Ministry for the Environment
Manatū Mō Te Taiao

ENVIRONMENT NEW ZEALAND 2007

SUMMARY

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Message from the Minister

The Government welcomes the publication of the second national state of the environment report, and this summary of the report. Both *Environment New Zealand 2007* and this summary provide a wealth of information about our environment and how it is changing over time. They set a compass against which we can chart New Zealand's journey towards greater sustainability.

Putting sustainability at the heart of our thinking and decision-making is important to this Government: the environment underpins the very foundations of New Zealand's national identity and quality of life. As the world moves to take greater action on environmental issues and a growing number of consumers demand environmentally-friendly products, we face both challenges and opportunities. With our enviable natural environment, efficient primary production, strong track record in renewable energy, and innovative business sector, New Zealand is well placed to respond.

Global climate change is probably the most significant environmental issue of the 21st century. Around the world, governments, businesses, households, and individuals are striving to reduce their greenhouse emissions. New Zealanders, too, must play their part. Using our energy and natural resources efficiently, adopting more sustainable transport and primary production, reducing waste, and encouraging afforestation are all important steps in responding to climate change and moving towards greater sustainability.

Climate change is not the only challenge we face. The report and summary also highlight the decline in water quality New Zealand faces as a consequence of the increasing intensity of agricultural production. As we take action on this and other environmental concerns, regular environmental reporting will be important in tracking progress. Better understanding the impacts of our activities on the environment and targeting measures to reduce them will be an important part of reinforcing the 'clean and green' reputation we enjoy.

Environment New Zealand 2007 provides a timely platform for discussion about our environment and the pressures we are placing on it. I welcome the Ministry for the Environment's leadership in engaging with New Zealanders about how we can all play a part in making New Zealand a truly sustainable nation. I look forward to seeing progress towards this goal reflected in future state of the environment reports.

Hon Trevor Mallard
Minister for the Environment

Preface

The environment is central to New Zealand and the Kiwi way of life. Our iconic landscapes have shaped our identity as a nation, and the resources from the land, freshwater, and sea underpin our valuable primary industries. The varied urban and rural landscapes in which we live, work, and spend leisure time form an integral part of our social, cultural, and economic well-being.

This report is a summary of *Environment New Zealand 2007*, New Zealand's second state of the environment report. It provides a brief overview of the pressures on, and key aspects of, the environment discussed in *Environment New Zealand 2007*.

Both this summary and *Environment New Zealand 2007* are published at a time when there is heightened attention around the world on protecting the environment for our children and our children's children. The risks from a changing climate, the desire to use valuable natural resources more efficiently, and the need to protect our health have all created a global momentum for environmental action.

Since the first state of the environment report in 1997, New Zealand has made significant progress in ensuring sound environmental information is available to support environmental decision-making. Both *Environment New Zealand 2007* and this summary advance this work by using environmental indicators and a range of mapping tools to present an overview of key aspects of New Zealand's environment. Both reports also highlight for decision-makers the most urgent pressures on, and challenges for, our environment.

I am very pleased to bring you *Environment New Zealand 2007 – Summary*. I have confidence that, in providing an overview of New Zealand's environmental well-being, this report will help motivate New Zealanders to take action to protect and conserve their environment.

Hugh Logan
Secretary for the Environment

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SETTING THE CONTEXT

01

Our environment and people

New Zealand's geographic isolation and long period without human habitation allowed a unique natural environment to flourish. Our environment is known for the richness of its biodiversity, with more than 80,000 native animal, plant, and fungus species. As a result of New Zealand's isolation, much of our flora and fauna are not found anywhere else on earth.

Humans are relatively recent additions to the New Zealand environment. The Polynesian ancestors of Māori (the indigenous people of New Zealand) arrived here about 30 generations ago, with European settlement only occurring in the late 18th century. Today, New Zealand is home to just over 4 million people, with an average age of 36 years.

Most New Zealanders live in urban areas within 50 kilometres of the coast. Three out of four of us live in the North Island. While our overall population density is low, it is high in major urban areas. New Zealand's demography and the way it is changing have implications for both the way we live our lives, and the impact of our lifestyles on the environment.

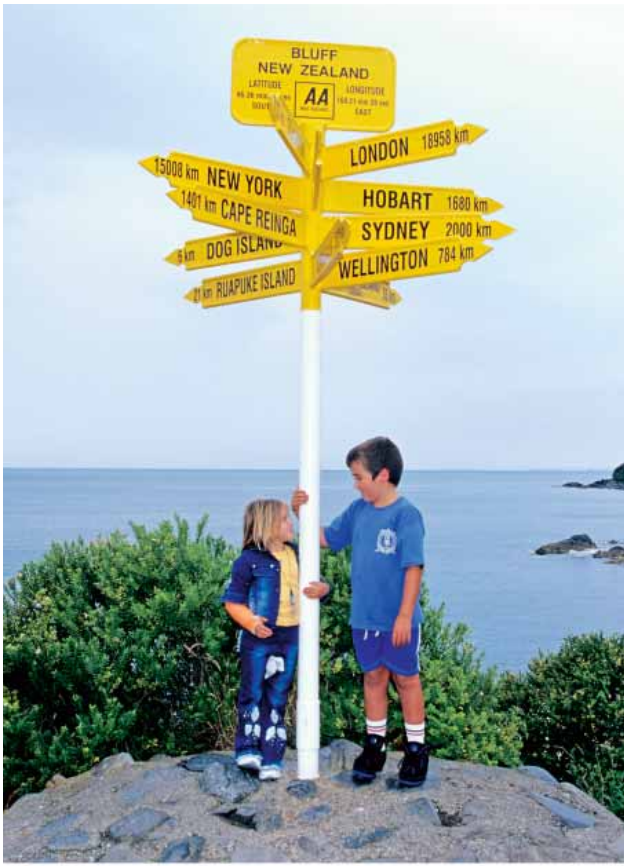
New Zealanders' relationship with the environment is a defining feature of our national identity. We frequently use images of our natural scenery and rural heritage to present New Zealand to the rest of the world. Māori have a particular relationship with the environment as tangata whenua (people of the land).

Increasingly, New Zealanders perceive the environment to be not only our iconic wilderness and rural areas, but also the urban areas where most of us live and work.

New Zealand's natural environment is fundamental to our economic and social well-being. Our stunning landscapes, forests, and productive agricultural and horticultural land generate a significant part of New Zealand's wealth. Careful stewardship of our natural landscapes and resources is therefore important: both tourism and our primary production sectors rely on New Zealand's 'clean and green' reputation internationally.

Safeguarding the environment for future generations is becoming increasingly important to New Zealanders. Many of us are taking action to conserve the environment for future generations in ways that protect our economic well-being, social systems, and cultural wealth.

NEW ZEALAND IS A SMALL ISLAND NATION IN THE SOUTHWEST PACIFIC OCEAN.



Source: Nature's Pic Images.

Geography

New Zealand's land area of about 270,000 km^2 is about the same as that of Japan or the United Kingdom. Our location on the boundary of the Pacific and Indo-Australian tectonic plates has shaped our landforms. The resulting earth movements have produced hilly and mountainous terrain over two-thirds of the land, with frequent earthquakes in most parts of the country and a zone of volcanic and geothermal activity in the central North Island.

New Zealand's terrain, climate, rock type, and vegetation have interacted to produce more than a hundred different soil types. Despite this diversity, our soils are generally low in nutrients because the rocks they come from are geologically young.

Flora and fauna

Among New Zealand's most notable species are the:

- kiwi, which lays one of the largest eggs in the world compared with its body size
- kākāpō, the world's heaviest and only flightless parrot
- kea, one of the world's only mountain parrots
- giant wētā, the heaviest insect
- tuatara, a reptile of prehistoric origins
- giant kauri tree, which is among the largest in the world and holds the record for the greatest timber volume of any tree.

TUATARA, NEW ZEALAND'S REPTILE OF PREHISTORIC ORIGINS.

Source: iStockphoto.

While most of the world's ferns grow in tropical climates, New Zealand hosts an unusually large number of ferns for a temperate country. Primeval trees, mosses, and lichens continue to flourish here, and flightless, ground-dwelling birds have evolved to fill niches that elsewhere in the world would have been taken by mammals. Indeed, New Zealand's only endemic land-based mammal is the bat, of which we have several species. By comparison with other countries, we have comparatively few native flowering plants and land-based vertebrate animals.

Climate

New Zealand's climate is influenced strongly by geographic factors. These include:

- its location in a latitude zone with prevailing westerly winds
- the large area of surrounding ocean
- mountain chains that modify weather systems as they move eastward, so that climatic contrasts are much sharper from west to east than they are from north to south
- tropical weather patterns (that is, storms that start out as tropical cyclones elsewhere can redevelop in the region, bringing warm moisture-laden tropical air that interacts with colder polar air).

As a result of these factors, New Zealand's weather is more variable than that of larger, continental countries.

Rivers and lakes

Dynamic tectonic movement means New Zealand's landscape is dominated by mountains: more than three-quarters of our land area is higher than 200 metres above sea level. As a result, steep and fast-flowing stony streams and rivers dissect the landscape.

Rivers also feed numerous lakes, of which 3,820 are more than 1 hectare in area. Most lakes were formed through volcanic or glacial activity, or after the formation of land barriers. Lake Taupō in the North Island is New Zealand's largest lake, with an area of about 62,000 hectares and a maximum depth of 163 metres.

As well as having numerous mountains, lakes, rivers, and geothermal areas, New Zealand has 360 glaciers in the South Island, which carry away snow and ice from the many peaks of the Southern Alps.

Coasts and oceans

Compared with its land area, New Zealand has one of the longest coastlines of any country in the world, at more than 18,000 kilometres.

New Zealand's vast marine area contains a diverse range of marine ecosystems, which provide habitats for many species. Scientists have identified almost 16,000 marine species in New Zealand waters, although it is estimated that tens of thousands of species may still be undiscovered.

Environmental reporting

People who make decisions affecting the environment need accurate and reliable environmental information. With this information, they can make informed decisions about natural resource management and set environmental policy. Environmental reporting also helps us know whether policy initiatives or management approaches are effective over time.

Environmental indicators and classification systems

We cannot continuously measure every aspect of our environment so environmental reporting relies on using a range of 'indicators' to assess the overall state of the environment in a practical, cost effective, and meaningful way. In the same way that gross domestic product is an indicator of economic activity, each environmental indicator allows us to measure and report on a specific aspect of the state of the environment. The value of an indicator lies in its ability to show whether things are getting better or worse. Environmental indicators can be used to trigger action to address environmental problems.

New Zealand's geography is highly variable and its environment can change greatly over relatively short distances. However, geographically remote areas can have similar environmental characteristics (that is, similar climate conditions, landforms, and soils) that support particular ecosystems (habitats and species). These areas are said to be ecologically similar.

Once we have identified and mapped areas that are ecologically similar, we can compare environmental data from these areas. Environmental data from one area can also be used to extrapolate what might be happening in an ecologically similar area for which environmental data is not available. In this way, data from a limited number of monitored sites can be used to build a national picture of the state of the environment.

Environment New Zealand 2007 – the publication on which this summary report is based – uses a set of core national environmental indicators and ecological classification systems to present a national picture of key aspects of the New Zealand environment.

ROADSIDE MONITORING BY AUCKLAND REGIONAL COUNCIL.

Source: Ministry for the Environment.

Collecting and reporting information about the environment

In New Zealand, environmental reporting happens at the national level (for example, in reports such as *Environment New Zealand 2007*), and at regional and local levels.

National state of the environment reporting in New Zealand relies on partnerships for the collection and sharing of environmental data. Data for the core set of national environmental indicators is collected by central and local government agencies, non-government organisations, and Crown Research Institutes, which are listed as reporting partners in Table 1.2 on page 11.

Local government undertakes a wide range of environmental monitoring to meet its obligations under the Resource Management Act 1991. The scope of environmental monitoring by councils differs around the country. For example, Auckland Regional Council has an extensive marine sediment monitoring programme, reflecting the intensive pressures on the Auckland marine environment. Councils in rural areas that are intensively farmed are likely to focus their monitoring efforts on freshwater quality and quantity, the health of aquatic ecosystems, soil quality and erosion, and sustainable land management.

Right across New Zealand, many iwi, hapū, and community groups are involved in projects to monitor, protect, and enhance the health of their local environment. Local monitoring and reporting play an important role in environmental management: careful tracking of local environments can identify emerging pressures and ensure measures are put in place to manage pressures at an early stage.

Some culturally-based environmental monitoring and reporting is also undertaken in New Zealand. By incorporating traditional knowledge with science-based reporting, the values Māori associate with the environment – in particular, the concept of mahinga kai, or customary food and resource gathering – can be taken into account in environmental decision-making.

As an example, conventional environmental monitoring may assess the quality of water for swimming, but it does not identify whether it is safe to gather mahinga kai or drink the water. Moreover, the presence at a site of a particular species, such as tuna (eels), does not mean the species is abundant or healthy enough to harvest.

GREATER WELLINGTON REGIONAL COUNCIL AIR QUALITY MONITORING STATION.

Source: Ministry for the Environment.

New Zealand's core set of national environmental indicators

Environment New Zealand 2007 reports on information provided by a core set of 19 national environmental indicators. The indicators in this core set have been chosen to provide the key information needed for national environmental policy-making and natural resource management. They were also selected for their ability to provide the best representation of the information that is currently available on high-priority issues for the environment. They form a representative sample of indicators, which can be added to over time as further national-level data becomes available.

To help decision-makers use the information from the core environmental indicators in a meaningful way, indicators are often developed within a particular framework or model. The model is used to highlight what type of information the indicator is trying to show, and how this information can best be used.

The Ministry for the Environment has developed the framework for the core set of national environmental indicators from two well-tested analytical models:

- the Driving force – Pressure – State – Impact – Response (DPSIR) model, which was developed from the Organisation for Economic Co-operation and Development's Pressure – State – Response model
- the typology of indicators developed by the European Environmental Agency.

DPSIR indicators aim to address four fundamental questions:

- What is happening to the environment?
- Why is it happening?
- Are the changes significant?
- What is society's response?

Depending on where an indicator sits in the DPSIR model, we may say, for example, that it is a 'pressure' or a 'state' indicator. Table 1.1 describes each DPSIR indicator.

+ TABLE 1.1:
DESCRIPTION OF DPSIR INDICATORS

INDICATOR TYPE	DESCRIPTION OF INDICATOR TYPE
Driving force (driver)	Describes social, demographic, and economic developments. Primary driving forces are population growth and changes in people's needs and activities. These change lifestyles and overall levels of production and consumption, which in turn exert pressures on the environment.
Pressure	Tracks people's use of natural resources and land, and production of waste and emissions (for example, greenhouse gases and particulates into the air). These pressures can change environmental conditions.
State	Describes the quantity and quality of the environment and natural resources (for example, water quality, air quality, or land cover).
Impact	Describes the effects that environmental changes have on environmental or human health (for example, the level of human illness related to exposure to air pollution).
Response	Describes responses by government, organisations, or the community to prevent, compensate, ameliorate, or adapt to changes in the environment (for example, the introduction of regulations such as national environmental standards and legislative initiatives to protect native vegetation and biodiversity).

Source: Adapted from European Environment Agency, 2003.

Table 1.2 shows how New Zealand's core set of environmental indicators have been classified using the DPSIR framework. Sometimes, an indicator may be classified in more than one way, depending on the information it provides, or how we choose to interpret it.

+ TABLE 1.2:
NATIONAL ENVIRONMENTAL INDICATORS USED IN *ENVIRONMENT NEW ZEALAND 2007*, THEIR POSITION IN THE DPSIR FRAMEWORK, AND RELEVANT REPORTING PARTNERS

NATIONAL ENVIRONMENTAL INDICATOR	POSITION IN DPSIR FRAMEWORK	REPORTING PARTNER
Household consumption	Driving force	StatsNZ
Vehicle kilometres travelled (VKT) by road	Driving force	MoT
Energy supply and consumption	Driving force	MED
Solid waste disposed of to landfill	Pressure	Regional councils, territorial authorities
Air quality in managed airsheds	State	Regional councils
Emissions and removals of greenhouse gases	Pressure	MED, MoT
Stratospheric ozone levels	State	NIWA
Land cover	State	DOC, MAF, regional councils
Land use	Pressure	DOC, MAF, regional councils
Soil health	State	Regional councils, MAF, CRIs
Soil intactness of erosion-prone hill country	State	Regional councils, MAF, CRIs
Water quality in rivers, lakes, and groundwater aquifers	State	Regional councils, NIWA
Freshwater demand	Pressure	Regional councils
Fish stocks under the quota management system	Driving force, pressure, and response	MFish
Seabed trawling in deep waters	Driving force and pressure	MFish
Water quality at coastal swimming spots	State	Regional councils, territorial authorities
Marine areas with legal protection	Response	DOC, MFish
Land area with native vegetation, including area under legal protection	State and response	DOC, QEII, regional councils, territorial authorities
Distribution of selected native species	State	DOC, OSNZ

Note:

CRIs = Crown Research Institutes; DOC = Department of Conservation; DPSIR = Driving force – Pressure – State – Impact – Response model; MAF = Ministry of Agriculture and Forestry; MED = Ministry of Economic Development; MFish = Ministry of Fisheries; MoT = Ministry of Transport; NIWA = National Institute of Water and Atmospheric Research; OSNZ = Ornithological Society of New Zealand; QEII = Queen Elizabeth the Second National Trust; StatsNZ = Statistics New Zealand.

Source: Ministry for the Environment.

PRESSURES ON THE ENVIRONMENT

02

Household consumption

Our lifestyles and the environment

Consumption by households affects the environment. Our lifestyle choices, the goods and services we consume, and how these are produced and disposed of all affect the extent and manner of our impact on the environment.

While the pressure on the environment caused by a single household may appear small, the combined impact of all households in New Zealand can be significant. As an example, households are now the largest energy use 'sector' in New Zealand, when transport fuels are included.

Household consumption is a driving force behind the production of goods and services, and the generation of waste. The impacts on the environment from households have grown over recent decades, and are expected to intensify over the next two decades, especially for energy, transport, and waste.

Purchasing patterns can change over time. They are influenced by several factors, including population size, income, the availability and affordability of goods and services, economic trends, and consumer preferences. Table 2.1 summarises observed trends in household behaviours, and how these behaviours relate to environmental impacts.

Increasing total and per capita consumption

As our population and economy have grown, so, too, have spending and consumption by New Zealand households.

Between 1997 and 2006, real *total* household consumption expenditure (that is, expenditure adjusted for inflation) increased by 39 per cent, compared with growth of 30 per cent in gross domestic product (GDP), and a population increase of around 11 per cent over the same period. However, we cannot attribute our increasing expenditure solely to our increasing population and wealth. Real *per capita* household consumption expenditure increased by about 26 per cent, which was more than the increase of per capita GDP. Real consumption expenditure *per household* increased by 20 per cent over the same period.

These figures may reflect to some degree how household numbers (number of dwellings), household size (number of people living in a dwelling), and the size of our households (floor area) are changing in New Zealand. Overall, the trend has been toward more households and larger dwellings with fewer occupants. This trend can affect household consumption. As an example, larger houses need more energy to heat them, on average, than smaller houses, likewise, smaller households – fewer people occupying a housing unit – generally use more space, energy, and water, and generate more waste per person than do larger households.

+ TABLE 2.1:
SUMMARY OF TRENDS IN AND ENVIRONMENTAL IMPACTS OF HOUSEHOLD WASTE GENERATION AND CONSUMPTION OF ENERGY AND WATER

TRENDS AT HOUSEHOLD LEVEL	DETERMINANTS OF ENVIRONMENTAL IMPACT	ENVIRONMENTAL IMPACT
Growing demand for energy and water services tied to larger homes, and more energy and water appliances	Scale of energy and water use	Greenhouse gas emissions and air and water pollution linked to the generation and use of energy
Growing waste generation and recycling	Energy and water efficiency rates	Water resource depletion and pollution
Diversification of waste stream	Fuel source for heating and electricity generation	Greenhouse gas emissions and air, water, and soil pollution from inappropriate waste management
	Availability and quality of water resources	
	Volume and composition of waste and method of waste disposal	
	Recycling rates and waste prevention	

Source: Adapted from Organisation for Economic Co-operation and Development, 2002.

Changing consumption patterns

New Zealanders are not only spending more than they were 10 years ago, the things they buy have also changed.

Household consumption expenditure can be broken into seven separate categories, such as food and beverages, clothing and footwear, transport, or housing (excluding mortgages and housing purchases). Since 1997, 'housing', 'transport', and 'food and beverages' have consistently appeared as the top three expenditure classes in New Zealand, with housing the largest single item until 2005.

