



## New Zealand's Contribution to Montreal Process Overview Report 2003

2003



Ministry of Agriculture and Forestry  
Te Manatū Ahuwhenua, Ngāherehere

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# Extent of area by forest type

## Description

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

Table 1: Status

	Planted Forest	Indigenous Forest
1. Data Availability	Most data readily available	Most data readily available
2. Data Quality		
a) Reliability	Good data sources	Good data sources
b) Historical Coverage	1953 on	1953 on
c) Frequency of Collection	Annual	5-yearly
3. Source of Aggregation	Sub-nationally	Sub-nationally
4. Area Coverage	100%	100%
5. Future Data Availability	High	High
6. Reporting Methodology	Quantifiable data	Quantifiable data
7. Difficulty of Reporting	Easy	Moderate

## Rationale

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

## 2003 Country Report

### What are we measuring?

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% of indigenous forest by area.

## Factual description

The area in indigenous forest as at 1996 was calculated as being 6.24 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 is an estimated 2.68 million hectares of scrubland.

The planted production forest area as at 1 April 2001 totalled an estimated 1.80 million hectares.

Hence, the total estimated forest area of New Zealand is approximately 8.0 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 the balance (22 percent).

**Table 1: Total forest areas by class in New Zealand**

Forest Type	Plantation (000 ha)			Total (000 ha)
	Indigenous forest (000 ha)	Native	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%)
<b>Total</b>	<b>8,916</b>		<b>1,799</b>	<b>10,715</b>

## 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 1996-1997. The overall mapping accuracy of the LCDB across all land cover classes was estimated as 94%. 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 & Forestry, Wellington, 2001). The extent of indigenous forest area in plantations is considered to be negligible.

## Timber production

### Description

Indicator 22: Area of forest land and net area of forest land available for timber production

### Status

	Planted Forest	Indigenous Forest
1. Data Availability	Data readily available	Most data available
2. Data Quality		
3 a) Reliability	Reliable source	Reliable source
b) Historical Coverage	1983 onwards	1953 onwards
c) Frequency of Collection	Annual	5 yearly
3. Source of Aggregation	Sub-nationally	Nationally
4. Area Coverage	100%	100%
5. Future Data Availability	High	High
6. Reporting Methodology	Quantifiable data	Quantifiable data
7. Difficulty of Reporting	Easy	Moderate

## 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

### What are we measuring?

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 provision 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 Maori owned indigenous forest established under the South Island Landless Natives Act, 1906 (SILNA land) is exempt from the sustainable forest management provisions of the Forest 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 are net stocked forest areas. All other indigenous forest areas quoted (including the potential future area for timber production) of forest are gross forest areas and may include some unstocked forest land.

### Factual description

#### *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 is covered by sustainable forest management plans and permits registered with the Ministry of Agriculture and Forestry. The remaining 20,000 hectares of forest is on SILNA land (as described above).

In future it is likely that the area of indigenous forest available for timber production will increase. There is approximately 1 million hectares of privately owned indigenous forest, of this 226,000 hectares have protective covenants. The balance of the privately owned

indigenous forest (774,000 ha) 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 due 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.

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 01/06, Ministry of Agriculture and Forestry, Wellington, New Zealand, 2002.

## Insects, disease, fire etc.

### Description

Indicator 3a: Area and percent of forest affected by processes or agents beyond the range of historic variation, e.g. by insects and domestic animals.

### Status

	Planted Forest	Indigenous Forest
1. Data Availability	Readily available	Data is not presently available
2. Data Quality		
a) Reliability	High	
b) Historical Coverage	Varies by process or agent	
c) Frequency of Collection	Varies, annual to erratic	
3. Source of Aggregation	Varies, national to sub-national	
4. Area Coverage	Nearly 100%	
5. Future Data Availability	Good	Low
6. Reporting Methodology	Quantifiable and narrative	Case study example Explanatory narrative
7. Difficulty of Reporting	Relatively easy	Difficult

### 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

### Introduction

New Zealand generally has some difficulty reporting on the three indicators under Criterion 3. Some information is unable to be aggregated on a national basis. In addition there are a number of agencies with responsibility for the management of pests and diseases that makes the aggregation difficult. Indicator (b) is not seen as relevant for New Zealand.



