THE STATE OF
NEW ZEALAND'S
ENVIRONMENT

CHAPTER TEN

CONCLUSIONS ON THE STATE OF NEW ZEALAND'S ENVIRONMENT

In many respects New Zealand is a picture postcard country. Lest we forget it, the nation is awash with coffee table books, calendars and evocative television advertisements that showcase our spectacular scenery. The images, photographed through crisp, clean air, are of green and productive farmland, dazzling white mountain peaks, blue glacial lakes, swift mountain streams, yacht-bespeckled bays and harbours, tall pine plantations, and remote native forest tracks. These images show the environment as it really is in many parts of New Zealand, and most of us take considerable pride in that fact.

But, of course, they are not the full story. To focus exclusively on the pretty pictures is to be lulled into a false sense of security about our environment. This first comprehensive report on the state of New Zealand's environment adds to the pictures with words and figures and identifies the environmental problems we face and our remedial actions. In some cases (e.g. air, soil and water contamination) the problems appear to be less severe than in more densely populated parts of the world, but they are still serious enough to merit our concern and they have the potential to worsen if we are complacent. In other cases (e.g. habitat decline and threatened species) the problems are severe and widespread and appear to be getting worse, even as our wildlife documentaries prosper on world television.

Evidence of our environmental impacts is not hard to find. Because humans have been here for only 700–800 years, our first impacts are still detectable in sediment layers that show past erosion, buried charcoal, the pollen of incinerated plants, and the bones of more than 30 extinct birds. The more recent impacts are all around us: in our still declining populations of native animals, plants and fungi; in the pests and pastures that have displaced them; in localised instances of flash floods, erosion, pollution and other soil and water problems; in the haze of car fumes and chimney smoke that forms in some urban areas; and in the burning February sunlight that intensifies as the thinning ozone layer reaches its annual low point.

The fundamental source of most of these problems is the dramatic ecological change that occurred when a land of forests and shade was turned into a land of open pastures and towns. This big change reduced, fragmented and destabilised ancient ecosystems, altered water tables and run-off patterns, accelerated erosion in some areas, and set the scene for a raft of human activities that have sometimes led to air and water pollution, soil contamination and an influx of exotic pests and weeds.

While there are some exceptions, most of today's large environmental problems are either the legacy of past changes still taking their toll (e.g. flooding, habitat and species decline, contaminated sites), or the combined effect of many small impacts that are not quite in balance with the environment's ability to absorb them (e.g. water pollution from diffuse sources and local air pollution from motor vehicle emissions and household chimneys). Cumulatively, over time these small impacts can add up to much larger impacts on the environment and on our quality of life.

Using the information in previous chapters, we can now draw some conclusions about the state of New Zealand's environment, as far as present data allow us. We will do this by considering what they tell us about some of the important environmental issues facing New Zealand. The Government's *Environment 2010 Strategy* identifies eleven priority issues that need to be addressed over the next decade (see Chapter 4). Six of these issues are concerned with sustaining valued aspects of the environment (i.e. biodiversity, fisheries, soil, water resources, air quality and the ozone layer). Five are concerned with controlling pressures on the environment from various sources (i.e. pests and weeds, waste and hazardous substances, energy use, transport, and greenhouse gas emissions). Although the issues are listed as if they are independent, they are, in fact, all interconnected to some degree (Ministry for the Environment, 1995). For example, water quality is affected by, among other things, land use, pests and weeds, and pollution from wastes and transport leaks and residues.

Atmospheric and air quality are also affected by land use, transport, and other forms of energy use. Soil quality is affected by land use, pests and weeds and waste disposal. And biodiversity is affected, to some extent, by all of these things.

So, rather than see the issues as separate, it is more accurate to think of them as facets of the same picture or interconnected strands in a web. Some strands are relatively short and connected to only a few others. Some are long and connected to many others. In all cases, none can be changed independently without affecting some of the other strands. Addressing the issues effectively, then, requires an integrated approach to environmental management, such as that envisaged in the Resource Management Act.

It also requires something else—good information. One of the key goals of the *Environment 2010 Strategy* is for New Zealand to develop a sound information base through well coordinated research and a nationally standardised approach to monitoring. The OECD's 1996 performance review of New Zealand considered our current information base to be very limited and stressed the need for better environmental information (OECD, 1996). This lack of good environmental information and data is not confined to the public sector. In a recent survey of company environmental reporting in thirteen countries, New Zealand companies came bottom, with only 39 percent of those surveyed mentioning the environment in their annual reports and none producing a separate environmental report (Wennberg and Larsson, 1996).

The need for better environmental information is highlighted by the chapters of this report. While they show that New Zealand has a lot of environmental information and some very good analysis, they also show that much of this is too limited in place, time or topic to depict national trends or even provide a national snapshot (see Table 10.1). To ensure that environmental management is well focused, we need to have a coherent, consistent picture—and this picture should help integrate our responses to issues. Our first, and strongest, conclusion then is that New Zealand's environmental information, including the collection and integration of data, needs to be improved. Many of the other conclusions in this chapter should be read with the caveat that they are often based on limited information.

Conclusion 1:
New Zealand's environmental information needs considerable upgrading if the state of the nation's environment is to be accurately described and trends detected.

With the passing of the Resource Management Act and the increasing involvement of New Zealand in international environmental agreements and information exchanges, the need for better environmental information is now widely recognised. The improvements are needed in three areas: national indicators, basic research and applied research.

Indicators are important because they enable us to detect environmental changes through regular monitoring of a few symptoms or signs of change. To be useful nationally, indicators need to be measured using standardised methods and protocols. The Ministry for the Environment's National Environmental Indicators Programme is now addressing this need (see Chapter 1). The programme focuses on eleven sets of core indicators, corresponding to each of the priority issues identified in the *Environment 2010 Strategy*. Rather than duplicating or cutting across the monitoring programmes of councils and other resource management agencies, the indicators programme encourages collaboration so that common techniques can be developed and research and planning can be better targeted and coordinated. The information from the national indicators programme will also form the basis of future national reports on the state of the environment.

