the experience tourists receive (i.e. how the resource and the tourist experience can be degraded through the over-allocation of concessions).

The Department of Conservation and local authorities have worked with private land owners to obtain community access to important areas of indigenous forest, outside of the public estate. As mentioned previously, the Department manages 150 walkways which cross (in part or whole) private property. Land owners with ecologically important tracts of forest have also shown a willingness to protect these areas, through covenants, which often allow a degree of public access.

The main commercial forestry companies in New Zealand have generally supported the use of their forests for recreational purposes, where it can be accommodated within harvesting and silviculture operations. The companies consider that this is part of being a responsible corporate citizen. "We encourage the public to use our forests and allow access to parts of our forests for recreation and educational purposes to the extent that neither our company's operations, forest security nor public safety is compromised" (City Forests, Recreation Statement, 2002).

Within the major commercial forests there are normally a number of walking tracks, amenity areas and information points. In recent years, a number of specialised mountain bike tracks have also been developed, of which the 30 kilometre track in Fletcher Challenge Forest's Whakarewarewa Forest (near Rotorua) is one of the most well known, both to domestic and international visitors. The majority of companies also operate permit systems, which allow access to specified forestry blocks, primarily for hunting.

Planted forests also serve to accommodate recreational activities that may be less appropriate to the conservation estate, e.g. war games, motorised sports, etc.

Sources of Information

- AA Guides, New Zealand Walking Tracks (www.aaguides.co.nz/walking.html).
- Department of Conservation, Annual Visitor Estimates.
- Department of Conservation, Annual Report for the Year Ended 30 June 2001.
- Department of Conservation, Statement of Intent, 2001-2004.

- Department of Conservation, Visitor Strategy, 1996.
- City Forests, Recreation Statement (www.cityforests.co.nz/).
- Fletcher Challenge Forests, Environment Policy. (www.fcf.co.nz/).
- Wenita Forest Products, Management Plan (www.wenita.co.nz/mgmtplan.html).
- Richardson, B., Barnard, T., Brockerhoff, E., and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

6.2.c: Number of Visitors

DESCRIPTION

6.2.c: Number of visitor days attributed to recreation and tourism, in relation to population and forest area.

RATIONALE

This indicator provides a useful measure of the overall amount of recreation and tourism use and suggests the amount of demand. Number of visits per annum is a key variable in determining the potential pressure of visitors and, within management constraints, the sustainability of forest recreation and tourism.

2003 COUNTRY REPORT

The Department of Conservation has an ongoing programme of monitoring visitor numbers to the conservation estate, to assess the pressure on natural resources and to plan for future demand. In the year ending November 2001, the Department estimated that there were slightly over 28 million visits to national parks, conservation parks, reserves and world heritage areas[29]. When set against New Zealand's total population of 3.7 million (March 2001) and international visitor numbers of 1.7 million (June 2001), this represents a high rate of usage by the resident and visitor population.

The Departmental figures are for the entire conservation estate of eight million hectares. A separate breakdown is not available for the 5.2 million hectares of indigenous forest, as most parks and reserves combine elements of forestry, open grasslands and alpine moraine.

The largest category of visitors (at 12.4 million) was short stop travellers, who utilise the boundaries of conservation areas for a break in their journey. The sites utilised are along the major transport routes and visitors normally spend less than an hour at the location, undertaking passive activities such as picnics and sightseeing. The second largest category consists of day visitors, who were estimated at 11.8 million.

The sites visited range from reserves on the urban fringe to back country tracks that can be walked in a day. Day visitors are generally seeking natural settings for walking and sightseeing. One of the most well known day trips is the Tongariro Crossing in the central North Island. It is a seven to eight hour, high-level walk that is traversed by 50,000 to 70,000 visitors a year.

Overnight visitors to campsites and huts (accessible by vehicle or boat) were estimated to be in the vicinity of 800,000. These visitors are generally seeking a short holiday break in an accessible natural area. This visitor category has a high proportion of family groups, who tend to utilise sites with a wider range of facilities.

[29] This figure includes repeat visitors (i.e. visitors who have visited a site or range of sites more than once).

Table 19: Visitor Numbers (Thousands) to Public Conservation Lands

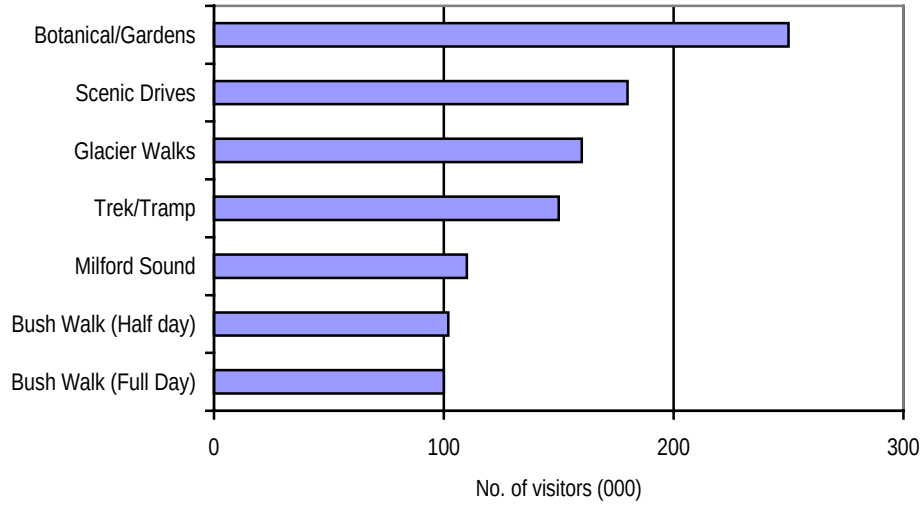
	Year Ending November 2001 (000)
Short Stop Traveller	12,400
Day Visitor	11,800
Overnighter	800
Back Country Comfort Seeker	1,300
Back Country Adventurer	1,800
Remoteness Seeker	28
Total	**28,128**

Source: Department of Conservation, Annual Visitor Estimates

Table 19 shows the three groups who spend an extended time in the conservation estate are the remoteness seekers (28,000), back country adventurers (1,800,000) and back country comfort seekers (1,300,000). They represent only 11 percent of total visitors but they are the principal users of the 1,041 back country huts and 12,569 kilometres of tracks. Their length of stay varies depending upon the activity. The major tracks take between three and six days of tramping (i.e. Routeburn Track – three days, Milford Track – four days and Heaphy Track – four to six days), while hunting and fishing expeditions in the high country frequently exceed seven days.

Back country comfort seekers stay mainly on the well known tracks. They are seeking a low-risk, comfortable experience in the backcountry. This group is frequently new to the back country experience. Back country adventurers are those seeking the traditional high country (or forest) life. They utilise the more remote tracks or work their way through bush. This group includes hunters and those interested in fishing. The remoteness seekers want to experience natural settings, outside of the formal track and hut system. They explore the more remote areas and are prepared to accept the associated risk attached to this form of recreation.

Figure 13: Activities Undertaken by Visitors to New Zealand (year ended June 2001)



Source: Tourism New Zealand International Visitor Survey 2001

Note: The Glacier Walks are undertaken almost exclusively in Westland National Park.

International visitors to New Zealand are also important users of the conservation estate and forested areas. Tourism New Zealand produces figures on the activities undertaken by these visitors, from an international visitor survey. The June 2001 figures record 1,672,677 visitor arrivals and show that international visitors undertook a range of forest-related activities, from

scenic drives in conservation areas through to extended wilderness treks. 10.6 percent of international visitors participated in scenic drives, while 15.2 percent visited botanical sites and ecological reserves[30]. At the more physical end of the spectrum, 9.5 percent of visitors undertook trekking, 6 percent participated in full day walks and a further 6.1 percent took half-day bush walks.

The activity figures show that international travellers tend to visit a few key sites in national parks. These include the Glacier Walks in Westland National Park (9.9 percent of visitors) and the Milford Sound area of Fiordland National Park (6.3 percent). International visitors focus on these sites, as the short duration of their visit limits the number of locations they can cover (in both self-drive and arranged tours). This concentration of international visitor numbers is placing pressure on key areas in the conservation estate. The Department closely monitors these sites and introduces remedial action where necessary. The activity figures also show that 18.6 percent of visitors (311,425) participated in organised sightseeing tours and 53.6 percent (897,009) were involved in general sightseeing. The organised sightseeing tours frequently involve visits to conservation areas (such as remnant stands of indigenous forestry and ecological reserves); while self-drive tourists normally utilise amenity areas in the conservation estate during the course of their sightseeing.

There is currently no systematic recording of tourist numbers utilising the amenity areas and walkways in planted forests. These forests are generally frequented by residents from the immediate vicinity and are used for a range of activities, including bush walking, sightseeing, war gaming and hunting. A number of planted forests are gaining an international reputation for their mountain tracks, such as Naseby Forest in Central Otago and Whakarewarewa Forest in the central North Island. These sites are receiving a growing volume of international tourists but their numbers are still relatively low compared with the established conservation estate forests.

Sources of Information

- AA Guides, New Zealand Walking Tracks (www.aaguides.co.nz/walking.html).
- Department of Conservation, Annual Visitor Estimates.
- Department of Conservation, Annual Report for the Year Ended 30 June 2001.
- Department of Conservation, Statement of Intent, 2001-2004.
- Department of Conservation, Visitor Strategy, 1996.
- Tourism Industry Association of New Zealand (www.tianz.org.nz).
- Tourism New Zealand (www.tourisminfo.govt.nz).

Further Reading

- Richardson, B., Barnard, T., Brockerhoff, E. and Dunningham, A. 2001. *Defining Montreal Process…* Forest Research, Rotorua.

[30] The International Visitor Survey asks respondents to record the range of activities they undertook during their visit. This means that respondents frequently list multiple activities.

6.3 Investment

6.3.a: Value of Investment

DESCRIPTION

Indicator 6.3.a: Value of investment, including investment in forest growing, forest health and management, planted forests, wood processing, recreation and tourism.

RATIONALE

This indicator provides a measure of the short- and long-term commitment to forest management, processing of forest products and other forest uses.

2003 COUNTRY REPORT

For the purposes of this indicator, investment is taken to be the value of the assets owned by the entity or enterprise undertaking the activity described. Forest valuation is a complex exercise, and recent work by the New Zealand Institute of Forestry has attempted to set guidelines and reporting standards for forest valuation. Investment in developing a planted production forest may be viewed as similar to investing in an annuity in that, once harvesting commences, the revenue stream from this can be thought of as return on the capital.

In principle the indigenous forests could be ascribed a value, but for the purposes of this indicator this is not regarded as an investment valuation. Hence this indicator, in the New Zealand context, is regarded as applying only to the planted production forests and to wood processing. Work could be undertaken on the valuation of the infrastructure in place for recreation and tourism purposes, but no recent studies have been done on this.

If this indicator is taken to be the total assets owned by enterprises, some limited information is available from the business activity statistics published by Statistics New Zealand. For example, total assets held by enterprises in ANZSIC group A030 (Forestry and Logging) for the latest available Annual Enterprise Survey (AES) 2000 year (which covers the period 1 October 1999 to 30 September 2000) were valued at $13.0 billion. This can be interpreted as the total investment by enterprises engaged in owning and managing forests, forest nurseries, felling logs, etc. This information is obtained from the financial accounts of the businesses concerned and will reflect the methods used by these businesses in valuing their assets.

In a similar way, the total assets owned by enterprises engaged in Log Sawmilling, Timber Dressing and Other Wood Product Manufacturing (ANZSIC groups C231 and C232) in the AES 2000 year were valued as $2.6 billion.

Indicators of commitment to future development include new planting intentions, intentions to carry out pruning, and investment intentions in wood processing.

In the year 2000, the Ministry of Agriculture and Forestry carried out a survey of new planting intentions out to 2010. This showed a range of intentions, depending on circumstances, of between approximately 20,000 hectares and 60,000 hectares per year. Recent analysis of trends (Ministry of Agriculture and Forestry 2002 pers. comm.) indicate the long-run average may be around 30,000 to 35,000 hectares per year.

Pruning of radiata pine normally occurs in the 6 to 10 year age class. Intentions to prune are gauged through the National Exotic Forest Description (NEFD) surveys. The latest (as at

April 2001) indicates that of the 359,000 hectares in that age class, almost 62 percent will be pruned some time in the following five years.

The Ministry of Agriculture and Forestry measures wood processing investment intentions by monitoring publicly announced intentions. As at July 2002 investment intentions for the seven-year period 2003 to 2009 total over $345 million compared with $1.3 billion in the previous seven years.

Sources of Information

- Statistics New Zealand – Business Activity Survey.
- *A National Exotic Forest Description as at 1 April 2001* (Ministry of Agriculture and Forestry, Wellington, 2001). Online at www.maf.govt.nz/forestry/publications/index.htm.

Further Reading

- Brown, C. and Ortiz, G. (2001), *The Forest Processing Environment,* Report prepared for the Ministry of Agriculture and Forestry, Forest Research.

6.3.b: Research, Development & Education

DESCRIPTION

Indicator 6.3.b: Level of expenditure on research and development, and education.

"Research, science and technology are critical to assuring New Zealand's future competitiveness, environmental sustainability and social well-being." (Minister of Research, Science and Technology, 1997).

RATIONALE

Sustainable management of forests requires expenditure in research, development, extension and education if the efficiency and effectiveness of the expenditures are to be maintained in a sustainable manner in the long term.

2003 COUNTRY REPORT

Research and Development

The level of government and private sector expenditure on research and development (R & D) has been climbing steadily over the past decade (in both nominal and real terms). Additional resources are being committed to ensure that New Zealand firms remain competitive on the international scene and have access to innovations that are tailored to local conditions. Without this investment, New Zealand would struggle to improve its standard of living and the environmental health of its land and marine resources.

The principal source of R & D funding is central government, which has allocated $688 million[31] to this sector in the 2002/03 financial year (this includes university research, funded through the education vote). Government research funding is equivalent to 0.63 percent of GDP and represents almost two thirds of all reported R & D expenditure. The contribution by industry is relatively low (by international standards) but has been growing at a solid pace in

[31] This figure is exclusive of Goods and Service Tax (GST).

recent years (Ministry of Research, Science and Technology, 1999, p. 10). The reason for the low business expenditure relates to the size of the New Zealand economy and of business units.

With a population fewer than four million people, New Zealand businesses have found it difficult to launch new innovations, as only a small proportion of any market is willing to trial an alternative product[32]. New Zealand is also a nation of small businesses (83 percent of enterprises employ fewer than six people), which means that most firms have a limited capacity for research investment and that there are few businesses capable of funding dedicated research units (Thompson, 2000, p. 2).

The forestry sector differs somewhat from this model, as the industry has a number of medium- to large-scale enterprises, which have the capacity for internal or contract research. The forestry sector also has the advantage of a wider market for trialling products, owing to its strong export focus.

The objectives that the Government is seeking to achieve through its provision of R & D funding include:

- enhancing the capacity of New Zealand businesses to adopt innovations;
- improving the international competitiveness of enterprises;
- protecting the environment through better knowledge of biophysical systems;
- advancing the well-being and inclusiveness of New Zealand society (Minister of Research, Science and Technology, 1997, p. 3).

The agency with primary responsibility for implementing these objectives is the Ministry of Research, Science and Technology (MoRST). The Ministry co-ordinates the allocation of research funding and monitors the effectiveness of this public sector investment, through descriptive and statistical analysis. MoRST distributes its research budget through three funding agencies, the largest of which is the Foundation for Research, Science and Technology (FRST).

The Foundation has a budget allocation of approximately $400 million. Three-quarters of this allocation is classed as Public Good Science and Technology funding (PGST)[33] and is distributed under the headings of Research for Industry; Social Research; Environmental Research; and Māori Knowledge and Development Research. The Foundation also allocates funding via the New Economy Research Fund (NERF) and the Technology New Zealand Scheme. Research institutions, businesses and universities can apply to each of these funds for project financing.

The Foundation has worked closely with key stakeholders to determine how New Zealand's major business sectors should be performing in the future. As part of this process a series of strategic objectives has been prepared, for each industry. The objectives for the wood fibre industry include:

- developing new and improved product lines and processes to maximise the value from timber;
- creating production and processing regimes to achieve greater efficiency gains throughout the value chain (including energy efficiency);
- development of environmentally sustainable and economically viable production and treatment regimes;

[32] Between 5 and 7% of a target market is likely to purchase a new innovation.
[33] This was formerly known as the Public Good Science Fund.

- breeding the next generation of the planted resource – including alternative (non-radiata) species;
- developing new areas of endeavour, based around technologies employed in forest related activities (including electronics, machinery and biofuel production);
- identifying technologically based opportunities for horizontal linkages with other sectors, such as the development of secondary crops and extracting value from waste products;
- determining the influence of the sector's activities on the environment and immediate communities;
- achieving a greater understanding of environmental sustainability and the integration of forestry in multiple land use applications.

(Foundation for Research, Science and Technology, 1999, pp. 5-7)

The Foundation uses these objectives as a guideline when assessing research applications made under the PGST and NERF funding categories.

Table 20: Expenditure on Research and Development (1996 to 2000)

Year	Total public good science funding (1) ($ million)	PGSF forestry allocation (3) ($ million)	Industry investment (2) ($ million)
1999/2000	307.1	25.4 (8.3%)	na
1998/1999	304.0	24.7 (8.2%)	32.6
1997/1998	294.5	24.6 (8.4%)	44.8
1996/1997	266.8	22.7 (8.5%)	36.0

Sources: (1) FRST: Note – excludes Non-Specific Output Funding.
(2) New Zealand Forest Industries Council – survey of members (1999)
(3) Ministry of Agriculture and Forestry
na = not available

The majority of the applications made for timber processing, forest management and plant science research are lodged under the PGST funding classes. The forestry sector has generally received about 8 percent of this funding pool, as is shown in Table 20. The table also highlights that the level of public investment in forestry research has been rising in line with the Government's overall expenditure for this budget area. The Foundation reports that the level of funding for forestry projects in the 2000 to 2002 period is comparable (in percentage terms) with the level recorded in the late 1990s[34].

In recent funding rounds the Foundation has placed an increasing emphasis upon projects that increase our knowledge of forest ecosystems, the maintenance of soils under production forests, biosecurity and forest health. A selection of the projects approved in the 2001 to 2002 funding round is outlined below:

- maintenance of soil quality and productive capacity of forest sites (Forest Research – $1,179,000);
- forestry and Society (Forest Research – $202,000);
- floras of New Zealand (Landcare Research – $351,300);
- processes maintaining bio-diversity in landscapes (Landcare Research – $472,000);
- indigenous forestry (Landcare Research – $300,000).

The major slice of the public investment in forest research and a significant proportion of the private expenditure are channelled through a single Crown research institute, Forest Research. In the year to June 2001, Forest Research had total revenues of $40 million, of which FRST

[34] The Foundation has recently altered its funding structure, which precludes a direct comparison between the 2000 to 2002 figures and those of earlier years.

funding contributed $23.5 million. Other institutions involved in the forestry research area are Landcare Research, Industrial Research, Hort Research and a number of universities.

Table 20 also highlights that the forest industry is providing more R & D funding than the Government. Part of this investment is undertaken in-house, but a large proportion is conducted by Crown research institutes (principally Forest Research) and the university sector. In addition to its direct investment, the industry provides a large amount of "in-kind" research investment, through trial blocks and the use of mill equipment (and time) for technical experiments. A recent initiative by one of New Zealand's major forestry companies, Carter Holt Harvey, has been to establish a venture capital fund ($15 million) which is being used to encourage its employees and customers to put forward ideas for new products and production processes. The fund will investigate and, where practical, bring these products onto the market.