## Summary

Overall, there is reasonable information on many aspects of indicator 3a. In many cases, historical data is available and trends can be established, although there are occasionally difficulties with the way that data have been recorded. New Zealand's plantations 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. 5 years) for sufficient data to accumulate.

## Fire

### *What are we measuring?*

The New Zealand National Rural Fire Authority (NZRFA) 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 are summarised for three types of land cover: grass lands, scrub, and forest. "Forest" includes indigenous as well as plantation forests.

Plantation-specific data is available, but these 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 to plantation 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.

### *Factual description*

The area of all forest burned in New Zealand 1986-2001 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.

Table 2: New Zealand rural fire statistics for the period 1986/87-2000/01, showing percentage of total forested area burned (Source: NRFA 2001)

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	1296	0.016
1998/99	213	0.003
1999/00	141	0.002
2000/01 <sup>(1)</sup>	412	0.005

Note (1) Based on returns from 89% of RFAs.

### *Sources of Information*

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

## Introduced pest animals

### *Factual description*

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 on many of New Zealand’s native flora such as rata, rewarewa, kohekohe, kamahi; over 100 species in total. 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 native 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.

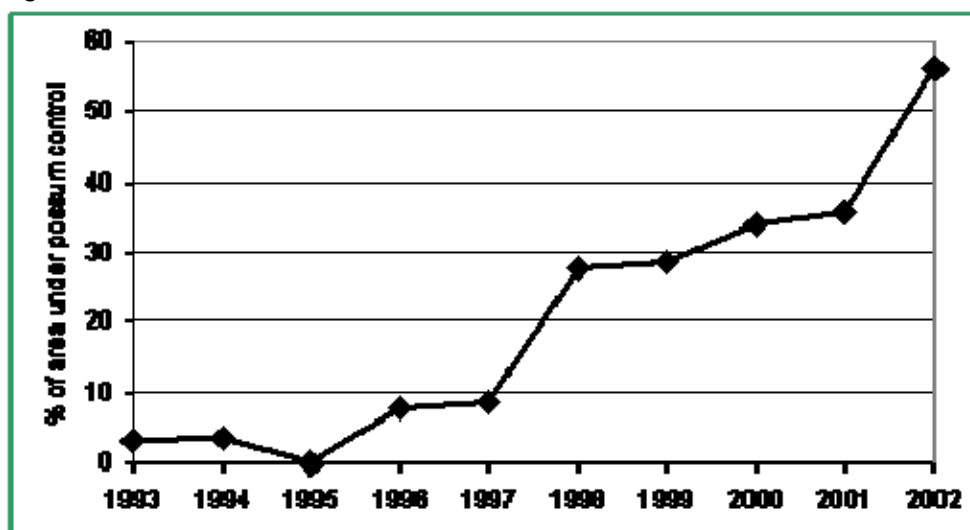
The possum is distributed throughout mainland New Zealand. It has been estimated that there are as many as 70 million possums in New Zealand.

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 is a further 1.8 million hectares of indigenous forest

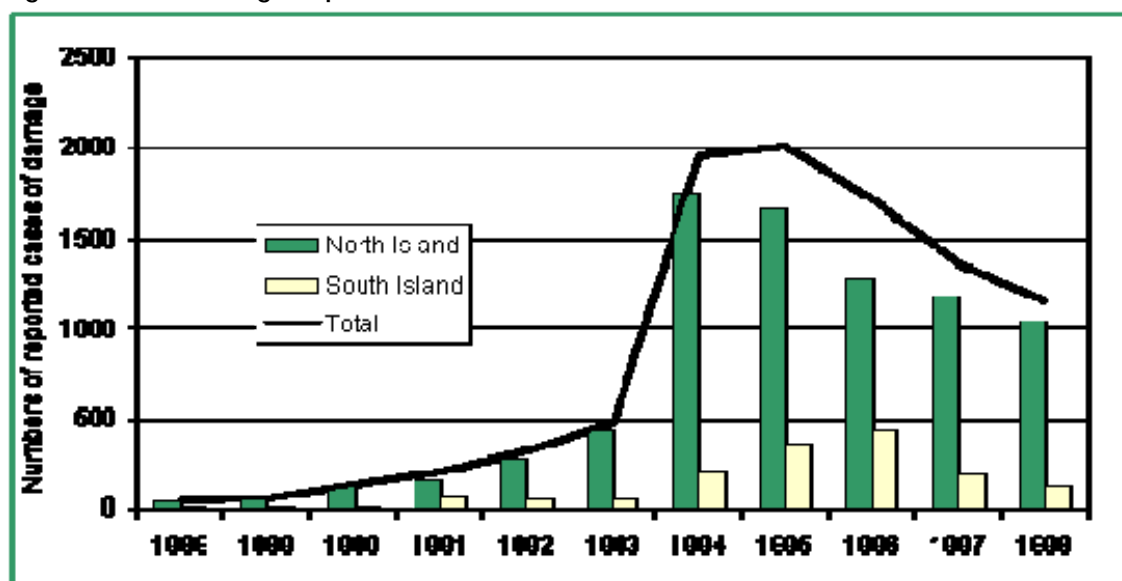
in private ownership for which there is little data available on the control of possums or other animal pests.