However, Figure 2.1 shows that in 2006, each New Zealander spent more on 'food and beverages' than any of the other goods and services categories. This ranking is affected somewhat by the way expenditure figures over several years are adjusted for inflation. For example, if we consider expenditure figures for the year 2006 without adjusting them for inflation, housing remains the top category for that year.

Among the seven consumption categories, per capita expenditure between 1997 and 2006 on 'food and beverages' and 'household goods and services' (for example, electricity, major appliances, and furniture), showed the greatest absolute increases. Per capita expenditure on 'household goods and services', and 'clothing and footwear' showed the greatest percentage increase in the same period (about 45 per cent per person in both cases).

Environmentally responsible consumption

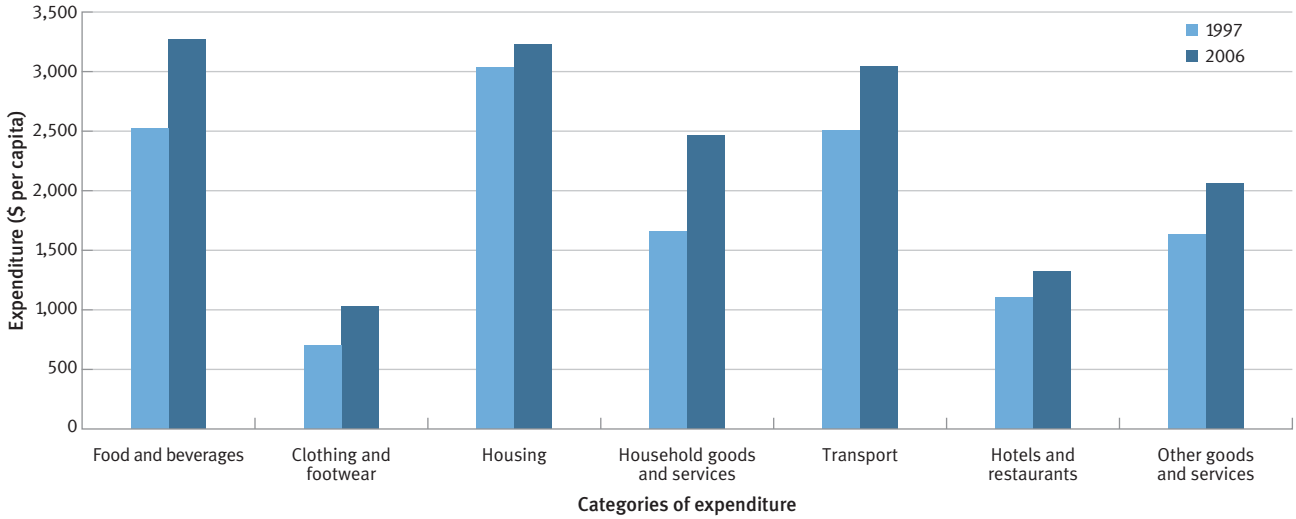
Today, many New Zealanders are interested in reducing the impact of their purchasing habits on the environment. We can do so by buying only what we need, choosing products with less packaging, and choosing durable products instead of disposable ones.

As consumers, we can also use our purchasing power to influence the supply chain. By selecting products that have been produced sustainably and that generate less waste, we support the transition to cleaner production processes. By buying products that minimise resource use during their life cycle – such as a fridge with a high ENERGY STAR rating – we reduce our impact on the environment over the long term.

Many of these actions have important co-benefits such as saving us money or – in the case of walking short distances rather than driving – making us healthier.

A number of local and government initiatives are now available in New Zealand to help householders reduce their transport, energy and water use and their waste. Some of these are detailed in other sections of this report. Examples include the Sustainable Living Programme, developed by eight local and regional councils; government-supported eco-labelling schemes which help consumers to identify and buy greener products; and the Government's new Household Sustainability Programme which focuses on helping New Zealanders take practical action in and around the home to become more environmentally-friendly.

+ FIGURE 2.1:
REAL HOUSEHOLD CONSUMPTION EXPENDITURE PER CAPITA, IN 1997 AND 2006 (MARCH FINANCIAL YEARS)



Note:
Data is expressed in 1995/1996 prices.
Data sources: Adapted from Statistics New Zealand, 2007a; Statistics New Zealand, 2007b.

Transport

New Zealanders value their mobility. We want to be able to get from A to B easily, and as quickly and safely as possible. We rely on transport daily to get to work, school, and to take part in leisure activities. In the holidays, we often travel for hundreds of kilometres to reach our destination.

Transport underpins New Zealand's social and economic well-being by enabling the movement of people and goods, and providing connections to international markets.

New Zealand's transport system has been shaped by our geography and demography: we have small pockets of population and occupy a large and elongated land area. Road transport – most of it by passenger cars – has become the central element of New Zealand's transport system.

In recent years, New Zealanders have become increasingly reliant on road transport. At approximately 0.7 vehicles per person – the fifth-highest rate of vehicle ownership among member countries of the Organisation for Economic Co-operation and Development (OECD) – we had three times as many vehicles in 2005 as we did in the 1950s. Our vehicles (and their engines) have also been getting larger and older, and we are driving them further than we did in the past.

The extensive use of cars and trucks in New Zealand is putting pressure on the environment and human health. The use of fossil fuels creates exhaust emissions that affect air quality; run-off from roads affects water quality; greenhouse gas emissions from the combustion of transport fuels contribute to climate change; and end-of-life oil, tyres and vehicles require careful disposal.

Travelling further

The total number of vehicle kilometres travelled (VKT) on New Zealand roads is estimated to have more than doubled between 1980 and 2000, from 18.52 to 37.33 billion kilometres, indicating that New Zealanders are becoming increasingly mobile. In 2006, New Zealanders travelled over 39.2 billion vehicle kilometres.

The passenger car is the largest contributor to vehicle kilometres travelled, contributing 84 per cent of kilometres travelled in 2006. Together, light and heavy commercial vehicles, buses, and motorcycles accounted for the remaining 16 per cent of kilometres travelled.

The number of vehicle kilometres travelled in New Zealand has long shown an uninterrupted increase, but this trend was broken in 2006, when a slight decrease in total vehicle kilometres travelled was recorded across all vehicle types.

An ageing fleet

On average, the vehicles on our roads are getting older. In particular, the age of a vehicle provides an indication of its overall efficiency and whether it is likely to have technology to control its exhaust emissions. Older vehicles are generally less fuel efficient – and therefore emit more greenhouse gases per kilometre travelled – and are more polluting (particularly with regard to small particles known as PM_{10} particulates) than newer vehicles. This issue is discussed further in the *Air* section.

The average age of the New Zealand light vehicle fleet has increased in recent years and, in 2006, stood at 12.4 years, compared with 11.9 years in 2000. In 2006, 61 per cent of New Zealand's vehicle fleet was over 10 years old, up from 57 per cent in 2001.

Figure 2.2 shows that, in 2006, the average vehicle kilometres travelled per vehicle decreased as the age of the vehicle increased, that is, we drive our newer vehicles further than our older ones. Vehicles in the 0–4 year age class, which make up 17 per cent of the fleet (just over 530,000 vehicles), contributed the highest average vehicle kilometres travelled of 17,271 kilometres per vehicle. This is partly because of the rapid turnover of vehicles in business and rental fleets in this age bracket. Vehicles which were 20 years or older, travelled the lowest average kilometres of all vehicle classes, at 6,515 kilometres.

+ FIGURE 2.2:
AVERAGE VEHICLE KILOMETRES TRAVELLED (VKT) PER VEHICLE AND TOTAL NUMBER OF VEHICLES IN EACH AGE CLASS, 2006

Note:
Vehicles that do not have to be licensed are not included. For example, vehicles used off-road (such as tractors, agricultural machinery, and quad bikes) and vehicles with restoration licences (held when a vehicle is under repair or being restored) are excluded.
Data source: Ministry of Transport.

GOVERNMENT ACTION on transport

New Zealand Transport Strategy

The *New Zealand Transport Strategy* is the strategic framework for achieving the vision that 'by 2010 New Zealand will have an affordable, integrated, safe, responsive, and sustainable transport system'.

National Walking and Cycling Strategy

In February 2005, the Government launched a national strategy to encourage walking and cycling, *Getting There – On Foot, By Cycle*. To coincide with the strategy, an additional $1.15 million in funding was made available for walking and cycling initiatives.

Fuel $aver website

The Fuel $aver website (www.fuelsaver.govt.nz) was launched in 2006. The website provides up-to-date information about the fuel efficiency of vehicles sold in New Zealand. This information lets consumers assess different vehicles on the basis of fuel consumption.

Bigger engines and better fuel

The size of a vehicle's engine influences the amount of fuel the vehicle uses. In general, the smaller the engine, the less fuel it uses. The average engine size of vehicles on New Zealand roads has increased since 1997, with the average engine size of light vehicles climbing from approximately 2 litres in 2000 to just over 2.2 litres six years later.

This change partly reflects the fact that New Zealand is a 'technology taker', which means we have to import our vehicles, and the engine size of the vehicles we import from overseas is getting larger. It also reflects lower vehicle prices: as the average price of vehicles has fallen, we have been able to afford larger vehicles.

The quality of New Zealand fuels has improved since 1997. Since 2001, there has been a 60-fold reduction in the sulphur content of diesel fuel, and further reductions are expected by 2009. The reduction in the sulphur content of diesel ensures the fuel is suitable for use in the newer, low-emission diesel vehicles that are being imported into New Zealand.

Changes to our fuels continue with the uptake of biofuels (see box 'Biofuels Sales Obligation') and increasing numbers of hybrid vehicles. In the future, electricity is likely to become a more significant transport fuel, as electric cars become a more common feature on our roads.

Biofuels Sales Obligation

A Biofuels Sales Obligation was announced in 2006. It requires companies that sell petrol or diesel in New Zealand to also sell biofuels. The amount of biofuels they will have to sell will be a percentage of their total combined petrol and diesel sales each year, measured in petajoules and based on the volumetric energy content of each fuel. The amount has been set at a minimum of 0.53 per cent for year 1 (2008) and will increase each subsequent year. By 2012, at least 3.4 per cent of all fuel that oil companies sell in New Zealand will have to be biofuels.

Taking buses and trains

Although public transport usage is generally low in New Zealand when compared with other modes of transport, the number of people choosing to use public transport is growing. Between 1999 and 2006, the number of passenger boardings on bus, rail, and ferry services increased by 68 per cent in Christchurch, 43 per cent in Auckland, and 23 per cent in Wellington. On average, passenger boardings increased across the country by 45 per cent. This increase in the use of public transport replaced an estimated 49 million car trips.

Transport planning by regional councils and central government has increasingly recognised the impact of transportation on the environment. More emphasis is being given to the role of public transport, encouraging people to walk or cycle, designing our urban spaces to minimise the need for motorised forms of transport, and encouraging people to buy and use more fuel-efficient vehicles.

PUBLIC TRANSPORT OFFERS BENEFITS TO THE ENVIRONMENT IN THE FORM OF LESS AIR POLLUTION, LOWER FUEL CONSUMPTION, AND LESS TRAFFIC CONGESTION COMPARED WITH PRIVATE TRANSPORT.

Source: Ministry for the Environment.

LOCAL ACTION on sustainable transport

Walking school buses

Walking school buses have been established in communities throughout New Zealand to give children a safe and sustainable way to travel to school and back. Groups of families form a roster to take turns walking the families' children to school. A walking school bus usually comprises several families, with one parent 'driving' up to eight children, either from the 'driver's' house or by 'picking up' children on the way to school.

Cycle Safe Christchurch

Cycle Safe Christchurch is a cycle safety education programme targeting year 6 pupils in Christchurch primary schools.

Land Transport New Zealand and the Christchurch City Council fund the programme. The programme aims to enable children to cycle more safely to and from school by increasing their competency and confidence levels, and to encourage parents to let their children cycle.

'Park and ride' bus stations

Poor accessibility to public transport can inhibit people's use of public transport. To help overcome this, two 'park and ride' bus stations have been created in Auckland. People who commute by bus from North Shore City to Auckland City can drive to the 'park and ride' bus stations at Constellation and Albany, park their cars, and board an express bus to Auckland City. Parking is free, so people have an incentive to leave their car at the bus stop and take the bus, instead of driving across the Auckland Harbour Bridge and adding to traffic congestion.

WALKING SCHOOL BUSES ARE A SAFE AND SUSTAINABLE WAY TO TRAVEL TO AND FROM SCHOOL.

Source: Courtesy of Land Transport New Zealand.

The road ahead

The environmental impacts of our growing mobility (fossil fuel use, air pollution, congestion, noise, and greenhouse gas emissions) reinforce work underway to enhance the sustainability of New Zealand's transport system.

Global measures to reduce greenhouse gas emissions from transport – a major contributor to New Zealand's emissions, and one of our fastest growing emissions sectors – are likely to give added momentum to initiatives to improve fuel efficiency and increase the use of biofuels and alternative means of powering vehicles (such as electricity).

Such measures alone, however, are unlikely to be enough if we continue to buy more and bigger vehicles and drive them further. Public transport and other measures, such as more sustainable urban planning, are likely to play a larger role in future.

CYCLING IS A SUSTAINABLE MODE OF TRANSPORT WITH BENEFITS FOR HEALTH AND FITNESS.

Source: Ministry for the Environment.

Energy

New Zealand has access to a wide range of energy sources, both renewable (hydro, geothermal, wood, wind, biogas, and solar) and non-renewable (oil, gas, and coal).

In 2005, 28 per cent of New Zealand's primary energy supply consisted of renewable sources. Non-renewable sources accounted for the other 72 per cent, made up of 39 per cent oil, 20 per cent gas, and 13 per cent coal.

All forms of energy generation and use have an impact on the environment. For example, our growing consumption of non-renewable energy contributes to increased greenhouse gas and particulate emissions, which affect the environment and human health.

Energy supply

In 2005, New Zealand's total primary energy supply was about 740 petajoules (PJ), of which around two-thirds (494 PJ) was used as consumer energy. The remaining one-third was used or lost in transformation and in bringing the energy to consumers.

Between 1995 and 2005, New Zealand's total primary energy supply increased by 10 per cent, from 675 petajoules to 740 petajoules. In recent years, we have become increasingly reliant on imported oil and oil products to meet growing consumer demand. The share of renewable energy varies from year to year, depending on water inflows to hydro-electricity lakes, and consumer demand for energy.

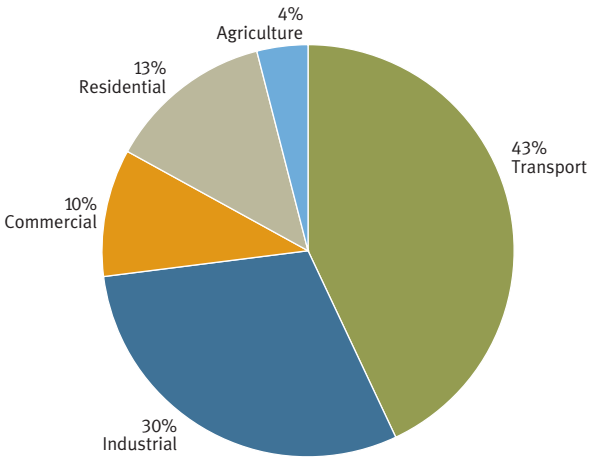
New Zealand's use of renewable sources for electricity generation is high by international standards. In 2005, renewable sources accounted for about 66 per cent of New Zealand's electricity generation, with hydro-electricity providing 56 per cent of New Zealand's total electricity generation.

Energy demand

As our population grows and our lifestyles change, so do our energy needs. Between 1995 and 2005, total consumer energy demand increased by 21 per cent, from 407 petajoules to 494 petajoules.

The greatest growth in energy demand occurred in the commercial sector, which increased by 32 per cent. This was closely followed by the transport sector, which increased by 30 per cent. Figure 2.3 shows consumer energy demand by sector in 2005. Transport was the largest energy-consuming sector, accounting for 43 per cent of New Zealand's total energy consumption. Industry had the second largest share, at 30 per cent.

+ FIGURE 2.3:
CONSUMER ENERGY DEMAND BY SECTOR, 2005



Notes:

(1) The industrial sector includes primary industry not accounted for in the other sectors: food processing; textiles; wood, pulp, paper, and printing; chemicals; non-metallic minerals; basic metals; mechanical/electrical equipment; and building and construction.

(2) Transport includes land transport (road, off-road, and rail), coastal shipping, and air transport within New Zealand. It also includes transport fuel that could not be accurately allocated to the agricultural, industrial, commercial, or residential sectors.

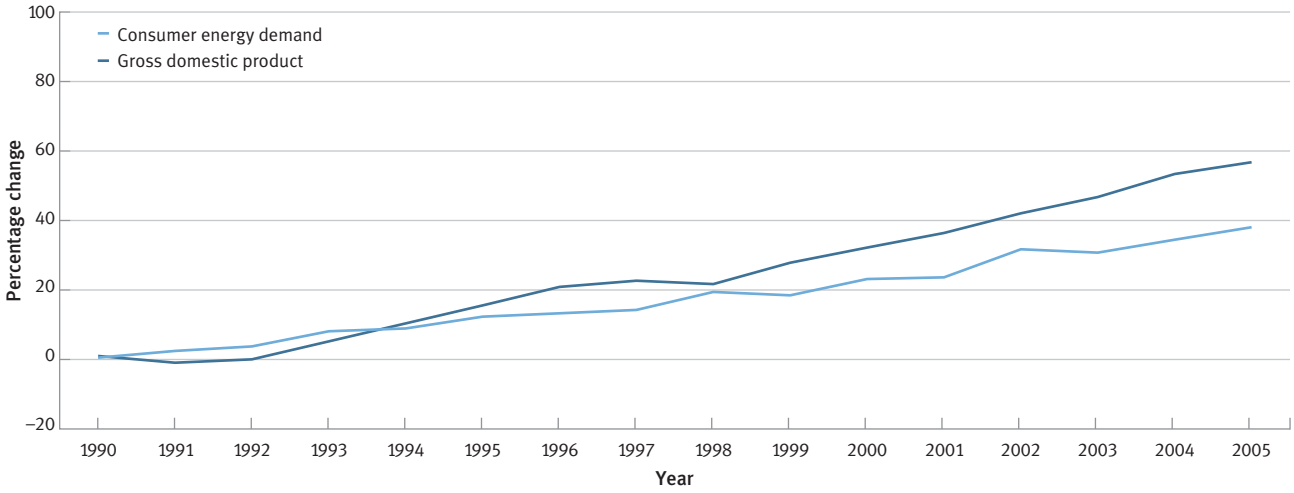
Source: Ministry of Economic Development, 2006.

Although our energy use is increasing, the growth in energy consumption is not as fast as growth in the economy, as Figure 2.4 shows. From 1990 to 2005, New Zealand's total consumer energy demand increased by 37 per cent. Over the same period, the size of the New Zealand economy, as measured by gross domestic product (GDP), increased by 56 per cent.

These figures suggest the economy is reducing its reliance on energy, at least to some degree. This is known as 'decoupling', meaning that the pressure on the environment has, to a certain extent, been separated from economic growth. As shown in Figure 2.4, the relationship between energy demand and economic growth has varied during the period.

+ FIGURE 2.4:

CONSUMER ENERGY DEMAND COMPARED TO GROSS DOMESTIC PRODUCT (PERCENTAGE CHANGE, 1990–2005)



Data source: Adapted from Ministry of Economic Development, 2006; Statistics New Zealand, 2006.

LOCAL ACTION: waste-to-energy

Awareness is growing in New Zealand of the opportunities to produce energy from waste. Waste-to-energy projects have benefits for the environment, including reduced greenhouse gas emissions and reduced reliance on fossil fuels.

Christchurch City Council has turned waste into a resource by capturing gas from the closed Burwood landfill to heat and power the QEII Park swimming pool complex. This use of landfill gas at QEII Park will replace 1.5 million litres of liquid petroleum gas each year, helping to reduce the Council's reliance on fossil fuels. The project also has benefits for reducing greenhouse gas emissions, because methane gas is captured instead of being released into the environment.

Through the Government's Projects to Reduce Emissions programme, the Christchurch City Council was allocated 200,000 carbon credits for the project in return for emission reductions between 2008 and 2012.

METHANE GAS FROM THE FORMER BURWOOD LANDFILL HEATS THE QUEEN ELIZABETH II SWIMMING POOL COMPLEX IN CHRISTCHURCH.

Source: Courtesy of Christchurch City Council.

Developing renewable energy resources

In 1997, New Zealand had one wind farm – Hau Nui in the Wairarapa region – and one turbine at Brooklyn in Wellington. There are now eight wind farms operating throughout the country, with several more projects at various stages of planning.

Demand for solar energy is small but is increasing, particularly for water heating. Industry sales of solar water heating systems indicate that, as of June 2006, about 35,000 solar water heating systems had been installed in New Zealand homes and commercial buildings. Ten per cent (3,500) of these were installed in the year leading up to June 2006.