The Government, FRST and the forest industry have worked collaboratively over the past two years on the development of an Integrated Research, Science and Technology Strategy for the sector. This work has been undertaken as part of the National Wood Processing Strategy and was completed in July 2001. The Strategy identifies the type of research needed to build the industry and the mechanisms for increasing investment by industry and the Government. The key elements of the strategy include:

- developing better market intelligence, in order to meet consumer needs and opportunities;
- distinguishing between the needs of the existing planted forest resource and the future resource, as they will have different requirements;
- the development of pan-industry research platforms built around key issues such as wood/fibre properties, wood quality, market access and bio-security;
- the identification of different funding mixes for research, depending upon whether the work is classed as "business as usual", "added-value" or "transformation" (i.e. new opportunities, outside the existing business realm).

The Strategy is seen as a blueprint for guiding R and D investment in New Zealand forestry over the medium to long term.

Education

Forestry training covers a broad spectrum in New Zealand, from silviculture and harvesting techniques through to timber machining, fibre science and product marketing. Some of these skills are taught throughout New Zealand (e.g. harvesting techniques) but for more specialised activities, such as fibre analysis, training courses are held in only one or two locations. The institutions providing forestry training include four of New Zealand's universities, the majority of the polytechnics, a number of industry bodies and a range of private institutions. Skill New Zealand[35] monitors the number of trainees in forestry courses and has provided the following breakdown of students, as at 31 December 2001:

- 8,155 forest industry trainees (3,229 in wood processing[36]);
- 299 forestry modern apprenticeships (63 in wood processing);
- 275 training opportunities forestry trainees;
- 198 youth training forestry trainees;
- 33 skill enhancement forestry trainees.

The majority of the 8,155 trainees who are undertaking skill and professional courses are doing so while still in full employment. This is being achieved through increasing use of on-

[35] Skill New Zealand is a Crown Agency that assists in adult learning and in bringing education into the workplace.
[36] Wood processing includes: solid wood processing, timber machining, wood panel manufacturing, wood product manufacturing, saw doctoring, energy and chemical plant operation, tissue converting and pulp and paper.

site training programmes. Employers are developing programmes in conjunction with Forest Industries Training (FIT) and with the New Zealand Qualifications Authority. This workplace training is normally supplemented by technical block courses. A major provider of these intensive, short courses is the Waiariki Institute of Technology, based in Rotorua. The growth in on-site training programmes is progressively improving the skill base of workers within the industry. In addition to this, they are leading to an improvement in workplace practices.

The major training providers and the range of courses they offer are summarised in Table 21. The principal university involved in forestry training is the University of Canterbury, which has a dedicated School of Forestry, offering degree courses through to doctoral level. The School of Forestry offers courses in forestry science, management and engineering. Three other universities offer forestry courses ranging from diploma through to master's level (covering pulp and paper technology, forest planning, agro-forestry and industry economics).

A number of New Zealand's polytechnics offer single year silviculture, harvesting and timber machining courses. Trainees can progress from these courses to more specialised training at the Waiariki Institute of Technology and the Nelson Marlborough Institute of Technology. Waiariki provides certificate and national diploma courses in aspects of wood processing and forest harvesting. The Nelson Marlborough Institute offers a national diploma in forest management.

There are also a number of private institutions providing forestry training, normally at the silviculture and harvesting level. These courses are often a stepping stone to further learning (i.e. fulltime and on-site training).

The Government, in partnership with the industry, has recently launched a major initiative to address the skill shortages that are beginning to arise in the sector, owing to the steady increase in harvest volumes. A National Centre of Excellence in Wood Processing Education and Training is to be established in Rotorua. The initial phase of development, costing $2.7 million, will be funded predominantly by central government ($2 million), while the further implementation phase (estimated at $10 million to 12 million) will be funded through a mix of industry and public sources.

Table 21: Principal Providers of Forestry Training Courses

Name of institution	Training courses
Forest Industries Training	FIT creates training programmes that match the needs of employers and employees. FIT also organises the delivery of training, both on and off the job-site.
Lincoln University	Bachelor of Commerce (Forestry) Master of Applied Science (Agro-forestry)
Nelson Marlborough Institute of Technology	Certificate in Forest Silviculture and Certificate in Forest Harvesting National Diploma in Forestry (Forest Management)
University of Auckland	Diploma in Pulp and Paper Technology (undertaken in partnership with the Pulp and Paper Research Organisation)
University of Canterbury (School of Forestry)	Bachelor of Forestry Science and Bachelor of Engineering (Forestry) Master of Forestry Science, PhD
University of Waikato	Bachelor of Science (Technology) – a forestry option is included within this degree
Waiariki Institute of Technology	Forestry: Certificate in Log Making; Certificate in Advanced Practical Logging; Certificate in Forest Harvesting and National Diploma in Forestry (Forest Management) Wood Processing: Certificate in Solid Wood Processing; Certificate in Saw Doctoring; Certificate in Wood Mouldings and Re-manufacturing; Certificate in Timber Machining; Certificate in Timber Grading and National Diploma in Wood Processing Technology

The training providers involved in the Centre are the University of Auckland, Waiariki Institute of Technology and the Forest Industries Training Education Council. The University of Auckland will establish a Bachelor of Engineering in Wood Processing, to be followed by a Master's programme, while the Waiariki Institute is developing a National Diploma in Wood Processing (Level 6). This initiative is intended to meet the growing industry demand for engineers and skilled plant technicians.

Sources of Information

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- Foundation for Research, Science and Technology (www.frst.govt.nz/research).
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- Kininmonth J.A., (1997), *A History of Forestry Research in New Zealand,* New Zealand Forest Research Institute.

6.3.c: New Technologies

DESCRIPTION

Indicator 6.3.c: Extension and use of new and improved technologies.

RATIONALE

This indicator measures a commitment to continuous improvement in forest management. This indicator is based on the assumption that improvements in forest management are related to the level of effort in seeking out and implementing better methods. Higher values for this indicator demonstrate that major users of the forests are willing to encourage innovation in the way forests are managed and used.

2003 COUNTRY REPORT

"The rapid dissemination of knowledge and the embodiment of technology into solutions that can be readily implemented are important facets of any programme of research" (Foundation for Research, Science and Technology, 1999, p. 7).

New Zealand forestry and processing managers recognise the importance of working with research institutions in the development and adoption of new technologies. It has been these technologies which have enabled the forestry sector to compete on the international stage, despite the extended distances (and transport costs) to our principal markets.

The relationship between the research community and the forestry sector is a close one in New Zealand, as the end users of research are brought into the development programmes, and often participate in the testing process. This ranges from providing input into the project design through to the provision of trial blocks, or allowing the use of plant equipment in tests. This high level of interaction was identified in a Ministry of Research, Science and Technology commissioned study of publicly funded forestry and forest product research programmes, over the 1992/93 to 1996/97 period (Davenport review). "In nearly all cases the research providers indicated that potential users had had some form of input to the work. For nearly a third of the programmes for which information was received, the user link was extensive and covered all three areas of 1) strategy development 2) sharing of research facilities and 3) fully collaborative research" (Davenport, 1998, p. 7).

The Ministry now specifies in its strategic outline for wood-fibre investment that research linkages have to be developed with a range of end users, including individual companies, sector associations and regulatory agencies. The Ministry also requires research organisations to develop specified means of engagement (extension) with the forestry community (particularly small foresters and Māori stakeholders) and with the firms that are likely to be the manufacturers of the new products. Involving the potential users in the development of projects improves the chances of product uptake, as the research programmes are more tailored to business needs and the target companies are familiar with the product or innovation prior to its launch.

The institutions involved in forestry research[37] disseminate their information to the industry using a variety of means. One of the principal methods of exchange has been through the technical reports produced by Forest Research and the other Crown research institutes. These reports outline the basis of the new technologies and processes they have developed. The

[37] The major institutions undertaking research in the forestry area are Forest Research, Hort Research, Industrial Research and Landcare Research.

Davenport review of forestry research programmes found that these reports are used extensively by the industry.

More than half of the survey respondents had obtained research reports in the past five years; and the majority of these companies "indicated that the research reports and manuals had positively affected or had the potential to generate increased sales, market share and efficiency…" (Davenport, 1998, p. 47). They also reported that the information contained in the reports and manuals could not be obtained from other sources (i.e. an overseas source).

In addition to technical reports, the research institutes circulate information sheets, which provide snapshots of recent developments or updates on how projects are progressing. Increasingly, these information sheets are available on the websites of the research institutes, which enables companies to directly download the latest technical information.

The research community also uses field days and seminars to keep the industry informed of research findings and the progress with new products and services. Forest Research holds regular field days based around its trial blocks and it organises presentations to update the industry of developments in its key research areas (i.e. composite wood products, solid wood solutions, forest health developments and the sustainable management of planted forest systems). Industrial Research periodically holds workshops on developments in mill and energy technology. Recent workshops have covered the optimisation of the cutting performance of band saw blades and the progress being made in the development of small-scale energy generation systems (including biomass generation).

In addition to these activities, the research institutions arrange fora for discussing developments in technology and they participate in the key Pacific Rim forestry conferences. A recent development in this area has been the establishment of the Wood Technology Research Centre at the University of Canterbury (a joint initiative by the School of Forestry and the Engineering Department). The Centre was developed as a vehicle for releasing research findings and for convening workshops and conferences on major industry themes.

The uptake of new technology is being encouraged not only by the research community but also by the industry associations. The associations are bringing new developments to the attention of their members, who are generally the end users of these products, and the ones who will be deciding whether to adopt the technology. The associations achieve this through their journals and regular series of seminars and field days. The key associations are the:

- Forest Industry Engineering Association of New Zealand (FIEA);
- New Zealand Farm Forestry Association (NZFFA);
- New Zealand Forest Industries Council;
- New Zealand Forest Nursery Growers' Association;
- New Zealand Forest Owners' Association;
- Forest Industry Contractors' Association;
- New Zealand Pine Remanufacturers' Association.

The work of these associations can be illustrated by looking at the activities of the FIEA and the NZFFA. The FIEA has as its objective the promotion of production, technology, education and research within the solid wood processing sector. To this end, the FIEA holds regional fora and national workshops, where the developers (or promoters) of new technologies are given an opportunity to present their case before a critical audience. Frequently, the Association will bring together the competing technologies in an industry (i.e. kiln technology, log scanning equipment and wood waste systems) to give industry participants a chance to compare their appropriateness for their individual firms.

The NZFFA is the representative organisation for smaller forest growers and seeks to educate owners in the planting, maintenance and use of trees. The regional branches hold field days and seminars, where practical demonstrations of new management and harvesting practices are introduced. The Association also uses its national journal (*New Zealand Tree Grower*) to disseminate research findings on issues ranging from forest health through to alternative tree species. Industry participation in these associations (and their activities) is generally high, meaning that their information activities reach a high proportion of the industry.

Forestry companies are also being introduced to new technologies through consultancy firms, which are engaged to appraise the current business structures of an operation and identify opportunities for the adoption of new processes and technology.

The use of these new technologies is having a measurable impact upon activity within the forestry sector. The review undertaken by Davenport (1998) reported high rates of awareness and use of technical reports, and of new products and services. Of the companies that had adopted these new technologies, the majority indicated that they were experiencing (or expected to experience) increased sales and efficiencies. A significant proportion of these companies also reported that without the adoption of these technologies their performance would have been impaired and their survival less assured.

Another point highlighted by the review was how the adoption of new technology was generally raising the skill level of workers and making companies more aware of technological issues. This increased awareness is likely to make companies more willing to search out and adopt new processes and products in the future.

A further example of the industry's preparedness to adopt new technology can be seen in the increasing use of genetically advanced tree stocks (see Table 22). In 1993, 87 percent of the radiata pine sold in New Zealand for new plantings and re-stocking had a Growth and Form (GF) rating of 19 or less[38]. In the following eight years, as more genetically advanced stock became available (and at a reasonable price), the industry moved to higher grades. The situation for the last planting year is almost a reverse of the 1993 situation. 62 percent of the radiata pine sold in 2001 had a GF rating of over 19, or was produced from cuttings. This trend indicates that the technical information about the growth characteristics of higher-grade stock has been disseminated effectively among New Zealand's corporate planters and the many thousands of private growers.

Table 22: The Growing Use of Higher GF Rated Tree Stocks

	1993 (%)	1995 (%)	1997 (%)	1999 (%)	2001 (%)
Radiata pine – GF 19 and Under	87	78	59	43	38
Radiata pine – GF Greater than 19 Including Cuttings and GF – Plus)	13	22	41	57	62

Source: Ministry of Agriculture and Forestry (Annual Nursery Survey)

Sources of Information

- Davenport, S (1998) *Evaluation of the PGSF's Output Area 5: Forest and Forest Product Industries;* Ministry of Research, Science and Technology – Report No. 88; Wellington.
- Foundation for Research, Science and Technology (1999) *Strategic Portfolio Outline: Wood Fibre-Based Industries;* Foundation for Research, Science and Technology; Wellington.
- Foundation for Research, Science and Technology (www.frst.govt.nz/research).

[38] In 1987 Forest Research introduced the Growth and Form (GF) rating system for radiata pine seed lots, to provide a means of comparing the genetic quality of different seed lots.

- Minister of Research, Science and Technology (1997) *The Government's Policies and Priorities for Public Good Science and Technology;* Ministry of Research, Science and Technology; Wellington.
- Ministry of Research, Science and Technology (1999) *New Zealand Research and Development Statistics 1997/98;* Ministry of Research, Science and Technology – Publication No. 17; Wellington.
- Ministry of Research, Science and Technology (www.morst.govt.nz).
- Technology New Zealand (www.technz.co.nz).
- Thompson, S (2000) *Research and Development in New Zealand: How are we Placed to Become a Knowledge Economy?;* Foundation for Research, Science and Technology; Wellington.

6.3.d: Rates of Return

DESCRIPTION

6.3.d: Rates of return on investment.

RATIONALE

The internal rate of return on investment is an indicator of the financial attractiveness of the forest industry to capital.

2003 COUNTRY REPORT

Discounted cash flow(DCF)analysis

The conventional economic approach to assessing the commercial performance of forestry projects is discounted cash flow analysis. This focuses upon those things that directly affect investors; specifically how much money/resources will be required to establish and manage the project, and how much will be received from the project. Indirect benefits and costs for a forestry project such as watershed protection, recreation potential, changes to water flows and water quality, and impacts on air and noise pollution, are not generally included. These are important considerations in assessing sustainable management.

Discounted cash flow analysis takes account of both the amount and timing of cash flows. The sum of the present values of a series of future cash flows is referred to as the net present value. The choice of discount rate is critical for this analysis and is often the most contentious input.

The discount rate at which discounted costs equal discounted returns is referred to as the internal rate of return (IRR). The highest IRR will give the highest return on investment, but not necessarily the greatest return at maturity.

Table 23: Internal Rates of Return – Planted Forests

	Low	Medium	High
Radiata pine	7.9%	8.9%	12.0%
Douglas-fir	5.2%	6.9%	8.5%
Eucalyptus (Pulp)	3.1%	7.8%	12.0%
Eucalyptus (Sawlog)	N/a	6.6%	N/a

Sources (see below)

Note
1. N/a = not available.
2. Discount rates are 8% in all cases.

Indigenous Forest
Insufficient information exists to establish a reliable range of IRRs for sustainable management for wood production from indigenous forests. Work on establishing commercial returns of sustainable harvesting under section IIIA of the Forests Act is underway. This will eventually assist in estimating IRRs.

Few indigenous forests have been purchased specifically for commercial management. Where such purchases have occurred, the purchase prices are not available.

IRRs for commercial management of indigenous forests will vary widely depending upon the resource size and economies of scale, the species present, the difficulty of access, and the costs of compliance with legislative and planning requirements.

Sources of Information

- Information on planted forest rates of return was derived from:
  - Ministry of Agriculture and Forestry (various internal DCF analysis, 2001/02);
  - DANA. 2002. *The Forest Products Industry Review.* DANA Publishing, Rotorua.
- Information on indigenous forest rates of return is from the Indigenous Forests Unit, Ministry of Agriculture and Forestry.

Further Reading

- Hammond D. (1995) *Forestry Handbook*, New Zealand Institute of Forestry, Christchurch.
- Ministry of Forestry (1993-6) *Zone Study Series*, Wellington.

6.4 Cultural, Social & Spiritual Values

6.4.a: Forests for Cultural, Social & Spiritual Values

DESCRIPTION

Indicator 6.4.a: Area and percent of forest land managed in relation to the total area of forest land to protect the range of cultural, social and spiritual needs and values.

RATIONALE

This indicator measures the amount of forest land placed under the range of tenure classifications and/or management regimes which are specifically designed to protect cultural, social and spiritual values, including land that is formally recognised as being under indigenous tenure.

2003 COUNTRY REPORT

The Department of Conservation administers the majority of publicly owned land in New Zealand that is protected for scenic, scientific, historic and cultural reasons, or set aside for recreational purposes.

The Department of Conservation works with iwi and hapu in almost all aspects of its work. Its national network of 14 Kaupapa Atawhai Managers in each conservancy keeps in close contact with Māori communities.

The Department has a strategy setting out how it will work with Māori. The Kaupapa Atawhai Strategy's vision is "The department, Māori and the community at large are working co-operatively to conserve the natural and historic heritage of New Zealand for present and future generations."

The strategy has eight goals, with the first three relating to the Treaty of Waitangi, as well as biodiversity, cultural heritage, visitor services, public awareness and staff issues.

Section IV of the Conservation Act requires it to be interpreted in a way that gives effect to the principles of the Treaty of Waitangi.

The Department helps negotiate Treaty settlements where they impact on conservation land. Through the Nga Whenua Rahui fund, which the Department services, Māori land owners can be helped in protecting their land of conservation value.

Table 24: Protected Areas Managed by Department of Conservation

Conservation resource type	Area (ha)
National Parks	2,891,391
Reserves	614,571
Conservation Areas	4,235,251
Wildlife Areas	23,572
Protected Private Land	71,744
Total	7,836,529

Source: Department of Conservation

Notes:
National parks include specially protected areas, wilderness areas and other areas not sub-categorised.
Reserves include national, historic, scenic, nature, scientific, wildlife purposes, wilderness areas, marine, faunistic and others not specified, and excludes any reserve with another administering body.
Conservation areas include conservation parks, ecological areas, sanctuary areas, wilderness areas, other specifically protected areas and stewardship lands.
Wildlife areas include refuge, sanctuary, and management reserves. They do not include other Department of Conservation areas, or areas for wildlife purposes administered under the Reserves Act 1977.
Protected private lands include conservation covenants, Nga Rahui Kawenata, protected private land agreements and management agreements.

Conservation non-governmental organisations (NGOs)
New Zealand has many private organisations actively involved in conservation and environmental issues. These vary from local clubs concerned with the protection or restoration of the local environment to national and international groups concerned to preserve the environment for its ecological, scientific, recreational or scenic value.

As an example, the Royal Forest and Bird Protection Society, New Zealand's oldest environmental NGO, owns and manages 35 reserves with a total area of 1,394 hectares.

6.4.b: Non-Consumptive Use

DESCRIPTION

Indicator 6.4.b: Non-consumptive use forest values.

RATIONALE

Non-consumptive "goods" are those that do not lead to the physical taking of products from the forests. They would include recreation, photography, birdwatching, education, and contemplation or meditation.

2003 COUNTRY REPORT

An estimate of the level of participation in outdoor-based recreation in New Zealand can be gained from membership totals of a selection of recreational organisations. Membership figures (Table 25) for some organisations may only represent a fraction of the actual number

Table 25: Membership Figures

Organisation	Approximate membership 2000/01
Nature conservation	
Royal Forest and Bird Protection Society	40,000
Ecologic Foundation	1,700
New Zealand Ornithological Society	1,000
New Zealand Botanical Society	300

of people who participate in an activity informally. Likewise for recreation activities such as bushwalking or picnicking, New Zealand has no means of estimating the actual number of people who participate in these types of activities (see International Visitors Information Survey section below).

Activities that take place in both indigenous and exotic forest, for some of which access permission is required, include:

- picnicking
- bushwalking
- photography
- filming
- camping
- meditation
- community activities
- educational school visits
- wildlife appreciation
- birdwatching

International Visitors Survey

The International Visitors Survey is a face-to-face survey of international visitors to New Zealand and is a continuous ongoing survey, providing quarterly information on visitor trends, including where they go and which activities and attractions they participate in, to assist industry planning and development[39].