Table 10.1

The state of our environmental data: a summary

Environmental issue	State of the data
Biodiversity	*Only 30,000 of perhaps 80,000 multicellular species have been identified. Most of the undescribed species are insects and fungi. Wildlife habitat sites and a number of ecologically representative areas have been surveyed and recorded over the past two decades, but relatively few have been monitored since the initial survey. The status of most species and ecosystems is not known.*
Pests and weeds	*Considerable data exist on vertebrate pests, economic pests and a range of ecological and economic weeds, though we still lack population estimates and distribution maps for many of them. Very little is known about invertebrate pests in natural ecosystems.*
Fisheries	*Considerable raw data have been collected on marine fish and invertebrates, but analysis has largely been confined to the commercially important target species. Catch data are the main monitoring method. Status estimates are available for about half the commercial quota stocks. The status of marine ecosystems and non-target species is unknown.*
Soil quality and quantity	*No current information exists on the national state of our soils, though the land use capabilities of our soils are known. Erosion data are 20 years old, except in some areas which have been more recently updated. Other indicators of soil quality (e.g. nutrient loss, carbon loss, compaction, acidification, site contamination) have not been surveyed at the national level, though variable data exist at regional and local levels.*
Water quality and quantity	*Considerable information exists on rainfall and river flows. National survey data exist on river quality, and lake and groundwater quality are now being monitored through a national network. Coastal waters are monitored for toxic algae. More than a third of drinking water supplies are of unknown quality because of inadequate monitoring. Most water quality monitoring focuses on chemical and physical indicators. Ecosystem monitoring is just in the developmental stage. A lot of information is held by regional councils, but not in forms that can be easily aggregated nationally.*
Air quality	*Very little air monitoring has been done in most parts of New Zealand. The data which do exist come from just a few cities, most notably Christchurch and Auckland. A national air quality monitoring network is now being developed.*
Waste and hazardous substances	*The collection of national data on sewage waste was discontinued in the mid-1980s and has only recently been revived with the development of a national waste treatment plant database. There is little information and monitoring of other liquid wastes. Except for the national litter survey which has been run since 1987, national data on solid waste were non-existent until the mid-1990s. With the development of the Waste Analysis Protocol to systematise waste data collection, and the completion of our first landfill census in 1995, national estimates of solid waste are now possible. However, gaps still remain in identifying the particular sources of waste, the amount and sources of hazardous waste and the extent of recycling.*
Environmental impacts of energy	*A considerable amount of information exists on the economic uses of energy but little national data exists on the environmental impacts of energy use (e.g. waterways transformed, land areas flooded, sites contaminated, air pollution from fires, greenhouse gas emissions). Statistics on oil spills at major ports are now being kept and estimates of greenhouse gas emissions are calculated from economic data.*
Environmental impacts of transport	*National data on the environmental impacts of transport are virtually non-existent though local studies of the impacts on stormwater and air quality have been conducted in some cities (e.g. Auckland). Estimates of some transport impacts may be inferred from existing data on vehicle fleet size and composition, kilometres travelled, size of roading network and petrol and diesel consumption.*
Greenhouse gases and potential climate change	*National data on weather patterns, temperature, rainfall etc. are generally of high quality and go back many decades. Data on greenhouse gas concentrations in the atmosphere are also of high quality and go back two decades. Data on some greenhouse gas emissions are still limited and uncertain, but estimates of carbon dioxide emissions from energy and industrial processes can be accurately calculated from economic data. Good data on carbon storage in pine plantations are available, but are lacking for indigenous forests and soils*
Ozone depletion	*Data on ozone concentrations are of high quality and go back about a decade. National data on imports of some ozone-depleting substances exist, but no data exist on the use and emission of ozone-depleting substances.*

While indicators alert us to the signs of environmental change, basic research provides a deeper understanding of the processes of cause and effect that underlie it. However, both indicators and basic research have limited value if the information they provide cannot be used to influence the change process. For this, applied research is vital because it translates the findings of basic research into useful methods of environmental management, such as new technologies or clear guidelines and codes of practice. The Ministry of Research Science and Technology has the prime responsibility for identifying research priorities and national science strategies.

The funding for research in priority areas comes largely from the Public Good Science Fund which is managed by the Foundation for Research, Science and Technology. Some basic and applied research is also funded by the Ministry of Fisheries (in part through user-pays levies on the fishing industry), the Department of Conservation, the Ministry of Agriculture, the Crown Research Institutes themselves, and the Minister for the Environment's Sustainable Management Fund. Most of the public good funding is for basic research while responsibility for commissioning applied research falls mainly to local authorities or to government departments whose role is to set environmental guidelines and standards or advise on fishery quotas.

Issue:
Protecting indigenous habitats and biological diversity.

If the scale of an issue is in any way reflected by the sheer amount of paper needed to describe it, then the chapters of this report would indicate that biodiversity decline is our most extensive and multi-faceted environmental issue. It is big because of the range of species and ecosystems encompassed by it, and also because it is linked to most of our other environmental issues, particularly those affecting land and water. These extensive links mean that tackling the biodiversity issue will inevitably lead to wider environmental benefits, particularly in land and water management.

The arrival of humans established two distinct biological communities in New Zealand. The first community consists of species that evolved here or adapted after arriving by wind or water during the past 80 million years (including such recent self-introductions as the swallow, waxeye and reef heron). The second community consists of humans and the species that came with us, particularly those that have arrived within the past two centuries.

For both economic and recreational reasons, we have managed the country's resources largely for the benefit of the second community (including unintended beneficiaries, such as rabbits) while leaving the native species to survive as best they could, often in habitat remnants and protected areas. Only in recent decades have the efforts of, first, the Wildlife Service and then the Department of Conservation begun to successfully turn the tide in some parts of the protected estate.

At present, the scale of the problem and the degree of threat facing most species and ecosystems is only approximately known. Ignorance of species and ecological processes is particularly acute for invertebrate animals, fungi and micro-organisms, though even many large animals and plants are only poorly known.

About 30,000 of our estimated 80,000 indigenous animals, fungi and plants have been formally identified, and only a fraction of these are known well enough to have their conservation status assessed. National vegetation maps describing our ecosystems at the landscape level have not been updated for more than a decade. Only a few of the habitat areas in the Department of Conservation's nationwide SSWI database (Sites of Special Wildlife Interest) have had their status updated since 1985, and most of the representative ecological areas surveyed to date by the Protected Natural Areas Programme are not monitored for trends and changing conditions. Water ecosystems have tended to be monitored for physical and chemical contaminants rather than for biodiversity, though moves are now underway to survey marine ecological areas around the coast. There has been little research and little monitoring of our marine ecosystems except in a few small reserves.

Of the species whose condition is known, a larger number than previously thought appear to be threatened. At least 800 species and 200 subspecies, virtually all of them endemic, are considered threatened. They include both of our endemic marine mammals, two-thirds of our endemic birds, 20 percent of our coastal rockpool fish, and 10 percent of our native plants. These threatened species may be the growing swell of a third extinction wave. The first and second extinction waves followed the two main periods of human colonisation, and wiped out 32 percent of our endemic land and freshwater birds, 18 percent of our endemic seabirds, 1 of our 3 native bats, at least 3 out of 64 reptiles, and at least 12 invertebrates.

Conclusion 2:
Biodiversity decline is New Zealand's most pervasive environmental issue, with 85 percent of lowland forests and wetlands now gone, and at least 800 species and 200 subspecies of animals, fungi and plants considered threatened.

The main pressure on most species is insufficient natural habitat caused by past land development and water management practices. The areas of greatest habitat loss have been in lower-lying, developed parts of the country where habitat destruction and fragmentation has been extensive. Around 85 percent of the original lowland forests and wetlands have been removed since human settlement. Complex and diverse ecosystems have been replaced by monocultures and built-up areas. Large areas of land and freshwater are now dominated by a small number of exotic species and sustain relatively few native species.

Although ongoing deforestation and drainage have now largely ceased, their legacy is an 'extinction debt' that has forced the decline of many threatened species. Surviving indigenous habitat areas continue to decline in biodiversity through the impacts of pests and weeds and the inability of small isolated populations to indefinitely withstand external pressures. Human predation, particularly fishing activities, can also still have an impact on some species.