International energy policies have led to the development of a global market for renewable transport fuels and technologies. This has prompted the introduction of biofuels for commercial use in the New Zealand transport sector. The marine environment also has the potential to contribute to New Zealand's energy needs in the future – wave and tidal energy can be harnessed to generate renewable electricity.

Using energy efficiently to reduce environmental impacts

Using energy supplies efficiently saves money and helps New Zealand companies become more competitive as they reduce their energy costs. It will also help reduce New Zealand's need for new energy supplies.

The Energy Efficiency and Conservation Act 2000 highlights the benefits of demand management – in other words, the benefits of influencing the quantity and pattern of energy used by the end user. The Act has prompted programmes to improve insulation in older homes and encourage the uptake of efficient home heating and lighting options.

The ENERGY STAR energy efficiency rating programme enables consumers to compare the energy efficiency of household appliances, and there are now also Minimum Energy Performance Standards in place for some household appliances, such as fridges, air conditioners, and electric hot-water cylinders. Other demand management measures include energy efficiency requirements in the Building Code, and voluntary schemes to help businesses, households, and organisations save energy.

Our energy future

Recent changes in international energy supply and higher global energy costs, coupled with concerns about climate change, have resulted in a worldwide drive towards greater energy efficiency and increased use of renewable fuels.

As New Zealand takes action on climate change, the focus on renewable energy, and energy efficiency and conservation is increasing. Safeguarding security of supply will also remain a concern. The challenge for New Zealand is to maintain economic and social well-being, while it reduces the environmental costs of energy use.

Much of New Zealand's efficiency gains will have to be achieved in the transport sector, given that this is both the single largest user of energy in New Zealand and one of our fastest growing sectors by consumption. Scope for efficiency improvements also exists in the residential sector, and attention has now turned to this through improvements to the Building Code, and through insulation and solar water heating programmes.

GOVERNMENT ACTION on energy

New Zealand Energy Strategy to 2050

The New Zealand Energy Strategy to 2050, *Powering our Future: Towards a sustainable low emissions energy system,* was released in October 2007. The strategy provides long-term direction for energy policy and promotes the development of an energy system that supports economic growth in an environmentally responsible way.

New Zealand Energy Efficiency and Conservation Strategy

The New Zealand Energy Efficiency and Conservation Strategy, *Making it Happen: Action plan to maximise energy efficiency and renewable energy* was released in October 2007 to replace the National Energy Efficiency and Conservation Strategy. It will help achieve the objectives of the New Zealand Energy Strategy to 2050. It includes measures to reduce electricity demand; address energy use in transport, buildings, and industry; and promote greater consideration of sustainable energy in the development of land, settlements, and energy production.

Solar Water Heating programme

The Solar Water Heating programme promotes the uptake of solar water heating in homes, which in turn reduces the demand for electricity and gas. In 2006, an investment of $15.5 million was announced for the first three-and-a-half years of a five-year programme to increase the use of solar water heating. The New Zealand Energy Efficiency and Conservation Strategy has set a target of 15,000–20,000 solar water heating units to be installed by 2010.

Waste

Waste can represent an inefficient use of valuable resources. Improperly disposed of, waste can also pose a risk to human health and the environment.

The amount of waste generated in New Zealand has increased over time as our population and levels of production and consumption have grown. However, in recent decades, the amount of waste recovered from the waste stream to be reused, recycled, or reprocessed has also increased.

LOCAL ACTION to reduce waste

Second Hand Sundays

Gisborne District Council has made progress over the past few years in reducing the level of community waste being disposed of to landfills and in increasing the rates of recycling. Refuse collection volumes are down 59 per cent since 1999. Recycling tonnages are up 52 per cent since 2000.

A number of innovative Council programmes have contributed to this success. One such initiative is Second Hand Sundays, well-publicised days on which people may put used goods out on the kerbside for others in the community to take away for reuse. Each time this initiative is run, about 50 tonnes of waste is diverted from landfills.

Business and community initiatives

Throughout New Zealand, a large number of non-government organisations have set up programmes to work with the community to reduce waste and promote recycling and resource efficiency. These organisations include professional and industry associations, and not-for-profit organisations such as the Waste Management Institute of New Zealand, New Zealand Business Council for Sustainable Development, Sustainable Business Network, Packaging Council of New Zealand, and Zero Waste New Zealand Trust.

The programmes also include a significant number of community-based recovery and recycling centres, which make an important contribution to the quantities of waste that are reused, recycled, and recovered in New Zealand. They also contribute to the economy by creating employment.

Kai to Compost

Kai to Compost is a food waste collection scheme for restaurants and businesses in Wellington city. The scheme collects food waste from restaurants and takes it to the Living Earth plant at the Southern Landfill, where the material is mixed with green waste and used to produce compost.

A trial scheme was funded by the Ministry for the Environment's Sustainable Management Fund, Wellington City Council, and Living Earth and involved 50 local businesses. The scheme is now run on a user-pays basis. Up until the end of 2006, the Council had collected 456 tonnes of food waste as part of the programme (177 tonnes in 2005–2006 and 278 tonnes in 2006–2007), which has reduced carbon dioxide emissions by an estimated 411 tonnes.

KAI TO COMPOST FOOD WASTE COLLECTION SCHEME.

Source: Courtesy of Mark Coote.

Improving waste management

Between 1995 and 2006, the amount of waste disposed of in New Zealand landfills is estimated to have decreased slightly from 3.180 million tonnes per year to 3.156 million tonnes per year, in spite of a growing population and economy. This is illustrated in Figure 2.5.

Because the economy grew significantly during the same period, this drop represents a decrease of 29 per cent per dollar of gross domestic product (GDP) when adjusted for inflation. In other words, the amount of waste going to landfills was decoupled from economic growth during the period considered. This decoupling can probably be attributed to the increase in recycling and reprocessing, and possibly also to the advent of user charges at landfills and for municipal rubbish collection.

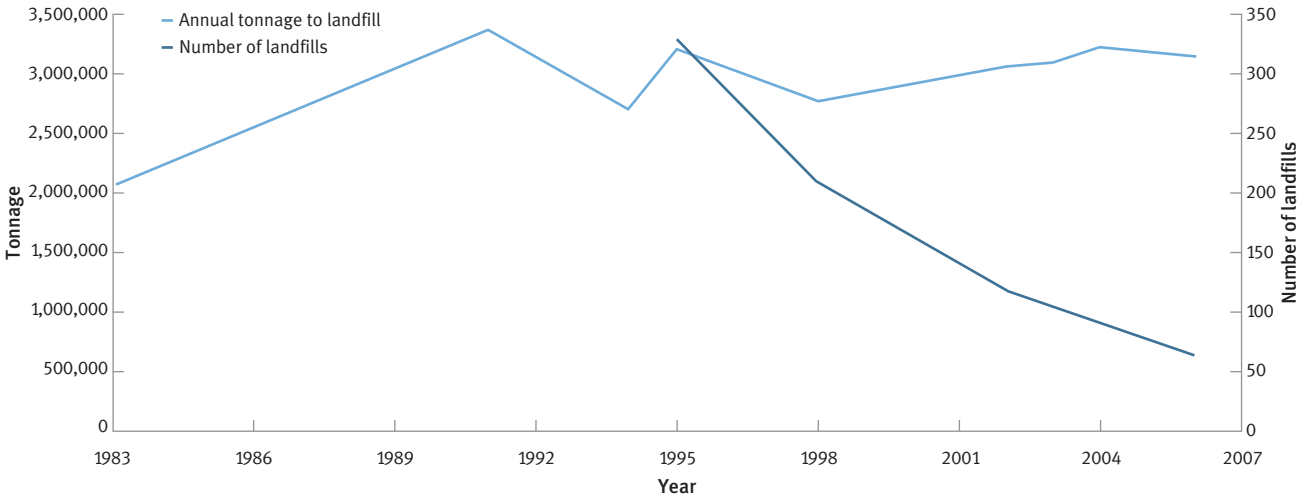
However, we do not know how much waste that would be normally disposed of in landfills was disposed of in other types of disposal facilities during this period. For example, some of this waste may have been diverted to the 300-odd cleanfills that accept inert material such as soil, rock, and concrete rubble that does not have a harmful effect on people or the environment. We also do not know whether a possible reduction in the amount of waste *generated* in New Zealand was a factor.

The management of landfills in New Zealand has improved during the last decade. In 1995, 327 landfills were operational in New Zealand, and many had poor environmental controls. As Figure 2.5 shows, today, there are around 60 landfills. Of these landfills, 54 per cent are installed with an engineered liner, 77 per cent collect leachate, and 23 per cent recover landfill gas.

Municipal wastewater (made up of sewage, stormwater, and liquid trade waste) is managed as a waste in New Zealand. Today, 56 per cent of the 269 monitored wastewater treatment plants for which information is available operate secondary treatment of wastewater to remove solids and associated contaminants, and a further 36 per cent treat their wastewater to the highest level (tertiary treatment).

Twenty-six wastewater plants, serving almost 30 per cent of the New Zealand population, annually divert 155,000 tonnes of biosolids (sewage sludge) from landfills. Most of the diverted biosolids are used to reclaim land, or applied to forested land as a fertiliser. Even with high levels of recovery and reuse of biosolids, about 80,000 tonnes of residual biosolids from these treatment plants are disposed of in landfills each year.

+ FIGURE 2.5:
ESTIMATES OF WASTE DISPOSED OF TO LANDFILL, 1983–2006, AND NUMBER OF LANDFILLS OPERATING, 1995–2006



Data source: Ministry for the Environment, 2007a.

Increased recycling

About 73 per cent of New Zealanders had access to kerbside recycling in 2006, up from 20 per cent in 1996. Ninety-seven per cent had access to either kerbside recycling or drop-off facilities.

In 2005, municipal recycling diverted 329,283 tonnes of paper, plastic, glass, steel, and aluminium from landfills. This equates to 10 per cent of the total tonnage disposed of in landfills. When commercial waste is included, the total amount of material diverted from landfills is estimated to be around 2.4 million tonnes a year.

However, despite these advances, many potentially useful materials continue to be disposed of in New Zealand landfills and cleanfills. Organic waste (garden and food waste), timber, and construction and demolition waste make up nearly 50 per cent of waste disposed of in landfills.

SEVENTY-THREE PER CENT OF NEW ZEALANDERS HAD ACCESS TO KERBSIDE RECYCLING IN 2006.

Source: Ministry for the Environment.

Hazardous waste

Information on hazardous waste is limited in New Zealand, because of a lack of formal record keeping and reporting on waste flows in the past. As well as this, a significant proportion of hazardous waste is handled by private waste operators, whose data is considered commercially sensitive.

Local authority trade waste bylaws control a large proportion of New Zealand's hazardous wastes, of which as much as 70–85 per cent are liquid and discharged to municipal wastewater treatment systems. In 2004, solid hazardous waste was estimated to account for 11 per cent of waste disposed of in landfills. About one-quarter of this waste is rendered inert (stabilised) at waste treatment facilities before disposal. Some major industries – for example, the mining industry – treat and dispose of hazardous waste separately from municipal systems.

LOCAL ACTION on hazardous waste

Used oil

About 33 to 40 million litres of used oil is generated in New Zealand each year. In 1997, around three-quarters of this amount was dumped at landfills, burnt, poured onto roads to control dust, used to lubricate chainsaws and stain fences, and lost or discarded in various unknown ways. Today, the Used Oil Recovery Programme collects and reuses 21 million litres of used oil a year.

Waste electrical and electronic equipment

Waste electrical and electronic equipment, including products that contain hazardous components such as batteries, computers, cell phones, televisions, and lighting appliances (for example, fluorescent tubes), are disposed of in landfills in New Zealand every year at a rate of up to 80,000 tonnes. Several industry schemes to reuse, recycle, or recover waste electrical goods have been introduced in New Zealand in the last decade.

Used vehicles

Vehicles that have come to the end of their useful life can cause a waste problem even if they are sent to the scrap yard. Various hazardous substances (for example, used oil, refrigerant, batteries, and circuit boards) must be removed from end-of-life vehicles for proper management. About 100,000 vehicles are legally disposed of every year, but another 25,000 cars are dumped illegally, at a cost of $6 million to local authorities.

GOVERNMENT ACTION to minimise waste

The Govt³ programme was established by the Ministry for the Environment in 2003 to encourage government departments to show leadership in waste minimisation as well as sustainability in buildings, transport, and the purchase of office consumables and equipment.

In the waste area, the Govt³ programme helps agencies reduce the waste they send to landfills by recycling and composting it instead.

By July 2007, 48 agencies had joined the Govt³ programme.

NEARLY 300 TONNES OF OLD COMPUTER EQUIPMENT AND MOBILE PHONES WERE COLLECTED FREE-OF-CHARGE DURING NEW ZEALAND'S FIRST NATIONAL 'E-DAY' IN SEPTEMBER 2007.

Source: Ministry for the Environment.

The changing face of waste management

Since 1997, significant gains have been made in New Zealand in managing the effects of waste on human health and the environment. These have been driven primarily by stricter controls on waste disposal and management under the Resource Management Act 1991, the Hazardous Substances and New Organisms Act 1996, and the Local Government Acts (1974 and 2002).

In response to these controls, our waste management practices have improved through the closure of substandard landfills, better management of remaining landfills, and greater recycling efforts. Councils have also made progress in implementing waste management plans, waste bylaws, and the 2002 New Zealand Waste Strategy.

While hazardous waste flows are still not well understood because of the lack of available data, hazardous substances and their wastes are now better controlled through the Hazardous Substances and New Organisms Act 1996, trade waste bylaws, and national environmental standards.

Nonetheless, New Zealanders continue to throw away large quantities of potentially valuable materials. Many of these could be recovered and reused or recycled.

In parallel, New Zealand industries are increasingly aware of the cost benefits of using raw materials more efficiently. Several industry groups have taken the lead in minimising the waste generated from their production processes. We need to build on this if we are to move toward becoming a 'zero waste' society.

Encouraging industry to take further responsibility for minimising waste generation, producing 'low-waste' goods, and promoting 'lower-waste' purchasing choices is likely to be an integral part of future waste initiatives in New Zealand. Consumers, too, can play their part in purchasing low-waste products, or products that are made from or packaged in recycled or recyclable materials.

STATE OF THE ENVIRONMENT

03

Air

New Zealand has good air quality in most places for most of the time. Nevertheless, emissions from wintertime home heating and road traffic can affect air quality in about 30 locations around New Zealand. Around 53 per cent of New Zealanders live in these locations. Both large urban areas and small settlements can be affected by poor air quality.

In most areas that experience poor air quality, the cause is high winter levels of small particles from coal and wood home heating. These are known as PM_{10} particulates, because they are smaller than 10 microns in diameter (about a fifth of the thickness of a human hair). The Auckland area, home to about one-third of the country's population, also occasionally experiences high PM_{10} particulate levels from road transport. Regional PM_{10} particulate monitoring networks have been expanded and upgraded to ensure continuous monitoring where levels are of concern.

Air quality and human health

Pollutants in the air can affect human health because they are inhaled into our lungs. Vulnerable groups such as the very young, very old, and those with underlying respiratory or cardiac disease, are particularly at risk. In New Zealand, around 1,100 people die prematurely each year from exposure to air pollution. Of those, the number of people dying prematurely from traffic-related air pollution is close to the number killed in road accidents.

PM_{10} particulate levels

Figure 3.1 on page 32 shows that PM_{10} particulate levels appear to be falling in some of the main centres of population, although the influence of weather on air pollution makes it difficult to assess trends. Levels of PM_{10} particulates at roadside locations in Auckland appear to have fallen over the past 10 years.

Overseas, health experts have, in recent years, become concerned about the health impacts of even smaller particles in the air ($PM_{2.5}$). The monitoring for $PM_{2.5}$ particulates that has been carried out in New Zealand so far shows a strong correlation between high levels of PM_{10} particulates and high levels of $PM_{2.5}$ particulates.

AIR POLLUTION IN A RURAL COMMUNITY DURING WINTER.

Source: Courtesy of Greater Wellington Regional Council.

LOCAL ACTION on air pollution

Auckland Regional Council 0800 Smokey campaign

In August 2000, Auckland Regional Council began a public education campaign designed to raise awareness of Auckland's air pollution problems from motor vehicles. The aims of the 0800 Smokey campaign were to:

- raise awareness that motor vehicle emissions cause more than 80 per cent of the air pollution in Auckland and that owners should tune their vehicles to reduce the impact of motor vehicle emissions
- promote the 0800 SMOKEY hotline and website through which people could report smoky vehicles
- raise the profile of air quality in the region to influence national policies on fuel quality and vehicle importation.

Throughout the campaign, free exhaust emission checks were offered to vehicle owners.

Over a 15-week period, 20,000 people reported 23,000 different smoky vehicles. One vehicle was reported 67 times.

Nelson City Council and Tasman District Council Good Wood scheme

Firewood retailers are encouraged to become 'Good Wood' suppliers who agree to supply dry wood (or wood that will be dry for the following winter). Suppliers must have moisture meters to confirm the moisture content of the wood supplied. Retailers who agree to the code can use the Good Wood logo. Regular marketing and promotion of Good Wood suppliers is carried out by the Nelson City Council and Tasman District Council.

Nelson City Council Smoke Patrol

Nelson City Council has a dedicated smoke patrol officer. The officer's role is to identify excessively smoky domestic fires and offer the householder advice on ways to reduce smoke, information about Good Wood, and financial assistance to upgrade old burners and improve insulation.

National environmental standards for air quality

National air quality standards adopted in 2004 are helping improve air quality, including by reducing PM_{10} particulate levels (see box 'National environmental standards for air quality').

National environmental standards for air quality

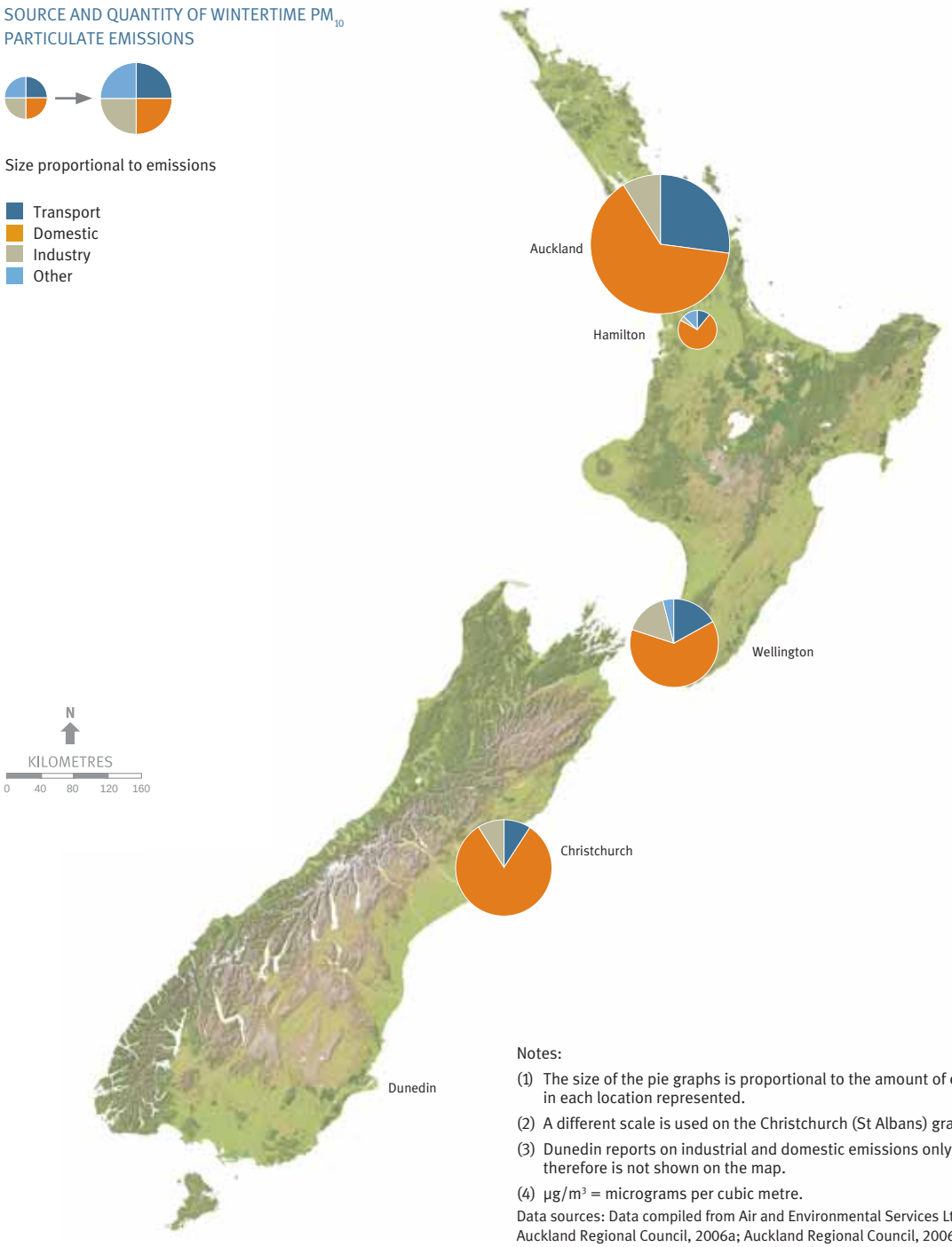
The Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004 set air quality standards for PM_{10} particulates, nitrogen dioxide, carbon monoxide, sulphur dioxide, and ground-level ozone. In addition, certain activities are prohibited, such as burning tyres, bitumen, coated wire, and oil in the open. The standards also prohibit the use of incinerators at schools and health care institutions, unless authorised by resource consent. New high-temperature waste incinerators are also prohibited.