In the year ending 30 June 2001, 1.7 million people visited New Zealand. Table 26 shows the number of people who participated in forest and bush-related activities.

Table 26: Visitor Numbers by Activity

Activity	Number of visitors
Trekking/Tramping	158,396
Bush walk – Half Day	102,098
Walk – Full Day	99,816
Visit Botanical Gardens	253,585

Source: New Zealand Tourism Board

Sources of information

- Carter Holt Harvey Forest Resources, Kirsten Mills, Orewa office.
- Ecologic Foundation (www.ecologic.org.nz).
- Federated Mountain clubs.
- New Zealand Botanical Society.
- New Zealand Canoeing Federation.
- New Zealand Mountain Bike Association (nzmba@natcol.ac.nz).
- New Zealand Ornithological Society (www.osnz.org.nz).
- New Zealand Tourism Board (www.tourisminfo.govt.nz).
- Orienteering New Zealand (www.nzorienteering.com).
- Royal Forest and Bird Protection Society of New Zealand (www.forest-bird.org.nz).

[39] Over 5,000 interviews are conducted annually. These are then weighted up to reflect the actual number of visitors departing over the same period.

6.5 Employment & Community Needs

6.5.a: Employment

DESCRIPTION

Indicator 6.5.a: Direct and indirect employment in the forest sector and forest sector employment as a proportion of total employment.

RATIONALE

This indicator measures the contribution of the forest sector in providing employment at national and regional levels. It is a useful measure of community well-being (e.g. livelihood and economic activity).

2003 COUNTRY REPORT

Comprehensive domestic employment statistics are collected regularly by Statistics New Zealand. The reference date is as at mid-February of each year with sample-based statistics for the other three-quarters of the year.

Direct employment in the forest sector is taken to be the numbers of persons engaged in forestry and first-stage processing activities.

Indirect employment is not regularly estimated but can be derived from Input-Output studies of the economy. No recent studies have been undertaken to estimate the employment multipliers generated from the forest sector.

The information available for this indicator is in Table 27.

Table 27: Employment in Forestry and First-stage Processing as at mid-February

ANZSIC code	Description of activity	1998	1999	2000	2001	% change 2000 to 2001
A030100	Forestry	2,520	2,070	1,860	1,620	-12.9
A030200	Logging	3,740	3,620	4,050	4,710	16.3
A030300	Services to Forestry	2,620	2,680	3,380	3,700	9.5
C231100	Log Sawmilling	6,630	6,160	7,080	7,420	4.8
C231200	Wood Chipping	100	100	140	35	-75.0
C231300	Timber Resawing and Dressing	1,350	1,220	1,380	1,450	5.1
C232100	Plywood and Veneer Manufacturing	1,800	1,690	1,980	1,970	-0.5
C232200	Fabricated Wood Manufacture	710	720	820	970	18.3
C233100	Pulp, Paper and Paperboard Manufacturing	3,230	3,100	2,880	2,440	-15.3
	Forestry and First-Stage processing	**22,700**	**21,360**	**23,570**	**24,315**	**3.2**
Total Labour Force as at March quarter		**1,872,400**	**1,882,800**	**1,892,100**	**1,915,400**	**1.2**

Source: Statistics New Zealand

Forestry and first-stage processing as a proportion of total New Zealand employment as at mid-February 2001 can thus be estimated as being 1.3 percent of the total labour force.

Source of Information

- The source for this information is Statistics New Zealand.

Further Reading

- Le Heron R.B., Pawson E. and Britten S. (eds), (1996) *Changing Places in New Zealand – A Geography of Restructuring,* New Zealand Geographical Society, Christchurch (Ch5 pp 92-124).
- Fairweather J.R., Mayell P.J. and Swaffield S.R. (2000) *A Comparison of the Employment Generated by Forestry and Agriculture in New Zealand,* AERU, Lincoln University.

6.5.b: Wages & Injuries

DESCRIPTION

Indicator 6.5.b: Average wage rates and injury rates in major employment categories within the forest sector.

RATIONALE

This indicator measures forest sector wage rates and injury rates because they reflect workforce health and welfare. A sustainable industry will ensure high levels of workforce health and welfare and wage rates comparable with other rural industries. Comparison of wages in wood and wood product industries with wages in similar occupations in the region gives an indication of the economic benefits of income security derived by communities. Decreasing injury rates in the forest sector reflect improved occupational health and safety and employment quality from which social benefits for the community may be derived.

Table 28: Average Total Weekly Earnings for Selected ANZSIC Groups

	Standard ANZSIC industry groups $ per week		
Quarter	Forestry and Logging	Wood Processing and Wood Products Manufacture	Paper and Paper Products
August 1999	827.32	619.59	856.97
November 1999	735.88	621.95	926.86
February 2000	740.88	617.28	941.79
May 2000	731.50	614.01	940.08
August 2000	734.00	616.55	927.10
November 2000	753.15	637.58	925.45
February 2001	739.34	645.35	951.14
May 2001	732.09	644.73	996.73
August 2001	757.99	651.13	947.44
November 2001	727.97	663.53	917.26

Source: Statistics New Zealand, Quarterly Employment Survey

2003 COUNTRY REPORT

Wage Rates

Average total weekly earnings data for selected industrial activity groups are collected quarterly across the New Zealand economy. This can be taken as an indicator of average wage rates in major employment categories within the forest sector.

The data are not of occupations.

An example of the type of information that is available is in Table 28.

Injury Statistics

There are two sources of injury statistics for the forest sector: Accident Corporation (ACC) and Occupational Safety and Health (OSH) – a branch of the Department of Labour.

A recent OSH report (March 2002 OSH pers. comm.) on injuries to forestry workers showed that one in 48 forest industry employees had an accident resulting in an injury claim to the ACC in 2000/01, down from one in 33 the previous year.

Commercial forestry, especially harvesting, has a high fatality rate. In the period 1991/92 to 2000/01 there were 57 fatalities in tree felling operations, compared with 62 in the 1981/82 to 1990/91 period.

The statistics show that injuries and fatalities in the forestry sector are the highest amongst all employment statistical groupings, including agricultural and construction industries.

OSH's primary focus in helping to make forestry a safer occupation is to focus on employers' health and safety management systems, particularly on the training and supervision of new employees in high-risk forestry operations.

Current codes (usually known as "bush codes") and guidelines continue to be improved and new codes are being developed by OSH to establish best practices.

Sources of Information

- Statistics New Zealand: *Quarterly Employment Survey*.
- Occupational Safety and Health Service.
- The Centre for Human Factors and Ergonomics (COHFE), Forest Research, (www.forestresearch.co.nz).

Further Reading

- Tomlinson C.J., Fairweather J.R. and Swaffield S.R. (2000) *An Analysis of Impediments to Forest Sector Development – Gisborne/East Coast Field Research to Land Use Change,* Agribusiness and Economics Research Unit, Lincoln University, New Zealand, Research Report No.249 (Chapter 4).
- COHFE (2001) *Annual Summary Report 2001: Logging*, Forest Research, Volume 3, No.4.
- COHFE (2001) *Annual Summary Report 2001: Silviculture,* Forest Research, Volume 3, No.2.

6.5.c: Forest-Dependent Communities

DESCRIPTION

Indicator 6.5.c: Viability and adaptability to changing economic conditions, of forest-dependent communities, including indigenous communities.

RATIONALE

This indicator provides a measure of the extent to which communities are able to respond and adapt to economic change successfully. It should take into account that use of forests provides or improves access to resources for survival and the maintenance of traditional values and cultural heritage.

2003 COUNTRY REPORT

"… few rural communities in New Zealand are totally dependent on a single resource sector" (Taylor Baines and Associates, 1999, p. 11).

Although the forestry sector is a significant contributor to the New Zealand economy (in both labour and value terms) there are relatively few communities where the population could be classed as being dependent upon this resource for their survival. Community formation in New Zealand has been centred around pastoral production and to a lesser extent, fishing and mining, since the time of European settlement. Timber extraction and sawmilling were important features of early European settlement (with close to 250 mills operating at the turn of the 20th century) but they normally shifted between resource areas as they were exhausted, rather than being permanent fixtures of a community. They were used in the clearance of indigenous bush and the preparation of land for pastoral development.

Māori communities traditionally utilised the forested areas as one of their food gathering sources and they extracted selected trees for settlement construction and canoes (waka). With European settlement, the economic focus of Māori communities shifted to agricultural and horticultural production, while their reliance on forested areas lessened. There is now relatively little use of forested areas for subsistence purposes. Hunting of feral deer, goats and pigs by individuals and families remains a social and recreational activity for a section of the population. There is anecdotal evidence to suggest that hunting in some regions is more than a recreational pastime and may have a role to play in supplementing family needs and income. Communities now utilise the forestry resource primarily for commercial purposes (log extraction and non-timber products).

The number of communities with a high reliance on harvesting, silviculture and timber processing employment is relatively small. This can be seen in recent employment data. In the February 2001 year, 20,620 persons were engaged in forestry and first-stage timber processing, while the total labour force stood at 1,919,400 (March 2001) [40]. The employment figures show that all districts within New Zealand, except the Chatham Islands, had workers engaged in forestry.

The highest levels of participation in forestry employment are found in the Bay of Plenty–East Cape region of the North Island. The 1996[41] census figures for the 11 districts in this area show that nearly 4 percent of the paid workforce[42] was directly employed in forestry and further processing. A breakdown of these districts, by local authority wards, reveals that 39 of the 54 wards (72 percent) had less than 5 percent of their paid workforce in forestry and processing. Only four of the wards had more than 10 percent in this category, with the highest percentage being over 27 percent (Murupara). The wards with the higher rates of forestry employment are those where communities evolved during the 1950s and 60s to meet the labour needs of the central North Island planted forests and their associated processing facilities.

The township of Kawerau (eastern Bay of Plenty) was constructed to house the workforce for an integrated sawmill and pulp and paper facility. Forty years on, Kawerau still depends heavily upon the mill, with 16.5 percent of paid workers in the ward employed in forestry and first- stage processing. Other regions where there are examples of communities with a high reliance on logging and sawmill employment are the West Coast of the South Island and western Southland. In these areas, indigenous logging and milling operations have operated for more than a century and have provided employment for a number of settlements. In the

[40] The employment estimate for forestry and first-stage timber processing is derived from the Statistics New Zealand annual survey of economically active businesses, while the labour force estimate is calculated using the quarterly household labour force survey.
[41] The latest population census was in 2001, but at the time of writing this report detailed analysis of employment by district was not available.
[42] The employment categories included in this assessment are: forestry workers and loggers; hunters and trappers; sawmill and wood panel operators; pulp and paper preparation; and papermaking preparation.

Tuatapere ward of western Southland, employment in forestry and further processing made up 10.3 percent of the paid workforce in 1996, and in the Ahaura ward on the West Coast, the figure was 9.8 percent.

Māori participation in the commercial forestry sector is significant, through both employment and land ownership. At the 1996 census, 22.6 percent of the forestry labour force comprised Māori and a survey of forest owners in 2000 indicated that approximately 14 percent of New Zealand's planted forests (a net stocked area of 238,000 hectares) were sited on Māori-owned land[43].

New Zealand's forestry communities have faced a number of economic and political challenges over the past generation, which have been weathered with varying degrees of success. The key developments in this period have been the:

- phasing out of indigenous logging on the Crown estate and the move to sustainable harvesting practices on private lands;
- corporatisation and subsequent sale of the Crown's exotic forestry resource
- centralisation of public and private services;
- adoption of new technology at all levels of the forestry and timber processing chain;
- restructuring of forestry and processing activity to remain internationally competitive.

The phasing out of indigenous logging from the Crown estate and the requirement for private land owners to harvest on a sustainable basis[44] has seen the indigenous harvest fall. It has gone from 1,042,000 cubic metres of roundwood in 1970 to 76,000 in the March 2000 year (Ministry of Agriculture and Forestry, 2001, pp. 16-17). The decline in indigenous log supplies has led to extensive restructuring within this sector of the industry, leading to job losses and a number of mill closures.

Where mills have been in close proximity to maturing exotic forests there have been opportunities to upgrade plants to process new species. Investors have preferred to convert existing mills to process exotic species than develop "greenfield" plants, as the sites are already designated for industrial activity, which saves considerable time and expense in obtaining planning consents. The move to exotic timber processing has helped to safeguard jobs and in certain cases has been the springboard for expansion, particularly in the area of further processing.

Where mills have not been able to move into exotic processing or secure sufficient supplies of indigenous timber from sustainably managed blocks, there have been redundancies and mill closures. The response of these communities to plant closures, or to the downsizing of operations, has not been uniform, but there have been a number of common themes.

The communities, supported by their district councils[45], have normally undertaken scoping projects to identify alternative employment opportunities for their communities. In the case of the Tuatapere community (referred to previously), the Southland District Council assisted in developing a concept plan for the township, which built on its heritage sites (Houghton et al, 1996, p. 50). As a consequence of this report, community funds were invested in developing a major walking track, which has encouraged investment in accommodation and craft facilities. The Council also supported research into cool climate crops, which has seen the development of new horticultural ventures.

[43] Forestry companies and the State manage the majority of these forests, while Maori directly manage approximately 20,000 hectares.
[44] Sustainable harvesting of indigenous timber from private holdings was introduced through the 1993 amendment to the Forests Act (1949).
[45] This support is frequently through a development board or community trust.

Generally in these plans there has been a strong focus on utilising the historical values of the community and developing tourism activities associated with the natural environment. Communities are also exploring the utilisation of their forested areas for non-timber products, such as honey production, game trophy hunting and wilderness tours. The adjustment communities go through after the closure of a mill can be a difficult one for individuals and families. The skills of silviculture and processing workers are not necessarily compatible with the new initiatives being developed, which has meant that younger workers have frequently migrated in search of new positions, while older employees have taken early retirement or accepted lesser-skilled positions.

For the wider community, the loss of forestry revenue (through wages and service purchasing) has normally lead to a period of economic uncertainty. This persists while new ventures are explored and developed. In the case of tourism bush walks, the planning and development of a track and supporting facilities can take a number of years.

The forestry communities established during the 1950s and 60s to handle the growing volume of planted forest timber have, in recent years, experienced substantial economic restructuring. This has been driven principally by the need for the forestry sector to remain competitive on the international stage against producers with lower labour and infrastructure costs. Retaining New Zealand's competitive advantage is increasingly important, with the national harvest anticipated to increase from 18 to 31.3 million cubic metres over the 2000 to 2010 period. "The major forestry companies and smaller business units have sought to maintain their profitability by investing in more capital-intensive technology, reorganising their work practices, and reducing the size of their workforces" (McClintock and Taylor, 1999, p. 31).

The drive for cost efficiency can be seen in both processing and forest management. The Kinleith pulp and paper mill has progressively reduced its labour force from over 2,500 in the early 1980s to 772[46], through capital replacement and new technology adoption. At the harvesting level, improvements in haulage and delimbing systems are steadily improving the productivity of harvest workers, with a consequential reduction in the labour inputs required.

The replacement of labour by capital equipment is ensuring the commercial viability of forestry production but it has been at a cost to communities such as Kawerau, Tokoroa and Murupara, in the central North Island. Another economic challenge for these communities was the corporatisation of the Government's planted forest holdings, which represented 48.9 percent of the total planted forest estate. In 1984, these holdings were placed on a purely commercial footing, and in 1987 they were formed into a corporate entity. This led to a rationalisation of staffing, with a number of district offices closing, the contracting out of services and key management functions being centralised. The subsequent sale of the Crown's forestry cutting rights to private investors led to a further rationalisation of management functions.

These developments have had significant economic ramifications for communities with a high reliance on forestry employment. As the forestry workforce has been scaled back the spending power in these communities has declined. Falling disposable incomes have had a direct flow-on effect for retail and service activity. "Both the retail sector and other business firms in Murupara were seriously affected by the reduction of the workforces of Tasman Forestry and NZFS…" (McClintock and Taylor, 1999, p. 31).

[46] A further restructuring proposal is under review, which would reduce permanent staff to 369 and create a contracted maintenance workforce of between 160 and 190 workers.

Key services, including banking and postal outlets, were withdrawn from these centres, requiring residents to travel to regional centres[47]. The reduction in employment opportunities has impacted particularly on unskilled, older workers, who "do not have the technical skills to work the new technology … " (Taylor Baines and Associates, 1999, p. 6). Consequently, the level of dependence upon welfare payments by older workers is higher than the national average.

These centres have also experienced significant levels of outward migration in the last 15 years, with younger workers migrating in search of employment opportunities. This loss of the younger (reproductive) population has meant falling school rolls, an ageing population and declining support for community institutions (particularly sporting associations). The recent literature on community restructuring has also noted that the loss of senior forestry staff has meant that community organisations have lost access to certain skills (i.e. accounting and secretarial knowledge) and to those who are most likely to be tied into broader networks.

The response to the economic restructuring of recent years has taken a number of forms. A large proportion of the workers retrenched by the New Zealand Forest Service have remained within the industry, by setting themselves up as forestry consultants and contractors, or by joining other private firms. Workers have frequently used their redundancy payments to establish these ventures.

The new consultancy firms have tended to focus on the farming and private investment sectors, while harvesting and silvicultural contractors service both the farming sector as well as major forestry corporates, which generally prefer to out-source these activities. These new business units frequently operate over an extended geographical area, which has meant some relocation of staff (particularly where contractors are operating in new, first-rotation forests).

At a broader level, the forestry communities (usually represented by their district councils) have undertaken initiatives to strengthen and diversify their local economies. The initiatives in the central North Island have focused "on adding value to timber by further processing" (McClintock and Taylor, 1999, p. 32) or encouraging activities that support the forestry sector. The Kawerau District Council has established a light industrial park, which has attracted businesses that provide support services to the local pulp and paper mill.

This initiative has also been successful in attracting business activities outside the forestry sector. In several recent reviews of the restructuring that has occurred in the central North Island, the point was made that towns, such as Tokoroa, will continue to be vibrant communities, as they have high-class infrastructure and a skills base that will attract new and alternative forms of employment.

This section has focused on New Zealand's traditional forestry communities but it is important to appreciate that the focus of forestry production is moving away from the central North Island as the exotic planted forests in Northland, the East Coast of the North Island and Nelson-Marlborough mature. The anticipated increase in harvest volumes to 31.3 million cubic metres during the first decade of this century has the potential to generate 20,000 additional jobs, according to Ministry of Agriculture and Forestry estimates. These jobs will be spread throughout the country, with an emphasis on the three regions mentioned above. Forestry therefore has significant potential for new community formation.

[47] The withdrawal of services was not related simply to the downsizing of the forestry workforce. The past two decades have seen a national trend towards the centralisation of public and private services.

The Ministry also forecasts that the area of private indigenous forest under sustainable management plans and permits could reach 178,000 hectares by 2010, producing a harvest volume of 186,000 cubic metres (Griffiths, 2002, p. 6). A significant proportion of this growth is likely to come from Māori-owned indigenous forest. Māori currently own 441,000 hectares of indigenous forest, of which 100,000 hectares could potentially be brought under sustainable management plans (currently 930 hectares). The utilisation of this resource would generate a regular income stream for Māori communities, and could be used to facilitate long-term economic development.

Sources of Information

- Fairweather, J. et al. (2000); *A Comparison of the Employment Generated by Forestry and Agriculture in New Zealand;* Agribusiness and Economics Research Unit (Lincoln University); Lincoln.
- Griffiths, A. (2002); *Indigenous Forestry on Private Land: Present Trends and Future Potential;* A Report Prepared for the Indigenous Forestry Unit (Ministry of Agriculture and Forestry – Technical Paper 01/6).
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- University of Otago Consulting Group (1993); *Forestry and Community: A Scoping Study of the Impact of Exotic Forestry on Rural New Zealand Communities Since 1980*; A Report for the Ministry of Agriculture and Fisheries – Technical Paper 94/8; Wellington.