Conclusion 3:
The main pressures on indigenous biodiversity today are insufficient habitat in lowland areas, declining quality of many of the remaining land and freshwater habitats, the impacts of pests and weeds and, for some marine species and ecosystems, human fishing activities.

Around 30 percent of the national land area is now in a protected conservation estate. Although this is among the highest percentages of protected land in the OECD, most of it is steep and mountainous, containing relatively few areas of lowland forest, wetland, duneland or even sub-alpine grassland. Within the protected estate the Government has provided significant additional funding in recent budgets to carry out extensive pest control programmes on areas at severe risk from habitat collapse and also to implement highly successful species recovery programmes both on offshore islands and for some mainland 'islands'. The Government also funds voluntary protection of existing forest and open-space remnants, but, as yet, there is no broad strategy for enhancing native biodiversity in lowland areas.

Among our protected areas, coastal ecosystems are under-represented. Active protection applies to 1–2 percent of the coastal waters within a kilometre of the main islands. The vast bulk of New Zealand's protected marine areas are located around the Kermadec and Auckland islands. Because of their size, they make up about 7 percent of our territorial waters, well under 1 percent of our Exclusive Economic Zone.

The Fisheries Act 1996 now requires that fisheries be managed in a way that sustains biodiversity and marine ecosystems, but tensions may arise between management of fishstock for sustainable yield and ecosystem management. New Zealand has ratified the Convention on Biodiversity. One of its responsibilities under that convention is to develop a National Biodiversity Strategy and these issues are likely to be addressed in the development of that strategy.

Conclusion 4:
The main responses to biodiversity decline have focused on ecosystem and species recovery programmes on offshore islands and extensive pest control operations on the mainland, but the need for partial restoration of representative indigenous lowland and coastal ecosystems and for wider protection of marine ecosystems has yet to be addressed.

The loss of any endemic native species is a loss not only for the nation but for the world. Once they have gone from New Zealand, they have left the planet forever. However, biodiversity loss is not confined to endemic species. Beneficial exotic species are vital to the New Zealand economy, but most high yield strains and varieties have limited genetic diversity. In the event of disease, significant climate change, or new market preferences, such crops and livestock have a limited ability to adapt without genetic input from their lower yield and wild type relatives. It is therefore important to maintain the genetic diversity of beneficial exotic species.

At present, many minority crop and livestock strains and varieties may be disappearing from New Zealand because of poor storage facilities and limited knowledge of their existence or importance. While many of these strains can be imported or recreated from overseas gene pools, some are specifically adapted to New Zealand conditions and would be difficult to recreate quickly.

Conclusion 5:
Many strains and varieties of beneficial exotic species may be disappearing and this may have significant economic impacts on New Zealand's agriculture, horticulture and forestry.

Issue:
Managing pests, weeds, and diseases

Introduced pests, weeds and diseases pose a serious risk to biodiversity, agriculture, forestry and aquaculture. The nation's estimated 70 million possums are currently considered to be the nation's most destructive pests. Every night they eat about 21,000 tonnes of vegetation, kill native birds and invertebrates, and help spread tuberculosis to domestic cattle. Rabbits are another high profile pest, though their greatest impact is limited to the 'tussock predominant' grasslands of the South Island where their pressure has combined with that of invasive weeds and grazing sheep to degrade an area of about 1 million hectares. Less obvious, but more widespread, is the combined pressure from many smaller invaders, such as insects, parasitic worms, weeds and fungi. These threaten native species, exotic crops, forests or livestock and their pressure grows with each new arrival (e.g. the white spotted tussock moth).

Air and ship travel has allowed many exotic organisms to leapfrog the ocean barrier that once protected New Zealand from biological invaders. With the success of our economy based largely on the sale of high quality primary produce in distant markets, it is vital to control the entry or subsequent spread of new organisms. We also need to assure buyers and governments that our quality standards will not allow the inadvertent export of any pests.

Careful management is needed to contain these risks. Measures employed to date include: border controls (i.e. the monitoring of incoming passengers and freight and the incineration of aircraft rubbish); technological controls (e.g. pesticides, animal traps, the release of biocontrol organisms, the breeding of pest-resistant crop and livestock strains, careful husbandry practices); and ecological controls (i.e. spreading the risk by increasing crop, stock or ecosystem diversity). The most cost-effective approach in the longer term, integrated pest management (IPM), combines all or several of the technological methods.

The sheer numbers of some species (e.g. possums and rabbits) together with public concern about some technological control methods (e.g. pesticides, gin-traps, biocontrols, and genetically engineered crop and livestock strains) means that the pest control war is likely to be a never-ending one—for some species at least. For the foreseeable future, vigilant pest and border control in concert with comprehensive species recovery and ecosystem restoration programmes are our only means of ensuring ecological and economic security. Because of its scale, continuous pest control will only be sustainable economically and socially if it continues to become safer, more humane and more cost-effective.

Conclusion 6:
Pest control, especially of possums, is now a vital means of protecting our environment as well as being important for our economy. Pest control will need to become increasingly safe, humane and cost-effective to remain economically and socially sustainable.

Issue:
Sustainably managing our soil quantity and quality

Two-thirds of our soils are on mountains and hills, most of which consist of soft sedimentary rocks that have been fractured and raised by frequent earthquakes. These young erosion-prone mountains have produced a land that is rich in sand and gravel but has relatively few metal deposits other than gold and ironsands. The mountains also create a rain-shadow effect in eastern and northerly parts of the country, occasionally subjecting the soils to drought conditions.

The New Zealand climate is ideal for growing pasture grass and exotic pine forests, but the soils that nourish these plants are often less than ideal. The general characteristics of our soils are well known, thanks to comprehensive soil maps and assessments of land use capability made several decades ago. Having evolved under forests, most of our soils tend to be thin and acidic and generally have low levels of nitrogen, phosphorus and sulphur. They are not well suited to agriculture and so need to be modified and managed in order to support farming and cropping regimes.

Only about 30 percent of the land can sustain pastoral farming without risk of significant erosion problems. A further 28 percent can support limited livestock grazing but this must be accompanied by erosion management measures such as tree planting, farm forestry and, importantly from a biodiversity viewpoint, encouraging native plant regrowth and expansion.

However, while the general soil characteristics are known, national data on the current quality and condition of the soil are non-existent. Local occurrences of soil degradation and erosion are known to land owners and regional council officers, but a national overview of the extent of these is not available. Current estimates of erosion are based on the New Zealand Land Resource Inventory of the 1970s. However, in some parts of the country this information has been updated, and in some cases to a finer scale than the original work.

The challenge of maintaining production from soils that are prone to erosion, nutrient loss, or episodic drought has been met in New Zealand by extensive grazing systems rather than intensive ones, heavy use of fertilisers and lime, and heavy use of irrigation water where required. In addition, the need to control native and introduced pasture pests has required widespread use of pesticides. Each of these land management measures has environmental impacts. In many cases, too, impacts have resulted from a lack of management, such as failing to provide adequate tree cover on erodible slopes and river banks.