Fig 1: Possum control in DOC forest



Based on information reviewed by Hosking (2000b), leader breakage of younger trees is the most significant damage in plantation forests by possums, but on the symptoms, including needle clipping, have been recorded. A secondary problem is infection of damaged trees with the fungal pathogen *Diplodia pinea*.

Fig 2: Possum damage in plantation forests



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.

#### Sources of information

- Possums: Forest Health Database (Forest Research), Gordon Hosking (Hosking Forestry) and Ian Payton (Landcare Research)
- Animal Health Board manager – Nick Hancox
- Handbook of NZ Mammals
- Journal of the Royal Society Vol 31, No.1

- Efford, M 2000. The Brushtail Possum. Biology, Impact and Management of an Introduced Marsupial. Editor Montague. Chap 5, pp 47-61. Manaaki Whenua Press, Lincoln, New Zealand. ISSN 0-478-09336-5.

## Disease

### *Factual description*

Economic losses due 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 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 (Bulman, pers comm).

To provide an overview of the relative importance of tree diseases, a loss ranking is shown in Table 3:

**Table 3: Losses from exotic forest pathogens**

Disease	Host	Loss (NZ\$ mil/annum)
<i>Cyclaneusma minus</i>	<i>Pinus radiata</i>	51
<i>Dothistroma Pini</i>	<i>Pinus radiata</i>	24
<i>Sphaeropsis sapinea</i>	<i>Pinus radiata</i>	4
Others	<i>Pinus radiata</i>	4
<i>Phaeocryptopus gaeumannii</i>	<i>Pseudotsuga menziesii</i>	1
<i>Cypress cankers</i>	<i>Cupressus spp</i>	1
Research, diagnosis and surveillance	All plantation spp	2
<b>Table Totals</b>		<b>87</b>

### *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.
- L S Bulman and P.D. Gadgil (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.

The other diseases are estimates based on data from the National Forest Health database.