Further Reading

- Le Heron, R.B. Pawson, E. and Britten, S. (eds), (1996) *Changing Places in New Zealand – A Geography of Restructuring,* New Zealand Geographical Society, Christchurch (Ch5: Forestry and Farm, pp. 92-124).
- Roche, M.M. (1990) "Perspectives on the post 1984 restructuring of state forestry in New Zealand", *Environment and Planning,* 22(7), pp 941-959.
- Forest Industries Training, Forestry Insights Website (www.insights.co.nz).

6.5.d: Subsistence Purposes

DESCRIPTION

Indicator 6.5.d: Area and percent of forest land used for subsistence purposes.

RATIONALE

This indicator measures the extent to which forest land is used to provide basic products needed for survival, and which are provided outside the economic or market-based system.

Such uses of the forest are valid and their extent should be known so that forest management can explicitly cater for them, amongst the range of other values being managed.

2003 COUNTRY REPORT

The Montreal process defines that subsistence is the harvesting or growing of products directly for personal or family livelihood. Subsistence needs generally include foodstuffs, fuelwood, clothing and shelter. Subsistence goods can be considered any good that is a substitute for a market good.

Māori made extensive use of the indigenous forest resource for centuries, which has influenced Māori culture and values. Currently there is something of a renaissance of interest in community knowledge of the forest and its fauna and flora. Māori take wood for carving, vegetable materials for weaving, feathers of indigenous birds and other materials for traditional purposes.

No data are currently available on the area of land used for these activities.

Further Reading

- Orbell M. (1985) *The Natural World of the Māori,* Collins: David Bateman, Auckland.
- Barlow, C. (1991) *Tikanga Whakaaro: Key Concepts in Māori Culture*, Oxford University Press, Auckland.

Criterion 7: Legal, Institutional & Economic Frameworks

DESCRIPTION

Legal, institutional and economic framework for forest conservation and sustainable management.

INTRODUCTION

New Zealand is well placed in terms of its legal, institutional and economic framework to support the conservation and sustainable management of its forests, both planted and indigenous. New Zealand is able to report on the majority of the indicators under this criterion.

There is a strong legislative framework supporting sustainable forest management, a key component of which is the Resource Management Act 1991. This Act takes an integrated approach to the sustainable management of natural and physical resources. New Zealand also has a number of other pieces of legislation which provide for conservation, public participation and effective planning, support best practice codes for forest management and take into account the rights of Māori and conserve special environmental values. Legal information in New Zealand is relatively accessible and, therefore, provides for ease of reporting.

New Zealand also has a well developed institutional framework, and aspects of this are detailed below. Reporting on these indicators was more difficult as much of the information is kept by a number of different agencies and organisations.

7.1 Legal Framework

DESCRIPTION

7.1 Extent to which the legal framework (laws, regulations, guidelines) supports the conservation and sustainable management of forests.

7.1.a: Property Rights

DESCRIPTION

Indicator 7.1.a: Clarifies property rights, provides for appropriate land tenure arrangements, recognises customary and traditional rights of indigenous people, and provides means of resolving property disputes by due process.

RATIONALE

All countries possess a framework including the body of enacted and/or customary rules permitting activities and providing remedies for perceived wrongs. When applied to forests this framework, complemented by the natural laws of forest ecosystems, can promote the sustainability of forests. The frameworks have developed in response to the diverse societies in all countries and so reflect many customs and values.

The frameworks establish the basis for the ownership of and responsibility for forests, and for the participation of individuals and groups in the management of forests. The management of forests thus takes place within the frameworks. The frameworks reflect the values and needs of the various communities and can encourage the acceptance of long-term values necessary for sustainability. The level of stability and acceptance of these frameworks can enhance the degree to which sustainability is attained.

2003 COUNTRY REPORT

The Property Law Act 1952 sets out a general basis for property rights in New Zealand. Land tenure in New Zealand is based on a system of land survey and registration of title under the Land Transfer Act 1952[48]. Legislation containing "forestry-specific" property rights includes the Forestry Rights Registration Act 1983 for planted forests and Part IIIA of the Forests Act 1949 for indigenous forests. Forestry rights under the Forestry Rights Registration Act are the rights to establish, maintain and harvest a crop of trees on land, and are commonly used in joint-venture situations where a forester establishes a forest on land owned by the other party.

The Forests Act 1949, amended in 1993, requires timber milling in New Zealand's privately owned indigenous forest to be carried out on a sustainable basis[49]. This is achieved through registered sustainable forest management plans and permits, which will only be granted where an applicant can show that the rate of harvest will be limited to a level at which the forest can continue to supply an annual or periodic non-diminishing yield in perpetuity.

A small amount of land is held in Māori tenure and is known as Māori customary land. Both Māori customary land and Māori freehold land are subject to Te Ture Whenua Māori/Māori Land Act 1993,which recognises the special significance of land to Māori, and restricts its alienation. Such land is still open to the full range of forestry uses, if the owners so wish.

The foundation legal document recognising the rights of the Māori people in New Zealand is the Treaty of Waitangi, signed in 1840. Its principles are provided for in many pieces of domestic legislation, including the Conservation Act 1987 and the Resource Management Act 1991[50].

The Waitangi Tribunal is the judicial body that considers claims from Māori who believe that they are prejudiced by government action inconsistent with the principles of the Treaty. Many claims relate to the return of government land. Land subject to a claim has its title annotated accordingly so that the claim is not affected should the land be sold.

Property disputes, as with other disagreements, are resolved through a variety of formal and informal means. Contractual disputes may follow a formal process through the Small Claims Tribunal or District or High Courts, depending on the financial value of the dispute. However, arbitration and mediation are also well established processes.

The Environment Court determines land use and resource management issues that do not respond to the consultation, negotiation or mediation procedures set out in the Resource Management Act. Appeals (on questions of law) can be taken on to the High Court and Court of Appeal.

[48] The State grants title to land through registration and guarantees the accuracy of that title. The register is a public "document" that records the status of any land, restrictions that might be placed on it and other facts including mortgages and leases.
[49] Some South Island Maori land and West Coast production forests are exempt from Part IIIA of the Forests Act.
[50] Under section 6(e) of the Resource Management Act, the relationship of Maori with their ancestral lands, water, sites and treasured resources is a matter of national importance, to be recognised and provided for by all who exercise functions under that Act. The principles of the Treaty of Waitangi must also be taken into account in managing the use, development and protection of natural and physical resources (s8).

Sources of Information

- Arbitration Act 1996.
- Conservation Act 1987.
- Forestry Rights Registration Act 1983.
- Forests Act 1949.
- Land Transfer Act 1952.
- Property Law Act 1952.
- Resource Management Act 1991.
- State-Owned Enterprises Act 1986.
- Statistics New Zealand 2000. *New Zealand Yearbook*. Statistics New Zealand, Wellington.

Further Reading

- Williams D.A.R. (ed) (1997), *Environmental and Resource Management Law,* (Second Edition), Butterworth, Wellington.
- McSoriley J. (1995) *List of Statutes Relevant to Forestry,* in Hammond D. (ed), *Forestry Handbook,* New Zealand Institute of Forestry, Christchurch.
- McSoriley J., and Herrington, G., (1994): *Forestry,* in *New Zealand Forms and Precedents,* Butterworth, Wellington; and the Ministry of Forestry, Wellington.

7.1.b: Planning, Assessment, & Policy Reviews

DESCRIPTION

Indicator 7.1.b: Provides for periodic forest-related planning, assessment, and policy review that recognises the range of forest values, including co-ordination with relevant sectors.

2003 COUNTRY REPORT

Central government has devolved much of the responsibility for environmental planning and policy making to local authorities through the Resource Management Act 1991. Regional and district plans developed under the Resource Management Act control adverse effects of resource management activities including the effects of forestry on the environment. They are required to provide protection for significant indigenous vegetation, and "have regard to" trees with significant amenity or heritage value.

Under the Resource Management Act, every regional council must have a regional policy statement with which regional and district plans must be consistent. A full review of all plans and policy statements is required every 10 years.

Considering the needs of relevant sectors prior to establishing district and regional plans and policy statements is achieved through an extensive consultation process. Public submissions must be called before policy statements and plans are finalised. Consultation with affected parties is also required before a resource consent may be granted[51]. Any submitter who is not satisfied with the Council's decision may appeal to the Environment Court, and then to the High Court (on points of law only).

[51] A resource consent gives a person or organisation permission to develop a natural or physical resource, and/or carry out an activity that affects the environment in some way for a stated period.

The Conservation Act 1987 requires the Department of Conservation to develop conservation management strategies in accordance with the legislation under which the Department operates. These strategies provide an overview of conservation issues and give direction for the management of conservation areas. Conservation management strategies are reviewed every 10 years.

The amended Forests Act contains provisions for the Ministry of Agriculture and Forestry, through its Indigenous Forestry Unit, to approve forest management plans for indigenous forests and to approve and monitor annual logging plans. The Ministry is required to consult with the Department of Conservation and where appropriate the Ministry of Māori Development (Te Puni Kokiri), prior to approving a sustainable plan or permit.

Sources of Information

- Conservation Act 1987.
- Department of Conservation (www.doc.govt.nz).
- Forests Act 1949.
- Ministry of Agriculture and Forestry (www.maf.govt.nz).
- Resource Management Act 1991.
- Statistics New Zealand 2000. *New Zealand Yearbook*. Statistics New Zealand, Wellington.

Further Reading

- Ali Memon P. and Perkins H. (eds) (2000) *Environmental Planning and Management in New Zealand,* Dunmore Press, Palmerston North.

7.1.c: Public Participation

DESCRIPTION

Indicator 7.1.c: Provides opportunities for public participation in public policy and decision-making related to forests and public access to information.

2003 COUNTRY REPORT

National forest policy making is undertaken by central government. To ensure that Ministers receive sound, comprehensive and co-ordinated policy advice, departments preparing papers are charged with ensuring that they consider the interests both of other departments and of other government agencies and consult them at the earliest possible stage. Where appropriate, consultation with outside interest groups is encouraged when developing policy.

Examples of groups consulted when developing forestry policy include industry organisations such as the New Zealand Forest Industries Council and the New Zealand Forest Owners' Association, environmental non-government organisations, and professional and land owners' organisations, such as the New Zealand Institute of Forestry and New Zealand Farm Forestry Association. The public generally may also be consulted on some issues.

All government Bills[52] are referred to select committees for consideration. Select committees also consider petitions, carry out inquiries, consider the Estimates and conduct the annual financial reviews of departments and other public organisations. Select committee

[52] Except those taken under urgency, and Appropriation and Imprest Supply Bills.

consideration allows the members of the House, interest groups and the general public to examine and have input, through written and oral submissions, into draft legislation before it passes into law.

At a regional level, the Resource Management Act (RMA) provides for members of the community to take part in managing the resource of their area. Some avenues for public input include public consultation when preparing policy statements and plans, and submissions to local authorities after they have notified the public about policy statements or plans, plan changes and resource consents. In addition, many councils provide opportunities for input in the initial stages of preparing policy statements and plans before they are formally notified. In some cases application for resource consents for a proposed activity under an operative RMA plan with potentially adverse environmental effects must be publicly notified and allow for submissions.

The Official Information Act 1982 makes official information more freely available to facilitate better public participation in the making and administration of laws and policies. The main principle governing release of official information is that *information shall be made available unless there is good reason for withholding it*. The Act defines the grounds on which information can be withheld.

Under the Ombudsmen Act 1975, the Ombudsman can investigate any grievance raised by a member of the public relating to any decision or recommendation made or any action taken by public service departments. The Ombudsman may report and make recommendations on complaints.

The Parliamentary Commissioner for the Environment (PCE) is an independent Officer of Parliament whose job is to review and provide advice on environmental issues and the system of agencies and processes established by the Government to manage the environment. The primary objective of the PCE is to contribute to maintaining and improving the quality of the environment in New Zealand through advice given to Parliament, local councils, business, tangata whenua[53], communities and other public agencies.

Sources of Information

- Cabinet Office Manual (www.dpmc.govt.nz).
- Ministry of Agriculture and Forestry.
- Office of the Parliamentary Commissioner for the Environment (www.pce.govt.nz).
- Ombudsmen Act 1975.
- Resource Management Act 1991.
- Statistics New Zealand 2000. *New Zealand Yearbook*. Statistics New Zealand, Wellington.

7.1.d: Best Practice Codes

DESCRIPTION

Indicator 7.1.d: Encourages best practice codes for forest management.

[53] Maori family (hapu) and tribal (iwi) groups that have customary authority over specific land areas.

2003 COUNTRY REPORT

The *New Zealand Forest Code of Practice* was produced in 1990 and revised in 1993. It is an industry standard for achieving efficient and environmentally acceptable forest operations and is used by the forest industry as a guide to forestry planning and practice.

Safety is part of sustainability and in 1999 the Occupational Safety and Health group of the Department of Labour issued an *Approved Code of Practice for Safety and Health in Forest Operations.* This is a statement of statutory requirements, rules and provisions, based on preferred work practices and arrangements, to ensure the health and safety of forestry workers. The Code is supported by guidelines containing safety, health, training and operational information and outlining preferred work practices or arrangements on the major components related to each part. This provides practical information for those carrying out or directly associated with the work.

Other codes relevant to sustainable forest management that have been adopted are the *Forest Accord and Principles for Commercial Plantation Forest Management*. Most private forestry companies have in-house codes of practice for environmental and worker safety.

A *Code of Practice for the Management of Agrichemicals* 1999 covers the application, distribution, transport and storage of agrichemicals. Information is identified in the Code as appropriate for the three different user groups: applicators, contractors and distributors. This reviewed Code incorporates legislative changes and has comprehensive coverage of animal remedies and spray drift management issues. It incorporates an earlier *Code of Practice for the Use of Pesticides on Plantation Forestry Operations* which covered a wide variety of operations arising from the use of pesticides. These include policy and planning, controlling on- and off-site environmental effects, storage, transport and disposal of chemicals, property rights, risk control, emergency procedures, and audit procedures.

At the time of endorsing the *Code of Practice for Forest Harvesting in Asia-Pacific* in 1998, the Asia-Pacific Forestry Commission (APFC) recognised that major efforts would be required to effectively implement the Code. To ensure more co-ordinated, focused and effective implementation, the APFC ad hoc Working Group on Sustainable Forest Management (of which New Zealand is a member) will develop a comprehensive regional strategy for implementing the Code.

An *Environmental Management System* (EMS) for forestry contractors was developed in 1996 with funding from the Ministry for the Environment. This manual is not a true forestry code of best practice although it is widely used by forestry contractors and organisations. The EMS targets harvesting and other forestry operations such as spraying and roading. It provides a checklist to assist contractors on such issues as harvest planning, compliance with legislation and environmental monitoring.

The *New Zealand Forest Code of Practice* is a useful tool for local authorities when developing plans and considering resource consents. Self-monitoring through codes of practice is encouraged by many regional councils and the Ministry of Agriculture and Forestry, as these codes promote "ownership" of resource consents, provide councils with a consistent base for gathering information, and are cost effective.

Standards and Guidelines for sustainable management of New Zealand indigenous forests have been developed by the Ministry of Agriculture and Forestry to reflect the statutory requirements under Part IIIA of the Forests Act and specify structured indigenous forestry standards for approval and administration of sustainable forest management plans and permits. Each criterion and subset of goals, indicators, benchmarks and verifiers provide guidance on how Ministry of Agriculture and Forestry will apply provisions of the Forests Act. The objective of the Ministry of Agriculture and Forestry Standards and Guidelines is to present detailed procedures and practice standards for sustainable forest management.

7.1.e: Conservation of Special Values

DESCRIPTION

Indicator 7.1.e: Provides for the management of forest to conserve special environmental, cultural, social and/or scientific values.

2003 COUNTRY REPORT

The Resource Management Act requires all persons exercising powers under it to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna. In determining what is *significant*, environmental, cultural, social and/or scientific values are considered.

Cultural and social values in particular are provided for by *heritage orders* under sections 187-198 of the Resource Management Act. These orders provide protection for places of special interest, character, intrinsic or amenity value or visual appeal, including places of spiritual value to Māori. Once a heritage order is in place, no-one can do anything to that land or property that would nullify the effect of the order unless they have written consent from the applicable Heritage Protection Authority. A heritage order takes precedence over the provisions of a district plan or a resource consent.

Heritage sites can also be protected under the Historic Places Act 1993. The primary objective of that Act (section 4) is to *promote the identification, protection, preservation and conservation of the historical and cultural heritage of New Zealand.* In addition to heritage orders, heritage covenants (voluntary agreements) are encouraged. It is unlawful under sections 22 and 23 of the Historic Places Act to destroy, damage or modify any archaeological sites.

The Forests Act provides for the sustainable management of indigenous forests through restrictions on the harvesting, milling and export of indigenous timber and forest products. Forest owners who wish to harvest trees must obtain a sustainable forest management plan or permit. Plans and permits require forest land to be managed in a way that *maintains the ability of the forest growing on that land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values.*

The Forests Act recognises many values of indigenous forests including flora and fauna, soil and water quality protection, amenity and commercial values.

The New Zealand Forest Accord is a voluntary agreement between members of the New Zealand Forest Owners' Association and environmental groups under which protection is provided for indigenous forest owned by Association members.

The majority of indigenous forest in New Zealand is held in public ownership under the Conservation Act, or National Parks Act. Conservation Act land is managed *for conservation*

purposes, while the National Parks Act requires such parks to be preserved *as far as possible in their natural state*.

Further Reading

- Rainbow S. and Derby D. (2000) *Heritage and Planning,* in Ali Memon and H. Perkins (eds), *Environmental Planning and Management in New Zealand*, Dunmore Press.
- Hall C.M. and McArthur S. (eds) (1996) *Heritage Management in Australia and New Zealand,* Melbourne, Oxford University Press.
- Department of Conservation (1998) *Historic Heritage Management Review: Report of the Ministerial Advisory Committee,* Department of Conservation, Wellington.

7.2 Institutional Framework

DESCRIPTION

Indicator 7.2: Extent to which the institutional framework (including capacity) supports the conservation and sustainable management of forests.

7.2.a: Public Involvement Activities

DESCRIPTION

Indicator 7.2.a: Provide for public involvement activities and public education, awareness and extension programmes, and make available forest-related information.

RATIONALE

Within the overall legal framework, countries possess institutions and organisations that can promote sustainability. The framework can integrate public needs and aspirations into the process of planning and can maintain this infrastructure on an ongoing basis. The structures needed to develop the requisite skills must be in place along with the means to ensure that plans are implemented. A wide variety in the needs of societies from forests means that a similarly wide variety of skills must be continuously developed. The planning, implementation, and enforcement activities should be open and transparent to provide evidence of a country's commitment to sustainability. The frameworks accommodate a variety of societal values ensuring sustainability and are designed to engender broad public support for implementation and enforcement. The degree to which these institutions are in place and functioning on a continuous basis is a measure of sustainability.

2003 COUNTRY REPORT

The Ministry of Agriculture and Forestry

The Ministry of Agriculture and Forestry compiles statistical and other information in fulfilling its responsibilities to the Government and makes this available to the forest industry, forestry interest groups, and the public. The information is available in printed, and increasingly in electronic, forms, with much of the information available (sometimes in summarised form) on the Ministry's website (www.maf.govt.nz).

The Ministry has a specific focus on the collection and dissemination of information and statistical data concerning planted forests (forest areas, areas by age class, new planting, harvesting, restocking, and woodflow forecasts), the primary processing of wood products, and international and domestic trade of wood products.

The Ministry does not provide an "extension service" to forest owners/managers, other than providing some initial advice on the requirements of Part IIIA of the Forests Act 1949. It is considered that private forest consultants more appropriately provide extension activities. Similarly, the Ministry does not convene forestry field days and seminars, but may participate in such events organised by others.