A large area of New Zealand has been converted from natural forests, wetlands or dunelands to farm or forestry land (52 percent compared to the world average of 37 percent). This has accelerated erosion of some soils by exposing them to the impacts of wind and rain. In moister, high fertility areas, some soils are exposed to the risk of nutrient loss, compaction and carbon loss from over-cultivation and stock treading. In some areas, too, soil has been contaminated by the careless storage, use or disposal of chemical products from various industries and urban landfills, and in a few rural areas, from the past heavy use of organochlorine pesticides.

Over half of New Zealand is affected by slight to moderate soil erosion, mostly on hill pastures and drought-prone pasture land. Two decades ago, nearly 10 percent of New Zealand suffered from severe to extreme erosion. This was mostly concentrated in a few high risk areas along the east coast of the North Island from Gisborne to Wairarapa, in parts of Taranaki and the South Island High Country.

Conclusion 7:
The main pressures on soil are from past deforestation of erodible land, localised accumulations of harmful chemicals or waste products, and the impacts of over-cultivation or overstocking on erosion-prone and compaction-prone land.

As early as the 1870s, people realised that impacts on land were serious and needed resolution. From this era on, there was a progressive development of laws and institutions to enable controls to be put on land use to reduce the effects of erosion and, more recently, its causes.

Regulating land use to sustain soils is difficult except where significant adverse effects would occur from that land use. Previous policies of subsidising agricultural production often encouraged land use practices such as the clearance of steep land for pasture that led to environmental problems such as erosion and subsequent siltation of streams and rivers. Today all production subsidies have been abolished and native trees are returning to some slopes.

Current responses to land use problems tend to emphasise providing land users with accessible, usable and relevant information, backed by effective science. Through community-based approaches, such as landcare groups, it is intended that land use problems will be tackled continuously and at their source. This information focused approach is, nevertheless, supported by background regulation and controls available through the Resource Management Act.

Responses to soil problems are increasingly the land users' responsibility. This has led to some positive environmental effects (e.g. reduced sheep numbers and the increase of native scrub or plantation forests on former erosion-prone pasture land) as well as negative ones (e.g. the downturn in fertiliser and lime use in the late 1980s, the economically-motivated deferral of soil conservation measures by some farmers, and the inadequate use of conservation measures by others).

Conclusion 8:
Soil conservation is increasingly the land users' responsibility. Forest planting, regeneration of native vegetation on some erosion-prone land, and the formation of landcare groups are the main response trends.

Issue:
Managing the quantity and quality of our water resources

Many parts of New Zealand are prone to problems of either too much or too little water. The uneven distribution of our rainfall means that the mountains and the West Coast are very wet by world standards while the eastern and northerly rainshadow areas are sometimes relatively dry. Most of the population and many of our livestock live in these rainshadow areas.

With expanding urban demand and expanding dairy herds, some water supplies are vulnerable to pressure during occasional summer droughts. This has the potential to significantly reduce river flows and put stress on freshwater animals and ecosystems. Many water supplies rely heavily on groundwater and also on large reservoirs. However, water supplies cannot be indefinitely expanded, and the wisdom of water conservation measures is now beginning to be recognised.

Conclusion 9:
The main pressures on water flows have been from drainage and channelisation (which have reduced wetlands and altered the natural character of rivers including lowland aquatic habitats), deforestation (which has intensified flooding and sedimentation in steep catchments), and increasing demand for urban water supplies, livestock and irrigation.

All areas are subject to intense flooding from time to time. For most of this century, the main responses to water problems focused on managing water flows, principally through engineering channel straightening and flood protection stop banks. These modifications reduced the frequency of small floods but also encouraged settlement in flood-prone areas, exposing more people and property to risks from large floods. Flood control and land use modifications, together with hydroelectricity schemes, also rechannelled and redistributed many river flows. Through such changes, together with the removal of riparian vegetation and the draining of 85 percent of the original wetlands, the natural character and habitat quality of many freshwater and estuarine ecosystems has been lost or degraded.

As it became evident that floods were directly related to upper catchment deforestation, responses have gradually shifted from flood control to flood reduction through preventative measures such as conservation of mountain forests and reafforestation in parts of some catchments.

Conclusion 10:
Responses to water flow problems that historically focused on flood control and drainage works downstream and on increasing the supply of drinking and irrigation water are now looking more to whole catchment approaches involving afforestation and water conservation.

Although Maori communities have a long developed respect for water quality and have applied customary rules to it, water quality only became subject to legislation in the mid-1960s. Since then, New Zealand has made significant progress in reducing point source pollution such as piped discharges from factories and sewage treatment plants. Relative to other countries, New Zealand has a small industrial base and little significant heavy industry. This means that large discharges from industrial processes can be relatively easily identified, though many smaller discharges are harder to detect and manage.

With the advent of the Resource Management Act and the Hazardous Substances and New Organisms Act, point sources of pollution are likely to improve further. Under the Resource Management Act existing discharge consents are progressively being renewed and, where necessary, tighter standards will be applied to new consents. However, this will not happen quickly unless major problems are found in a water body. Where no serious problems are apparent, the discharge standards will reflect current knowledge and community requirements.

As point source pollution continues to improve, attention is now switching to New Zealand's most difficult water quality problem—the diffuse runoff of pollutants from land into water. Some of this pollution comes from sediment runoff caused by erosion from extensive pastoral use. But there is increasing pollution from intensive agriculture, particularly dairying, where both animal wastes and nitrogenous fertilisers wash into surface water or leach into ground water.

The scale of the potential problem is large: the total amount of excreta from our livestock equals that of 150 million people. Only a fraction of this enters waterways but that is still a significant amount when concentrated in the lower parts of many catchments. Non-point source pollution is also a major problem in stormwater from urban areas. Large paved surfaces such as roads, carparks and areas around houses and factories contribute considerable amounts of pollution to nearby waterways.

Conclusion 11:
The main sources of pressure on water quality are non-point source pollution (from diffuse pasture runoff of animal wastes, fertiliser and sediments as well as runoff of pollutants from paved surfaces in urban areas) and point source discharges (e.g. from factories and sewage outfalls).

Because most of the pressures on water quality tend to accumulate downstream, water quality is highest in mountain streams and in the upper reaches of rivers in sparsely developed areas. Such high quality waters are widespread in the South Island and in the upper catchments of most North Island rivers. However, water quality declines measurably in some lowland streams and rivers. Nutrients from run off and animal wastes make some waters unsuitable for swimming, and water quality in some intensive dairying areas is badly polluted from these sources.

Nearly 60 percent of the population receives drinking water from supply and reticulation systems that are safe from contamination. However, a further 40 percent receive water that is either unsafe or of unknown quality. This includes 15 percent of the population who are not connected to water supply systems, 8 percent whose water supply systems are vulnerable to contamination, and a further 8 percent whose water supply systems are too small to be formally graded.

Conclusion 12:
The quality of our water is high by international standards, except in some low-lying rural streams and small lakes, some shallow groundwaters, and some piped water supplies.