The national environmental standard (NES) for the five air pollutants mentioned above is defined in terms of a maximum concentration of the pollutant in the air and the frequency with which that maximum concentration may be exceeded without breaching the NES.

The NES requires air quality to be measured and publicly reported by regional councils and unitary authorities wherever air pollution exceeds levels set by the standards. Councils have identified airsheds where PM_{10} particulates are known, or suspected to be, of concern. PM_{10} particulate levels in these airsheds are required to comply with the ambient air quality standard by 2013. After August 2013, no resource consents to discharge PM_{10} particulates to air can be granted if the air quality standard is still being breached (that is, exceeded more than once in 12 months).

The NES also includes a design standard for new wood burners installed after September 2005 to reduce particulate emissions and provide better heat efficiency. Although the wood burner standard only limits emissions of small particulates, it has the additional benefit of controlling emissions of other harmful pollutants such as carbon monoxide, volatile organic compounds, hydrocarbons, and dioxins.

+ FIGURE 3.1:
PM_{10} PARTICULATE LEVELS AND EMISSIONS IN MAIN CENTRES OF POPULATION



Notes:

(1) The size of the pie graphs is proportional to the amount of emissions in each location represented.

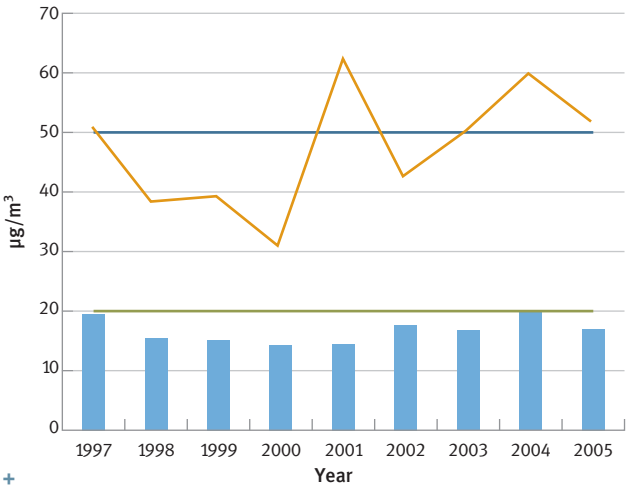
(2) A different scale is used on the Christchurch (St Albans) graph.

(3) Dunedin reports on industrial and domestic emissions only and therefore is not shown on the map.

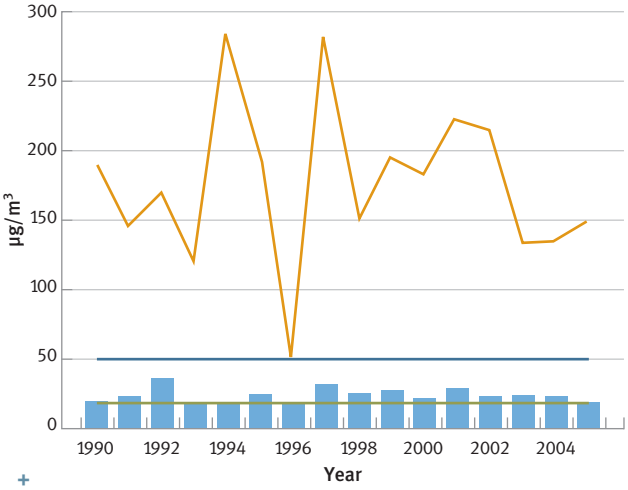
(4) $\mu g/m^3$ = micrograms per cubic metre.

Data sources: Data compiled from Air and Environmental Services Ltd, 2001; Auckland Regional Council, 2006a; Auckland Regional Council, 2006b; Environment Canterbury, 2004; Environment Canterbury, 2006; Environment Waikato, 2006a; Environment Waikato, 2006b; Greater Wellington Regional Council, 2005; Otago Regional Council, 2005a; Otago Regional Council, 2005b.

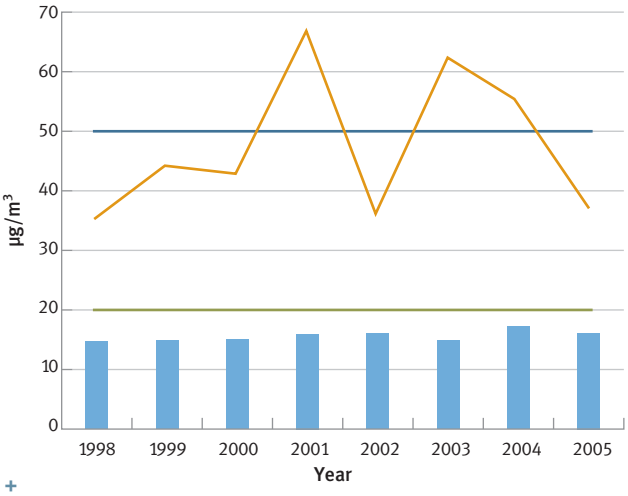
AUCKLAND (TAKAPUNA) PM_{10}



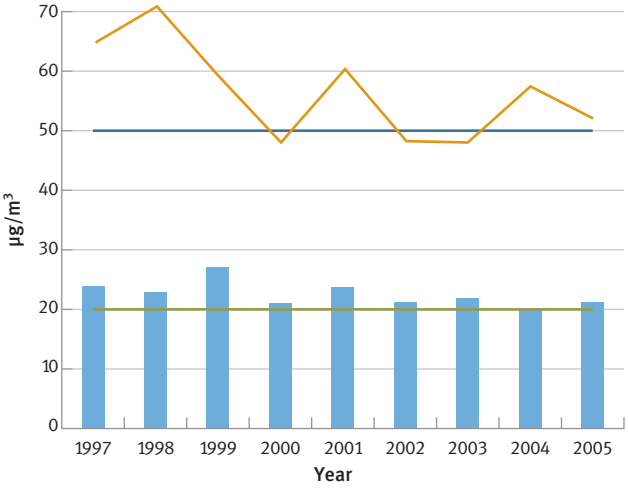
CHRISTCHURCH (ST ALBANS) PM_{10}



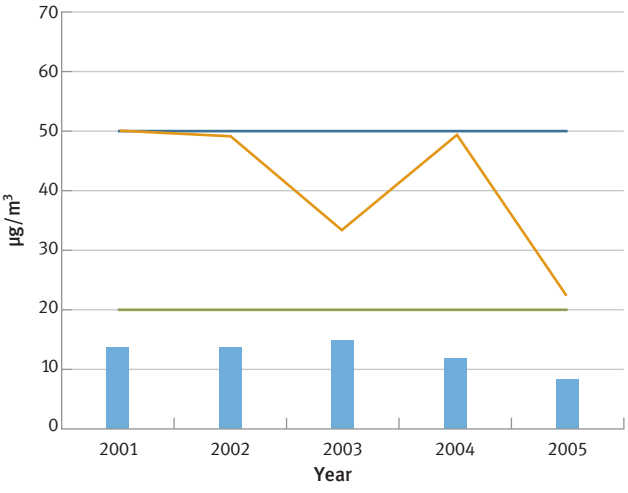
HAMILTON PM_{10}

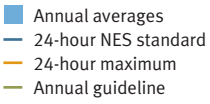


DUNEDIN PM_{10}



WELLINGTON (UPPER HUTT) PM_{10}





The box 'Other air pollutants monitored in New Zealand towns and cities' shows the status of other air pollutants in New Zealand, including nitrogen dioxide, carbon monoxide, sulphur dioxide, ground-level ozone, benzene, and lead.

Other air pollutants monitored in New Zealand towns and cities

Environment New Zealand 2007 presents an extensive overview of air quality monitoring of contaminants other than PM_{10} particulates. In brief:

- Levels of *nitrogen dioxide* are at an acceptable level around New Zealand, with the exception of some locations in Auckland that are affected by traffic emissions. Emissions of nitrogen dioxide in Auckland appear to be increasing.
- Levels of *carbon monoxide*, mostly from traffic emissions, were of concern 10 years ago. Since then, levels appear to have fallen at sites that have historically experienced high concentrations. The improvement is most likely due to improvements in vehicle technology.
- *Sulphur dioxide* concentrations declined in the 1980s and are considered to be low in most parts of the country. The exceptions to this are areas around the Marsden Point Oil Refinery and some other individual sources.
- As a result of traffic emissions, areas around Auckland, Hamilton, and Christchurch were identified in the mid-1990s as having the greatest potential for elevated levels of *ground-level ozone*. However, monitoring indicates that ozone levels are satisfactory in these locations.
- *Benzene* levels at monitored locations are satisfactory. Roadside levels are higher than in residential areas, but appear to be improving. This is probably due to changes in fuel composition.
- *Lead* was eliminated from New Zealand petrol in 1996 and airborne lead levels are now very low.

GOVERNMENT ACTION on air quality

Warm Homes initiatives

Through the Warm Homes project, central government is working with local government to help New Zealanders reduce the pollution effects of home heating while staying warm. The project aims to ensure all New Zealanders heat their homes cleanly, efficiently, and sufficiently. Pilot programmes were run in Tokoroa, Timaru, and Taumarunui to retrofit homes with insulation and new heating sources, and evaluate the impacts of this on air quality and health. In 2006, the Warm Homes project also ran seven community workshops in six regions across New Zealand.

Transport initiatives

Petroleum Products Specifications Regulations 2003

These Regulations specify the technical requirements for petrol and diesel supplied for retail sale (excluding aviation, jet boat, and motor racing). Progressive improvements in fuel specifications have reduced the amount of pollutants such as PM_{10} and benzene that are emitted from vehicle exhausts.

The Vehicle Exhaust Emissions Rule

This Land Transport Rule, introduced in 2003, requires all motor vehicles entering the New Zealand fleet for the first time to have been manufactured to the applicable emissions standards specified in the rule. Since 2006, the rule has required all vehicles to undergo a visible smoke test check at every compliance test (that is, border entry, warrant of fitness, and certificate of fitness inspections). This complements the Land Transport (Road User) Rule 2004 which requires that vehicles do not emit visible smoke for more than 10 seconds.

At the time of writing, government is consulting on proposed tighter emissions standards for new vehicles and used vehicles entering New Zealand.

Reducing the sulphur content of diesel in New Zealand

In 2002, the Government introduced regulations that reduced the sulphur content of diesel. By September 2002, the sulphur content of diesel available in Auckland and Northland had reduced from 3,000 parts per million to 1,000 parts per million.

In August 2004, levels were further reduced throughout New Zealand to 500 parts per million. This was followed by another decrease to 50 parts per million in January 2006, representing a 60-fold reduction in sulphur content since 2002. The sulphur content in diesel will be further reduced to 10 parts per million in January 2009.

Clearing the air

Today, the main focus for improving air quality in New Zealand is to reduce emissions of PM_{10} particulates from home heating and transport. Now that regular monitoring of air quality in managed airsheds has been put in place through the national environmental standards, the focus has shifted to monitoring how levels of PM_{10} particulates are tracking against the national environmental standard target set for 2013.

As the Resource Management Act 1991 is unlikely to be effective in controlling air pollution from traffic, other work is underway to minimise the impact of air pollution from road transport. This includes a visible smoke test when vehicles go for a warrant of fitness, and emissions standards for imported vehicles.

But, as noted in the *Transport* section, improvements in fuels and vehicle technology alone will not be enough to reduce air pollution from road transport. Further measures, such as a well-functioning and convenient public transport system, and, in the long run, changing the shape of our urban environment to reduce our dependence on motorised transport, will also need to be part of the mix.

Future work on improving air quality in New Zealand is also likely to focus on developing a better understanding of $PM_{2.5}$ particulate concentrations around New Zealand.

BUSY AUCKLAND MOTORWAY.

Source: Courtesy of Gavin Fisher.

Atmosphere

In recent decades, global attention has focused on two environmental issues in relation to the atmosphere: climate change and depletion of atmospheric ozone. In response, the international community has acted to quantify and reduce emissions of greenhouse gases and ozone-depleting substances.

Greenhouse gases, global warming potentials and CO_2 equivalents

The major greenhouse gases include water vapour, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other greenhouse gases at lower concentrations include sulphur hexafluoride (SF_6), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs).

Each greenhouse gas has a different warming potential (the relative warming effect of the gas when compared with carbon dioxide). For example, methane has 21 times the global warming potential of carbon dioxide. For ease of comparison, volumes of greenhouse gas emissions and removals are reported in terms of 'carbon dioxide equivalents' ('CO_2-e').

Our changing atmosphere

Echoing global trends, atmospheric levels of carbon dioxide over New Zealand increased from 324 to 379 parts per million between 1970 and 2006. Atmospheric nitrous oxide levels showed an average increase of 0.9 parts per billion each year over the last decade. Methane levels have shown a small reduction in recent years.

The changing climate

Average surface temperatures in New Zealand have risen by 0.9°C between 1920 and 2000. As a country reliant on primary production and tourism for its economic wealth, New Zealand stands to be much affected by the impacts of climate change. Historical climate patterns can no longer be taken as an accurate guide to the climate we will experience in the future. Climate change is likely to bring to New Zealand rising sea levels, increased floods and droughts, changes in wind and rainfall patterns, increasing temperatures, fewer frosts, and changes to our ecosystems and pest species.

Emissions and sinks

New Zealand's greenhouse gas emissions represent much less than 1 per cent of global emissions, but on a per capita basis we are the 12th highest emitter. In 2005, our total greenhouse gas emissions amounted to 77.2 million tonnes of CO_2-e. Between 1990 and 2005, our total greenhouse gas emissions increased by 25 per cent, reflecting our growing population and economy.

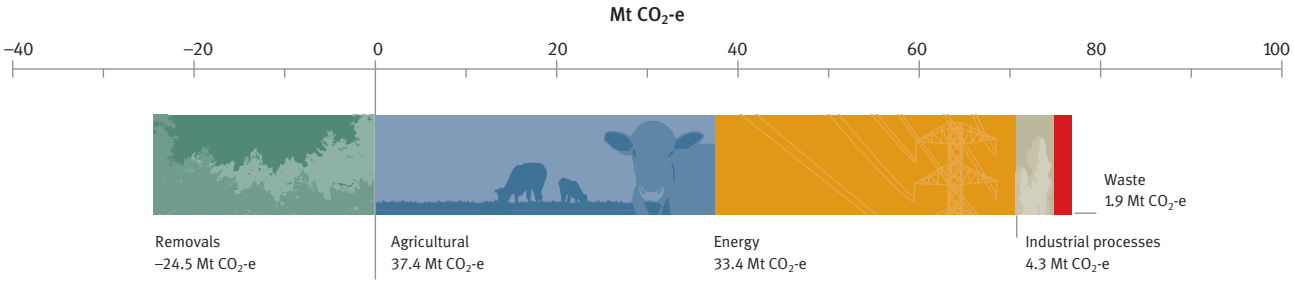
The largest growth in our emissions since 1990 has been in the energy sector (an increase of 9.9 million tonnes of CO_2-e) and agriculture sector (almost 5 million tonnes of CO_2-e). This growth has been offset by a concurrent increase in removals to forest sinks (5 million tonnes of CO_2-e, or 29 per cent since 1990). The increase in removals to forest sinks is largely due to increases in plantation forestry in the mid-1990s, as discussed further in the *Land* section.

FORESTS REMOVE CARBON DIOXIDE FROM THE ATMOSPHERE AND STORE IT AS CARBON.

Source: Courtesy of Peter Wiles, Ngahere Muri Forestry Limited.

New Zealand has an unusual greenhouse gas emissions profile for a developed nation. As Figure 3.2 shows methane and nitrous oxide from the agricultural sector contribute close to 50 per cent of our total emissions. Carbon dioxide emissions, largely from energy generation and transport, contribute most of the other 50 per cent. Many other developed nations have comparatively lower agricultural emissions and higher emissions from energy generation.

+ FIGURE 3.2:
NEW ZEALAND'S GREENHOUSE GAS EMISSIONS BY SECTOR, 2005



Notes:
(1) Removals indicate the uptake of carbon dioxide by forests.
(2) Mt CO_2-e = megatonnes of carbon dioxide equivalents.
Source: Ministry for the Environment, 2007b.

New Zealand and the Kyoto Protocol

The Kyoto Protocol under the United Nations Framework Convention on Climate Change was agreed in 1997 and came into force in 2005. The protocol sets targets for the greenhouse gas emissions of developed countries for the period 2008 to 2012 (the first commitment period). For that period, it aims to reduce the total greenhouse gas emissions of developed countries to 5 per cent below the level they were in 1990.

Different countries have different targets to achieve. New Zealand's target is to reduce its greenhouse gas emissions to the level they were in 1990, or take responsibility for excess emissions. Negotiations are now under way on further commitments for developed countries under the Kyoto Protocol.

The Climate Change Response Act 2002 put in place a legal framework to allow New Zealand to ratify the Kyoto Protocol and to meet its obligations under the United Nations Framework Convention on Climate Change and Kyoto Protocol. The Act enables New Zealand to trade emissions units (carbon credits) on the international market, and establishes a registry to record holdings and transfers of units. The Act also establishes a national inventory agency to record and report information relating to greenhouse gas emissions in accordance with international requirements.

Challenges and opportunities

Climate change is a long-term issue that presents both risks and opportunities for New Zealanders. We start from a relatively favoured situation with high levels of renewable electricity generation, and low average population density. Forest cover in New Zealand is extensive, we enjoy a temperate climate, and awareness of environmental issues is well established. But we also face challenges.

Much of our economy is based on primary production, which depends on a stable, benign climate for its prosperity. The costs of extreme weather events such as floods and droughts are already high, and are expected to get worse under a changing climate.

We are also distant from markets and customers, including our tourism markets, so there is a perception that the carbon footprint of our goods and services is high.

A number of sector-specific initiatives and policies are underway to reduce New Zealand's greenhouse gas emissions. In addition, an economy-wide Emissions Trading Scheme has been announced to put a value on emissions from 2008. Both economy-wide action and sector-specific initiatives will be needed if we are to achieve significant reductions in emissions and accelerate the development of more low carbon technologies and practices.

LOCAL ACTION on climate change

Communities for Climate Protection – New Zealand

Communities for Climate Protection – New Zealand (CCP-NZ) is a voluntary programme which helps local government reduce greenhouse gas emissions from council operations and within their wider communities. CCP-NZ provides a framework in which actions can be taken to reduce greenhouse gas emissions through energy conservation, renewable energy, waste reduction, sustainable transport, improved urban design, and emission-reduction technologies.

Adapting to climate change

In May 2005, the Western Bay of Plenty was hit by an intense storm that caused flooding throughout the region. A state of emergency was declared because flooding substantially damaged stormwater infrastructure, roading, and private property.

While average rainfall in the Bay of Plenty is expected to decrease with climate change, extreme rainfall events and flooding are projected to increase. This has significant implications for new subdivisions and development in the area.

In response, the Tauranga City Council now considers climate change impacts when designing all new and upgraded stormwater infrastructure. The Council has also incorporated increased high intensity rainfall into its planning blueprint for growth and development in the region over the next 50 years.

TAURANGA CITY COUNCIL HAS UPGRADED THE CITY'S STORMWATER INFRASTRUCTURE.

Source: Courtesy of Tauranga City Council.