To assist land owners, sawmillers and exporters to meet the requirements of Part IIIA of the Forests Act, the Ministry of Agriculture and Forestry has prepared written information on:

- *Indigenous Forestry: Sustainable Management* (prepared in partnership with the New Zealand Farm Forestry Association).
- *A Guide to the Forests Amendment Act 1993.*
- *Indigenous Forestry: Sustainable Management – A Guide to Plans and Permits.*
- *Standards and Guidelines for Sustainable Management of Indigenous Forests.*

A series of small forest management publications is available that provides information for those with modest planted forestry interests. Another series provides national and regional overviews of the forest industry.

The Ministry provides information and displays on sustainable forest management at national field days and exhibitions.

The Department of Conservation

Conservation in New Zealand is increasingly becoming a collaborative effort between the public, non-government organisations, businesses, and all levels of government. The Department of Conservation focuses on biodiversity and ecosystem protection, rather than on forests as an ecosystem type.

The Department relies on partnerships with the community to achieve its mission to conserve New Zealand's unique indigenous biodiversity. These partnerships include:

- a Treaty partnership with iwi Māori (New Zealand's first people);
- work with regional and district councils to implement their responsibilities for biodiversity conservation in regional and district plans and coastal plans under the Resource Management Act 1991;
- work with private land owners for the protection of natural areas through covenants and other conservation measures such as Nga Whenua Rahui;
- work with universities and research institutions to improve knowledge and techniques of conservation;
- providing opportunities for corporate sponsorship of conservation programmes;
- working with education providers to enable them to deliver conservation education programmes;
- providing and promoting opportunities for community involvement in practical conservation projects and policy development;
- joint programmes for protection of biodiversity, such as Project Crimson and organisations such as the Nature Heritage Fund.

Involving the community in caring for its heritage through education, sponsorships, awards, community involvement programmes, partnerships and events such as Conservation Week is a key part of the Department's work. Public involvement activities range from national-level initiatives to locally run community programmes.

The Department provides a range of levels of engagement for the public. Its visitor information centres provide interpretation of New Zealand's indigenous ecosystems. There

are volunteer programmes and annual events such as Arbor Day. Information about New Zealand's biodiversity is also made available through a number of different mechanisms such as educational resources for schools, fact sheets, scientific papers, public discussion documents, maps, and media articles. The Department's website (www.doc.govt.nz) provides access to these resources. In addition, the Department supports community-initiated conservation projects, either on conservation land administered by the Department or on other land with significant conservation value.

The Department has produced a draft Conservation with Communities Strategy that is currently going through a consultation process.

The New Zealand Forest Industry

The New Zealand forest industry comprises corporate and private forest owners and processors (as individuals and collectively represented in a range of industry associations), forestry practitioners, professional associations, research organisations, education and training institutions, and service providers. The different groupings provide forestry and forestry-related information through a variety of mechanisms such as websites, publications, conferences, seminars, field days, working demonstrations, tuition, and training courses.

Forestry Insights was a major educational initiative originally between the former Ministry of Forestry and the forest industry to provide free educational resources to all schools at all levels. This was achieved between 1992 and 1996. The project is now co-ordinated by Forest Industries Training and the original material has been revised. It is focused on students, teachers, industry trainees and the general public. All material is on the internet at www.insights.co.nz/.

Forestry Insights has five themes: At a glance; Forests and people; The magic habitat; Plantations and natural forests; and Processes and markets.

The New Zealand Institute of Forestry has prepared a National Policy on Forestry and an Indigenous Forest Policy based on a forest ecosystem approach to sustainable management.

The corporate owners of planted forests often provide for various forms of public recreation in their forests. This commonly includes walking, cycling, picnicking, and hunting where this is not in conflict with other uses.

Forest Research makes information available to the wider public through its website, various bulletins and directly through dissemination to interest groups and other stakeholders.

Other Organisations

New Zealand has several environmental organisations that are active in sustainable forest management issues and commercial planted forests, particularly with respect to indigenous forest, for example the Tane Tree Trust and Kauri 2000. These organisations provide written information to their members, convene field days, and participate in statutory planning and political processes for the sustainable management of natural and physical resources.

Sources of Information

- Ministry of Agriculture and Forestry (www.maf.govt.nz).
- Department of Conservation (www.doc.govt.nz).
- New Zealand Forestry (www.nzforestry.co.nz).
- New Zealand Forest Industries Council (www.nzfic.nzforestry.co.nz).
- New Zealand Forest Owners' Association (www.nzfoa.nzforestry.co.nz).

- New Zealand Pine Manufacturers' Association (www.pine.net.nz).
- New Zealand Farm Forestry Association (www.nzffa.org.nz).
- Forest Research (www.forestresearch.co.nz).
- Forest Industries Training (www.training.org.nz).
- New Zealand Institute of Forestry (www.forestry.org.nz).
- Forest Industries Engineering Association of New Zealand (www.technz.co.nz/organisations/inassoc/fengine.htm).
- *Forestry Insights* (www.insights.co.nz/).
- New Zealand School of Forestry (www.forestry.ac.nz/).
- Lincoln University (www.lincoln.ac.nz/study/areas/forestry.htm).

Further Reading

- Ali Memon P. and Hawes P. (2000), *Prospects for Sustainable Management of Indigenous Forests on Private Land in New Zealand,* in Ali Memon and H. Perkins (eds) *Environmental Planning and Management in New Zealand*, Dunmore Press.

7.2.b: Forest-Related Planning

DESCRIPTION

Indicator 7.2.b: Undertake and implement periodic forest-related planning, assessment, and policy review including cross-sectoral planning and co-ordination.

RATIONALE

Within the overall legal framework, countries possess institutions and organisations that can promote sustainability. The framework can integrate public needs and aspirations into the process of planning and can maintain this infrastructure on an ongoing basis. The structures needed to develop the requisite skills must be in place along with the means to ensure that plans are implemented. A wide variety in the needs of societies from forests means that a similarly wide variety of skills must be continuously developed. The planning, implementation and enforcement activities should be open and transparent to provide evidence of a country's commitment to sustainability. The frameworks accommodate a variety of societal values ensuring sustainability and are designed to engender broad public support for implementation and enforcement. The degree to which these institutions are in place and functioning on a continuous basis is a measure of sustainability.

2003 COUNTRY REPORT

National Policy

The Government's cross-sectoral planning and policy approach to resource management is to control adverse effects on the environment and establish a neutral legislative and economic framework within which investment decisions can be market driven. No national forest policy exists in New Zealand, and there is no target forest estate area or annual forest establishment target.

The Government has announced a number of goals to guide public sector performance and policy. These goals include:

- Protect and Enhance the Environment
  Treasure and nurture our environment with protection for ecosystems so that New Zealand maintains a clean, green environment and rebuilds our reputation as a world leader in environmental issues.

- Grow an Inclusive, Innovative Economy for the Benefit of All
  Develop an economy that adapts to change, provides opportunities and increases employment, and while reducing inequalities, increases incomes for all New Zealanders.

Environment 2010 Strategy

The Environment 2010 Strategy is a statement of broad strategic directions in environmental policy and sets out the New Zealand Government's vision, principles and goals for the environment to the year 2010. It establishes the framework within which central and local government and the private sector can develop their own policies and plans, based around the following 11 principles for integrating the environment, society and economy:

1. Sustainably managing natural and physical resources.
2. Applying the precautionary principle.
3. Defining environmental bottom lines.
4. Internalising external environmental costs.
5. Specifying property rights to achieve sustainable outcomes.
6. Ensuring that "least cost" policy tools are adopted.
7. Ensuring that social and environmental goals are mutually supportive.
8. Following full cost pricing principles in pricing public utility infrastructure.
9. Considering local, national and international dimensions of sustainable resource management in determining publicly funded research priorities.
10. Defining the limits of resource use and substitution.
11. Protecting our international competitiveness.

One of the goals of the Environment 2010 Strategy is to protect indigenous habitats and ecological diversity by:

- maintaining and enhancing the net area of New Zealand's remaining indigenous forests and enhancing the ecological integrity of other remaining indigenous ecosystems;
- promoting the conservation and sustainable management of biological diversity so the quality of our indigenous and exotic ecosystems is maintained or enhanced to guard against extinction and permit adaptation to changing environmental conditions.

Resource Management Act 1991

The Ministry for the Environment administers the Resource Management Act 1991 (RMA), with implementation principally through regional and district councils which prepare regional and district plans. It is the primary legislation for statutory resource management planning, having brought together laws governing land, air and water resources. The RMA concentrates on the environmental effects of human activities.

The purpose of the RMA is "...to promote the sustainable management of natural and physical resources". Sustainable management is described as:
"... managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well being and for their health and safety while:
(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
(b) Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment."

Matters of national importance are also identified in the Act and these must be recognised and provided for by those parties implementing the legislation. Included is:

"The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna".

The RMA is intended to control adverse effects of activities and not to directly control activities themselves. The presumption of the Act is that a land use or activity is permitted unless there is a rule in a plan that controls the effects of that activity. This effects-based planning is intended to provide an equitable planning framework within which all resource management activities must operate.

In practice land uses or activities are generally identified in plans for varying levels of control, and this does result in (arguable) inequities.

The RMA requires the Minister for the Environment to monitor the effect and implementation of the legislation. The Act also requires every local authority to monitor the state of the whole or any part of the environment of its region or district, to the extent that is appropriate to enable the local authority to carry out its functions effectively under the Act.

Conservation Act 1987

The Department of Conservation administers the Conservation Act. The Act promotes the conservation of New Zealand's natural and historic resources. Conservation is defined as: "…the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations".

Approximately 83 percent of New Zealand's indigenous forest resource (19 percent of the country's land area) is managed under the Conservation Act 1987 for the preservation and protection of the land and natural and historic resources. The Act does not provide for the taking or harvesting of wood from indigenous species, unless a current lease or licence providing for this was granted prior to the commencement of the Act, or it is authorised for traditional Māori purposes.

Conservation management strategies are required under the Conservation Act and are prepared by the Department. These strategies have 10-year terms, provide an overview of conservation issues and give direction for the management of conservation areas. Other non-statutory plans and strategies prepared by the Department must have regard to the relevant conservation management strategy.

Conservation management plans are 10-year statutory plans prepared by the Department to implement conservation management strategies in areas where there is a high level of activity or a complexity of issues. The plans establish detailed objectives for the integrated management of natural and historic resources within a particular area.

The process for preparing the strategies and plans is set out in the Conservation Act. The process may include the preparation of information leaflets and resource discussion documents, the circulation of draft material, and the facilitation of hui, public meetings and workshops.

Forests Act 1949

The Ministry of Agriculture and Forestry administers the Forests Act. An amendment in 1993 introduced Part IIIA (Provisions Relating to Indigenous Forests) that applies to most privately owned indigenous forest and sawmills processing indigenous timber.

The purpose of Part IIIA is to promote the sustainable management of indigenous forest land. Sustainable forest management is defined as:
"…the management of an area of indigenous forest land in a way that maintains the ability of the forest growing on that land to continue to provide a full range of products and amenities in perpetuity while retaining the forest's natural values".

Harvesting from most of the privately owned indigenous forest resource (about one million hectares or 17 percent of the total indigenous area) is subject to approved sustainable forest management plans or permits under Part IIIA of the Act. Of this one million hectares of privately owned indigenous forest, about 50 percent may have potential for sustainable forest management involving the harvesting of wood. As at June 2001, some 85,600 hectares of indigenous forest were covered by approved plans and permits, or were under consideration for approval.

Only sawmills registered under the Act may process indigenous timber.

Indigenous Timber Production from Government-Owned Land
Harvesting from indigenous forests on government-owned land was restricted in 1987 to about 2 percent of the total indigenous forest area. As at 31 March 2002, all but 12,000 hectares of indigenous forest on government-owned land were withdrawn from management involving timber production. These 12,000 hectares, over which a forestry right exists in favour of the local owners (the Waitutu Incorporation), are managed in accordance with the Part IIIA provisions of the Forests Act,.

Standards for the Assessment of Sustainable Forest Management
Forest industry groups and interested parties are currently developing national standards for the assessment of sustainable forest management to assist them qualify for third party certification, including Forest Stewardship Council certification.

The process involves a number of structures to which people are elected. The National Initiative Working Group is the highest level body and gives final approval to the standards set by two technical committees, one for planted forest standards and one for indigenous forest standards. Members of the Working Group and technical committees are elected in equal proportion from four chambers (economic, environmental, social and Māori).

Draft *National Standards for Plantation Forest Management in New Zealand* have been prepared by the technical committee and are currently open to discussion among the four chambers. It is expected that the draft National Standards will be issued for broad public consultation about late 2002.

A draft *Indigenous Forest Standard* has been prepared. However, because the environment chamber has decided not to participate in the indigenous standards technical committee meetings the National Initiative Working Group has not recognised these as "official" standards under this process. Further discussion is aimed at resolving this impasse.

Forestry Codes, Agreements and Guidelines
Codes of Practice
The Logging Industry Research Organisation (LIRO) produced the *New Zealand Forest Code of Practice* (NZFCOP)in 1990 and revised it in 1993. It is an industry standard for achieving efficient and environmentally acceptable forest operations and is used by the forest industry as a guide to forestry planning and practice.

In day-to-day forest management the voluntarily applied NZFCOP is influential in establishing high standards of operational management and protecting environmental values. This is focused on the management of planted forests, although many of the operational guidelines are relevant to forest management generally.

Safety is an important aspect of sustainable forest management and in 1999 the Occupational Safety and Health division of the Department of Labour issued an *Approved Code of Practice for Safety and Health in Forest Operations.* This is a statement of statutory requirements, rules and provisions, based on preferred work practices and arrangements, to ensure the health and safety of forestry workers. The code is supported by guidelines containing safety, health, training and operational information and outlining preferred work practices or arrangements on the major components related to each part. This provides practical information for those carrying out or directly associated with the work.. Most private forestry companies have in-house codes of practice for environmental and worker safety.

Principles for Commercial Plantation Forest Management
Environmental excellence in plantation forest management is the primary objective of these Principles. Signed by major plantation growers and users and conservation groups in 1995, the parties agreed that:

- inter-dependence of ecological, economic and social sustainability must be recognised
- efficient and effective Principle implementation monitoring is required;
- rural land users should be treated equitably, based on environmental effects of their activities;
- management practices must meet or improve on all statutory requirements and accepted best practices.

The New Zealand Forest Accord
This Accord was signed in August 1991, between representatives of New Zealand environmental organisations, wood growing and wood processing industries (listed below). The Objectives of Accord are to:

- define those areas where it is inappropriate to establish plantation forestry;
- recognise the important heritage values of New Zealand's remaining natural indigenous forests and the need for their protection and conservation;
- acknowledge that the existing area of natural indigenous forest in New Zealand should be maintained and enhanced;
- recognise that commercial plantation forests of either introduced or indigenous species are an essential source of perpetually renewable fibre and energy offering an alternative to the depletion of natural forests;
- acknowledge the mutual benefits emanating from an accord between New Zealand commercial forestry enterprises and conservation groups and the example that this unique accord can provide for the international community.

Signatories were: New Zealand Forest Owners Association, New Zealand Timber Industry Federation, New Zealand Farm Forestry Association, New Zealand Wood Panel Manufacturers Association, Royal Forest and Bird Protection Society of New Zealand, Environment & Conservation Organisations of New Zealand Inc, Federated Mountain Clubs, Friends of the Earth, Beech Action Committee, Pacific Institute of Resource Management, World Wide Fund for Nature (New Zealand), Japan Tropical Forest Action Network, Maruia Society.

Guideline
The preparation of a *Standard and Guidelines for Sustainable Management of Indigenous Forests* in accordance with Part IIIA of the Forests Act was published by the Ministry of Agriculture and Forestry in early 2002.

Sources of Information

- Ministry of Agriculture and Forestry.
- Ministry for the Environment (www.mfe.govt.nz).
- Department of Conservation.
- Environment 2010 Strategy.
- Resource Management Act 1991.
- Conservation Act 1987.
- Forests Act 1949.
- Forest Stewardship Council (www.fscoax.org).

Further Reading

- Dyck W.J. (1999) *Sustainable Forest Management – The New Zealand Model*, in International Experts Meeting on the Role of Planted Forests for Sustainable Forest Management, Santiago, Chile, 6-9 April, 1999, pp. 113-132.
- Dunningham A. (1998), *Report on International Environmental Agreements: A Review of Reporting Requirements for Forests and Land Use*, Forest Research, Report No.26, Prepared for the Ministry for the Environment.

7.2.c: Human Resource Skills

DESCRIPTION

Indicator 7.2.c: Develop and maintain human resource skills across relevant disciplines.

2003 COUNTRY REPORT

Industries and organisations involved with New Zealand's forests recognise the importance of developing and maintaining a high level of education and skill in their workforces. The training available includes: training for formally structured, nationally recognised qualifications as used by the forestry industry, in-house training programmes as used by the Department of Conservation, and training for community-based organisations, such as the New Zealand Mountain Safety Council, which is committed to fostering safe enjoyment of outdoor recreation.

Forest Industry Training

Industry training organisations (ITOs) are recognised by Skill New Zealand under the Industry Training Act 1992. ITOs are established by their industries to develop skill standards and national qualifications[54] to meet their needs. ITOs arrange training for employees in their industries and oversee the quality of training arrangements. Forest Industries Training (FIT), based in Rotorua, is New Zealand's largest ITO.

[54] Administered by the New Zealand Qualifications Authority, the National Qualifications Framework is a way of structuring national qualifications. The Framework is designed to provide nationally recognised, consistent standards and qualifications; and recognition and credit for all learning of knowledge and skills. Framework qualifications are quality assured and nationally recognised. For more information see www.nzqa.govt.nz.

The qualifications overseen by FIT include National Certificates and National Diplomas in the fields of Forestry, wood panels, pulp and paper, tissue converting and solid wood. Polytechnics and institutes of technology provide these courses. Undergraduate and postgraduate degrees and diplomas in forestry science, forest engineering, applied science and commerce as they apply to forestry are also available at certain universities. There are 11 forestry training and education providers around New Zealand.

The Conservation Estate

The Department of Conservation is the central government organisation charged with conservation. Its jurisdiction includes the majority of New Zealand's indigenous forest estate. The Department's mission is to conserve the natural and historic heritage of New Zealand for the benefit of present and future New Zealanders.

Table 29: Department of Conservation Field Staff Training Programmes

Programme	Description	Attendees 2000/01
Ecological Management Skills	Skills to manage natural ecosystems, sites and species populations in New Zealand	95
Leadership Foundations	Provides a range of management and leadership skills for improving performance	177
Te Pukenga Atawhai	Skills to build and maintain effective relationships with tangata whenua	453
People Matter	Skills to build and maintain effective relationships with the community and colleagues	103
Trainee Ranger	Trainees work in Area Offices and receive best practice, on-the-job training in conservation field techniques (2 year course)	13
Fire Training	Fire control techniques	1,000

Source: Department of Conservation, 2001

Note:
Field staff comprises Rangers, Programme Managers and administration support in each geographical area. These people are engaged in pest and weed management, plant and animal protection, track and structure maintenance, compliance and law enforcement, and staffing visitor centres.

The Department of Conservation provides a study assistance programme for staff undertaking tertiary study. It also contracts training in various other skills from external training providers[55].

New Zealand Mountain Safety Council training

The New Zealand Mountain Safety Council (NZMSC) is a national, volunteer and community-based organisation with recognised outdoor expertise. Through the Council, volunteer instructors share with communities and organisations their outdoor skills and knowledge, to promote safe participation in land-based recreational, educational and adventure activities.

Table 30: NZMSC Outdoor Skills Courses (year ended 30 June 2001)

Course	No. of courses	No. of participants
Bush	199	2,996
Abseil	76	2,320
Outdoor First Aid	78	932
Risk Management	26	427
Alpine	19	164
Total	**398**	**6,839**

Source: New Zealand Mountain Safety Council, 2001

Notes:
Courses run by NZMSC volunteers for the community. Statistics do not include lectures, supervision, consultancy or promotions undertaken by branch volunteers, or courses run by national office staff.
In addition, firearms' testing was carried out around the country.