New Zealand has a well developed history of water management and expertise, most of which now resides with its catchment-based regional councils. These organisations are well placed to identify and manage future water issues. As with other environmental issues, developing integrated and standardised indicators and monitoring systems are vital tools with which to identify and analyse problems.

Conclusion 13:
Responses to water quality problems have successfully focused on improving point source discharges (from sewage, factory and dairyshed outfalls) but the more difficult and pervasive problem of non-point source discharges has yet to be addressed and will require changes in land management.

Issue:
Sustainable fisheries

The Fisheries Act 1996 requires that fishstocks are utilised in a sustainable manner. This means sustaining target fish stocks while also sustaining marine ecosystems and non-target species. Most target stocks are harvested at rates that aim to maintain them at or near the level that produces the maximum sustainable yield (MSY). Maximum sustainable yield represents the optimum yield level for the fishery and is generally 25–60 percent of the biomass of the unfished stock. Catch limits are the main method of stock management.

Most stocks are thought to be at or near the level that produces the maximum sustainable yield. Some stocks of snapper, orange roughy and rock lobster, however, are currently estimated to be below this level. For these stocks, catch limits and other measures have been set to rebuild them to levels that can produce the maximum sustainable yield.

A total of 42 marine fish species are currently harvested under the Quota Management System (QMS)—about 4 percent of our marine fish species. For management purposes they are lumped into 30 'species groups' and then divided into 179 QMS stocks. Only 74 of these stocks are of known status and only 7 of these were considered to be below the MSY level in 1995-96.

Conclusion 14:
The status of more than half the commercially exploited fish stocks is unknown but, of the stocks whose status is known, about 10 percent are considered to be below the level of Maximum Sustainable Yield and measures have been set to rebuild these stocks.

Fishing puts direct pressure on target species and indirect pressure on other species, not only of fish but also marine mammals, birds, and marine invertebrates such as corals. Although measures designed to reduce bycatch of these species have been implemented, incidental captures and mortalities occur. It is estimated that as many as 1000 marine mammals, predominantly fur seals, may be caught each year. However reported seabird bycatches, once in the thousands, appear to have declined as the foreign tuna fleet in our waters has been reduced. An estimated 167 seabirds were caught in 1995 as incidental bycatch in tuna longline fishing operations.

Conclusion 15:
Pressures on marine life from fishing include direct harvesting pressure as well as indirect pressures from trawling and dumping of offal on nursery ecosystems (e.g. coral communities, seamounts, bryozoan mats), and bycatch of non-target species (e.g. 1,000 marine mammals, several hundred seabirds, and many non-target fish per year).

The marine environment is also subject to risk from exotic organisms, especially ones which are unintentionally introduced into New Zealand. Sources such as ballast water from ships or organisms which arrive on the hulls of ships pose potential and quite expensive risks. Toxic algal blooms have become a recurring problem for shellfish fisheries along parts of the east coast of both the North and South Islands.

The Fisheries Act 1996, is based on sustainability and requires this to be achieved in a way that not only with sustains fish species but also associated species and the ecosystems of which they are a part. It recognises that decisions must be based on the best available information, using a precautionary approach when information is uncertain, unreliable or inadequate. The successful implementation of the Act holds the key to ensuring a major economic and ecological resource is both maintained and sustained into the future.

Conclusion 16:
The new Fisheries Act 1996 recognises that environmental sustainability requires more that just sustaining the yield from target stocks but also requires the maintenance of marine biodiversity and ecosystems.

In addition to fisheries management controls, responses to marine and fisheries issues include preservation of some marine ecological areas through marine reserves and parks. Research on rock lobsters has shown that some reserves can act as both reservoirs of biodiversity and nurseries for some commercial fisheries. To date more than 90 percent of our protected marine areas are confined to two distant island groups (the Kermadecs and Auckland Islands). Less than 2 percent of the coastal ecosystems around the New Zealand mainland islands are protected.

Conclusion 17:
Protected marine areas can act as both reservoirs of biodiversity and nurseries for some commercial fisheries yet, apart from the Kermadec and Auckland Islands, protected marine areas are under-represented in both our coastal waters and our deep water ecosystems, e.g. seamounts.

Issue:

Maintaining clear, clean, breatheable air

Thanks to our location, geography, small population and economy, New Zealand generally has very good air quality. Indeed, many visitors are taken with the visual clarity of our air. Compared to more populated and industrialised countries, New Zealand seems like a place where one can 'see forever'.

However, this pristine picture has its blemishes. Recent monitoring has uncovered air pollution levels in some urban areas that, at times, exceed *New Zealand Ambient Air Guideline* values. These guideline values are based on agreed international human health standards. In particular, carbon monoxide levels in some inner city locations show exceedances at times during the year.

Lead levels in the air have been dropping since 1986 when the lead content of petrol was reduced. The production or importation of leaded petrol has been banned in New Zealand since 31 December 1995. Other pollutants such as particulate matter from dust and smoke have also been decreasing. Sulphur dioxide levels have been dropping over the past 20 years and are generally now fairly low.

Conclusion 18

New Zealand is thought to have good air quality by world standards but this judgement is based on little, but increasing, monitoring. In some locations in our larger urban centres, however, there is evidence of ambient air quality at times exceeding New Zealand guideline limits for protecting human health.

The significant sources of New Zealand's air pollution are industrial sources, multiple small discharges, such as domestic fires, and the motor vehicle fleet. The highest levels of pollution have been recorded in urban centres in winter months when all these sources are contributing. Vehicle use is growing substantially in a number of urban areas.

Conclusion 19

Instances of significant air pollution are caused by the combined effect of discharges from industry, small businesses and homes and the growing use of our vehicle fleet.

Generally, air emissions from industry can be managed more easily than the diffuse and dispersed emissions from homes and vehicles. Under the Resource Management Act, all discharges to air from industrial and trade premises can be controlled to the extent deemed necessary by regional councils, with some discharges currently uncontrolled while the Act is still in its transitional phase. Regional councils can set ambient standards and require that specific discharge controls be applied to point source discharges from chimneys. This new system is currently evolving but it has the potential to effectively manage all industrial and trade discharges. It also has the ability to impose controls on domestic fires (such as banning open fires and only allowing certain low emission burners) where their unrestrained use would otherwise result in a cumulative problem. Where cumulative problems occur, action is needed to appropriately address all sources.

At present there is limited control of motor vehicle emissions. Use of the Resource Management Act by regional councils may not be the most cost effective way to manage emissions from mobile sources and other measures are being investigated to control these emission sources. These will need to address a number of air pollutants including problems with small particles (PM_{10}).

Establishing ambient standards for air quality, and the quantity and concentration limits on the discharge of air emissions is new, as is comprehensive monitoring of air quality. Further work is needed to establish the magnitude of potential problems such as the discharge of small particles which impact on health as well as long term issues affecting air clarity and visibility and ecosystem protection, particularly from toxic air emissions. Development of national air quality indicators, together with a national monitoring programme, is a vital ingredient in discovering and helping eliminate unacceptable blemishes in our air quality picture.

Conclusion 20

Regional councils have mechanisms available under the Resource Management Act to deal satisfactorily with the point source discharges, both large and small, but these mechanisms are unlikely to be as effective on vehicle emissions.