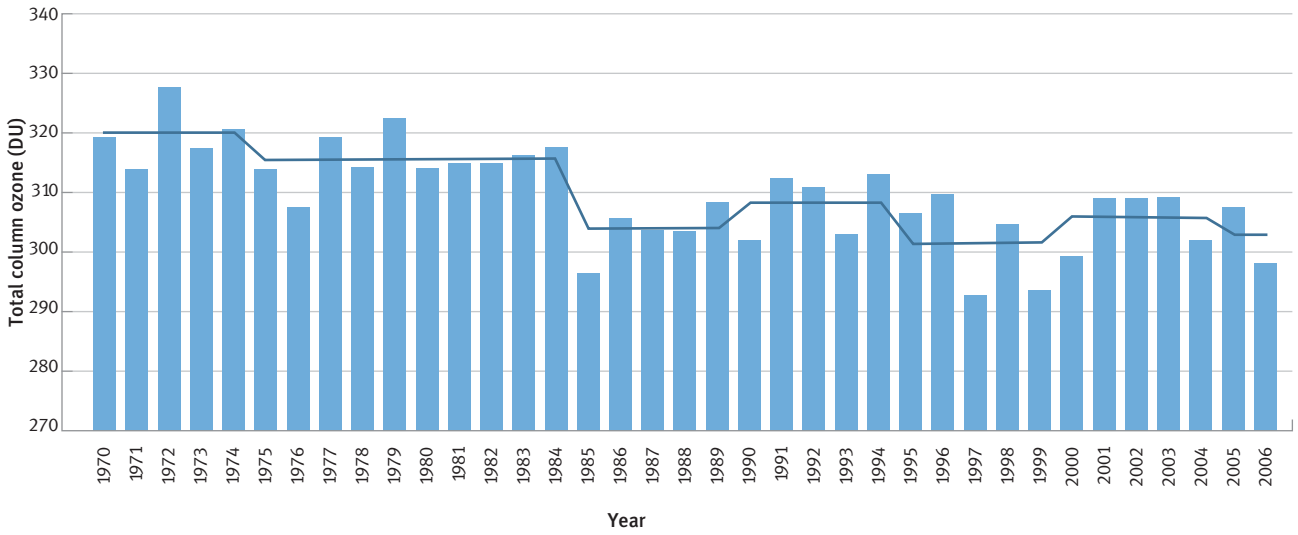
Protection of the ozone layer

Over the past 30 years, ozone levels over Antarctica have dropped by almost 60 per cent during the spring of each year and a 'hole' in ozone concentrations is clearly visible in satellite observations. This hole does not extend over New Zealand. In fact, New Zealand experiences its highest ozone levels in October, at the same time that the ozone hole occurs over Antarctica.

Nonetheless, summertime ozone levels over New Zealand continue to be strongly influenced by Antarctic ozone depletion. When New Zealand experiences a combination of lower ozone with high sun and few clouds, skin-damaging ultraviolet (UV) levels can be extreme.

Atmospheric ozone levels over New Zealand have varied considerably over time, as shown in Figure 3.3. Levels have stabilised in the last decade, reversing decreases in the 1980s and 1990s. Accordingly, monitored summertime UV levels in New Zealand have decreased in recent years. Also, atmospheric ozone levels over Antarctica are no longer reducing at the rate they were during the 1980s and 1990s.

+ FIGURE 3.3:
AVERAGE YEARLY OZONE LEVELS OVER NEW ZEALAND, 1970–2006



Notes:

(1) Five-year averages have been plotted to give an indication of trend in ozone concentration.

(2) DU = Dobson units.

Source: National Institute of Water and Atmospheric Research.

Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer 1987 sets targets for reducing the production and consumption of ozone-depleting substances. The protocol originally required parties to reduce chlorofluorocarbon (CFC) use to 50 per cent below 1986 levels by 1998, and to hold halon consumption at 1986 levels from 1992.

The provisions of the protocol have since been tightened through a series of amendments – CFCs and halons were phased out completely by the early to mid-1990s. Phase-out schedules were agreed for other substances as the impact of those substances on ozone layer depletion became better understood.

New Zealand's obligations under the Montreal Protocol are implemented through the Ozone Layer Protection Act 1996 and the Ozone Layer Protection Regulations 1996.

New Zealand is not a producer of ozone-depleting chemicals and it has regulated their import. Domestic controls reduce New Zealand's reliance on ozone-depleting substances by progressively restricting the volumes imported. Since 2000, over 30,000 tonnes of halons have been collected for safe destruction.

New Zealand is the world's 11th largest user of methyl bromide, an ozone-depleting substance that is used for maintaining biosecurity at New Zealand's borders. The importation of methyl bromide for uses other than quarantine and pre-shipment treatments is now prohibited.

Land

New Zealand is recognised internationally for its stunning landscapes and productive agricultural and horticultural land.

Since human settlement, the way we have used our land has fundamentally shaped our nation. Land is important to many of us in other ways – it can contribute to our sense of belonging to this country, and represent the place we call home.

New Zealand has developed internationally-recognised expertise in the productive use of land resources, exporting high-value agricultural, horticultural, wine, and timber products to the rest of the world. In recent decades, New Zealand has also marketed itself internationally as an attractive destination for scenic and adventure tourism.

A definition of land

Land is considered to include:

- the aesthetic components of landform and landscape including the vegetation cover
- the physical components of soil and parent material (the soils and underlying rock types that give rise to soil)
- the plant and animal communities in the soil, such as insects, mites, springtails, nematodes, worms, fungi, bacteria, and algae
- the exotic and native ecosystems resident on the land, such as exotic forestry, urban settlements, native forests, and tussock grasslands.

Land and our economy

Land plays an integral part in supporting New Zealand's top two export earners: tourism and primary production. In 2007, agriculture, forestry, horticulture, and viticulture generated $16.1 billion, $3.6 billion, $2.5 billion, and $662 million respectively in export earnings. In other words, about one-sixth, or 17 per cent, of New Zealand's gross domestic product (GDP) depends on the top 15 centimetres of our soil. In 2006, tourism generated $8.3 billion in export earnings.

Land use and environmental impacts

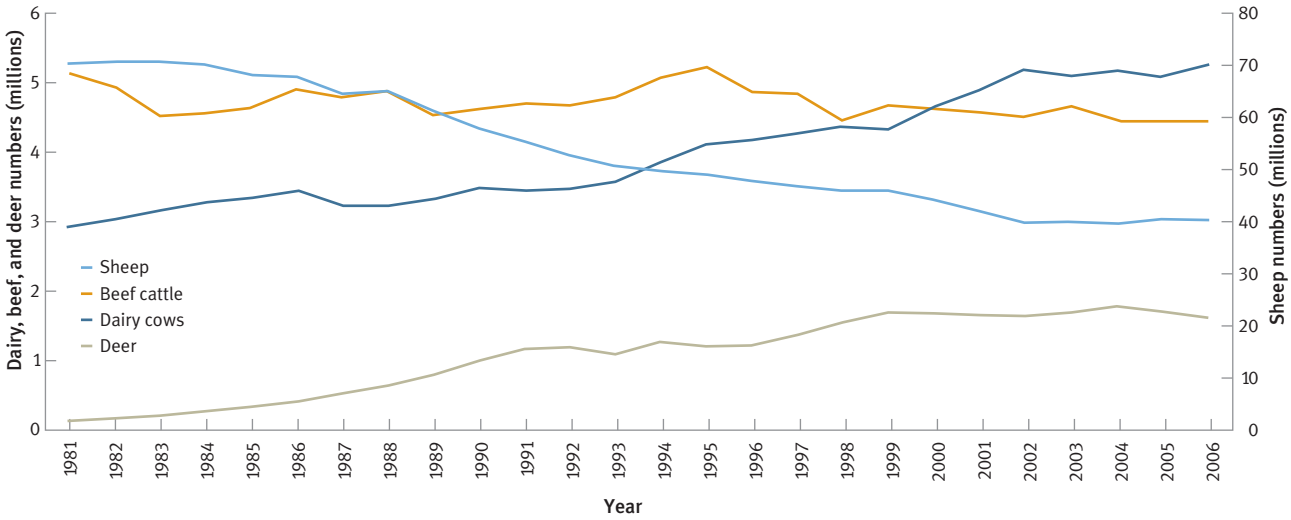
Using land for production and urban development puts pressure on the wider environment: urban and rural run-off pollutes our waterways and coasts; urban expansion leads to the loss of versatile soils; and more intensive agricultural land use increases the risk of detrimental long-term effects on soil quality, and the quality of our waterways.

Intensification of pastoral land use

Recent trends in land use in New Zealand include an increase in intensive pastoral land use (for example, higher stocking rates, increased use of fertilisers and agricultural chemicals, and increases in irrigation use).

For example, Figure 3.4 shows that by 2006, dairy cow and deer numbers had increased to just over 5.2 million and 1.5 million, respectively. Between 1996 and 2006, the national dairy herd grew by 24 per cent. The recent expansion of dairy and deer farming has been particularly notable in the South Island. On the other hand, the number of sheep decreased to just over 40 million, and beef cattle numbers dropped to just under 4.5 million.

+ FIGURE 3.4:
LIVESTOCK NUMBERS IN NEW ZEALAND, 1981–2006



Data source: Ministry for the Environment, 2007b.

OUR PRIMARY PRODUCTION SECTORS RELY ON THE LAND.

Source: Ministry for the Environment.

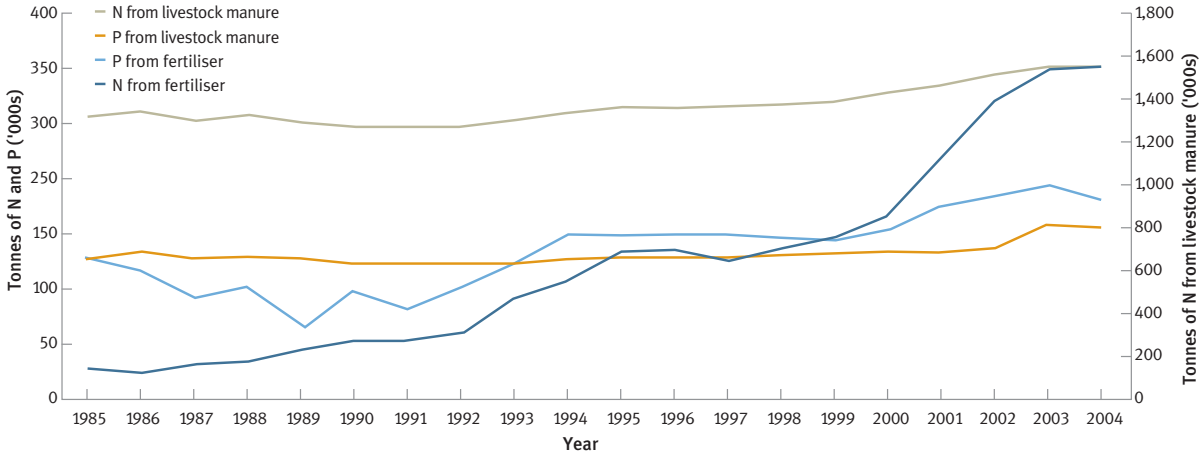
Fertiliser use

Intensification of pastoral land use has led to a noticeable increase in the use of fertilisers in high-producing exotic pastures. Most of the increased fertiliser inputs are removed from the land as production, but there is no doubt that the intensification of pastoral land use has increased the pressure on our surface waterways and groundwater, as discussed in the *Freshwater* section.

Total fertiliser use significantly increased in New Zealand between 1985 and 2004 (see Figure 3.5). The amount of nitrogen fertiliser used in New Zealand has increased about ten-fold since 1985 and has doubled since the mid-1990s. Nitrogen from livestock manure, which contributes around five times the amount of nitrogen to the land as nitrogenous fertilisers, also steadily increased.

These changes coincide with the trend towards more intensive forms of farming; particularly dairy farming, with its high density of grazing stock. Dairy cows excrete almost seven times the amount of nitrogen and phosphorus in their faeces and urine as breeding ewes, and around three-and-a-half times that of breeding hinds (deer).

+ FIGURE 3.5:
SOURCES OF NITROGEN AND PHOSPHORUS IN AGRICULTURAL CATCHMENTS, 1985–2004



Notes:
(1) N = nitrogen.
(2) P = phosphorus.
Data source: Ministry of Agriculture and Forestry.

Land cover

Reflecting changes in land use, land cover in New Zealand continues to change as our population grows, land prices change, and international commodity prices fluctuate.

In 2002, native forest, native vegetation, and other natural land cover (for example, rivers, lakes, snow, ice, and scrub) made up 50 per cent of New Zealand's total land cover area. Pasture was our second largest land cover at just over 39 per cent. Exotic forest covered 7.31 per cent of New Zealand's land area.

Table 3.1 reports satellite measurements between 1997 and 2002, which showed that:

- pastoral land cover decreased by 125,200 hectares (or just over 1 per cent)
- human settlements increased by just over 5,300 hectares (or 3 per cent). This represents 96 per cent of the total increase in artificial surfaces of 5,500 hectares.
- native vegetation and native forest decreased by 17,200 hectares (or 0.15 per cent)
- exotic forest cover increased by 139,500 hectares (or about 8 per cent)
- horticultural land area increased by 4,500 hectares, with the total area of horticultural land at just under 1.6 per cent of New Zealand's total land area.

+ TABLE 3.1:
CHANGES IN LAND COVER BETWEEN 1997 AND 2002

LAND-COVER CLASS		1997 AREA (HECTARES)	PERCENTAGE OF TOTAL LAND AREA (%)	2002 AREA (HECTARES)	PERCENTAGE OF TOTAL LAND AREA (%)	CHANGE IN AREA (HECTARES)
Exotic forest		1,822,300	6.79	1,961,800	7.31	139,500
Exotic shrubland		370,900	1.38	363,300	1.35	–7,600
Native forest (including mangroves)		6,485,400	24.18	6,483,100	24.17	–2,300
Native vegetation		5,263,400	19.62	5,248,500	19.57	–14,900
Other native land cover		1,588,400	5.92	1,589,100	5.92	700
Primarily horticulture		413,000	1.54	417,400	1.56	4,500
Primarily pasture	High-producing exotic grassland	8,985,200	33.50	8,885,800	33.13	–99,400
	Low-producing grassland	1,678,100	6.26	1,652,300	6.16	–25,800
Artificial surfaces		215,000	0.80	220,500	0.82	5,500
Total		26,821,600	100	26,821,600	100	

Note:
Figures rounded to the nearest 100 hectares.
Data source: Ministry for the Environment, Land Cover Databases 1 and 2.

Land use

In 2004, pastoral land use (for example, sheep, beef, and dairy farming) was New Zealand's largest human land use at just over 37 per cent of New Zealand's total land area.

Although the total area of New Zealand land in pasture has been decreasing since 1972, the area of land in *dairy* pasture has increased. This intensification of agricultural land use has occurred as farmers have responded to economic signals by converting suitable dry-stock pasture, exotic forestry, and existing dairy farms into more intensive dairy farms.

Over the past 10 years, increased diversification of land use has been evident, especially for horticultural land, including vineyards, orchards, and perennial crops. As an example, the area of land in vineyards increased by 28 per cent between 1997 and 2002.

Hill-country erosion

Hill-country erosion is estimated to cost New Zealand between $100 million and $150 million each year through the loss of soil and nutrients; loss of production; damage to houses, fences, roads, phone and power lines; and damage to waterways and aquatic habitats. About 10 per cent of New Zealand is classed as severely erodible.

During the 1990s, hill-country erosion eased in some regions. Satellite measurements between 1997 and 2002 showed that 36,400 hectares of land on erosion-prone hill country was converted from pasture to other land cover during this period. The large majority of this (36,300 hectares) was converted to exotic forestry, or retired and left to revert to scrub.

SOIL SLIP EROSION ON HILL-COUNTRY PASTURE.

Source: Ministry for the Environment.

Forestry

In 2006, the total area of planted (exotic) forestry was estimated to be 1.8 million hectares. From 1990 until 2003, a trend of increasing land area in exotic forestry was observed.

Figure 3.6 shows that, from a peak in the mid-1990s, there has been a significant reduction in the amount of new exotic forestry plantings. In 2005, the rate of new exotic forest plantings declined to its lowest level since 1959. Moreover, from 2004, a new trend became apparent of not replanting exotic forestry after harvesting or, in some cases, converting immature forest to pasture.

Land use and soil health

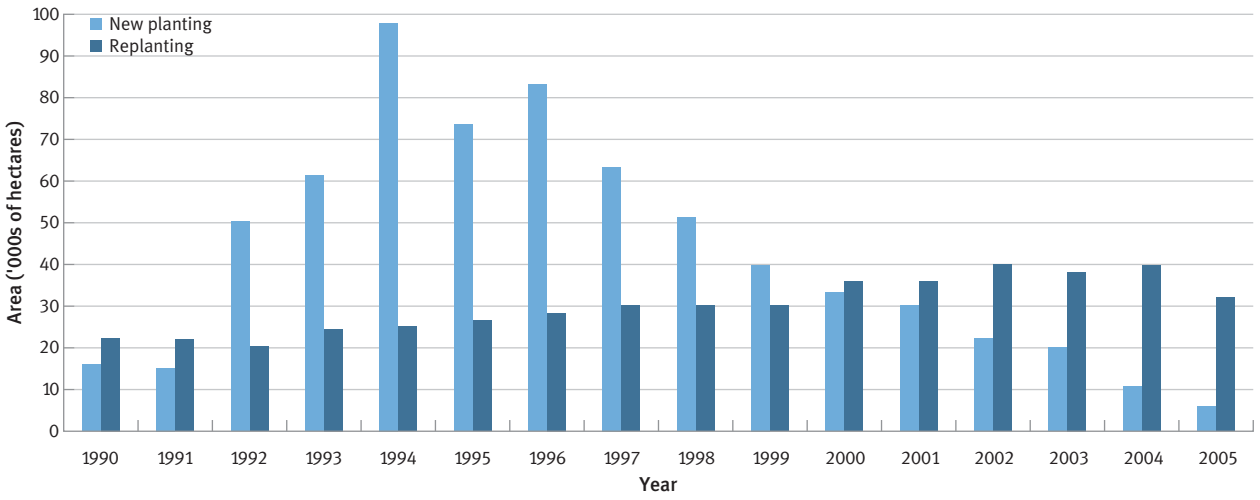
Land use affects soil health. Results from environmental monitoring under the 500 Soils Project and subsequent regional council programmes show changes in New Zealand soils, particularly as intensive land use becomes more widespread.

A large proportion of monitored pasture soils show moderate compaction as a result of stock treading damage, which can lead to reduced pasture growth and increased rates of sediment and nutrient run-off. Some soils under dairy pasture show high phosphate levels and may also be reaching saturation point for organic forms of nitrogen. Saturation increases the risk of excess nitrate being leached to waterways.

Some intensively cropped soils (such as market gardens) also show high phosphate levels and have lower organic matter content and poorer soil structure than pasture soils. Native and exotic (plantation) forest soils generally show similar acidity, and are more acidic than soils associated with other land uses, reflecting the use of lime and phosphate fertilisers to develop agricultural land.

Because pasture lands are so widespread in New Zealand, the condition of pasture soils has a major bearing on soil health nationally. Most declines in soil health are potentially reversible, but the shift toward more intensive farming practices in many regions around New Zealand may make a reversal difficult to achieve for some soils.

+ FIGURE 3.6:
NEW PLANTINGS AND REPLANTING OF EXOTIC FORESTRY, 1990–2005



Data source: Ministry of Agriculture and Forestry.

Sustainable primary production

Driven by the growing market demand for clean green products, New Zealand's primary industry associations are increasingly adopting environmental management systems (EMS) to demonstrate the commitment of their sectors to sustainable primary production. Examples of existing initiatives are Sustainable Winegrowing New Zealand (490 members in 2006), Forest Stewardship Council standards (covering 42 per cent of New Zealand's commercial plantation forests), Market Focused (a dairy farmers' EMS initiative in 2001), and Official Organic Assurance (as of 2003, 800 farms were either certified or converting to organic status).

Ultimately, New Zealand land owners can benefit by managing, and being seen internationally to be managing, their land in a sustainable way, taking account of the impact of their activities on waterways, erosion, soil health, and also climate change.

Sustainable land management – present and future

Historically, environmental management of land in New Zealand has focused on managing hill-country erosion, minimising flood risk, and improving the health of pasture soils. More recently, attention has turned to protecting riparian stream margins, excluding stock from waterways, minimising nutrient enrichment of our waterways, including through nutrient budgeting and use of nitrification inhibitors, and protecting our land-based primary production sector from pests and diseases from overseas.

Looking ahead, focus is likely to intensify on:

- how best to minimise the impacts of intensified land use on our soils and waterways
- identifying and managing land contaminated by historical agricultural and industrial activities (see 'Contaminated sites' following)
- continuing to manage hill-country erosion and biosecurity risks to New Zealand's primary production sector and native species
- meeting growing consumer demand for sustainably produced agricultural, horticultural, and forestry products.

Landcare Trust

The New Zealand Landcare Trust was established in 1996. Currently, more than 250 landcare groups operate around New Zealand with the vision of promoting sustainable land management. Each group's level of activity depends on the community in which they are based and the specific issues they are trying to address. Landcare groups are particularly active where regional councils have programmes for biodiversity protection and offer incentives or assistance to landholders.