[55] Other common training carried out in the Areas includes: health and safety; first aid; search and rescue; growsafe; electric fishing; poisons licensing; driving courses; fencing; boat licences; chain saws and other mechanical appliances; track and hut inspection, maintenance and use of dataloggers; personnel and administration training.

Sources of Information

- Department of Conservation (www.doc.govt.nz).
- Forest Industries Training (www.training.org.nz).
- New Zealand Mountain Safety Council (www.mountainsafety.org.nz).
- New Zealand Qualifications Authority (www.nzqa.govt.nz).
- Skill New Zealand (www.etsa.govt.nz).

7.2.d: Infrastructure

DESCRIPTION

7.2.d: Develop and maintain efficient physical infrastructure to facilitate the supply of forest products and services and support forest management.

RATIONALE

This indicator enables the monitoring of physical infrastructure development to enable the domestic and international supply of forest products and the management of the forest resources. The degree to which infrastructure developments are in place and functioning on a continuous basis is a measure of sustainability.

2003 COUNTRY REPORT

New Zealand has in place physical infrastructure to support a broad range of activities, including the forest industry. Central and local governments fund and operate the public road network, which is the largest capital investment in New Zealand's transport system. Tranz Rail operates most of New Zealand's rail network on a long-term lease of the corridor from the Crown. There is a heavy reliance on sea transport for overseas trade with over 99 percent of imports and exports moved by sea. International shipping lines handle virtually all of the overseas trade.

Table 31: Road Infrastructure in New Zealand

	Kilometres of Road		
	Sealed	**Unsealed**	**Total**
State Highway	10,715	59	10,774
Local Authority	47,470	33,963	81,433
Total	58,185	**34,022**	**92,207**

Source: Transfund New Zealand Roading Statistics 2000/2001

New Zealand has an extensive land transport infrastructure and exports are well catered for through 13 main export ports. The forecasts show the potential sustainable supply of wood available from New Zealand's planted production forests could rise from 18.3 million cubic metres in the year ended March 2000 to 30 million cubic metres by 2006. This increase will however require increased capacity of export ports and the upgrading of many roads to log transport standards.

Table 32: Forestry Logging Traffic on New Zealand Roads

	Million tonne per kilometre	Percent
State Highways	513	60
Local Roads	60	7
Private Roads/Rail	285	33
Total	**858**	**100**

Source: Forestry Logging Traffic on New Zealand Roads 1992 – updated 1993.

Note: New Zealand Forest Owners' Association advises that the above data has not been updated since 1993. However, this is indicative of the ratios.

Road Infrastructure

New Zealand has an extensive roading network with a total length of 92,000 kilometres of formed road. The major roads (State Highways) cater for the

higher volume traffic and the local authority roads provide the secondary network.

Unsealed roads make up approximately 37 percent of the national network but only account for 3 percent of the vehicle kilometres travelled.

A substantial portion of log transport takes place on private roads (i.e. other than State Highways or local authority roads). New Zealand Forest Owners' Association data shows that 33 percent of log transport is on private forest roads or rail (Table 32).

Table 33: RUCs purchased for log haulage vehicles

Year	Distance Purchased (km)
1999	68,166,000
2000	93,514,000
2001	119,997,000

Source: Land Transport Safety Authority

An indicator of the increasing use of State Highways and local authority roads for log transport can be obtained from the level of Road User Charges (RUCs)[56] purchased for log haulage where the vehicle is either diesel powered and/or over 3,00kilograms in weight. The total distances purchased for 1999-2001 are included in Table 33. The figures indicate a 76 percent increase in RUCs purchased for log haulage between 1999 and 2001.

Rail

Railway infrastructure in New Zealand includes 3,898 kilometres of narrow gauge track, consisting of 1,811 kilometres of main lines connecting the major cities and ports and 2,102 kilometres of secondary and branch lines.

Raw and processed forestry products, such as logs, pulp, sawn timber and panel products, are carried by rail to domestic destinations and export ports. The majority of pulp and paper is hauled by rail but trucks dominate the market for hauling logs, lumber and wood chips. Tranz Rail's infrastructure will enable it to meet some of the future demands of the forest industry for logs, processed and semi-processed forest products.

Ports

Port reforms initiated in the late 1980s have resulted in greater efficiencies and more flexible working hours, with consequent economic benefit to port companies. There are 13 commercial ports that are predominantly owned by local authorities, although six are partly privatised. Improving log storage and covered storage facilities for processed forest products are the two areas most forest product exporting ports are focusing on. New port facilities have been developed with the $65 million Marsden Point port expansion in Northland and a new forestry wharf at Shakespeare Bay, Port Marlborough.

Sources of Information

- Ministry of Agriculture and Forestry. 2000. *National Exotic Forest Description*, and *National and Regional Wood Supply Forecasts 2000*.
- Ministry of Agriculture and Forestry. 2001. Statistics Release, *Exports of Forest Products for the Year Ended 31 December (Provisional)*.
- Ministry of Agriculture and Forestry 2001. Statistics Release, *Estimated Roundwood Removals from New Zealand Forests*.
- Land Transport Safety Authority "Log Haulage" RUC distance purchased data, Pers com.
- Transfund New Zealand Roading Statistics 2000/2001.
- Tranz Rail Annual Report 2000/2001.

[56] Road User Charges (RUCs) are the charges that recover road costs from diesel vehicles through an average weight-distance paper licence system.

7.2.e: Enforce Laws

DESCRIPTION

7.2.e: Enforce laws, regulations and guidelines.

RATIONALE

Within the overall legal framework, countries possess institutions and organisations that can promote sustainability. The framework can integrate public needs and aspirations into the process of planning and can maintain this infrastructure on an ongoing basis. The structures needed to develop the requisite skills must be in place along with the means to ensure that plans are implemented. A wide variety in the needs of societies from forests means that a similarly wide variety of skills must be continuously developed. The planning, implementation and enforcement activities should be open and transparent to provide evidence of a country's commitment to sustainability. The frameworks accommodate a variety of societal values ensuring sustainability and are designed to engender broad public support for implementation and enforcement. The degree to which these institutions are in place and functioning on a continuous basis is a measure of sustainability.

2003 COUNTRY REPORT

Laws and regulations are enforced by both central and local government agencies.

Ministry of Agriculture and Forestry

The Ministry of Agriculture and Forestry enforces the Forests Act and parts of the Biosecurity Act. Enforcement includes bringing prosecutions against those who contravene the Acts and their regulations.

Part IIIA of the Forests Act applies to the large majority of the privately owned indigenous forests. The number of prosecutions under this Act (generally brought for illegal harvesting of indigenous timber) has been very low in recent years. This reflects an efficient control system of sawmill registration, improved understanding by forest owners of the provisions of the Act, and ongoing monitoring by the Ministry. In isolated areas, however, smaller-scale offences can be difficult to detect.

The current seizure provisions of the Forests Act are hindering prosecutions. These are being addressed through the Forests Amendment Bill currently before Parliament.

The Biosecurity Act is considered below under Central and regional government.

Department of Conservation

Compliance and law enforcement by the Department of Conservation apply to all the legislation it administers. It is a system based on complete integration, and the powers exercised across the various Acts are similar.

The estate administered by the compliance and law enforcement warranted officers of the Department of Conservation relevant to Indicator 7.2.e consists of:

- reserves (including wildlife protected areas) in a marine or terrestrial setting;
- national parks (some e.g. Fiordland and Abel Tasman, are in a marine context as well as a terrestrial context);

- conservation areas.

In fulfilling its biosecurity role the Department employs the same powers for conservation law enforcement staff as discussed below, but is not boundary specific.

The Department of Conservation is currently developing a new law enforcement framework in the form of the Conservation Law Reform Bill. This Bill aims to bring together the compliance statutes the Department administers under 11 different Acts. The primary Acts are the Conservation Act 1987, the National Parks Act 1980, the Reserves Act 1977 and the Wildlife Act 1953.

For the following reasons the Department generally undertakes its own enforcement work:
- the operations frequently occur in remote locations where it is not practical to call in the Police;
- specialist knowledge and skills are often needed for conservation enforcement work, in terms of both understanding the legislation and understanding the assets and values it manages;
- staff often need to act quickly in order to apprehend an offender, or in order to prevent the offence causing major environmental effects.

The Department's powers have been redrafted in the marine and terrestrial context to deal with the inconsistency across the legislation and are due to be part of the law reform.

Currently the Department uses the powers:
- to intervene to stop offending (and prevent further damage);
- to require personal particulars to be provided;
- to stop persons and other things (can only currently stop boats under the Reserves Act);
- of entry and search;
- of seizure of arrest for offences committed using boats in national parks and reserves.

Warranted compliance and law enforcement staff with powers can both deal with an offence they see occurring and investigate and collect evidence about an offence that they believe, on reasonable grounds, has been committed. The law reform will allow the Department to be more effective in enforcement than it has been in the past.

The Department has divided law enforcement into three facets. High-level officers are available to operate in a national context to deliver the chain of evidence required for serious offending e.g. the taking of plants (indigenous forest) or biosecurity threats. These officers carry out planned operations in areas of high risk for the Department, or where information is received that illegal activity is taking place.

The second level is a specific role for field staff dealing with incidents in their own locations and submitting prosecution files. The last level involves all staff employed by the Department. They have a role to be the eyes and ears for any offending and pass on information to the second level for investigation. The National Compliance and Law Enforcement Co-ordinator provides the national strategic direction for complete integration for training and delivery of all the powers across all the legislation for which the Department is responsible.

Honorary Ranger System
The Department has functions New Zealand wide. It is impossible to carry out its statutory role without the involvement of the community on the basis of the scale involved. For example, in the whitebait fisheries surrounded by forests in the remote parts of New Zealand (Wild Places to Big Bay and Martins Bay on the West Coast) the honorary officer carries out the Department's role. It would be impossible expense and time wise for the full-time Department staff with compliance roles to spend the entire season in the location. The honorary system also assists the Department to have capacity to carry out its statutory function. Regular reporting is an obligation that is part of holding the honorary warrant.

Honorary officers work in three ways:
- in teams with Department staff in surveillance roles on planned operations;
- advocacy and education, including publicising and promoting material relating to conservation;
- surveillance outside normal work hours.

All honorary officers undertake the same five-day compliance and law enforcement course as Department of Conservation staff. Regular refresher courses are made available, as are opportunities to be part of the yearly whole-of-government cross-agency training.

Aerial and Surface Surveillance
In conjunction with other intelligence, aerial and surface surveillance provides a picture of activity on conservation land. Given the high cost of using over-flight aircraft, it is important to ensure that there is co-ordination of assets and that programming reflects the requirements of a particular patrol to achieve an effective law enforcement outcome. The Department of Conservation has provided a national tasking plan for enforcement (including forestry protection) to the Royal New Zealand Air Force. Many opportunities not previously available to the Department have been granted by the Air Force to increase its capacity to carry out its statutory function.

Aircraft over-flight is a cost-effective method of providing terrestrial surveillance. Patrol aircraft can cover large terrestrial areas in a relatively short period of time and gain a very accurate picture of activity. They can undertake enforcement action by photographing and detailing illegal activity, such as illegal logging on conservation land. Evidence collected by an aircraft can then be used as the basis of a prosecution. The surveillance capability of the Air Force is being upgraded to enable it to meet civilian requirements for aerial patrol. The P3 Orions are having their navigation, communications and radar equipment upgraded to meet the demands of the surveillance task as a result of seeking to address the whole-of-government needs as part of the Maritime Defence Review.

Maritime Co-ordination Centre
The Maritime Co-ordination Centre is being developed to meet whole-of-government needs. This will assist the Department in looking after closed terrestrial areas with high conservation values in a whole-of-government security model. Currently Department Warranted Enforcement staff are regularly given the opportunity to be on other agencies' assets to protect terrestrial values located in a marine setting (e.g. significant wildlife refuges, forests and protected species). The Department enjoys a strong relationship with the Royal New Zealand Navy and New Zealand Customs Service to patrol high-risk areas and carry out surveillance. Information collected results in prosecution where a chain of evidence is achieved. Surface vessels are able to maintain a physical presence that aircraft cannot. This presence serves to deter would-be offenders and demonstrates the commitment to protecting the terrestrial environment and carrying out the Department's statutory function.

Vessels also provide the capability to board, inspect and arrest offending vessels that may be engaged in illegal or unregulated activities in the terrestrial environment that are not identifiable from the air. The Department has provided a national tasking plan for enforcement including forestry management to the parties that make up the Maritime Co-ordination Centre.

The Department of Conservation has a large area over which to carry out its statutory function. There are a large number of terrestrial and marine interagency relationships that are important for biodiversity protection. Authorised persons under the Department's legislation who can currently exercise powers are:

- Conservation Act – Fisheries officers and Police officers.
- National Parks Act – Police officers and the commander of New Zealand naval/merchant vessels.
- Reserves Act – Police officers and the commander of New Zealand naval/merchant vessels.

The law reform will extend the class of persons authorised under the Department's legislation to fit into the interagency model to meet whole-of-government needs as described above.

The Department of Conservation has an enforcement hotline to report any illegal activity to the Department. This is a way of involving the public of New Zealand in the protection of the environment.

Local Government

Local government (regional and district councils) primarily implements the Resource Management Act. Enforcement orders can be sought from the Environment Court by councils and (in certain circumstances) individuals that require a person to cease, or prohibit a person from commencing, anything done or to be done on behalf of a person that:

- contravenes or is likely to contravene the Act, any regulations, a rule in a plan, a resource consent, and certain other requirements;
- is, or is likely to be, noxious, dangerous, offensive, or objectionable to an extent that it has or is likely to have an adverse effect on the environment.

Enforcement orders can also require a person to do something that is considered necessary to ensure compliance with the Act, any regulations, a rule in a plan, a resource consent, and certain other requirements, and to avoid, remedy or mitigate adverse effects on the environment caused by that person.

A council can issue an abatement notice for a similar range of circumstances as outlined above.

Penalties for offences vary depending on the nature of the offence, but extend to imprisonment for up to two years or a fine not exceeding $200,000 and, where the offence is a continuing one, a fine not exceeding $10,000 for every day that the offence continues.

Central and Regional Government

Central and regional government agencies administer functions under the Biosecurity Act 1993. The Act provides a framework to manage pests and unwanted organisms in New Zealand. The work is led and co-ordinated by the Ministry of Agriculture and Forestry, which has a specialist enforcement team with powers of prosecution for breaches of the biosecurity law. Penalties for offences against the provisions of the Act vary according to the nature of

the offence. For an individual person penalties range up to imprisonment for a term not exceeding five years, a fine not exceeding $100,000, or both. In the case of a corporation the penalties involve fines of up to $200,000.

New Zealand is relatively free of major pests and diseases owing to its geographic isolation and strong border controls. Incoming passengers and freight are physically checked for items that could be carrying dangerous pests and diseases. In the year ended March 2001 some 143,710 plant product items were seized. The maximum penalty for making a false declaration is a fine of up to $100,000 or imprisonment for up to five years. An instant fine of $200 is levied on anyone who completes their declaration card incorrectly or forgets to declare items.

Where regional pest management strategies exist and a land occupier fails to comply with any rule in that strategy, the relevant regional council may require the land owner to undertake specified actions to address the situation. Failure to comply with a legal direction can result in the regional council entering onto the land to carry out the work itself and recovering actual and reasonable costs from the land owner.

Sources of Information

- Ministry of Agriculture and Forestry.
- Department of Conservation.

7.3 Economic Framework

DESCRIPTION

Indicator 7.3: Extent to which the economic framework (economic policies and measures) supports the conservation and sustainable management of forests.

7.3.a: Investment & Taxation

DESCRIPTION

Indicator 7.3.a: Investment and taxation policies and a regulatory environment which recognise the long-term nature of investments and permit the flow of capital in and out of the forest sector in response to market signals, non-market economic valuations, and public policy decisions in order to meet long-term demands for forest products and services.

RATIONALE

Forests are the source of a range of products that are traded in the marketplace. These products thus have an economic value. Documenting and monitoring the economic frameworks, which will vary in their details among countries, will provide opportunities to demonstrate whether the economic products are being sustained, over-exploited or under-utilised. The linkages between market sustainability and ecological sustainability are not well understood, nor is there sufficient knowledge to say whether economic factors are sensitive enough to identify changes needed in forest management before there is impact on forest ecosystems. Indicators in the subsections of Criterion 7 may allow sufficient tracking of the economic framework to permit a strengthening of the linkages between the market and management of forests.

2003 COUNTRY REPORT

The New Zealand Government is a strong advocate of foreign investment and has created an environment attractive to international capital. Liberal foreign exchange policies have been introduced which allow currency to be freely taken into and out of New Zealand. A well developed, stable and cost-competitive business infrastructure, with low inflation, low energy costs and high labour productivity ensures internationally competitive returns. This is reflected in:

- increases in new forest plantings (Table 34)
- the change of forest ownership from government to private, and investment in forest processing over the last 10 years (Table 35).

Table 34: New Planting and Restocking Indicators by Year of Planting

Planting year	New planting (ha)	Restocking (ha)
1991	15,000	22,000
1992	50,200	20,500
1993	61,600	24,800
1994	98,200	25,000
1995	73,900	26,300
1996	83,600	28,200
1997	63,700	27,900
1998	51,200	29,900
1999	40,400	29,300
2000	33,600	35,700
2001(p)	31,300	34,600

Source: Ministry of Forestry
(p) = provisional

Table 35 Ownership of New Zealand's planted forests

Year Ended	Planted forest area (000 ha)		
31 March	State	Private	Total
1987	598	556	1154
1988	588	626	1214
1989	607	633	1240
1990	607	654	1261
1991	361	928	1289
1992	356	952	1308
1993	262	1066	1328
1994	267	1121	1388
1995	274	1204	1478
1996	274	1268	1542
1997	109	1521	1630
1998	108	1571	1679
1999	104	1627	1731
2000	94	1675	1769
2001	93	1706	1799

Source: Ministry of Agriculture and Forestry

Taxation System

The main forms of taxation that affect forestry are income tax and GST. Costs incurred by a forestry business for planting, tending and maintenance are fully deductible against income from any year in which the costs were incurred. Changes made in 1992 also allow land preparation costs, including roading, fencing and land clearing, to be amortised.

Investment Mechanisms

Investment in the forest growing and forest product processing sectors can be made in a number of ways, giving flexibility for investors. Mechanisms include:

- direct investment e.g. through the purchase of land, forestry cutting rights or processing facilities;
- joint ventures facilitated through the Forestry Rights Registration Act 1983;
- shares in forestry companies;
- investment companies;
- partnerships.

Foreign Direct Investment

Regulations set out the requirements for an overseas person to obtain consent before investing in a New Zealand company or land. Approvals are not always required. Under the regulations, an "overseas person" must obtain consent from the Overseas Investment Commission in order to acquire or take "control" of 25 percent or more of:

- businesses or property worth more than $50 million;
- land over five hectares and/or worth more than $10 million;
- any land on most off-shore islands;

- certain sensitive land over 0.4 hectares (e.g. on specified islands, containing or next to reserves, historic or heritage areas, the foreshore or lakes).

The Act has established investment criteria, which require that non-land investments be approved if an applicant can satisfy an "investor" test based on business experience and acumen, financial commitment and good character. Recent amendments to the Act require an investment to demonstrate substantial and identifiable benefits to New Zealand or to a region, district or general locality where the investment is targeted.

In terms of wood processing, the Overseas Investment Act constitutes a relatively minor barrier to investment. In terms of greenfields investments, the Act applies to moderately large-scale processing facilities.

Table 36: Investment in Forest Growing 1992-2000

	Category forestry net investment ($ millions)	Total net investment ($ millions)	
1992	627.5	6,739.8	9%
1993	184.4	9,408.9	2%
1994	512.2	5226	10%
1995	258.2	4877	5%
1996	1,076.7	4,727.4	23%
1997	470.3	1,696.9	28%
1998	98.3	7,127.8	1%
1999	131.3	3,455.8	4%
2000	1,158.3	5,345.7	22%
2001	29.1	1,181.4	2%
	4,546.3	**49,786.7**	**9%**

Sources: 1992 – 95 Attachment 4 OIC Release 23/7/97
1996 – 2001 Attachment 2.2 OIC Release 24/5/02

The New Zealand forest growing industry is an attractive avenue for foreign investment. Forestry accounted for 9 percent of the total net value of requests approved by the Overseas Investment Commission calendar years 1992 to 2001 (see Table 36).