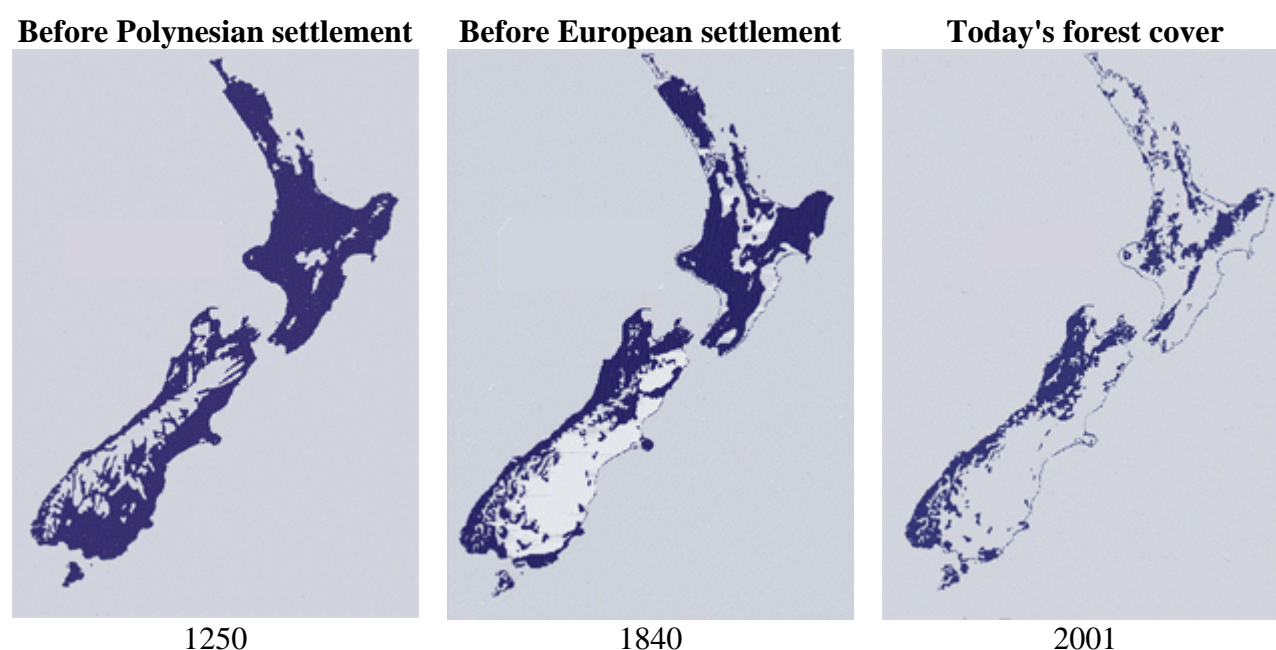
## Land Clearance

Before the first Maori settlers arrived in the 13th Century, 75 to 80% 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 Maori settlement involved extensive burning-off of forest. Fire was used to encourage growth of bracken fern that was part of the staple diet for Maori. 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 & scrub continued to be burned.

By the time that European settlement had begun to intensify in 1840, the forest cover had fallen to 53% (14.3 million hectares). Today, 24% 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<sup>1</sup>.

Fig 3: Extent of New Zealand forest cover through time



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 4 to 5 million hectares of steep-land forest for erosion and flood control. Since then, indigenous timber production has declined to be replaced by yields from exotic plantation forests.

In 1987, the majority of indigenous forest in state ownership was allocated to the Department of Conservation to be protected. Many major forest companies are signatory 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 management plan or permit. The results are 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 exotic plantation forest is currently increasing at about 35,000 hectares per year.

### Sources of information

- Maclaren, J P, 1996, Environmental Effects of Planted Forests. ISSN : 0111-8120

- Taylor, R, & Smith, I, 1997 The State of New Zealand's Environment. Ministry for the Environment, Wellington, New Zealand. ISBN 0-478-09000-5.

## Wind

Probably the best general references for information on wind damage, including risks 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 4.

Table 4: Mean percentage net stocked planted forest area lost per year due to wind

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

John Moore (Forest Research) has tried, so far without success, to initiate a more formal scheme for monitoring wind damage in plantations.

As well as catastrophic incidents of wind damage, there is also 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 et al. 1989.

## Insect Pests

Forest health surveillance surveys (in New Zealand these are essentially pest detection surveys) are regularly carried out across the plantation 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 plantation species (radiata pine and Douglas-fir), but there were outbreaks in the 1940's and 1950's of several species, some of which are referred to below.

### *Factual description*

Currently there are no serious insect pests of the major plantation species (radiata pine and Douglas-fir). However, serious outbreaks of the exotic wood wasp *Sirex noctilio* over more than 100,000 ha 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 native looper *Pseudocoremia suavis* occurred in the 1950's in pine plantations in Canterbury, and in the early 1970's 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 plantation forests. A number of potentially extremely harmful insects and pathogens occur overseas. Chile's pine plantations suffer from widespread damage from the European pine shoot moth causing major economic losses. 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 *Pinus radiata* and other pines (Storer et al. 1997), and it has the potential to cause major damage to New Zealand's plantations if it got here. Many other insects and pathogens occur in North America and Europe.

The Biosecurity Authority in the Ministry of Agriculture and Forestry manages border control and other biosecurity processes. In the 1990's, 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 and Dutch elm disease (see Forest Health News, Forest Research), however, eradication will not always be possible or feasible.