Contaminated sites

New Zealand soils generally contain low levels of contaminants, but past industrial, domestic, or agricultural activities (such as the manufacture and use of pesticides, the production of coal and gas, mining, timber treatment, and sheep dipping) have contaminated some sites. Some of these activities – for example, the use of DDT in sheep dips from the 1940s to the 1960s – were not known to be hazardous at the time.

We do not accurately know the extent of contaminated sites in New Zealand. Rough estimates undertaken in the early 1990s put the number of contaminated sites between 7,000 and 8,000. About 1,500 of these were deemed to be a high risk to human health or the environment. However, there are now thought to be over 50,000 contaminated sheep dip sites alone around the country.

Regional councils, central government, and private land owners are gradually making headway in tackling the problem. Seven councils have now screened 4,424 sites across the country. To date, 559 high-risk sites have been identified. Of these, 56 per cent have already been cleaned up, or have a clean-up or management programme in place.

Mapua clean-up

The abandoned Fruitgrowers Chemical Company site at Mapua, near Nelson, was heavily contaminated by a range of toxic pesticides such as DDT, aldrin, lindane, and dieldrin. Central government and the local council, working in partnership, have provided $8 million to clean up the site.

By August 2007, all the known contaminated soil had been treated on site, and de-commissioning of the plant had begun. The project is on target to be completed in late 2007, and the land handed back to the owners, Tasman District Council. About 40 per cent of the land is to be set aside as public space, and the rest designated for residential and commercial land use.

AERIAL VIEW OF THE ABANDONED FRUITGROWERS CHEMICAL COMPANY SITE AT MAPUA.

Source: Courtesy of John Roosen.

Freshwater

New Zealand has 425,000 kilometres of rivers and streams, almost 4,000 lakes larger than 1 hectare in size, and about 200 groundwater aquifers.

By international standards, freshwater in New Zealand is both clean and in good supply. However, some aspects of water quality are getting worse in areas dominated by intensive land use. Demand for water is increasing, particularly in areas that are already water-stressed.

How clean are our rivers and streams?

Rivers in undeveloped catchments make up around half of the total river length in New Zealand and generally have good water quality. The remaining river length is located in farmed and urban catchments (at a ratio of about 40:1) and these areas generally have much poorer water quality.

Pollution of our waterways from organic waste has considerably reduced since the late 1980s as a result of improvements in the effluent from sewage treatment plants, meat works, and farm ponds. However, pollution from diffuse sources, such as run-off from farm land (animal dung and urine, and fertilisers) and urban areas, has proven difficult to tackle. As Figure 3.5 on page 42 shows, the quantity of nutrients applied to agricultural land has increased significantly since the mid-1980s. Results from water quality monitoring show that a proportion of these nutrients will end up in our waterways.

Figure 3.7 on page 50 shows that urban streams are the most nutrient-enriched waterways in New Zealand, followed by rivers and streams in predominantly pastoral catchments. The average nutrient levels in both urban and pastoral waterways breach the Australia and New Zealand Environment Committee Council guidelines for ecosystem protection. Rivers and streams in unmodified catchments, such as those that are covered in native bush or alpine tussock, have the lowest levels of nutrient pollution measured in New Zealand waterways.

The Dairying and Clean Streams Accord

The Dairying and Clean Streams Accord is a voluntary agreement between Fonterra Co-operative Group (the largest dairy company in New Zealand), regional councils and the Ministers for the Environment and of Agriculture and Forestry. Signed in May 2003, its aim is to achieve clean, healthy waterways in dairying regions.

The accord sets out practical targets for farmers; for example, that "50 per cent of regular stream crossing points are to have bridges or culverts by 2007 and 90 per cent by 2012". This target has already been met, while there has also been a steady increase in the number of waterways from which stock have been excluded (up from 67 per cent in 2003–2004 to 75 per cent in 2005–2006). However, the level of non-compliance of discharges of dairy shed effluent (33 per cent) falls significantly short of the target set.

Riparian planting in Taranaki to protect water quality

Taranaki Regional Council is one of many councils working with farmers to develop sustainable land management and riparian planting plans. Up to June 2007, 12,400 kilometres of stream bank and 60 per cent of all dairy farms in the region were covered by riparian plans. By the same date, more than 1 million plants had been provided to farmers by the Council, at cost, for land and riparian planting.

Water quality at swimming spots

More than 230 sites on rivers and lakes throughout the country are regularly monitored for recreational water quality. These are sites where water-based activities such as swimming, water-skiing, and diving are common.

Water samples are typically taken once a week over the summer (November to March) and are tested for *E. coli*, the indicator of faecal pollutants in freshwater. When *E. coli* levels are higher than those recommended by the *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*, regional councils liaise with health authorities to make sure the public is warned (by signs or other means) of the health risk.

Figure 3.8 on page 52 shows that, over the 2006–2007 summer, 60 per cent of monitored swimming spots on rivers and lakes had water quality that met New Zealand guidelines for water-based (contact) recreation almost all of the time (that is, at least 95 per cent of samples taken at these sites were within acceptable levels), and were therefore safe for swimming.

Sampling over the past four seasons suggests that bacteria levels have improved over the monitoring period, but the data is sensitive to the weather (that is, whether the summer is dry or wet) and it is too early to draw firm conclusions from this sampling.

GOVERNMENT ACTION to manage freshwater quality

The Sustainable Water Programme of Action

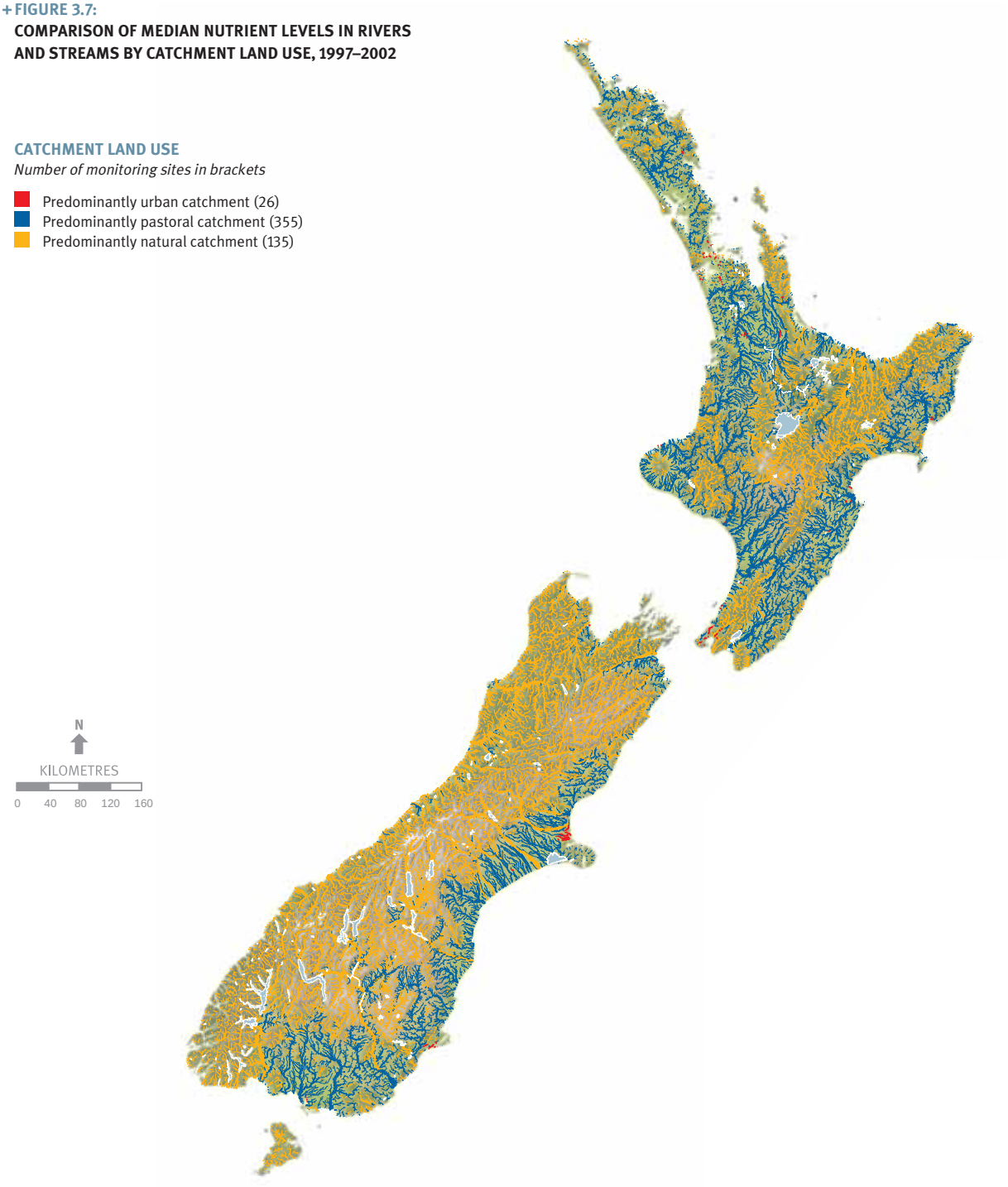
In 2003, the Ministry for the Environment and the Ministry of Agriculture and Forestry jointly launched the Sustainable Water Programme of Action (SWPoA) to identify priorities for government action to improve freshwater management in New Zealand. The SWPoA has a particular focus on addressing the pressures on water bodies from land-use change and intensification. Extensive consultation in 2005 revealed broad support for the development of policy in a number of areas of freshwater demand and quality management.

By 2007, Cabinet had approved the development of a national policy statement on freshwater, as well as two national environmental standards, including one that will ensure methods used to allocate water are geared to safeguard aquatic ecosystems. Another focus of the SWPoA is to produce tools and best-practice guidance for regional councils on water quality and land-use management.

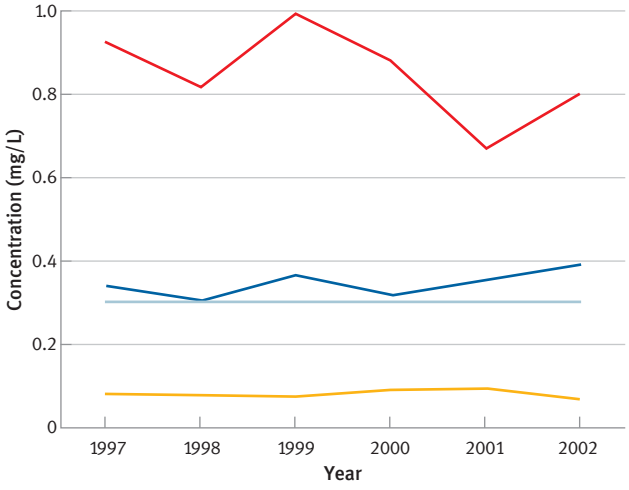
WATER-SKIING ON LAKE TAUPŌ.

Source: Ministry for the Environment.

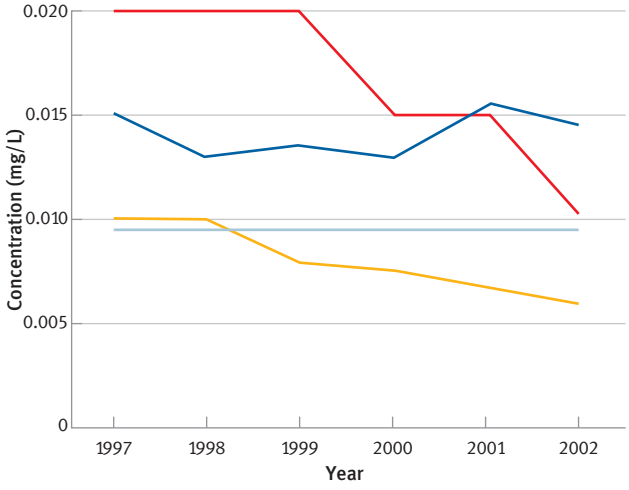
+ FIGURE 3.7:
COMPARISON OF MEDIAN NUTRIENT LEVELS IN RIVERS AND STREAMS BY CATCHMENT LAND USE, 1997–2002



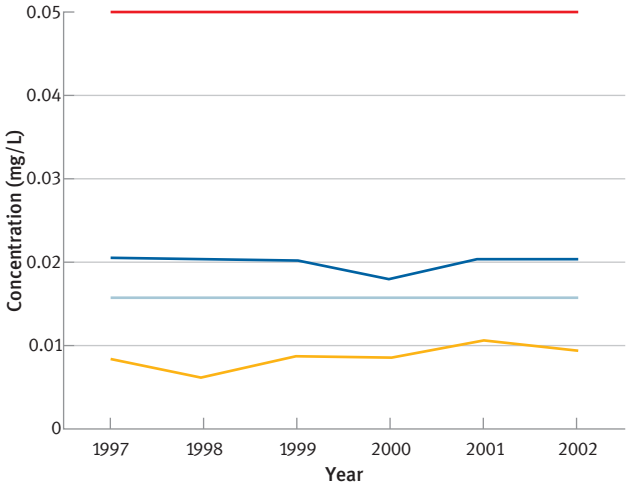
NITRATE NITROGEN



DISSOLVED REACTIVE PHOSPHORUS



AMMONIACAL NITROGEN



CATCHMENT LAND USE

Number of monitoring sites in brackets

- Predominantly urban catchment (26)
- Predominantly pastoral catchment (355)
- Predominantly natural catchment (135)
- ANZECC guidelines (ecosystem protection)

Notes:

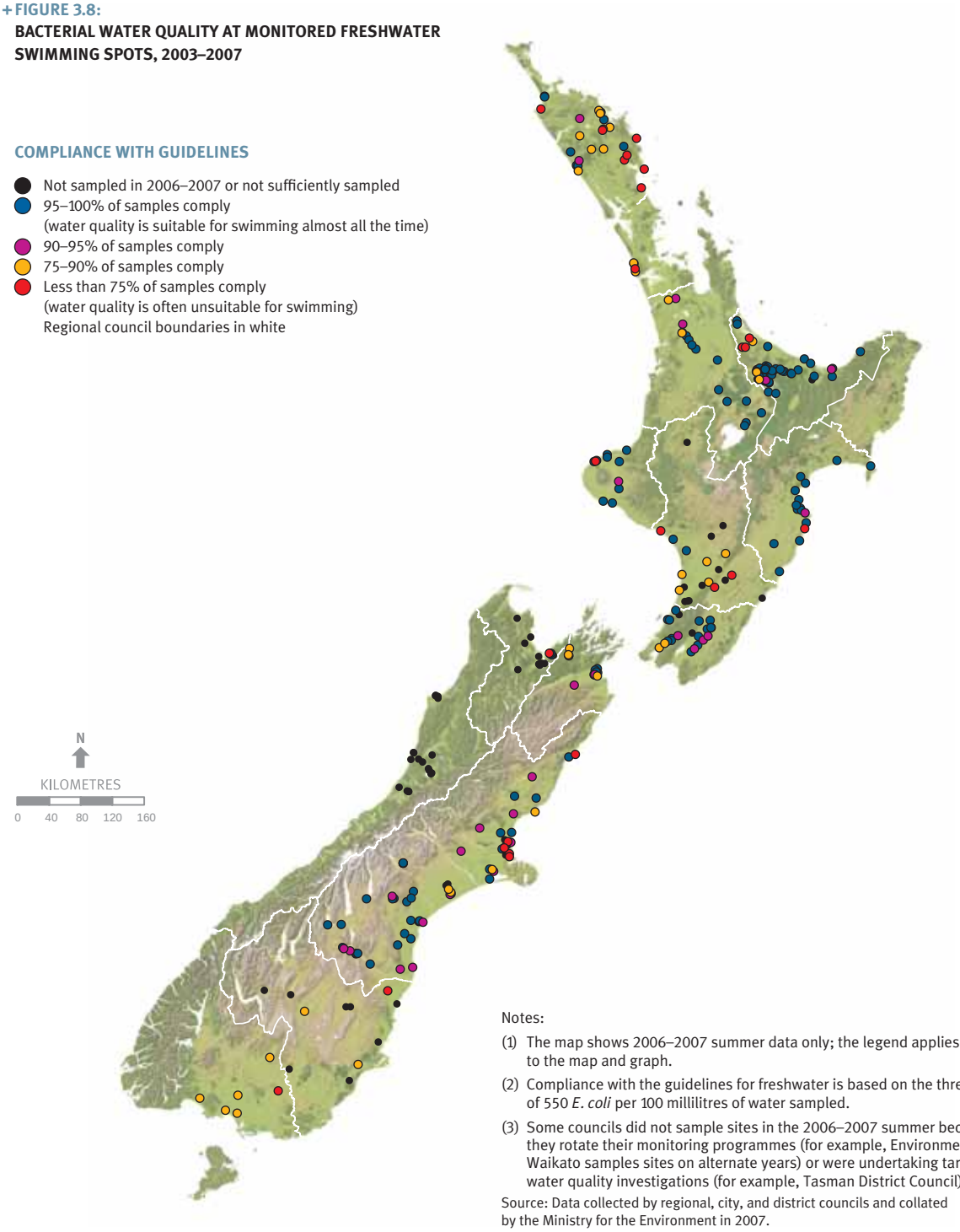
(1) Catchments are defined as 'natural' unless pasture exceeds 25 per cent of the catchment area (in which case, it is classed as 'pastoral'), or unless urban land use exceeds 15 per cent of the catchment area (in which case, it is classed as 'urban').

(2) The Australia and New Zealand Environment Committee Council guidelines provide 'trigger values' for the protection of ecosystems and the recreational and aesthetic values of waterways. If a trigger value is reached, it does not necessarily mean that ecosystem damage is occurring or that recreation is no longer possible, but it provides advance warning that a problem may be emerging.

(3) mg/L = milligrams per litre.

Data source: Adapted from Ministry for the Environment, in press a.

+ FIGURE 3.8:
BACTERIAL WATER QUALITY AT MONITORED FRESHWATER SWIMMING SPOTS, 2003–2007



Notes:

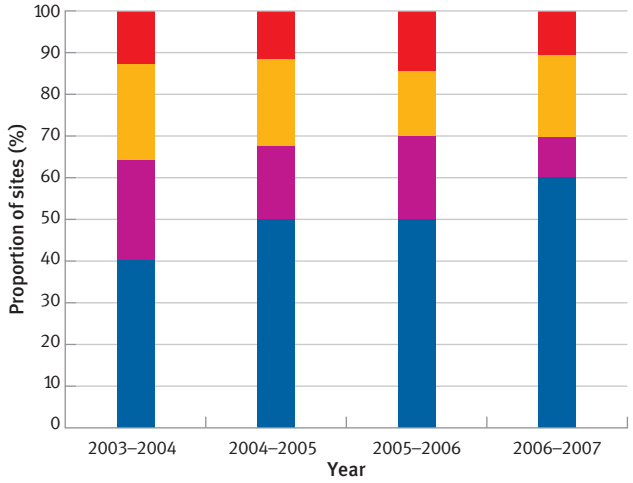
(1) The map shows 2006–2007 summer data only; the legend applies to the map and graph.

(2) Compliance with the guidelines for freshwater is based on the threshold of 550 *E. coli* per 100 millilitres of water sampled.

(3) Some councils did not sample sites in the 2006–2007 summer because they rotate their monitoring programmes (for example, Environment Waikato samples sites on alternate years) or were undertaking targeted water quality investigations (for example, Tasman District Council).

Source: Data collected by regional, city, and district councils and collated by the Ministry for the Environment in 2007.

PROPORTION OF SITES IN EACH COMPLIANCE CATEGORY 2003–2007



Iwi monitoring of freshwater: Cultural Health Index

The Cultural Health Index for Streams and Waterways (CHI) is a tool developed by Ngāi Tahu and supported by the Ministry for the Environment, Te Rūnanga o Ngāi Tahu, and Ngāti Kahungunu. Its purpose is to facilitate the monitoring of waterways by Māori.

The CHI gives iwi/hapū the opportunity to assess and report on the cultural health of a catchment or stream in their area. It provides a basis for iwi/hapū to assign priorities for the management or restoration of specific sites and monitor changes in them over time. It also provides a common platform for resource management agencies and iwi/hapū to discuss and incorporate Māori values for stream health in management decisions.

The CHI works by assessing and providing a 'score' for three aspects of the monitored waterway:

- the significance of the freshwater site to Māori
- the cultural use values of the site
- the health of the stream or river.

The first measure assesses whether the site is of traditional or contemporary significance to Māori. It also evaluates whether Māori would return to the site in the future given its present state.

The second measure assesses the ability of the site to sustain cultural use. To do the assessment, the CHI identifies food resources (mahinga kai) present at the site, compares them with traditional mahinga kai sourced from the site, evaluates how easy it is for Māori to access the site, and determines whether or not Māori would return to use the site in the future.

The third measure assesses stream or river health by considering eight different criteria: water quality, water clarity, flow and habitat variety, catchment land use, riparian vegetation, riverbed condition/sediment, use of riparian margin, and channel modification. The scores for each criteria are averaged to produce a final stream health score.