Investment in wood processing in the period (year ended March) 1992-2002 has been mostly through foreign direct investment. Over that period, more than $1.4 billion has been invested by companies either wholly or majority owned by offshore interests, compared with $173 million by New Zealand-owned companies.

Sources of Information
- Statistics New Zealand.
- New Zealand Ministry of Forestry (2001) *National Exotic Forest Description.*
- New Zealand Forest Service (historical data).
- Overseas Investment Commission.

7.3.b: Trade Policies

DESCRIPTION

Indicator 7.3.b: Non-discriminatory trade policies for forest products.

RATIONALE

Forests are the source of a range of products that are traded in the marketplace. These products thus have an economic value. Documenting and monitoring the economic frameworks, which will vary in their details among countries, will provide opportunities to

demonstrate whether the economic products are being sustained, over-exploited or under-utilised. The linkages between market sustainability and ecological sustainability are not well understood. Although the linkages between forest management and its effects on, and relationship to, ecological sustainability are becoming better understood, there is insufficient knowledge to say whether economic factors are sensitive enough to identify changes needed in forest management before there is impact on forest ecosystems. Indicators in the subsections of Criterion 7 may allow sufficient tracking of the economic framework to permit a strengthening of the linkages between the market and management of forests.

2003 COUNTRY REPORT

Trade liberalisation is consistent with, and a necessary complement to, New Zealand's market-led domestic economic reforms of the past decade. The free-market philosophy is based around the concept that when firms and people are completely free to buy and sell goods and services, those goods and services will, all other things being equal, be allocated to those who value them most highly. Similarly, a non-discriminatory trade policy will assist achievement of sustainable forest management by helping to ensure forest resources are appropriately valued.

New Zealand operates a relatively open trade policy. During the GATT Uruguay Round New Zealand supported a zero-for-zero sectoral initiative which advocated across-the-board elimination of tariffs on wood and paper products. The failure of this wood products initiative led to New Zealand retaining some relatively low tariffs (maximum 7 percent) on solid wood products. For pulp and paper items, however, New Zealand signed a zero-for-zero undertaking and for pulp this has already been achieved. Stepped tariff reductions for paper are being implemented that will leave a zero tariff regime in place by 1 January 2004. New Zealand is also committed to ensuring its border protection operations and technical standards and regulations are consistent with the *WTO Agreement on Sanitary and Phytosanitary Measures* and the *WTO Agreement on Technical Barriers to Trade.*

New Zealand is a foundation member of Asia Pacific Economic Cooperation (APEC), a co-operative which promotes trade liberalisation, facilitation and economic development. New Zealand subscribes to APEC's *Declaration of Resolve* agreed in Bogor in 1994 that proposes a timetable liberalisation throughout the region. According to the Bogor timetable by 2010 free and open trade and investment will be achieved by the developed economies and 2020 by developing economies.

New Zealand has a free trade agreement with Australia, the Australia-New Zealand Closer Economic Relations Trade Agreement (ANZCERTA). Under this agreement, all forestry trade between the two countries is free of tariffs. New Zealand also entered a Closer Economic Partnership Agreement with Singapore on 1 January 2001, which similarly ensures that all forestry trade between the two countries is tariff free.

New Zealand has also ratified the Pacific Agreement on Closer Economic Relations (PACER), which is expected to enter into force later in 2002. PACER sets out principles and objectives to guide future trade relations in the Pacific region, and provides for free trade to be established gradually among Pacific Island Forum members. It includes a future undertaking to commence negotiations with Australia and New Zealand on a Forum-wide free trade agreement. The South Pacific Regional Trade and Economic Co-operation Agreement (SPARTECA), under which Australia and New Zealand currently provide non-reciprocal duty-free access for Forum island countries to our markets, is not affected by PACER and all its provisions will remain in force. For most products, including all forest products,

SPARTECA entails duty-free access. The agreement is designed to ameliorate the large deficits run by the island countries in their trade with Australia and New Zealand.

In terms of its domestic forests New Zealand does operate a differential export policy in relation to its planted and indigenous forests. No quantitative restrictions are placed on the export of wood products (including logs) sourced from planted forests. For conservation reasons, however, exports of logs and woodchips (and in the case of some species, sawn timber) produced from indigenous forests are prohibited. There are no restrictions on the export of finished products manufactured from indigenous timbers.

Sources of Information

- Ministry of Foreign Affairs and Trade.
- Ministry of Agriculture and Forestry.

Further Reading

- Asia-Pacific Economic Co-operation (APEC), (1999), *Study of Non-Tariff Measures in the Forest Products Sector*, A Report prepared by Forest Research for the Committee on Trade and Investment, Rotorua.

7.4 Measuring & Monitoring

DESCRIPTION

Indicator 7.4: Capacity to measure and monitor changes in the conservation and sustainable management of forests.

7.4.a: Availability of Data

DESCRIPTION

Indicator 7.4.a: Availability and extent of up-to-date data, statistics and other information important to measuring/describing indicators associated with Criteria 1-7.

RATIONALE

The ongoing evaluation of sustainability of forests depends on the ability to measure biological, social and economic parameters in a continuous, reliable and agreed fashion. The structures may be part of duly constituted governments and/or other organisations and/or individuals with interests in forests. An agreed-upon understanding of sustainability will be based on measures clearly understood and accepted by societies. An open and transparent measurement system will enable support to be generated for policies promoting sustainability. The degree to which sustainability is being achieved will then be enhanced by the ability of countries to develop methods of assessment and common reporting. The acceptability of the use of indicators is strengthened if the system in place to monitor and measure is itself demonstrated to be sufficient to the task.

2003 COUNTRY REPORT

New Zealand has a rich set of production forestry statistics, some dating back to the 1920s. These statistics cover forest planting, harvesting, production, processing and trade in forestry products.

The Ministry of Agriculture and Forestry produces about 40 detailed forestry statistical releases each year. These releases cover the production of forestry products, forestry trade, employment, and roundwood removals. Some of these statistics have been collected and published from as far back as the 1920's. The statistical releases produced include:

Annual production surveys
The Ministry of Agriculture and Forestry undertakes national annual postal surveys (year ended March) of sawmilling, pulp and paper production and panel products. The surveys cover the production of the main forestry products, mill capacities, fibre supplies and known mill expansion plans. Results are made available through *Statistical Releases* issued in November each year.

Quarterly production and stock level surveys
The Ministry of Agriculture and Forestry conducts national postal surveys for the quarters ended March, June, September and December of sawmilling, pulp and paper production, and panel products. The surveys are designed to estimate quarterly production of outputs and stock levels at the end of each quarter. Results are made available through *Statistical Releases* issued six to eight weeks after the end of each quarter.

Roundwood Removals
Using the results from the annual and quarterly surveys of production described above and using log export volumes from Statistics New Zealand the Ministry of Agriculture and Forestry estimates – using roundwood conversion factors – roundwood removals for the quarters ended March, June, September and December. A reconciliation of wood flows is undertaken for the March year. The quarterly results are made available through *Statistical Releases* issued six to eight weeks after the end of each quarter. The March year reconciliation is generally released by December of the same year.

Employment in Forestry and Wood Processing Activities
The Ministry of Agriculture and Forestry compiles total New Zealand employment in forestry and wood processing activities from statistical information supplied by Statistics New Zealand. The reference date is as at mid-February and the *Statistical Release* is normally available in October.

Exports of Forestry Products
The Ministry of Agriculture and Forestry prepares a series of compilations on forestry exports using detailed trade data supplied by Statistics New Zealand. This work results in several *Statistical Releases*:

- comprehensive forestry exports statistics for the years ended March, June and December are produced eight weeks after the end of the reference year;
- quarterly *Statistical Releases* giving $fob (free on board) values and quantities of log and woodchip exports by port of loading and country of destination for the March, June, September and December quarters are available six weeks after the end of the quarter;
- quarterly *Statistical Releases* giving $fob values and quantities of logs and woodchips, sawn timber, plywood, particleboard, fibreboard, chemical pulp and mechanical pulp by country of destination for the March, June, September and December quarters are available six to eight weeks after the end of the quarter;
- quarterly index numbers compiled by Statistics New Zealand giving price and volume level movements for groupings of forestry products are distributed as *Statistical Releases* 10 weeks after the end of each quarter.

Imports of Forestry Products
The Ministry of Agriculture and Forestry prepares a series of compilations on forestry imports using detailed trade data supplied by Statistics New Zealand. Forest product import *Statistical Releases* for the years ended March, June and December are produced 12 weeks after the end of each reference year.

Further details on the statistics collected are available on the internet at www.maf.govt.nz/statistics/primaryindustries/forestry.

In addition to the statistics published by the Ministry of Agriculture and Forestry a number of statistics presented in the report are drawn from statistics published by Statistics New Zealand. Statistics New Zealand is New Zealand's central government statistical agency. A core focus of Statistics New Zealand is the production of key economic and population statistics. Further details on the range of statistics produced by Statistics New Zealand are available at www.stats.govt.nz.

The availability of data to allow reporting on forests other than exotic production forests is not quite so developed. In terms of wider environmental reporting, a great deal of environmental information is collected across New Zealand. Central and local government agencies, Crown research institutes, universities, businesses, iwi and other researchers collect information to assist environmental decision-making. It is also used to satisfy international reporting requirements (e.g. ozone and climate change agreements with the Organisation for Economic Co-operation and Development (OECD)) and national requirements (e.g. monitoring of forestry activities by forestry companies required by local government to satisfy resource consent procedures under the Resource Management Act process).

An *Environmental Performance Indicators Programme* is being developed by the Ministry for the Environment and will use indicators to measure and report how well we are looking after our environment (including forests). The Government's objectives for the Programme are:

- to systematically report on the state of New Zealand's environmental assets;
- to systematically measure the performance of its environmental policies and legislation;
- to better prioritise policy and improve environmental decision making.

These measures, coupled with the continual improvement requirements needed for forestry companies to maintain their FSC certificates, will greatly assist future Montreal Process reporting.

Sources of Information

- Ministry of Agriculture and Forestry.
- Statistics New Zealand.
- Ministry for the Environment.

7.4.b: Statistical Reliability

DESCRIPTION

Indicator 7.4.b: Scope, frequency and statistical reliability of forest inventories, assessments, monitoring and other relevant information.

RATIONALE

As for indicator 7.4.a.

2003 COUNTRY REPORT

Historically New Zealand's national forestry statistics, monitoring and inventory systems have focused on the economic production aspects of forestry. Since the late 1960s dependence on timber production from indigenous forests has greatly reduced and now almost all of New Zealand's timber production comes from planted production forests.

To date only one formal National Forest Inventory of New Zealand's indigenous forests has been undertaken. This was undertaken post the Second World War, with the results published in the early 1950s. Ecological-based vegetation monitoring has been undertaken over the last 50 years or so. This ecological data has been brought together in the National Vegetation Database (NVS) managed by Landcare Research.

A system of regular surveying of planted forest owners, the National Exotic Forest Description (NEFD), commenced operation in 1983 and has continued to evolve since that time.

During the major government sector restructuring that occurred in New Zealand in the 1980s and early 1990s many monitoring systems were downsized and some were ceased altogether. However, since the United Nations Conference on Environment and Development in 1992 there has been increasing awareness of environmental issues, enhanced by a range of international environmental agreements and their requirement for monitoring and reporting. In terms of forestry the most significant additional data collected has been the New Zealand Land Cover Database (LCDB). Very recently a national carbon monitoring system for indigenous forests, scublands and soils has commenced field data collection.

Below is a brief description of each of the key national monitoring and statistical systems of relevance to Montreal Process reporting.

Land Cover Database

The LCDB is a digital thematic map of land cover designed for use in a geographic information system or as a printed map. LCDB1 provides complete geographic coverage of the New Zealand mainland, derived mainly from summer 1996/97 satellite imagery.

LCDB1 Classification

The land cover classes are mutually exclusive and comprise polygon features and linear features. The main sources of images for LCDB1 were the SPOT 2 and SPOT 3 satellites. The minimum mapping unit is one hectare. The 16 land cover classes have been grouped into culturally derived and self-regenerating land cover types as follows:

Culturally Derived Land Cover Types

- Planted forest – planted forest, predominantly radiata pine.
- Shelterbelts – major shelterbelts (visible on imagery).
- Primarily pastoral – exotic pasture, enclosure distinguishes this from extensively managed tussock grasslands; includes arable land.
- Primarily horticultural – orchards, kiwifruit and market gardens.
- Urban area.
- Urban open space – sports fields, parklands, etc.
- Mines, gravel pits and dump sites.

Self-regenerating Land Cover Types

- Indigenous forest – forest cover dominated by indigenous tall forest canopy species.
- Shrubland – woody vegetation in which the cover of shrubs and trees in the canopy is >20 percent and in which shrub cover exceeds that of any other growth form or bare ground. Shrubs are woody plants e.g. manuka, kanuka, matagouri, gorse, broom, hawthorne.
- Tussock grassland or extensively managed grassland.
- Bare ground – non-pastoral exposed soil and rock.
- Inland wetlands – inundated by fresh water.
- Coastal wetlands – inundated by salt water.
- Coastal sands – beach sands and dunes.
- Inland water – lakes, ponds and rivers.
- Mangrove – sea level mangrove swamp land.

Data Quality

An accuracy assessment undertaken by Forest Research showed an overall user classification accuracy of 93 percent.

Imagery for a second LCDB (LCDB2) was acquired over the 2001/02 summer period using Landsat 7. Classification of this imagery has recently commenced. It is proposed to expand the number of land cover classes in LCDB2.

Further details on LCDB1 are available at www.maf.govt.nz/statistics/primaryindustries/landcover.

National Exotic Forest Description (NEFD)

The NEFD is a quantitative database of New Zealand's planted forests. The NEFD is New Zealand's official source of statistics on planted forests. It is used for a number of purposes, including:

- to support policy advice to government;
- to meet international reporting requirements;
- for planning and investment analysis by the forest industry;
- for infrastructure investment planning by local government;
- as input for a number of statistical measures of the New Zealand economy, including calculating GDP.

From inception in 1983, the NEFD has operated as a partnership between the Government (through its forestry department) and the private forest industry. The work is overseen by a Government/Industry Steering Committee. The NEFD partnership model has proved to be highly effective in providing stability for the NEFD programme during a time of unprecedented change in government agencies and the forest industry. It has ensured the willing participation of forest owners in providing quite detailed information on their forest resources for the collective benefit of the forest industry and the Government.

The Ministry of Agriculture and Forestry manages the NEFD database, which comprises two data sets:

- area age class data – net stocked forest area by local authority, year of planting, species and management regime;
- yield table data – stem volume (broken down into pruned, saw and pulp logs) by location, age, species and management regime.

Area age class data are collected annually through a postal survey of forest growers. Large forest owners provide data electronically from their stand record systems. In addition to the area age class information, data on planting, harvesting and some ancillary forest resource data are collected. NEFD forest area reports are published each year. Yield tables are published from time to time. Reports on forecast future wood supply are published at about five-year intervals.

Over the next three years it is intended to develop a spatial planted forest database which will either be linked to or replace the current NEFD database.

Further details are available at www.maf.govt.nz/forestry.

National Vegetation Survey (NVS)
The NVS Databank is a physical archive and computer databank containing records from approximately 45,000 vegetation survey plots – including data from over 12,000 permanent plots. NVS provides a unique record, spanning more than 50 years, of indigenous and exotic plants in New Zealand's terrestrial ecosystems, from Northland to Stewart Island and the Kermadec and Chatham Islands. Broad ranges of habitats are covered, with special emphasis on indigenous forests and grasslands.

The physical archive includes plot sheets, maps and photographs from many years of vegetation surveys. Software that was specifically prepared for summarising data and statistical analysis is available.

The New Zealand Forest Service, Department of Lands and Survey and the DSIR Botany Division conducted the original surveys. Ongoing surveys and research by the Department of Conservation, regional councils, universities and Landcare Research are constantly providing new data to NVS. Such widely sourced information collated in one databank is part of the value of NVS to New Zealand. At the same time, the interests of data providers are protected through written agreements that determine access rights to specific datasets within NVS.

Data within NVS supports reporting requirements for the Convention on Biological Diversity, Framework Convention on Climate Change, Resource Management Act, State of Environment, and the Montreal Process. It also assists resource management and ecological restoration. Historical information in NVS has significance in enabling New Zealand to address issues of current concern that were unforeseen at the time of data collection. They include assessing the impacts of climate change on indigenous ecosystems, the storage of carbon in indigenous ecosystems, and setting restoration goals in areas since degraded.

Two broad types of NVS data are collected:
1. General survey data, from plots that are usually not permanently marked. This data includes reconnaissance descriptions ("Recces") and Protected Natural Areas data. It is suitable for vegetation description, studies of species distributions, and studies needing only coarse measurement of changes in vegetation. More than 38,000 survey plots in NVS comprise:
- point-based compositional (and usually) structural description of vegetation;
- relative abundance in fixed structural tiers (usually included);
- location information (80 percent have New Zealand Mapping Series grid references).

Examples of uses include:
- vegetation description;
- detecting biodiversity trends;

- studying weed invasions;
- relating species distribution to environment.

2. Permanent plot data where fixed area plots or transects have been established, and the vegetation has been measured precisely (e.g. tagged trees, sapling and seedling counts, species lists). Assessments of about 12,000 permanent plots in NVS are ideal for monitoring vegetation changes and the effects of management.

- Nearly all follow standard methods, e.g. in forests all trees within a fixed area (usually 400 square metres) are permanently tagged to allow repeat measurements.
- Most forest plots contain permanently marked seedling subplots to determine changes in seedling and herbaceous composition with time.
- Most are along objectively located transects.
- More than 80 percent have NZMS grid references (for forest plots, >95 percent).

Examples of potential uses:

- forest plots: growth, mortality, and recruitment of tree species, changes in structure and composition
- grassland and scrubland plots: change in structure and composition.

Further details are available at: www.landcareresearch.co.nz/research/biodiversity/nvs

Indigenous Forest, Scrub and Soils Carbon Monitoring System (CMS)
Following a number of years of research and development, a system to systematically monitor carbon stocks in indigenous forests, shrublands and soils commenced field data collection in 2002. The CMS involves the periodic measurement of about 1,400 indigenous forest and scrub plots located on a national 8km x 8km grid. For indigenous forest the plot design is essentially the same as the standard permanent NVS forest plot.

The first two measurement cycles are planned to be undertaken over five-year periods. If the measurement timetable is met estimates of indigenous forest carbon stocks will be available in 2007 and again in 2012. The intention of a second measurement within five years of the first is to quickly resolve any measurement errors. Following the first two measurement cycles it is planned to remeasure the plots at 10-year intervals.

7.4.c: Compatibility With Other Countries

DESCRIPTION

Indicator 7.4.c: Compatibility with other countries in measuring, monitoring and reporting on indicators.

RATIONALE

The ongoing evaluation of sustainability of forests depends on the ability to measure biological, social and economic parameters in a continuous, reliable and agreed fashion. The structures may be part of duly constituted governments and/or other organisations and/or individuals with interests in forests. An agreed-upon understanding of sustainability will be based on measures clearly understood and accepted by societies. An open and transparent measurement system will enable support to be generated for policies promoting sustainability. The degree to which sustainability is being achieved will then be enhanced by the ability of countries to develop methods of assessment and common reporting. The acceptability of the

use of indicators is strengthened if the system in place to monitor and measure is itself demonstrated to be sufficient to the task.

2003 COUNTRY REPORT

There are two elements to defining sustainability of forests. The first is to identify the key components of sustainability and the second to set standards of performance for each criterion (or for the set of indicators under each criterion). While identifying the first can generally be common to a group of countries within a process, setting performance standards can be unique to each country. This is because the situation of each country is different and the value placed by society in each country on different aspects of forestry could thus be different.