Issue:
Managing waste, contaminated sites and hazardous substances

Waste is principally an urban problem. A high proportion of New Zealanders live in urban areas. These urban concentrations, though small by world standards, impose intense pressures on the environment. Urban pollution problems generally come from the combination of big industry, small industry and manufacturing, and importantly from diffuse non-point source run-off from a generally spread out, low density development pattern. This is exacerbated by land and water pollution from extensive use of motor vehicles, especially cars used for commuting to work.

The problem of stormwater runoff from hard surfaces has already been mentioned. This is added to by the activities that occur in urban areas, from motor vehicles which drop contaminants onto surfaces, through to manufacturing and other activities from which contaminants escape or from which they have escaped historically. In some areas, such as Auckland's Tamaki Estuary and its Manukau Harbour, the combined effect of pollutants, including some hazardous pollutants, is evident in the marine ecosystem.

The impacts from New Zealand's industry have been mainly from direct, point source discharges into water or the air. While in total these still represent a significant load on the environment, they are now being controlled and can be expected to keep improving. New Zealand has little tradition of heavy industry and the major contaminated sites associated with it. However, there are widespread low risk sites from landfills, service stations and various industrial activities. These perhaps exceed 7,000 in total although only 1,500 are thought likely to present a high risk to human health or the environment.

New Zealanders produce considerable quantities of solid waste. In 1995 we sent over 3 million tonnes of waste to landfills—about 900kg per person. Approximately 55 percent of this was from industrial sources and 45 percent 'residential', though the latter also included some wastes from small businesses and commercial activities while excluding some from households collected by private contractors. Though not strictly comparable, New Zealand's 400kg of 'residential' waste per person compares with the OECD average of 500kg of 'municipal' waste per person.

The composition of the waste going to New Zealand's landfills falls about half way between the waste profiles of typical rich and poor countries with 39 percent organic matter, paper 19 percent, construction and demolition waste 17 percent, potentially hazardous material 8 percent, plastic 7 percent, metal 6 percent, glass 2 percent and other 5 percent. This varies significantly from area to area and is seasonal with the majority of organic matter coming during the summer. Based on Auckland figures, however, the amount of landfilled solid waste is apparently increasing, although littering has stabilised after a decrease. Other waste trends are unknown.

Effective waste management, with its emphasis on reducing, reusing and recycling waste is an increasingly important environmental management issue in New Zealand, particularly in urban areas. Although landfill capacity is generally available, suitable sites are not always easy to obtain. In large urban areas it is increasingly difficult for landfill sites to gain the necessary approvals and they are expensive to build and operate. Poorly managed landfills can have significant adverse effects in the long term. Stringent standards were introduced by the Resource Management Act resulting in more pressure on landfill performance with consequent reduction in the quantity of landfills available. Guidelines have been developed for the management of landfills but the recent landfill census found significant gaps between the guideline recommendations and practices in the field, with key issues being open burning and lack of operator training.

Conclusion 21:
In many cities the amount of recycling has increased, in some places landfill fees have been raised, and cleaner production is being attempted by some organisations.

There is a growing awareness of the benefits of cleaner production, not just for big business, but also for small and medium sized business. Cleaner production is based on the goal of reducing the adverse impacts of production and service activities on the environment. In short, it means:

- Avoiding or reducing the amount of waste produced;
- Using energy and resources more efficiently;
- Producing environmentally sound products and services; and
- Achieving less waste, lower costs and higher profits.

Many of these improvements result from simple 'good housekeeping' changes. A number of enterprises are implementing cleaner production and, in doing so, helping the environment and themselves with significant reductions in waste, emissions and costs.

However the evidence suggests that these companies are still the exception rather than the rule. Auckland data indicate that solid waste appears to have increased in recent years in line with economic activity, while the volume of hazardous waste (98 percent of which is disposed in liquid form and is generally not monitored) appears to be greater than previously thought. The Auckland Hazardous Waste Study has concluded that there is still widespread indifference to the dangers of generating, handling and disposing of hazardous waste.

Conclusion 22:
While waste management responses increasingly include recycling, cleaner production systems and higher landfill fees, total waste has increased, our landfill management practices are generally poor, as are our practices and attitudes towards managing hazardous waste.

Issue:
Managing the environmental impacts of energy services

Towns and cities and food and fibre processing require energy and we are continuing to demand more of it to provide for our lifestyles. New Zealand's energy consumption has grown by more than six times since the Second World War. Since the 1960s there has been a big increase in gas use and a decline in coal use. Use of oil fuels has declined since the 1970s but is approaching the 70s levels again. Oil provides around 32 percent of our total primary energy, gas 27 percent and coal 7 percent. Since the 1950s oil and electricity have been the dominant consumer energy forms. The greatest energy consumption and growth is in the transport sector, which has increased its proportion of total energy consumed to some 39 percent. By contrast, agriculture's consumption of energy is only 5 percent of the total, although some of the transport use is agriculture related.

New Zealand makes greater use of renewable water based energy for its electricity supply than most other nations—we get up to 79 percent of our electricity energy from hydroelectric stations and up to a further 6 percent from geothermal stations. But there are limits to the ability to economically dam more lakes and rivers. There are also increasing environmental limits as communities seek to protect the ecological and recreational features of many of the wild and scenic rivers that remain. For these reasons, electricity generation has been moving to other sources of fuel, notably gas. However, New Zealand's principal gas reserve, the Maui field, is expected to reach the end of its economic life around 2006. New reserves that have been discovered so far will not be able to sustain Maui's rates of supply.

Conclusion 23:
Most of our electricity is of hydro origin (with impacts on river flows and lake levels) but around two-thirds of our total primary energy is from fossil fuels (with pollutant impacts on atmosphere, water and soil).

The environmental impacts of energy use vary according to the energy source and the scale of use. Impacts include altered waterways and aquatic ecosystems, loss of geothermal features, air pollution, greenhouse gas emissions, and contamination of soil and water from oil leaks and spills. Though our energy use continues to increase, little data has been collated on the national extent of these impacts so it is difficult to say whether they are increasing or decreasing as a result of more efficient and environmentally responsible technologies, such as wind farms, and co-generation industrial plants.

There has been increasing investment in recent years in relatively high efficiency co-generation industrial plants which burn fossil fuels to generate electricity and use the waste heat in the production processes in the industrial plants. There is also considerable potential for use of more renewable fuels, particularly wind and solar power, together with gains from energy efficiency. The Government is promoting energy efficiency as one of the main responses to the economic and environmental costs of energy use. Other responses include the Maritime Safety Authority's marine oil spill monitoring and contingency plan, and planned measures to reduce greenhouse gas emissions. Like all other sectors, the energy sector is subject to environmental controls under the Resource Management Act. This Act deals effectively with most impacts from stationary point sources (though not some greenhouse gases), but not from mobile sources.

Conclusion 24:
Responses to the environmental impacts of energy services include the requirement to obtain consents under the Resource Management Act, moves toward greater use of renewable energy forms (including the development of wind power) and the encouragement of energy efficiency.