What's happening in our lakes?

New Zealand mountain lakes have good visibility. As an example, underwater visibility in South Island mountain lakes is commonly more than 10 metres. Two-thirds of New Zealand lakes are in natural or partially developed catchments and are likely to have good to excellent water quality.

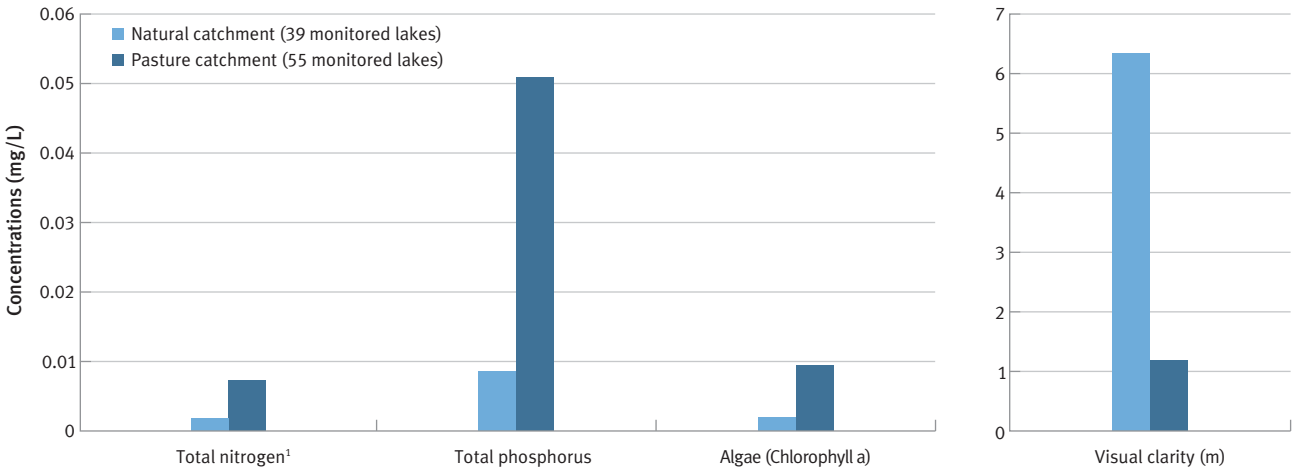
Figure 3.9 shows that lakes in natural catchments have water that is, on average, five times clearer than water in lakes in pasture catchments because of the higher algal concentrations in the latter. Figure 3.9 also shows that lakes surrounded by farmland are likely to have much higher levels of nutrients than lakes in natural catchments.

Of the 49 lakes for which we can establish longer-term trends in nutrient levels, most have shown no signs of change in nutrients since 1990. Ten show possible or definite signs of deterioration and six show signs of improvement. Many of the lakes showing signs of deterioration are already moderately nutrient-enriched (meso-eutrophic) and lie in largely developed catchments (for example, Waikere in Northland, and Waikare and Rotomanuka in the Waikato).

LAKE TEKAPŌ.

Source: iStockphoto.

+ FIGURE 3.9:
COMPARISON OF LAKE WATER QUALITY IN PASTURE CATCHMENTS AND NATURAL CATCHMENTS, 2004–2006



Notes:

(1) Total nitrogen concentrations are much higher than total phosphorus concentrations, but nitrogen values have been scaled down by 100 in this graph for the purposes of presenting information on both nutrients together.

(2) mg/L = milligrams per litre.

Data source: Ministry for the Environment, in press b.

LOCAL ACTION to protect water quality in Lake Taupō and the Rotorua Lakes

The Bay of Plenty and Waikato regional councils are working with district councils, Māori trust boards, land owners, and the wider community to protect the water quality of Lake Taupō and the Rotorua Lakes.

In the Rotorua district, action plans are under development for each of 12 lakes to reduce their nutrient (nitrogen and phosphorus) levels. One example of action planned is the construction of a channel that will limit the input of nutrient-rich water to Lake Rotoiti.

Environment Bay of Plenty has produced Rule 11, a set of regional rules designed to limit the loss of nitrogen and phosphorus from land-use activities.

In the Waikato, a proposed variation to the regional plan sets a water quality objective for Lake Taupō and changes land-use controls on nutrients entering the lake from urban and rural sources.

In addition, higher standards are proposed for domestic wastewater treatment and disposal near the lake, as well as limits on nitrogen leaching from all land in the catchment. For the first time, farmers in the Waikato region will be required to cap the amount of nitrogen that may leach from their farming activities.

The Government has committed $81.5 million to the long-term Lake Taupō protection programme and $4 million towards remedial work to improve water quality in Lake Rotoiti.

Groundwater

Nitrogen is found in groundwater in the form of nitrate and is monitored for both health and environmental reasons. From an environmental perspective, elevated levels of nitrate often indicate the potential presence of other pollutants from human activities, like faecal pathogens and pesticides (that is, nitrate can be a good indicator of general groundwater degradation).

In addition, nitrate-rich groundwaters can increase nutrient levels in the surface waters they drain into. Excessive nitrate levels in drinking water have been linked with blood disease in infants (known as 'blue baby syndrome'), although this condition is rare in New Zealand.

Sixty-one per cent of over 1,000 monitored groundwaters in New Zealand have normal nitrate levels; but the remainder have nitrate levels that are elevated above natural background levels.[1] Five per cent have nitrate levels that make the water unsafe to drink for infants, while 20 per cent of 520 monitored groundwaters have levels of bacteria that make general consumption unsafe. However, it is not known what proportion of these groundwaters are used to supply drinking water to people. High levels of nitrates and bacteria are particularly common in shallow, unconfined aquifers that are situated beneath areas of intensive land use.

Water quantity

Because New Zealand has a low average population density and high average rainfall, we have more total freshwater per person than most countries. However, not all of this water is in the right place at the right time; and many areas experience seasonal water shortages, suffer from flooding, or both.

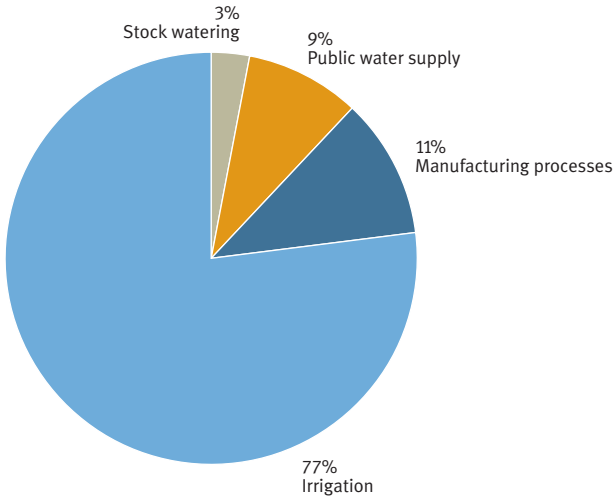
For all uses of water combined (that is, agriculture, industry, and domestic), we currently use an estimated two to three times more water per person than the inhabitants of most other Organisation for Economic Co-operation and Development countries. Demand for water is increasing, particularly in areas already short of water. Drier parts of the country have the highest demand: Canterbury and Ōtago account for three-quarters of all water allocated through regional council resource consents. Several eastern regions have surface water catchments that are highly allocated and therefore likely to be under pressure during drier times of the year.

1 Given that most monitored wells are located in areas where land has been developed, the statistics presented here are more representative of areas where contamination is likely than of the overall groundwater resource in New Zealand.

The rapid rise in irrigation

We do not have good information about how much water is actually used in New Zealand, but regional council resource consents tell us how much water is allocated. The volume of water allocated increased by 50 per cent between 1999 and 2006, driven mainly by an increase in land area under irrigation. Around 60 per cent of the total volume of water allocated comes from rivers and streams, 34 per cent from groundwater, and 6 per cent from lakes and reservoirs. Figure 3.10 shows that 77 per cent of all allocated water is allocated to irrigation and 11 per cent to manufacturing processes.

+ FIGURE 3.10:
USE OF ALLOCATED WATER IN NEW ZEALAND, 2006



Data source: Ministry for the Environment, 2006.

Managing our water resources

Past generations of New Zealanders have grown up with the idea that we would always enjoy an abundance of clean water. In recent times, however, we have begun to recognise that the resource is not infinite and that we need to manage it carefully.

The significant increase in recent years in the volume of water allocated in New Zealand underscores the urgency of balancing the competing needs of water users – recreational users, town water suppliers, hydroelectricity generators, tourist operators, and farmers – while maintaining the health of the aquatic habitat. For that, we need to better understand the environmental flow requirements of streams and rivers at different times of the year and how much water we are actually using. Increasing the efficiency of water use by all sectors may alleviate the pressures we are facing in some regions.

Effort is increasingly focused on halting the decline in New Zealand's water quality. The control of point-source pollution of freshwater under the Resource Management Act 1991 is now well in hand, and attention has turned to reducing diffuse pollution from intensive land use and urban run-off. As a result, there is greater emphasis than in the past on managing intensively used land through stream bank planting, nutrient budgeting, and exclusion of stock from waterways through bridging and fencing.

Oceans

New Zealand administers the sixth largest marine environment in the world. At more than 4.4 million square kilometres, our marine environment is about 14 times larger than our land area.

Many of New Zealand's economic activities depend on our marine environment. More than 99 per cent of our exports are transported by sea. Our marine industries are worth an estimated $3.3 billion (about 3 per cent of gross domestic product), including $1.34 billion in fisheries exports.

By international standards, New Zealand enjoys abundant marine resources and healthy marine environments offshore, where much of the environment is not easily accessible. Our marine environment contains a diverse range of ecosystems, including subtropical and subantarctic waters, inter-tidal estuaries, and seabed trenches. As much as 80 per cent of New Zealand's plant and animal species occur in the marine environment, and 44 per cent of these species are not found anywhere else in the world.

About 30 per cent of our marine environment, however, is thought to experience some degree of disturbance from human activities. As our population and technological capability grow, so do the pressures we put on our marine environment. These pressures include:

- commercial fishing and trawling, which have the largest impact on the New Zealand marine environment, both inshore and offshore
- increasing land development, which has increased discharges of land-based pollution, stormwater, nutrients, and sediments to the sea
- marine spills, which can put pressure on our marine environment in some areas
- climate change, which is expected to have a significant impact on our oceans and coasts.

Fishing and the environment

In 2006, around 525,000 tonnes of fish were caught by the commercial fishing industry in New Zealand waters. Of that catch, 65 per cent[2] by weight were from fish stocks for which enough information was available to assess the status (sustainability) of the stock (99 fish stocks).

The remaining 35 per cent comprised 519 stocks, the status of which could not be assessed because of insufficient information. For many of these fish stocks, there is no way to assess their status, because long-term data is needed for a meaningful assessment. Many of these stocks record catches of less than 10 tonnes each year, so they are not considered at risk of overfishing.

The 1996 Fisheries Act requires fish stocks to be managed so their numbers stay at or above a target level, which is generally set to allow a maximum sustainable yield. Table 3.2 shows that, of the 99 assessed fish stocks, 85 per cent (84 fish stocks) have been sustainably fished (are 'near or above' target levels, 'probably near or above' target levels, and 'possibly near or above' target levels), and 15 per cent have been overfished (are below target levels).

The 15 per cent of assessed fish stocks that are below target levels have rebuilding strategies in place. They include, for example, orange roughy in the Puysegur area (which has been closed to fishing since 1997).

+TABLE 3.2:
STATUS OF ASSESSED FISH STOCKS UNDER THE QUOTA MANAGEMENT SYSTEM RELATIVE TO TARGET LEVELS, 2006

STOCK STATUS	NUMBER OF ASSESSED STOCKS	PERCENTAGE OF ASSESSED STOCKS (%)
Near or above target biomass levels	51	52
Probably near or above target biomass levels	23	23
Possibly near or above target biomass levels	10	10
Total fish stocks near or above target biomass levels	84	85
Below target biomass levels	15	15

Data source: Adapted from Ministry of Fisheries, 2007a.

2 This figure excludes arrow squid, the annual catch limit for which is over 100,000 tonnes. This is because a meaningful stock assessment cannot be made because of its unusual life cycle. Current levels of fishing are, however, considered to be sustainable.

Trawling on or near the sea floor is the most widespread fishing activity in the New Zealand marine area that physically affects the seabed. However, the environmental effects of trawling activity on the seabed have not been the subject of extensive research and are therefore not well understood.

Between 1990 and 2005, around 970,000 seabed trawls were conducted by large commercial vessels. During this period, the area swept by trawls averaged 55,000–62,000 square kilometres per year. From a peak of around 67,000 square kilometres in 1998 by 173 vessels, the trawling effort by these large vessels has reduced to around 50,000 square kilometres by 94 vessels in 2005, probably because of reductions in the allowable catch for some species. Maps in *Environment New Zealand 2007* show where seabed trawling has taken place. In addition, smaller vessels undertook an estimated 3.5 million dredges and trawls between 1990 and 2005.

Since 2005, the Ministry of Fisheries has been implementing the Strategy for Managing the Environmental Effects of Fishing, which regulates the effects of fisheries to help achieve the sustainable use of fish stocks, as well as ecological sustainability.

Seabed fishing

Fishing effort on or near the seabed is known to affect the seabed environment. In Foveaux Strait, oyster dredging since 1863 has caused continuous reef modification and disturbance. This dredging has reduced oyster density. Dredging is known to remove epifauna (animals living on top of the seabed sediment) and damage reef systems. Analysis of oyster fisheries on three continents suggests that this pattern of impact is common in areas trawled.

We still have large gaps in our understanding of the wider ecosystem effects of seabed fishing. Historically, most fisheries management and research has focused on individual species and stocks. While this remains important, efforts have increased in recent years to gain a better understanding of the long-term and ecosystem impacts of trawling and other seabed fisheries activities.

FISHING IS THE MOST WIDESPREAD HUMAN ACTIVITY IN THE MARINE ENVIRONMENT.

Source: Nature's Pic Images.

Threatened marine species

Of the almost 16,000 known marine species in New Zealand, 444 are listed as threatened. Well-known species of particular concern include both subspecies of Hector's dolphin, New Zealand sea lion, southern right whale, Fiordland crested penguin, and New Zealand fairy tern.

Table 3.3 shows that a high proportion – 62.3 per cent – of our ocean-going seabirds are listed as threatened. Two species – the Campbell mollymawk and black petrel – have shown some signs of recovery in recent years, but seven species have become increasingly threatened over the past three years.

+ TABLE 3.3:
NUMBER OF MARINE SPECIES AND SUBSPECIES IN THE NEW ZEALAND THREAT CLASSIFICATION SYSTEM, 2005

GROUP	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	TOTAL NUMBER OF KNOWN SPECIES IN THREAT CATEGORIES	TOTAL NUMBER OF KNOWN SPECIES[1]	PERCENTAGE OF TOTAL NUMBER OF KNOWN SPECIES IN THREAT CATEGORIES (%)
Marine fish (sharks, bony fish)	0	2	50	52	1,246[2]	4.2
Marine invertebrates (crabs, corals, starfish, shellfish, limpets, octopus, and squid)	13	19	238	270	11,255	2.4
Marine mammals (seals, sea lions, dolphins, and whales)	6	0	2	8	48	16.7
Macroalgae (seaweeds and algae)	1	0	37	38	847	4.5
Seabirds (excluding waders and shorebirds)	22	14	40	76	122	62.3

Notes:

(1) Information from D Gordon, National Institute of Water and Atmospheric Research, pers comm, number of known marine invertebrates, mammals, and macro-algae in New Zealand.

(2) Information from A L Stewart, Te Papa Tongarewa, pers comm, number of known marine fish in New Zealand (inclusive of estuarine species).

Data source: Adapted from Hitchmough et al, 2007.

LOCAL ACTION to protect the marine environment

Central and local government are primarily responsible for decision-making, planning, and monitoring in the coastal marine area. However, local initiatives have become increasingly important for managing the coastal and marine environment. Council and community initiatives include beach clean-ups, dune restoration programmes, wetlands and habitat restoration, and stormwater management.

In particular, initiatives for the better integration of management in the coastal marine area have been undertaken in recent years. These initiatives focus on the coastal margin and include marine management initiatives such as the Fiordland Marine Guardians and Kaikōura Coastal Marine Guardians (Te Korowai o Te Tai o Marokura).

The Fiordland Marine Guardians began as a local fisheries committee in Fiordland. It grew to include other commercial and recreational fishers, tourist and ecotour operators, dive clubs, and conservationists.

The Fiordland Marine Guardians developed a community-initiated resource management plan to protect and sustain the unique marine environment in Fiordland. This plan included agreement that:

- recreational fishers would limit their daily bag to three cod per person
- commercial fishers would only fish in the open sea and outer fiords
- Ngāi Tahu would not fish under customary right.

This agreement was cemented through the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005. The Act brought into being the Fiordland Marine Area, which extends from Awarua Point to Sand Hill Point, covering about 928,000 hectares. Within the marine area, the Act established eight new marine reserves of 9,520 hectares, in addition to the two pre-existing marine reserves.

Protecting marine areas

Marine ecosystems, habitats, and species can be given protection through various instruments created by different laws. Thirty-one marine reserves now cover 7 per cent of our territorial sea – a high proportion by Organisation for Economic Co-operation and Development standards.

Nearly half of these have been established since 2000, and the area designated as marine reserve has almost doubled in this time. However, 99 per cent of the protected area is found in two offshore island marine reserves and some key habitats remain unprotected.

The objective of the Marine Protected Areas Policy and Implementation Plan is to expand the network of Marine Protected Areas to fully represent the range of New Zealand's coastal and marine ecosystems and habitats.

Under the Fisheries Act 1996, fisheries closures are in place for sensitive habitats such as seamounts, and it has been agreed that 30 per cent of the Exclusive Economic Zone will be closed to seabed trawling. Customary restrictions and closures also play an integral part in fisheries management (see Box 'Customary fisheries restrictions and closures').

MILFORD SOUND MARINE RESERVE – ONE OF A NUMBER OF MARINE RESERVES IN NEW ZEALAND.

Source: Courtesy of the Department of Conservation.

Customary fisheries restrictions and closures

Provision for customary fisheries method restrictions and closures is made under the Fisheries Act 1996. This includes the use of rāhui, mātaitai reserves, and taiāpure.

Rāhui is a traditional marine management tool, which creates a temporary closure of an area. Tangata whenua can ask for 'mātaitai reserves' (special management areas) and 'taiāpure' (locally managed fishing areas) to cover some of their traditional fishing grounds, or areas that have cultural and spiritual significance.

Within mātaitai reserves, tangata kaitiaki (customary-take guardians) set rules for customary and recreational fishing. Generally, commercial fishing is banned within mātaitai reserves. However, tangata kaitiaki may recommend that some types of commercial fishing be allowed.

Taiāpure are local fisheries in coastal waters that recognise the special significance of the area to local iwi or hapū, either as a source of seafood, or for spiritual or cultural reasons. Taiāpure give Māori greater say in the management of their traditionally important areas.

A major difference between mātaitai reserves and taiāpure is that commercial fishing is often allowed in taiāpure.

At the beach

Water quality at coastal beaches is mostly affected by human activity on land. Coastal beaches generally have lower background levels of bacteria and/or shorter lasting contamination events than river and lake swimming spots, because pollutants are rapidly diluted and dispersed by currents and the large volumes of water at the coast.

Over the 2006–2007 summer, 80 per cent of the 380 monitored beaches had safe water quality almost all of the time. Only 1 per cent of sites breached bacterial guidelines regularly. Water quality at our beaches appears to have improved in recent years, although the record is too short to discern definite trends.

Oil spills

Oil spills have the potential to affect marine biodiversity and habitats. Because of the concentration of shipping traffic, most oil spills occur in ports and harbours. The spill rate for ports is around three times as high as that for all other coastal areas.

By law, ships must report oil spills, but most marine oil spills are from unknown sources and the actual volume of oil spilled is not quantified. Records show a decrease in the amount of reported spills since 1999, and this may be due to improving practices in the fishing and shipping industries.

It is possible that some spills continue to go undetected or unreported, but in spite of a significant increase in shipping and tourism activities in recent years, there have been no large-scale marine spills in New Zealand since 2002.

The 2006 New Zealand Marine Oil Spill Response Strategy aims to minimise the impact of oil pollution on the marine environment within New Zealand's area of responsibility.

Integrating oceans management

Land-based pressures on the inshore marine environment, as well as pressures on fisheries stocks, can be expected to persist and, therefore, continue to pose a challenge to the health of the marine environment. The increasing number of introduced species brought to New Zealand through marine-based trade and travel, and climate change may exacerbate existing pressures. Further information about our marine environment is needed if we are to help set priorities for future use and protection of our oceans.