#### *Sources of information*

- For a summary of history and current forest health surveillance in New Zealand see Kershaw (1989) and Carter (1989).
- Data is available from the NZ Forest Research Institute.
- Information on wood and bark boring insects that have been intercepted at ports since 1948 (and were sent to Forest Research for identification) are recorded in the quarantine database (BUGS). The Forest Health Database contains comprehensive records of occurrence and incidence of all key pests.

An overview of the health of New Zealand's plantations is given by Sweet (1989).

#### **Weeds**

There is little publicly available information on the amount, types, and spread of weeds within plantations. 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 plantation 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 (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 plantation forests. While there is occasional damage to plantations from grazing animals, particularly in agroforestry situations this is of no practical significance. Feral cats and other domestic animals can cause problems by hunting native fauna.

### *Sources of information*

- Maclaren 1988

## Protection forestry

### Description

Indicator 4.1.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 is insufficient data currently available for reporting on this indicator.

## Biomass and carbon pool

### Description

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

### Status

	Planted Forest	Indigenous Forest
1. Data Availability	Most data readily available	Some data exist but are not readily available
2. Data Quality		
a) Reliability	Reliable source and forecast estimates	Preliminary estimate
b) Historical Coverage	1983	1953
c) Frequency of Collection	Annual	Varies
3. Source of Aggregation	Nationally	Nationally Ecological zone
4. Area Coverage	100%	100%
5. Future Data Availability	High	Medium
6. Reporting Methodology	Quantifiable data	Case study example
7. Difficulty of Reporting	Moderate	Difficult

### 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

### What are we measuring?

#### *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\_Change2. A national forest estate model (FOLPI3) 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 shrubland's commenced operation in early 2002 and will provide future estimates of carbon stocks and carbon stock changes. The carbon stock 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.

### Factual Description

#### *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 4).

#### *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 60.0% is stored in beech trees, 26.7% in other hardwoods, 13.2% in conifers and 0.1% 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).

Fig 4: Total Planted Forest Carbon Stocks (New Planting Scenarios)

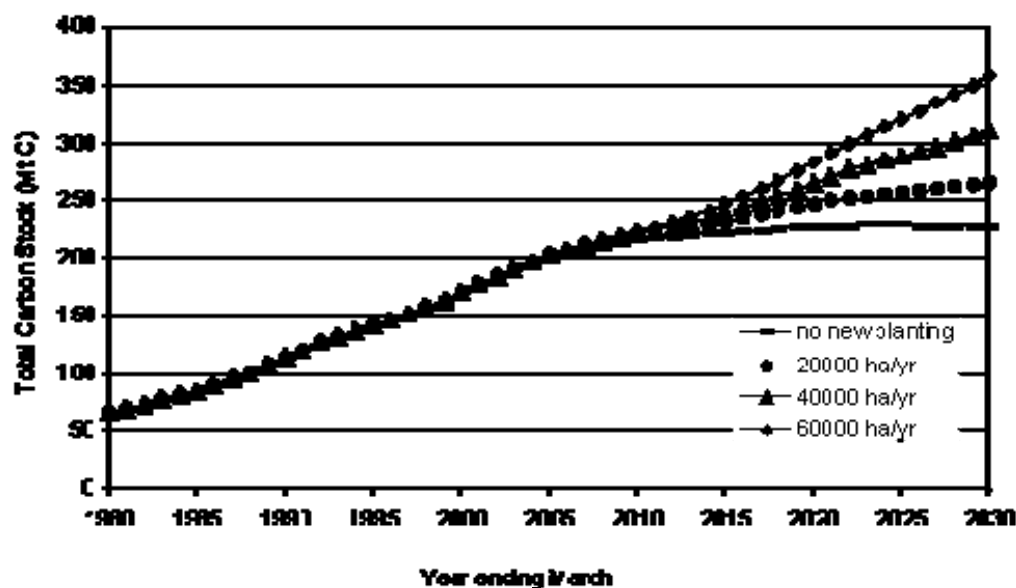


Table 5: Carbon stocks by forest type (million tonnes carbon)

Predominant forest type	Planted forest ecosystem carbon				Soil carbon <sup>4</sup>
	Indigenous <sup>1</sup> forest ecosystem carbon	Indigenous <sup>2</sup>	Exotic <sup>3</sup>	Forest ecosystem carbon	
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	
<b>Total</b>	<b>1460</b>	<b>0</b>	<b>177</b>	<b>1637</b>	

Source: MAF and MfE

<sup>1</sup>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.