Even when performance standards have been set it may be difficult to use them to define sustainability for all time since they may need to take account of society's changing values.

A definition of sustainability may not be necessary to determine whether a country is moving towards or away from sustainability. Since the Criteria have already identified the key components of sustainable forest management the movement of indicators over time can provide the direction of change. That will allow policy makers to intervene to correct any adverse trends so that positive progress could be maintained.

This being the first report for New Zealand, the data gathered will set the benchmark for the indicators. Subsequent reports will indicate the direction of movement. With knowledge and experience the indicators may need to be tweaked to provide appropriate information sufficient to the task. Thus the entire process needs to be treated as a dynamic system just like the forests it measures.

7.5 Research & Development

DESCRIPTION

Indicator 7.5: Capacity to conduct and apply research and development aimed at improving forest management and delivery of forest goods and services.

RATIONALE

Forest policies in all countries rely upon a base of knowledge that functions within socio-economic and legal frameworks. An integration of this knowledge into the various frameworks is essential for reporting on and demonstrating sustainability. In order to do this, countries and societies must develop, maintain and enhance the intellectual capital and be willing to share and disseminate this knowledge openly and freely. New methods, approaches, concepts and techniques must be developed and integrated within the decision-making frameworks if full benefits from forests are to be realised. Countries and societies accept that many types and degrees of knowledge can be valuable in attaining sustainability. Efforts at attaining the goal of sustainability can be enhanced by the degree to which innovative techniques are developed and used to assess human activities and needs from the forest and their relationship to the ecology of forests.

7.5.a: Scientific Understanding

DESCRIPTION

Indicator 7.5.a: Development of scientific understanding of forest ecosystem characteristics and functions.

RATIONALE

As for Indicator 7.5.

2003 COUNTRY REPORT

New Zealand's experience of the scientific understanding of forest ecosystem characteristics and functions is drawn from expert reports and peer-reviewed scientific studies, published internationally and in New Zealand. These cover pure long-term research into ecosystem functions, in addition to applied topics, such as monitoring the extent and condition of forest ecosystems.

Forest Research is one of the oldest forest based-research organisations in the world, founded in 1947. It was preceded by the Forest Experiment Station, established in 1920. Other research organisations involved with forestry and forest products include Landcare Research, National Institute of Water and Atmospheric Research Ltd (NIWA), and universities such as Canterbury, Lincoln, Waikato and Auckland.

Further Reading

- Kininmonth J. (1997) *History of Forestry Research in New Zealand*, New Zealand Forest Research Institute, Rotorua.

7.5.b: Costs & Benefits

DESCRIPTION

Indicator 7.5.b: Development of methodologies to measure and integrate environmental and social costs and benefits into markets and public policies, and to reflect forest-related resource depletion or replenishment in national accounting systems.

RATIONALE

As for Indicator 7.5.

2003 COUNTRY REPORT

Since 1995, the New Zealand Government has been working on the development of a series of environmental, social and economic indicators that will be used to assess the state of the country's environment, and provide credible evidence for public policy decisions. This work has been led by the Ministry for the Environment and Statistics New Zealand.

The Ministry for the Environment is currently preparing a set of Environmental Performance Indicators that will provide data on key aspects of air, land and marine management. This data will be used to monitor environmental conditions and the effectiveness of current policies (Ministry for the Environment, 1996, p.21).

Statistics New Zealand has been examining the socio-economic pressures on the country's physical resources and has developed a series of indicators to reflect these conditions. The two

sets of indicators are designed to complement each other. "The Ministry's environmental indicators are mainly designed to measure environmental states and pressures on the environment or society's response to these, while the socio-economic indicators are designed to provide additional information on the social or economic driving forces behind these states, pressures and responses" (Environmental Statistics Team, 2002, p. 6).

Statistics New Zealand is also preparing a series of "natural resource accounts" for the country. "Resource accounts provide information about the existing stocks of natural resources and the level of natural resource use and supply" (Ibid. p. 7). The accounts will be used to assess the sustainability of current economic and social practices, and how they are impacting upon the environment. A draft stock account for forestry has been prepared and is currently being reviewed.

The *Environmental Performance Indicators Programme* "aims to establish a relevant, credible core set of national environmental statistics to assess the state of the environment, to help assess the effectiveness of environmental policies, and to identify emerging environmental trends" (Ministry for the Environment, 1996, p. 21).

With this material, the Ministry for the Environment will have a greater capacity to report on environmental health and contribute more effectively to policy formation and evaluation. A large proportion of the material needed for these indicators is already collected by government and private organisations[57], such as in the Ministry of Agriculture and Forestry's Land Cover Data Base. The Ministry for the Environment will bring together this existing material and work with a range of organisations to develop new survey and assessment measures.

The Indicators Programme has 14 research strands, covering the spectrum from biodiversity through to energy and waste. Within the majority of these strands, there are indicators that have relevance to the forestry estate. Forestry-related indicators include:

- the biodiversity condition of selected ecosystems and habitats compared with historic and current baselines;
- the level of fragmentation in indigenous vegetation cover;
- percentage of New Zealand's different environments, ecosystems and habitats under protection;
- change in areas susceptible to hill and high country erosion;
- change in the extent of each land cover class.

A number of these indicators are currently operating, such as the land cover assessment, while work is continuing on the development of appropriate measures for biodiversity condition and land fragmentation.

In conjunction with this work, Statistics New Zealand has been preparing a series of social and economic indicators, which will be used to identify the driving forces behind environmental change. In developing these indicators, the Department has studied the pressures upon New Zealand's natural resources. From this research, the Department has put together key statistical measures that highlight the social and economic conditions shaping the resource base.

These indicators are aligned to the research strands in the Environmental Performance Indicators Programme. In the case of the land management research strand, Statistics New Zealand has compiled data on population pressures, livestock numbers, land use patterns, timber production and the funding of environmental protection.

[57] These organisations include government departments, local authorities, Crown research institutes, universities, iwi, businesses and private researchers.

The intention is to combine the social, economic and environmental indicators to "create the foundation for an integrated [environmental] reporting system. Such a system can report on individual trends and policy performance for a variety of socio-economic or environmental issues" (Environmental Statistics Team, 2002, p. 6).

Statistics New Zealand is also leading work on the development of a set of "natural resource accounts" for New Zealand. This involves the creation of stock and flow accounts for specific resources, such as the forestry sector[58]. These accounts are being prepared using the United Nations System of Environmental and Economic Accounting (SEEA), which is an extension of the national accounts system used by Statistics New Zealand.

The function of these accounts is to determine the current store of natural resources and the level of use and supply. "Stock accounts show opening and closing balances for each resource, and categorise the stock changes that have occurred over the specific time period. Flow accounts show how the natural asset is used throughout the economy, including what sectors and industries use the resource" (Environmental Statistics Team, 2002, p. 7).

The information from the stock and flow accounts will enable government agencies to examine how natural resources are currently used; assess whether resources are being effectively managed (i.e. used sustainability); and determine what contribution they make to individual sectors and industries.

The findings from this work will "be used to identify environmental problems (such as resource depletion), analyse government policy, support resource management and decision-making, and construct macro-economic indicators for environmental performance" (Environmental Statistics Team, 2002, p. 8). The stock account for forestry was the first of the natural resource accounts to be prepared, and is being followed by accounts for energy, fish, land, sub-soil assets and water.

Sources of Information

- Environmental Statistics Team (2002); *Socio-Economic Indicators for the Environment: Summary of Submissions and Final Indicators;* Statistics New Zealand; Christchurch.
- Ministry for the Environment (1996); *National Environmental Indicators: Building a Framework for a Core Set;* Ministry for the Environment; Wellington.
- Ministry for the Environment – Environmental Performance Indicator Programme (www.environment.govt.nz).
- Statistics New Zealand – Socio-Economic Indicators for the Environment (www.stats.govt.nz).

7.5.c: Socio-Economic Consequences

DESCRIPTION

Indicator 7.5.c: New technologies and the capacity to assess the socio-economic consequences associated with the introduction of new technologies.

RATIONALE

As for Indicator 7.5.

[58] The accounts will be expressed in both physical and monetary terms.

2003 COUNTRY REPORT

New technologies may have quite profound impacts on land use and communities. In reality, the effects of change are more likely to be felt within communities associated with planted forests than the indigenous estate given the level of economic activity associated with them. The Resource Management Act 1991 makes provision for the assessment of impacts on people as well as the environment. The Act contains a mandatory requirement to assess social and cultural impacts in the definitions of both "environment" and "effects". The Fourth Schedule to the Act refers to the need to assess "any effect on those in the neighbourhood and, where relevant, the wider community including any socio-economic and cultural factors". It goes on to state that in interpretation, regard should be had to any effect that has a bearing on "natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, cultural, or other special value for present or future". The Act makes provision for mandatory community consultation and also the monitoring of effects if change takes place.

To date (July 2002), forest certification through the Forest Stewardship Council (FSC) process has been adopted by 11 forestry companies in New Zealand with a combined area of approximately 610,000 hectares of planted exotic and natural indigenous estate. The Principles and Criteria of FSC forest certification require management planning and operations to incorporate the results of social impact assessment. FSC Principle 4.4 states "Management planning and operations shall incorporate the results of evaluations of social impact. Consultations shall be maintained with people and groups directly affected by management operations."

The need to assess the social impact of forestry more adequately has been recognised by policy makers and researchers, particularly at the regional level. Forest Research has run a programme exploring the relationship between forestry and society, funded by the Foundation for Research Science and Technology, focusing on the consequences of land use change on the East Coast of the North Island. Similar research has been undertaken elsewhere, notably in the Mackenzie Basin of the South Island and Northland.

Sources of Information

- Resource Management Act 1991.
- Forest Stewardship Council.

Further Reading

- Taylor N.C., and Bryan, H.C. (1987) Social Impact Assessment in New Zealand Resource Management, in Miller M.L., Dale R., and Brown T. (eds), *Social Science in Natural Resource Management Systems,* Boulder, Co., Westview Press.

7.5.d: Impacts of Human Intervention

DESCRIPTION

7.5.d: Enhancement of ability to predict impacts of human intervention on forests.

RATIONALE

As for Indicator 7.5.

Enhancement of the ability to predict impacts of human intervention on forests in New Zealand is especially strong in the area of modelling planted forest management, and radiata pine forestry in particular.

New Zealand has over the last three decades developed a highly sophisticated and very accurate modelling system to predict the growth and yield of radiata pine. The system is built around a suite of growth models embedded in a growth and yield modelling programme called Standpak. Standpak, and the models that make up the overall system, were developed at the New Zealand Forest Research Institute, latterly called Forest Research. Forest Research continue to develop, support and market the system, and various other modelling systems that have evolved out of the core Standpak principles, such as a carbon modelling system.

Standpak is able to model the impacts of a range of human interventions on the growth and yield of planted radiata pine forests, such as impacts of tree-breeding improvements and effects of different silviculture regimes and rotation length.

Forest Research has also developed a system for forest resource assessment (called ATLAS Cruiser). This is specifically tailored to pre-harvest inventory and involves three distinct phases:

- planning and designing an assessment;
- field cruising to gather data on the forest resource;
- analysing data to determine forest state and potential yield, both current and future.

New technology typically arises, either from extensions to existing, proven tools, or from new applications of techniques in a different problem domain.

Proven methods of forest assessment, such as independence of cutting strategies from cruise data, and optimal merchandising, are included directly in ATLAS Cruiser. An example is the Cruiser stem description method, which maintains compatibility with previous inventory data, removes the 26-code limit, and provides a new, more repeatable system for describing stem structure, size, shape and branching.

Traditional forest assessment methods focus on area as the basis for sampling, resulting in estimates of mean per-hectare yields. In many situations it is preferable to leave area out of the yield equation and focus on individual stems as the unit of sampling. New methods for automatic stem-counting from remote images may, in future, make this approach the norm. Cruiser supports individual-stem-based sampling and the statistical design of assessments on this basis.

Growth projection is an important adjunct to a forest assessment system, as it enables the prediction of product yields through time. Individual tree growth models, as well as stand-level models, have been incorporated into Cruiser, allowing the more flexible tree-list approach to be used in the generation of yield data for forest planning. Prediction of branching patterns and branch growth is also available through the use of branch models.

Over the last decade or so there has also been a lot of research into the impacts and effects of harvesting systems on forest growth and sustainability. Research into harvesting New Zealand's planted pine forest resource started in the early 1980s with the establishment of the Logging Industry Research Organisation, modelled initially along the lines of Scandinavian logging research institutes. As well as researching the economics of harvesting, a lot of work has gone into the effects of harvesting systems on soil, water, landscape and aesthetic values.

These have been developed into predictive modelling and decision support systems, and harvesting research programmes continue within the programmes of Forest Research.

As well as growth and yield predictions, there have been some three decades of research into radiata pine silviculture covering areas such as the effects on growth and sustainability from:

- soil compaction and soil management (e.g. ripping of hard pans)
- fertiliser application;
- slash burning and slash retention;
- methods of establishment;
- use of herbicides;
- effects of slash residues.

There are also a number of research programmes measuring the long-term sustainability of successive rotations of radiata pine. These show that generally, under New Zealand conditions and with the types of silviculture commonly practised in New Zealand, successive rotations of radiata pine do not unduly degrade sites, and in some situations (e.g. on podsolised sands) site conditions can be improved.

The results of all this research into the impacts of human intervention on radiata pine forests have also been incorporated into predictive models and decision support systems.

There has not been the same level of research into impacts of indigenous silviculture, particularly in the last couple of decades, as the focus has not been on indigenous forestry for timber production. During the late 1950s through to the late 1970s research of indigenous forest silviculture was undertaken. While interest waned during the 1980s and 1990s, interest in silvicultural research is renewing, particularly as it relates to sustainable indigenous forest management. Some past work still applicable for timber production on private indigenous forest land (under sustainable management plans or permits) includes work on beech (*Nothofagus sp*), for example in relation to coupe size, and regeneration of rimu after group or single tree harvesting. Quite a lot of research is being carried out into kauri and totara silviculture (e.g. the effects of thinning and provenance trials) that may be similarly applicable.

Research into the impacts of human-introduced pests on (particularly) indigenous forests has been undertaken, and can be modelled. Other human impact research into, for example, recreation activities in indigenous forests, could be improved, and/or increased. As in many potential research programmes that have a blurred connection to specific economic outcomes, the question of who pays for this type of research in New Zealand needs further debate.

Sources of Information

- Forest Research (www.forestresearch.co.nz).

Further Reading

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- Roche M.M. (1990) *The History of Forestry,* New Zealand Forestry Corporation in association with G.P. Books, Wellington.
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7.5. e: Climate Change

DESCRIPTION

Indicator 7.5. e: Ability to predict impacts on forests of possible climate change.

RATIONALE

As for indicator 7.5.

2003 COUNTRY REPORT

The likely impacts of climate change and global warming on New Zealand are based on expert reports and peer-reviewed scientific studies, published internationally and in New Zealand. Recent work builds on the last government-led assessment of climate change impacts carried out in 1990 and concentrates on areas where new knowledge has been gained over the last decade.

Indigenous Ecosystems

With few exceptions, climate change alone is unlikely to be the dominant cause of indigenous species extinction, but may act as a compounding pressure on ecosystems which are already under threat. Fragmented indigenous forests of drier lowland environments in Northland, Waikato, Manawatu and in the east from East Cape to Southland are probably the most vulnerable to climate change. Also, some terrestrial and freshwater species which are currently at the (climatic) limit of their natural range may be at long-term risk of extinction. However, many complex interactions between elements of natural ecosystems, introduced exotic species and climate are not yet fully incorporated in assessment models.

Planted Forests

The 25- to 30-year commercial rotation period of radiata pine implies that over the lifetime of a tree, relatively significant climate changes may occur. Many other farming systems work with shorter planning horizons and hence can adapt on shorter time scales.

The growth rate of trees under carbon fertilisation is expected to increase like that for most crops. Studies carried out on pine seedlings confirm increases of about 20 percent under doubled carbon dioxide concentrations, but questions have been raised over the long-term effect of carbon fertilisation. Older trees showed very little response to carbon fertilisation under growth chamber experiments. The full effect of increased carbon dioxide over the lifetime of a tree under free environment conditions, including the possibility of earlier harvesting, has yet to be verified.

A negative impact of climate change on planted forest growth rates could lie in changes in rainfall patterns. Radiata pine requires about 1,500 millimetres of annual rainfall for optimal growth, and drier areas in the East Coast of the North Island could experience growth reductions under projected rainfall reductions. However, this reduction could be offset by increased water efficiency of trees under increased carbon dioxide concentrations. Data and models are still too limited to allow quantitative predictions.

Higher temperatures may be beneficial to radiata pine growth in many areas, but may also increase the occurrence of damaging conditions such as upper mid-crown yellowing under dry conditions, and fungal diseases in warmer winters. The fact that night-time temperatures rise relatively faster compared with day-time temperatures, as predicted under the global warming scenarios, could have a negative effect on tree growth. Trees gain resources and energy during

the day through photosynthesis, but are likely to lose a greater proportion of these resources during the night under higher temperatures. Recently developed process-based models increase our understanding of the environmental factors contributing to tree growth rates, but they have yet to be linked with climate scenarios to allow quantitative predictions under future climate conditions. Warm and dry summer conditions could also increase the risk of fire to forest stands in areas where average rainfall is likely to decrease.

Sources of Information

- New Zealand Climate Change website and associated reports (hwww.climatechange.govt.nz/sp/resources/resources_publications_alt.htm).

Further Reading

- Ford-Robertson, J. (1998) *Implications of carbon accounting methods for harvested wood products in New Zealand*. Contract report for the New Zealand Forest Industries Council. Forest Research, Rotorua.
- Ford-Robertson, J. (2001) (Draft) *Carbon in harvested wood products in New Zealand* Contract report for the Ministry of the Environment. Forest Research, Rotorua.
- Hollinger, D.Y., MacLaren, J.P., Beets, P.N. and Turland, J. (1993) Carbon sequestration by New Zealand's plantation forests. *New Zealand Journal of Science*. Vol 23(2), pp 194-208.
- Wakelin, S.J, and Te Morenga, L.A. (1996) *Carbon Sequestration by Plantation Forests in New Zealand. Calculations Revised as at December 1996.* Contract report for the Ministry of Forestry and the Ministry for the Environment. Forest Research Institute, Rotorua.
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Appendix 1: List of Common & Botanical Names

Acacia	*Acacia* spp
Beech	*Northofagus* spp
Black beech	*Nothofagus solandri*
Broom	*Cytisus scoparius*
Cypress	*Cupressus* spp
Douglas-fir	*Pseudotsuga menziesii*
Eucalypts	*Eucalyptus* spp
Ginseng	*Panax ginseng and P. quinquefolium*
Gorse	*Ulex europaeus*
Hawthorne	*Crateaegus* spp
Kamahi	*Weinmannia racemosa*
Kanuka	*Kunzea ericoides*
Karamu	*Coprosma robusta*
Kauri	*Agathis australis*
Kohekohe	*Dysoxylum spectabile*
Koromiko	*Hebe salicifolia*
Kotukutuku	*Fuchsia excorticata*
Makomako	*Aristotelia serrata*
Mangrove	*Avicennia marina var. resinifera*
Manuka	*Leptospermum scoparium*
Matagouri	*Discaria toumatou*
Matai	*Prumnoptys taxifolia*
Pohutukawa	*Metrosideros excelsa*
Radiata pine	*Pinus radiata*
Rata	*Metrosideros robusta*
Red beech	*Nothofagus fusca*
Rewarewa	*Knightia excelsa*
Rimu	*Dacrydium cupressinum*
Southern rata	*Metrosideros umbellata*
Sphagnum moss	*Sphagnum cristatum*
Taraire	*Beilschmiedia tarairi*
Tawa	*Beilschmiedia tawa*
Tawari	*Ixerba brexiodes*
Totara	*Podocarpus totara*
Tussock grass	*Stipa trichotama*