Issue:
Managing the environmental effects of transport services

New Zealand has a relatively low density population, so New Zealanders tend to travel a lot, mostly by private vehicle. Between 1987 and 1992 the number of licensed vehicles fell but since then vehicle numbers have increased to their highest level ever. Vehicle use is growing substantially in a number of urban areas.

The low density of our cities multiplies the demand for travel and makes some public transport hardly viable without additional financial support. Encouraged by the availability of private vehicles, New Zealand cities have expanded dramatically in the last 40 years and, in some cases, their expansion has put pressure on surrounding air, land and water resources. New Zealand's relatively low population growth rate and the fact that most of its growth is concentrated in a small number of large urban areas, means that the problems caused by urban expansion do not directly affect the whole country.

Our high level of motor vehicle use produces some significant effects, again principally in large urban areas. Here, travel frequencies and patterns result in adverse effects on air quality particularly along traffic corridors, noise effects and amenity effects such as the intrusion into urban space caused by expanding roading and motorway systems.

There have been few studies of the environmental impacts of transport services, whether on land, sea or air. For land transport, there has been some monitoring of air quality within the traffic corridors in some large urban areas and short term surveys elsewhere. These studies show that at times, air pollutants in these corridors exceed *New Zealand Ambient Air Guideline* values. These guideline values are based on agreed international human health standards. In particular, carbon monoxide levels in high traffic density locations show exceedances at times during the year.

Transport contributes 40 percent of New Zealand's CO_2 emissions and these emissions increased by 7 percent in 1995. This is occurring even though vehicles have become more fuel efficient. The lead content of petrol was reduced from 1986 and from 1 January 1996, the production or importation of leaded petrol was banned in New Zealand.

Some 2600 petrol stations are listed among the nation's potentially contaminated sites though data on the extent of any contamination is still very limited. A guideline has been produced for the installation and operation of new underground storage tanks and many old fuel tanks have been removed and replaced.

Stormwater studies, particularly in the Auckland area, have identified extensive contamination of some harbours and estuarine areas with heavy metal and poly-aromatic hydrocarbons. Transport runoff is the major source of these pollutants along with other runoff, trade waste and sewage.

Conclusion 25:
Limited air and stormwater studies show that at times, carbon monoxide levels in some urban traffic corridors exceed the New Zealand Ambient Air Guidelines, and transport is also responsible for some of the extensive heavy metal contamination of some harbours and estuarine areas. Transport also contributes 40 percent of New Zealand's CO_2 emissions.

Many of the environmental effects of transport services are diffuse and this makes them difficult to deal with. At present the only control of motor vehicle emissions is Traffic Regulation No. 28 in which it is an offence if the smoke emitted from a vehicle limits visibility so much to be a safety hazard. There are no controls for environmental purposes. Use of the Resource Management Act by regional councils is unlikely to be the most cost-effective way to manage vehicle emissions. Other possible management options are under study in the Vehicle Fleet Emissions Control Strategy that is first examining emissions to air, then going on to examine and recommend measures to appropriately control emissions to water and noise.

Conclusion 26:
Apart from banning lead in petrol, systematic measures do not currently exist to deal with the environmental impacts of transport services. The Vehicle Fleet Emissions Control Strategy is investigating appropriate measures to control transport noise and emissions to air and water.

Issue:

Reducing the risk of climate change

On a per capita basis, New Zealand emissions of the human-induced greenhouse gas carbon dioxide are 25 percent lower than the OECD average, but about 50 percent higher than the global average. Half of these emissions are currently absorbed by forests which act as carbon 'sinks'. Commercial plantation forest growth should increase the CO_2 sinks over the medium term. This may be partially offset by biomass loss from indigenous forests caused by pests or be assisted by the regeneration of native vegetation on some marginal land where production subsidies formerly applied. Work is underway to quantify changes in carbon stored in indigenous forests and scrublands. While sinks provide an opportunity for increased absorption of CO_2, absorption is not expected to offset the increase in gross emissions this decade and New Zealand will have to seriously address reducing its growth in gross emissions.

New Zealand's per capita emissions of methane, another greenhouse gas, are almost six times the OECD average and ten times the global average. New Zealand's ruminant animals are a major source of methane. The decline in sheep numbers has reduced this source, but cattle and deer numbers are increasing. Overall these changes have reduced New Zealand's emissions by 4 percent between 1990 and 1995.

Conclusion 27:

New Zealand contributes an above-average share to the world total of human induced carbon dioxide gas emissions but less than the average for developed countries.

Globally and locally, greenhouse gases have increased rapidly in the past century while global climate has warmed by about 0.5°C, and may increase by 1–3°C over the next century if current models of the relationship between greenhouse gases and global temperature prove correct.

There is a common misconception that climate change, if it occurs on the scale predicted by climate models, will be a gradual warming that will enhance New Zealand's economy and society. A temperature rise would lengthen our growing seasons and thereby extend the subtropical and temperate growing areas further south. However some of the other effects of this are uncertain and it is likely that it would also usher in a raft of problems such as more storms and droughts, and greater risks from subtropical pests, weeds and diseases whose range would be extended. Climate change will exacerbate the pressure on ecosystems where they are already under stress.

New Zealand is a signatory to the Framework Convention on Climate Change and is an active participant in the negotiation of a new international agreement for greenhouse gas emission reductions through the Berlin Mandate process. New Zealand recognises that it will only be through joint action, across a substantial number of states, that effective responses will be possible. New Zealand has a programme of measures in place to reduce carbon dioxide emissions—these have achieved some reduction below a 'business as usual' projection. New Zealand is not, however, on track to achieve its current commitment under the FCCC of stabilising net CO_2 at 1990 levels by the year 2000, largely because the anticipated increase in absorption through new forest plantings has been lower than expected. New measures are under active consideration and New Zealand will decide on the form and extent of these additional measures following the conclusion of the Berlin mandate process in December 1997 when commitments and options for multilateral action are much clearer. Targets and possible actions for other non-CO_2 greenhouse gases are also being addressed.

Conclusion 28:

Although existing measures have achieved some reduction below a 'business as usual' projection, New Zealand is not on track to achieve its current commitment under the Framework Convention on Climate Change of stabilising CO_2 at 1990 levels by the year 2000.

Issue:

Sustaining the ozone layer

New Zealand's windy climate, small population and maritime location makes for clean air much of the time. Perversely, this clean air exposes us to risks caused by depletion of the ozone layer. The levels of ultraviolet radiation in New Zealand appear to be increasing. An 8 percent decrease in ozone since the 1960s has produced a 10–12 percent increase in ultraviolet-B radiation and will continue to worsen for several decades before slowly rebuilding throughout the next century. The potential impacts on New Zealand of increased UV-B radiation are rising skin cancer rates in people and unsheltered stock animals, property and crop damage, and ecological changes caused by plant and algal damage. International action to address ozone depletion is clearly of significance to New Zealand.

The pressures on atmospheric ozone come from many gases emitted by modern appliances and economic activities. The main gases appear to be halocarbons, such as the CFCs, whose manufacture and import in developed countries such as New Zealand was banned at the end of 1995. Another ozone-depleting substance, methyl bromide, is used as a fumigant in agriculture to kill pests in soils and for quarantine purposes to kill pests in products being imported and exported. With the decline in CFC imports, it appears to have become the dominant ozone-depleting gas released in New Zealand.