In recent years, management of New Zealand's marine area has started to shift from managing single parts of the environment to managing the effect of human activities on whole ecosystems. One example of this is work towards implementing a national network of marine protected areas and improved management of the impacts of fishing on wider marine ecosystems.

Improving the regulation of environmental impacts in the Exclusive Economic Zone is an emerging priority area. Recent years have also seen the emergence of innovative local initiatives for coastal management, such as that developed in the Fiordland Marine Area.

Biodiversity

New Zealand's varied landscapes and unique native plants and animals have helped shape our national character and cultural identity. Biodiversity helps sustain the ecosystems that support the country's primary production and tourism sectors.

Internationally, New Zealand is regarded as a significant contributor to global biodiversity, with an estimated 80,000 species of native animals, plants, and fungi. A large proportion of these species do not occur naturally anywhere else on earth. All our frogs and reptiles, more than 90 per cent of our insects, about 80 per cent of our vascular plants (plants other than mosses, liverworts, and hornworts), and a quarter of our bird species are found only in New Zealand.

Karori Wildlife Sanctuary

Run by a charitable community trust, the Karori Wildlife Sanctuary is a 252 hectare safe haven for endangered native birds and other wildlife located 2 kilometres from Wellington city. A predator-proof fence, specifically designed to exclude 14 species of non-native mammals, ranging from possums to mice, encircles the 8.6 kilometre perimeter.

Many threatened species of native wildlife are expected to be reintroduced to the sanctuary as appropriate habitats recover. The little spotted kiwi, stitchbird (hihi), weka, saddleback (tīeke), kākā, bellbird (korimako), whitehead (pōpokatea), and tuatara have already been released there.

BELLBIRD/KORIMAKO *(ANTHORNIS MELANURA)*.

Source: Courtesy of the Department of Conservation.

Protecting native habitat and vegetation

By international comparison, a large proportion (just over 32 per cent) of New Zealand's land area is legally protected for conservation purposes. The area of public conservation land increased by 4.56 per cent between 2004 and October 2007, bringing the total to 8.43 million hectares.

The area of private land protected under the Queen Elizabeth II National Trust (QEII Trust) and the Ngā Whenua Rāhui covenants, combined, increased by more than 51 per cent between 2004 and 2006 to a total of 221,473 hectares. By 30 June 2007, over 82,933 hectares were legally protected through more than 2,600 QEII Trust covenants. However, some of our land environments, for example, wetland and lowland ecosystems, are not well represented among the legally protected areas.

About 44 per cent of New Zealand's land area is covered by native vegetation, of which almost two-thirds is protected. This is mostly found in hill country and alpine areas. The vegetation types that have experienced the greatest loss are broadleaved native hardwoods, mānuka and/or kānuka, tall tussock grassland, and native forest. There is less native vegetation remaining in lowland areas and this has implications for species that need this type of habitat to survive.

Table 3.1 in the *Land* section shows that, in total, between 1997 and 2002, native land cover decreased by an estimated 16,500 hectares (0.12 per cent). This total decrease incuded an increase of 700 hectares of non-vegetative native cover, such as sand and gravel, and a decrease of 17,200 hectares of native vegetative cover. These changes either occurred through conversion of land to other uses, or as a result of natural processes.

Since humans arrived in New Zealand, the country has experienced one of the highest species extinction rates in the world, due to the loss of habitats and the introduction of pest plants and animals. Table 3.4 shows that almost 2,500 of our native land-based and freshwater species are listed as threatened. Decreases in population sizes since the 1970s are largely caused by the impacts of introduced pest species, rather than habitat loss.

A changing climate may further exacerbate pressures on our most endangered species.

+ TABLE 3.4:
DISTRIBUTION OF THREAT RANKING BY NATIVE SPECIES GROUP ACCORDING TO THE DEPARTMENT OF CONSERVATION'S THREAT CLASSIFICATION SYSTEM, 2005

GROUP		THREATENED			TOTAL THREATENED	DATA-DEFICIENT[1] SPECIES
		ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK		
Bats		4	0	1	5	1
Birds		62	25	66	153	50
Reptiles		10	23	34	67	12
Frogs		3	0	1	4	0
Freshwater fish		6	14	6	26	21
Invertebrates	Freshwater	14	3	97	114	29
	Land-based	237	52	654	943	1,541
Plants	Bryophytes[2]	88	0	87	175	8
	Vascular plants	175	108	585	868	155
Fungi		49	11	5	65	1,445
Total		648	236	1,536	2,420	3,262

Notes:
(1) Species for which data is deficient may be rare or threatened, but not enough is known to classify them that way.
(2) Bryophtes are non-vascular plants: mosses, liverworts, and hornworts.
Data source: Adapted from Hitchmough et al, 2007.

In some species groups, a large proportion of native species are threatened. For example, all native frog species are threatened because of habitat loss and predation. Diseases, such as the chytrid fungus and a ranavirus recently detected in some native frogs, are probably also responsible for declines in some species. Five out of six New Zealand bat species are endangered because of predation and loss of large trees required as roosts. Table 3.4 indicates that not enough is known about some groups to reliably determine their threat status. For example, many fungi and plants are listed as data-deficient.

Monitoring the extent of suitable native habitats for a selection of 'indicator species' is a practical way of assessing changes in New Zealand's native biodiversity. Changes in the distribution of a small number of indicator species over specific periods are used to illustrate the changing extent of native habitats over time. The three periods used are: before human settlement; during the 1970s and 1980s; and the present.

Seven indicator species have been selected from the national biodiversity indicator programme currently under development by the Department of Conservation. These species are all managed by the Department under recovery plans, and were selected for their usefulness as indicators, their habitat requirements, the availability of data for them, and their level of threat. Table 3.5 shows the selection of indicator species and their descriptions.

+ TABLE 3.5:
SELECTION OF NATIVE SPECIES USED TO ILLUSTRATE CHANGES IN NEW ZEALAND'S NATIVE BIODIVERSITY

NAME	WHAT IS IT?	WHY IS IT AN INDICATOR?
Lesser short-tailed bat/pekapeka (*Mystacina tuberculata)*	Endemic bat. Bats are our only native terrestrial mammal	Shows the general health and structure of forested ecosystems in many parts of New Zealand.
Kiwi (*Apteryx* spp.) (five species)	Endemic, flightless bird	A good indicator of the abundance of key mammalian predators in a range of forest types in many parts of the country.
Kākā (*Nestor meridionalis)*	Endemic forest parrot	A good indicator of possum and stoat abundance in a range of forest types in the North and South Islands.
Kōkako (*Callaeas cinerea)*	Endemic New Zealand wattlebird	An indicator of rat and possum densities in North Island forests. The kōkako, because of its sensitivity, only exists in managed sites.
Mōhua/yellowhead (*Mohoua ochrocephala*)	Endemic insectivorous forest bird	A very sensitive indicator of stoat and rat densities in South Island beech forest.
Wrybill/ngutu pare (*Anarhynchus frontalis*)	Small, endemic shorebird that is highly specialised for breeding in braided rivers	These birds depend on South Island braided rivers for their breeding habitat and provide a good indicator of various threats degrading this ecosystem, such as pest predators and direct human impact, including water extraction and four-wheel-drive activities.
Dactylanthus/Woodrose/pua o te rēinga (*Dactylanthus taylorii*)	Endemic, parasitic flowering plant	Indicates aspects of forest health in parts of the North Island, including densities of introduced browsers, presence of native pollinators, seed dispersers, and host trees.

Source: Ministry for the Environment.

Readers will find extensive information about the seven indicator species in the full *Environment New Zealand 2007* report. In this summary, Figure 3.11 on page 66 presents an example of distribution information for the kākā.

New Zealand Biodiversity Strategy 2000

The New Zealand Biodiversity Strategy reflects New Zealand's commitment to the United Nations Convention on Biological Diversity. The strategy sets out the Government's response to declining native biodiversity in broad terms. It identifies national goals and principles for managing New Zealand's biodiversity, and action plans for achieving the goals. The strategy sets four goals for conserving and sustainably managing New Zealand's biodiversity:

Community and individual action, responsibility and benefits

Enhance community and individual understanding about biodiversity, and inform, motivate, and support widespread and coordinated community action to conserve and sustainably use biodiversity.

Treaty of Waitangi

Actively protect iwi and hapū interests in indigenous biodiversity, and build and strengthen partnerships between government agencies and iwi and hapū in conserving and sustainably using indigenous biodiversity.

Halt the decline in New Zealand's indigenous biodiversity

Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments; and do what is necessary to maintain and restore viable populations of all indigenous species and subspecies across their natural range, and maintain their genetic diversity.

Genetic resources of introduced species

Maintain the genetic resources of introduced species that are important for economic, biological, and cultural reasons by conserving their genetic diversity.

LOCAL ACTION on biodiversity

Regional councils and territorial authorities use a range of tools to support native biodiversity. These include:

- conservation covenants and help with establishing QEII National Trust covenants
- subdivision controls
- incorporation of biodiversity protection in management plans and agreements
- rates relief for land under private conservation covenant
- education and advice for land owners
- support for volunteer community groups, landcare groups, and conservation trusts, and waiving consent fees.

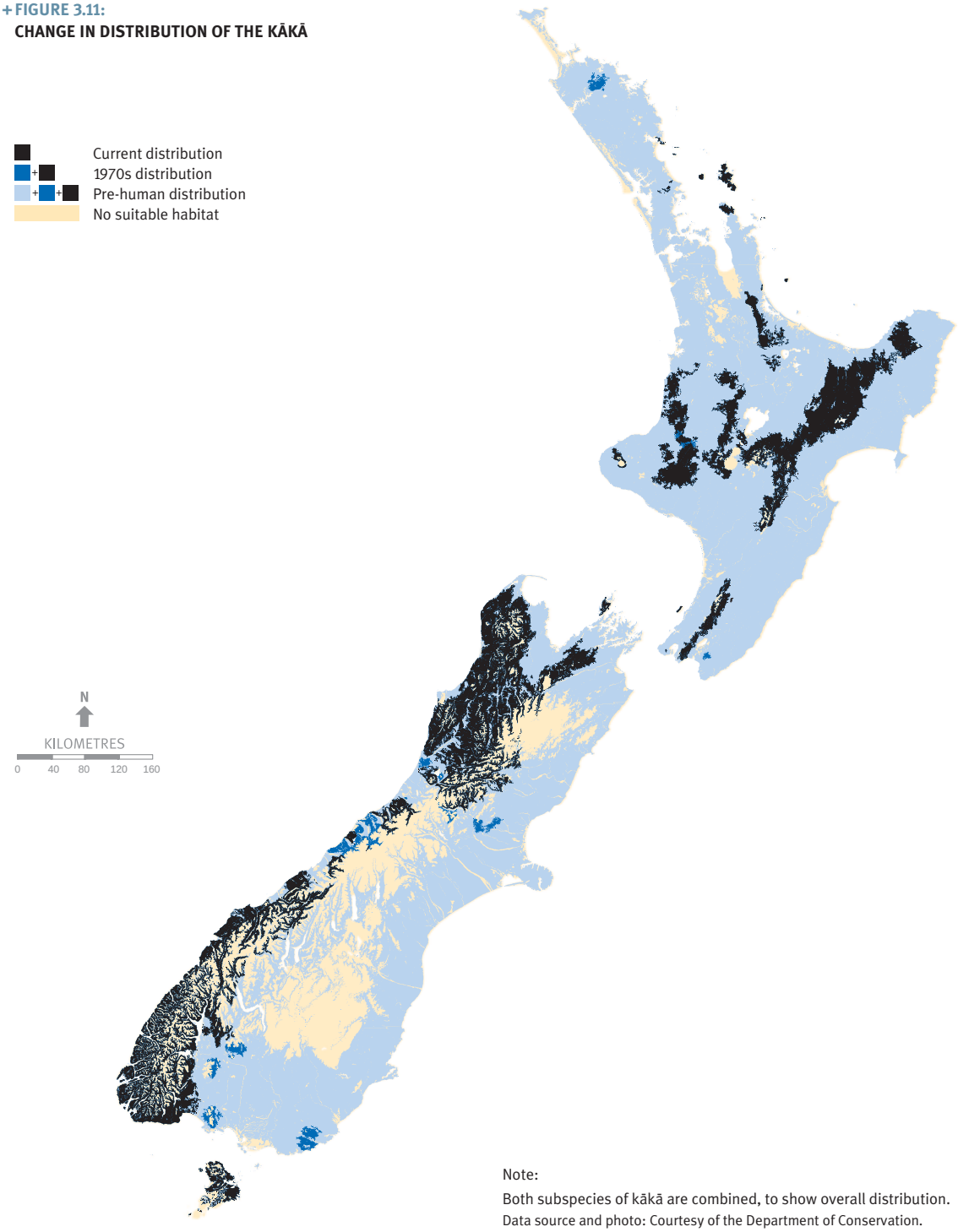
Since 1997, the extent of council effort and expenditure on biodiversity protection has increased. Regional councils now invest more than $4.26 million per year in contestable biodiversity funds. Many of these funds support on-the-ground activities such as covenants, landcare groups, education, and land owner advice.

One example is the Biodiversity Condition and Advice Fund, which aims to enhance the management of native biodiversity outside public conservation lands. By May 2006, these funds had directly benefited 4,800 private land owners, either through advice received or work undertaken on their property to protect biodiversity.

Some other examples of regional council approaches to protect local biodiversity are:

- provisions for native biodiversity in the regional policy statements for Taranaki, Hawke's Bay, Wellington, Canterbury, and Ōtago
- extensive biodiversity programmes in Auckland Regional Council's regional parks, such as:
  - protection programmes (including predator control) for threatened shorebirds in many coastal regional parks (such as Whakanewha, Wenderholm, and Mahurangi), many of them in conjunction with community groups
  - the Ark in the Park initiative, a joint programme with the Royal Forest and Bird Protection Society to restore birds to the Waitākere Ranges
  - a joint programme with the Department of Conservation to conserve kōkako in the Hūnua Ranges Regional Park
  - a sanctuary ('mainland island') established at Tawharanui in 2004
- coastal care groups operated by several regional councils (such as Waikato and Bay of Plenty).

+ FIGURE 3.11:
CHANGE IN DISTRIBUTION OF THE KĀKĀ



Note:
Both subspecies of kākā are combined, to show overall distribution.
Data source and photo: Courtesy of the Department of Conservation.

KĀKĀ (*NESTOR MERIDIONALIS*).

The käkä is a large, endemic forest parrot whose diet includes berries, seeds, nectar, and invertebrates. The käkä plays an important role in native forests by pollinating flowers and breaking up rotten wood, speeding its decay.

There are two subspecies; the North Island käkä (*N. meridionalis septentrionalis*), and the South Island käkä (*N.m. meridionalis*). Both are classified as nationally endangered due to the loss of their habitat in the past, coupled with the current pressure from predators like possums and stoats.

In areas without predator control, most käkä nests do not produce young and many nesting females are killed. Predator control in protected forest blocks has resulted in a rapid increase in käkä numbers in those areas.

With effective predator control, about 80 per cent of the nests produce young, which is a marked increase in breeding success, and far more breeding females survive.

In the 19th century, kākā were abundant throughout forests of both islands, but by 1930 had become more localised. North Island kākā are now almost absent from many large forested areas with high predator levels. They remain common in some central North Island forests, but even within these strongholds they are thought to be declining. They are still common on some larger offshore islands.

Although low in number, the South Island subspecies is still widespread and has become progressively more common down the West Coast of the South Island to Fiordland and on Stewart Island.

Kākā currently occupy less than 20 per cent of their original range, and recent evidence suggests that most populations without predator control are declining and remaining populations may consist predominately of males. Since the 1970s, the kākā's range has contracted a further 6 per cent.

Getting better at protecting biodiversity

In 2007, biodiversity in New Zealand faces the same pressures – notably introduced animal pest and weed species – as it did 10 years ago. Native plants and animals that survived the initial habitat modification caused by human settlement continue to be threatened by predators and competitors.

What has changed in the past ten years, however, is the greater area under pest control on both public and private land, much of it especially targeted at the habitats of the most threatened species. For instance, between 2000 and 2006, areas targeted for possum management by the Department of Conservation increased by 60 per cent. Those targeted by the Animal Health Board have increased by 40 per cent since 2001. Together, areas targeted by the Department of Conservation and Animal Health Board for possum management equate to around 37 per cent of New Zealand's land area.

Since 1997, pest control has become more effective as technology and knowledge have improved. The recent introduction of new Department of Conservation traps for stoats, as well as enhanced control regimes on Department of Conservation offshore and mainland island projects, demonstrate how pest control is evolving in New Zealand.

Increased biosecurity is now recognised as a key measure to protect New Zealand from new pest plants and animals (see box 'New Zealand's biosecurity system'). This is important not only for native biodiversity, but also for the introduced species on which much of our economy depends.

In the future, conservation priorities are likely to continue to focus on improved pest control and biosecurity protection, and on increasing the legal protection for those land environments and ecosystems that are not well represented in areas legally protected for conservation purposes. Attention is also likely to focus on the impacts of climate change on our native biodiversity.

New Zealand's biosecurity system

New Zealand's biosecurity system is a multi-agency programme that aims to exclude unwanted organisms at the border, and to control incursions and growth of pest populations within the country. It aims to exclude and control the invasive species that threaten our natural species and ecosystems, and those species that underpin our primary production sector.

Pests are unwanted organisms that adversely affect ecosystems and directly compete with native or commercial species. Established introduced pest species are the single largest threat to New Zealand's remaining biodiversity, and substantial efforts are directed towards controlling and eradicating them.

Biosecurity efforts include pest management for conservation and animal health purposes. Because bovine tuberculosis (Tb) – a disease affecting livestock and humans – is transmitted by possums, the control of possum numbers has benefits for both conservation and New Zealand's farming industry.

THE AUSTRALIAN BRUSHTAIL POSSUM HAS BECOME ONE OF THE GREATEST THREATS TO NEW ZEALAND'S BIODIVERSITY. IT WAS INTRODUCED IN 1837 TO ESTABLISH A FUR TRADE.

Source: Courtesy of the Department of Conservation.

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Glossary

Aquifer	An underground rock formation that stores water, most commonly one that stores sufficient quantities of water for people to use.
Biodiversity	Variation of life at all levels of biological organisation on earth, including diversity of genes, species, and **ecosystem**s.
Biofuel	Fuel that is derived from biomass (recently living organisms such as wood) or their metabolic by-products (such as tallow from cows). Biofuels are a renewable energy source.
Biosecurity	Measures taken to protect a nation's food supply, agricultural resources, and natural environment from introduced pest species and other unwanted organisms.
Cleanfill	A waste disposal site that accepts only inert wastes such as clay, soil, rock, concrete, and bricks which, when buried, will have no adverse effect on people or the environment.
DDT	Dichloro-diphenyl-trichloroethane, an insecticide that is also toxic to humans. It can no longer be legally used in New Zealand.
De-couple	To decrease the dependency between variables. It is often used in relation to the ability of an economy to grow without corresponding increases in environmental pressure.
Ecosystem	All plants, animals, and micro-organisms in a particular area, which interact with that environment's non-living physical factors.
Effluent	Liquid waste that enters the environment from a farm, factory, commercial establishment, or household.
Endemic	Something that is found only in its own place or region, which does not naturally occur anywhere else. It may also refer to species that breed only within a specified locality/region and are unique to that area.
Environmental indicator	A physical, chemical, or biological variable that may be used to track trends in the environment over time.
Exclusive Economic Zone (EEZ)	The area of sea and seabed beyond coastal waters, from 12 to 200 nautical miles offshore.
Fish stock	Any fish, seaweed, or other aquatic life of one or more species that are treated as a unit for the purposes of fisheries management.
Forest sink	The ability of a forest to remove a greenhouse gas from the atmosphere. In New Zealand, forests are the primary carbon sink.
Gross domestic product (GDP)	The value of all goods and services produced in New Zealand during a specified time period.
Hybrid vehicle	A vehicle with an internal combustion engine (petrol or diesel) which provides power to the wheels while also charging a battery. An electric motor then uses stored energy in the battery to move the vehicle at low speeds and while accelerating.
Landfill	An area for the controlled disposal of solid waste.
Maximum sustainable yield	The largest average annual catch of a **fish stock** that may be taken sustainably.
National environmental standards	Regulations to protect the environment and human health developed under the Resource Management Act 1991. These are binding on local authorities.
Nutrients	Chemicals needed by plants and animals for growth, especially nitrogen and phosphorus.
PM_{10} particulates	Airborne particles that are smaller than 10 microns in diameter (about a fifth of the thickness of a human hair).
$PM_{2.5}$ particulates	Airborne particles that are smaller than 2.5 microns in diameter.
Point source pollution	Discharge of pollutants from a single fixed point, such as a pipe. Examples include discharges from wastewater treatment plants and factories.
Riparian planting	Revegetating the banks of rivers and streams to reduce erosion and pollutant run-off to the waterway.

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