<sup>2</sup>The area of indigenous planted forest is insignificant.

<sup>3</sup>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 purposes of this table.

<sup>4</sup>Not currently available.

## Sources of information

Beets, P.N., Robertson, K., Ford-Robertson, J.B., Gordon, J. and Maclaren, J.P. Description of C\_Change: A Model for Simulating Carbon content in Managed Radiata Pine Stands. New Zealand Journal of Forestry Science, 29: 409-427, New Zealand, 1999.

García O, "FOLPI, A Forestry-Oriented Linear Programming Interpreter". In Nagumo, H et al (eds.). Proc. IUFRO Symposium, Forest Management Planning and Managerial Economics. University of Tokyo, Japan, 1984.

Hall G, Wiser S, Allen R, Moore T, Beets P, Goulding C, 1998. Estimate of the carbon stored in New Zealand's indigenous forest and scrub vegetation for 1990. Unpublished contract

report JNT9798/147 prepared for the Ministry for the Environment. Landcare Research, Christchurch and Forest Research, Rotorua, New Zealand.

Manley B, Papps S, Threadgill J and Wakelin S, "Application of FOLPI, A Linear Programming Estate Modelling System for Forest Management Planning", Ministry of Forestry, FRI Bulletin No. 164, 1991.

Marshall D and Wakelin, S, 2002. Carbon Inventory of New Zealand's Planted Forests. Calculations Revised as at April 2002. Unpublished contract report prepared for the Ministry of Agriculture and Forestry and the Ministry for the Environment. Forest Research, Rotorua, New Zealand.

MAF, 2000. National Exotic Forest Description 2000 National and Regional Wood Supply Forecasts. Edition 3. Ministry of Agriculture and Forestry, Wellington, New Zealand.

## Employment in the forest sector

### Description

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

### Status

	Planted Forest	Indigenous Forest
1. Data Availability	Most data readily available	Not distinguished from
2. Data Quality		planted forest data but is a
a) Reliability	Reliable source	very small proportion
b) Historical Coverage	1988	
c) Frequency of Collection	Annual	
3. Source of Aggregation	Nationally	
4. Area Coverage	100%	
5. Future Data Availability	High	
6. Reporting Methodology	Quantifiable data	
	Case study example	
7. Difficulty of Reporting	Medium	

### Rationale

- Measures the contribution of the forest sector in providing employment at national and regional levels
- Useful measure of community well-being (e.g., livelihood and economic activity)

### 2003 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. A multiplier of 1.8 is generally used to estimate indirect employment from figures of direct employment in forestry and first stage processing..

### Factual description

The information available for this indicator is in table 6 below.

**Table 6: 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	2520	2070	1860	1620	-12.9
A030200	Logging	3740	3620	4050	4710	16.3
A030300	Services to Forestry	2620	2680	3380	3700	9.5
C231100	Log Sawmilling	6630	6160	7080	7420	4.8
C231200	Wood Chipping	100	100	140	35	-75.0
C231300	Timber Resawing and Dressing	1350	1220	1380	1450	5.1
C232100	Plywood and Veneer Manufacturing	1800	1690	1980	1970	-0.5
C232200	Fabricated Wood Manufacture	710	720	820	970	18.3
C233100	Pulp, Paper & Paperboard Manufacturing	3230	3100	2880	2440	-15.3
	Forestry and First-Stage processing	22700	21360	23570	24315	3.2
<b>Total labour force as at March quarter</b>		<b>1877400</b>	<b>1882800</b>	<b>1892100</b>	<b>1915400</b>	<b>1.2</b>

*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% of the total labour force.

### Source of Information

The source for this information is Statistics New Zealand.

## Forest inventories, assessments and monitoring

### Description

Indicator 7.1.b: Scope, frequency and statistical reliability of forest inventories, assessments, monitoring and other relevant information.