Globally, CFCs and halons use is now declining rapidly as a result of swift international actions under the Montreal Protocol. New Zealand is a signatory to the Protocol and takes its obligations seriously. It played a significant role in the development of the Montreal Protocol and has consistently taken actions to achieve the targets set for Parties to the Protocol. Wherever possible, we have accelerated the elimination of imports of substances such as halons and HCFCs. Methyl bromide imports have been partially restricted to 1991 levels but like many other countries New Zealand currently has no phase-out schedule for this in its legislation.

Conclusion 29:

Depletion of the ozone layer will continue for many decades and requires international action. New Zealand has been, and remains, an active participant in the responses to ozone loss including the signing of the Montreal Protocol and the banning of CFC imports in their raw form. We have moved to phase out the use of ozone-depleting substances faster than internationally required but do not yet have a phase-out schedule for methyl bromide.

Embracing the sustainability ethic

While this report conveys a sense of what has been lost and what is under threat, it also shows that much is being done to halt and reverse the adverse environmental impacts. These days New Zealanders value their environment very highly. In a national poll conducted in 1993, two-thirds of the 70 percent who responded said that, if necessary, they would accept a drop in economic growth in order to protect the environment (Gendall *et al.*, 1994). In the same survey, 17 percent reported belonging to an environmental group, a third said they would accept much higher taxes and cuts in their standard of living to protect the environment, and half said they had given money to an environmental campaign in the past five years.

In such a climate of high environmental awareness, fewer people and industries these days are prepared to knowingly impose major impacts on the environment. The Christchurch Press reported that a survey of 380 manufacturers in 1994, for instance, found that three-quarters thought it was in their interest to preserve New Zealand's high environmental reputation.

There is a keen and growing social and economic sense of the value of sustainable environmental management. The ethic of ecological sustainability is enshrined in key pieces of environmental legislation such as the Resource Management Act, the Conservation Act, the Forests Act and the Fisheries Act. Accompanying this sustainability emphasis is a developing environmental management practice which includes the increasing use of the precautionary principle, of polluter pays and economic instruments that identify and transfer the costs of environmental damage to those who cause it.

Both central and local government have been and are setting sustainable environmental improvement targets through formal statutory and policy frameworks and strategies. Systematic monitoring and evaluation systems are being developed. National, regional and local environmental indicators are evolving and in some cases are in place. Work is underway to address the problems of unsustainable land use and to direct science funding toward research on sustainability problems.

Business increasingly values the attributes of a cleaner, more sustainable environment and are themselves busy developing and applying quality and environmental management systems to benchmark and improve their performance. New Zealand's competitive advantage lies in a diverse range of quality products from a quality environment. There is money to be saved from undertaking environmental audits of manufacturing, distribution and service systems and implementing cleaner production and waste reduction practices. There is also a future for nature-based tourism, provided the carrying capacity of the environment is carefully measured and respected.

The sustainability ethic is also helped by a growing awareness of the importance and utility of Maori views and values. These have developed over 700–800 years of sometimes hard-earned experience in living with the indigenous environment and they are most effectively expressed when Maori participate actively in environmental decision making and have the ability to make decisions for their own resources.

Environmental improvement: a challenge for everyone

Environmental impacts come from many sources and are often the result of a large number of small, diffuse impacts accumulating over time to produce a significant effect. Managing day to day impacts can help considerably. Individual and household behaviour is very important. Awareness of and active measures to manage the use of energy and water and of the generation and disposal of domestic waste can help considerably over time. Energy efficiency is a direct substitute for more power generation and provides the benefits of energy services at less overall cost to the user and the environment. If motor vehicles are driven carefully and conservatively, less fuel is used and fewer emissions generated. Again the user benefits economically and the environment benefits through cumulative reduction of adverse impacts.

In the primary production arena, small cumulative improvements can also deliver progressive gains. If every land user aimed to maximise diversity of plants and animals, enormous gains could be reaped. If remnant forest areas were left and fenced, wetlands protected or even recreated, riparian strips left free from use, steep erosion prone land retired, diverse tree species including natives planted, and more mixed crop and crop/animal combinations used, then production would be more economically and environmentally resilient and, over time, more sustainable. The less a farmer has to rely on importing agrichemicals to sustain farming, the better the result for the local and wider environment. Further, over time, such farming should cost less, too.

Where to from here?

This report provides a first comprehensive stocktake of the state of New Zealand's environment. Whilst much of its message may seem surprisingly grim to those who are not aware of the nature of environmental impacts in these temperate, wind-blown islands, there is much to be proud of, too. The pendulum of introduced change seems to have completed its swing and to be returning to a state of better balance. New Zealand is conquering its problems of point source pollution. A large amount of the country is now permanently protected. More than ever before people are aware of and value our heritage and are starting to use it constructively and sustainably. More diverse, quality managed and value added primary production offers a path to a richer and more environmentally beneficial future. Measures to define environmental quality and, from this, to identify problems, contain damage and reverse adverse trends are developing. And, finally, the challenge of protecting indigenous biodiversity has been accepted and work is underway to develop a New Zealand Biodiversity Strategy.

A lot has been done to recognise our environmental problems. Core institutions have been put in place to deal with them and legislative frameworks such as the Resource Management Act are based on the notion of ecological sustainability. Work is underway to deal with the big issue of managing the risks to the environment including developing an understanding of the comparative risks that different issues pose. New Zealanders are well placed to develop a constructive and beneficial relationship between the indigenous and human-induced environments.

There are clearly many environmental quality problems ahead and, with them, challenges for all New Zealanders—rural land users and urban dwellers alike. Encouraging the re-establishment of indigenous biodiversity back through and alongside the monocultures of modified New Zealand remains the biggest challenge of all. Measures to reduce non-point source (diffuse) pollution and to increase the

sustainable use of land are also very important. With the support and action of those who produce our fibre, food and fish, we should improve the state of our environment. Hopefully, the path from here on will keep the pendulum of change swinging back to a better and more sustainable balance between the indigenous and the modified, between the old and the new.

A key to all these actions, however, will be better, timely and systematic information that increases our awareness of the environment, shows us the improved environmental results we are achieving using our environmental legislation and helps us focus on areas where we need greater collaborative effort to achieve our goals.

REFERENCES

Gendall P.J., Hosie, J.E. and Russell D.F. 1994. *International Social Survey Programme: The Environment*. Department of Marketing, Massey University: Palmerston North.

Ministry for the Environment. 1995. *Environment 2010 Strategy: A Statement of the Government's Strategy on the Environment*. Ministry for the Environment: Wellington.

OECD . 1996. *Environmental Performance Reviews: New Zealand*. Organisation for Economic Co-operation and Development: Paris.

Wennberg, U. and Larsson, L.O. 1996. *International Survey of Environmental Reporting 1996*. KPMG Bohlins Environmental Advisors and the International Institute for Industrial Environmental Economics. Lund University: Sweden.