## Status

	Planted Forest	Indigenous Forest
1. Data Availability	Readily available	Some data exist but are not readily available
2. Data Quality	Reliable	Reliable source
a) Reliability		
b) Historical Coverage	1983	1953
c) Frequency of Collection	Annual	Varies
3. Source of Aggregation	District council	Nationally
		Ecological zone
4. Area Coverage	100%	100%
5. Future Data Availability	Medium/high	Low
6. Reporting Methodology	Quantifiable data	Case study example
	Explanatory narrative	
7. Difficulty of Reporting	Moderate	Difficult

## Rationale

- Public information and decisions should be based on comprehensive, current and sound data.

## 2003 Country Report

### Background

New Zealand has a rich set of production forestry statistics, some dating back to the 1920's. These statistics cover forest planting, harvesting, production, processing and trade in forestry products. In addition, a system of regular surveys of planted forest owners, the National Exotic Forest Description (NEFD), commenced operation in 1983 and has continued to evolve since that time.

Historically New Zealand's national forestry statistics, monitoring and inventory systems have focussed on the economic production aspects of forestry. Since the late 1960's 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 carried out post the Second World War, with the final results published in 1957. 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.

During the major Government sector restructuring that occurred in New Zealand in the 1980's and early 1990's many monitoring systems were downsized and some were ceased altogether. However, since UNCED 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, shrublands and soils 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 (LCDB)

The LCDB is a digital thematic map of land cover designed for use in a geographic information system or as a printed map. LCDB-1 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 source of images for LCDB-1 were the SPOT 2 and SPOT 3 satellites. The minimum mapping unit is 1 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 - plantation forest, predominately *Pinus radiata*
- 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% 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 94 percent.

Imagery for a second LCDB (LCDB-2) 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 LCDB-2.

Further details on LCDB-1 are available at:

<http://www.maf.govt.nz/statistics/primaryindustries/landcover>.

## National Exotic Forest Description

The National Exotic Forest Description (NEFD) is a quantitative database of New Zealand's planted forests. The NEFD is New Zealand's official source of statistics on plantation forests. Its uses include:

- 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 its 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. The database 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 is 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 is also 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 5-year intervals.

Over the next 3 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 <http://www.maf.govt.nz/forestry.aspx>.

## Forestry Statistics

The Ministry of Agriculture and Forestry produces about 40 forestry related statistical releases each year covering the production of forestry products, forestry trade statistics, 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 (sawn timber, panel products and pulp and paper);
- quarterly production and stock level surveys;
- roundwood removals;
- employment in forestry and wood processing;
- forestry products exports;

- forestry products exports price and volume indexes, and
- forestry products imports.

Further details on the statistics collected are available on:

<http://www.maf.govt.nz/statistics/primaryindustries/forestry>

## National Vegetation Survey (NVS)

The National Vegetation Survey Databank (NVS - 'Nivs') 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.

The New Zealand Forest Service, Department of Lands & 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 support reporting requirements for the Convention on Biological Diversity, Framework Convention on Climate Change, Resource Management Act, State of Environment, and the Montreal Process. They also assist 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:** These are from plots that are usually not permanently marked. These data include reconnaissance descriptions ('Recces') and Protected Natural Areas data. They are 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% have NZMS grid references).

*Examples of uses:*

- vegetation description;
- detecting biodiversity trends;
- studying weed invasions, and
- relating species distribution to environment.

**2. Permanent plot data:** These are where plots of fixed area 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 m<sup>2</sup>) 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% have NZMS grid references (for forest plots, >95%).

*Examples of potential uses:*

- Forest plots: growth, mortality, and recruitment of tree species, changes in structure and composition.
- Grassland and shrubland plots: change in structure and composition.

Further details are available on: <http://www.landcareresearch.co.nz/research/biodiversity/nvs>.

### Indigenous Forest, Scrub and Soils Carbon Monitoring System

Following a number of years of research and development, a system to systematically monitor carbon stocks in indigenous forests, shrub lands and soils commenced field data collection in 2002. The Indigenous Forest, Scrub and Soils Carbon Monitoring System (CMS) involves the periodic measurement of about 1400 indigenous forest and scrub plots located on a national 8km x 8 km 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 for 5-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.

### Data Source

Ministry of Agriculture and Forestry  
Ministry for the Environment  
Department of Conservation.

<sup>1</sup>MfE website

<sup>2</sup>C\_Change is a dry matter allocation model (Beets et al 1999).

<sup>3</sup>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 (MAF 2000).