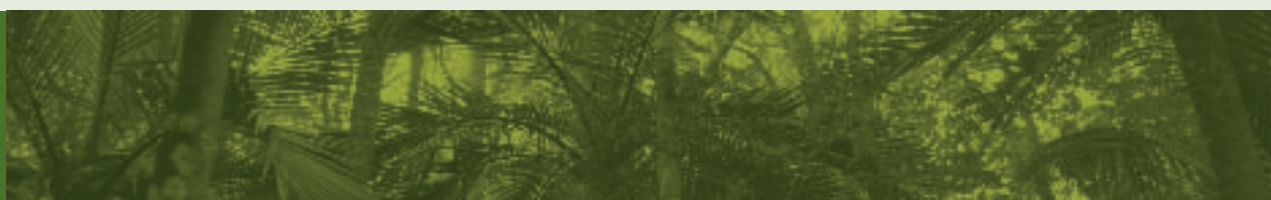
Biodiversity and the state of our ecosystems

Objectives

1. The overall quality (health) of ecosystems is increased.
2. Healthy functioning ecosystems are distributed throughout the region, including the rural and urban environments.
3. The area and quality of indigenous ecosystems in the region is increased.
4. The region has a diversity of healthy ecosystems which represent the full range of regional flora, fauna and habitats.
5. Special ecosystems in the region are actively protected and appropriately managed.



Doing well

- The need to protect, and manage the threats to, our unique biodiversity is becoming more widely understood.
- The community is rolling up its sleeves and helping to restore important degraded ecosystems.
- More and more landowners are legally protecting biodiversity on their land.
- At specific sites, intensive management has produced spectacular improvements in biodiversity.

Must improve

- We don't really know if we are making a difference for biodiversity and we need to develop means of measuring change in ecosystems.
- The region's once rich biodiversity is now significantly diminished and we cannot afford further loss of some ecosystems.
- Ecological processes are impaired as a result of fragmentation and plant and animal pests in most ecosystems.

Webs of intrigue

What is biodiversity? The word, short for **biological diversity**, can be defined as "the diversity of life on earth", the sum total of nature and all its constituent facets.

Ecosystems are one such facet.

Scientists describe an ecosystem as a community of plants, animals and micro-organisms of many different species interacting with each other and their surrounding environment. In this chapter, the term biodiversity means nature, and "ecosystem" defines a specific type of biodiversity, such as a wetland ecosystem or a lowland forest ecosystem.

Healthy ecosystems provide us with life's essentials: plants and animals for food and shelter, fibre for clothing, timber for construction, and so on. Ecosystems also supply the "services" that power the cycle of life – processes that purify air and water, decompose and detoxify wastes, give us productive soils, and stabilise climate extremes. We also value their aesthetic qualities and the sense of national (and regional) identity they give us, use them for our recreation, and treasure them in our cultures.

Today, many ecosystems are a fusion of indigenous and introduced plants and animals. This isn't necessarily a bad thing. A carefully managed farm, for instance, with wetlands and forest remnants protected, streams fenced with riparian buffer zones, erosion prone soils protected and with stocking rates matching the land's carrying capacity, can be ecologically, economically and socially sustainable. In general, though, this chapter is about our indigenous biodiversity.

Impacts on our biodiversity

The story of New Zealand's biodiversity is a remarkable one. Our land was cut off from the rest of the world for 80 million years, so our cargo of plants and animals is unique. That means only we can protect these species.

The first Polynesians arrived here about 1000 years ago, and the extinctions began soon after. But the most dramatic impacts came 150 years ago with the arrival of European settlers, who felled forests and drained wetlands with astonishing zeal. The change they brought to the New Zealand landscape has been described as the most abrupt in the world, resulting in a number of extinctions. Today about 1000 of our known animal, plant and fungi species fall into the "threatened" category.

A rat attacking a fantail (piwakawaka) on its nest. Rats are a major predator of our wildlife. Photo: David Mudge.

The Wellington region reflects that national picture. We have inherited a severely depleted biodiversity. For example, before human arrival, around 98 per cent of our region was cloaked in forest. Today, just 28 per cent survives – mostly in the hills.

Damage to our biodiversity goes well beyond habitat loss and the condition (or quality) of many of our ecosystems types is poor. The introduction of pest plants, such as old man's beard, and animals such as possums, goats, rats, cats and stoats has put further stress on our ecosystems, and nowadays we accept that they cannot thrive without our help.

Biodiversity also faces less obvious pressures:

- drainage of wetlands and channelling of natural waterways
- air and water pollution
- fire
- grazing of forest remnants and riparian areas
- clearance of regenerating scrub and native trees
- water extraction, which drives up temperatures and nutrient concentrations
- structures, urban expansion, and land-use changes that modify or destroy habitats
- pollution and over-fishing in coastal waters
- the effects of climate change.

Where we are now

One challenge we face is to get a fix on the state of our biodiversity. Work by various organisations, such as the Department of Conservation (DoC), Greater Wellington and city and district councils, has given us a reasonable idea of the **quantity** of various ecosystems. For instance, we know approximately how many hectares of wetlands we have left, and the extent and location of our remaining lowland forest ecosystems and dunelands.

By examining this data against our knowledge of the threats they face, DoC identified the region's most at-risk ecosystems:

- lowland forests
- rivers, lakes and river margins
- wetlands
- dunes
- estuaries
- coastal escarpments.

While we can quantify and map our regional ecosystems, it's much more difficult for us to judge the **quality** of our biodiversity. Apart from a few important sites such as Kapiti Island, the Karori Wildlife Sanctuary and Greater Wellington's Key Native Ecosystems, no detailed biodiversity monitoring is being done.

Most of what we do know is limited to terrestrial ecosystems – we know very little about the health of our waterways (although the gap is closing) and almost nothing about our marine ecosystems.

So how do we take the pulse of our biodiversity?

Ecologists recently developed a theory that relates the size of a particular land area to the number of species that area (be it a paddock or mountain range) can support. The theory, called the species/area relationship, expresses that relationship not as a line, but a curve. Initially, species might be lost only slowly, but as habitat is reduced, the rate of local extinctions speeds up.

Some scientists suggest that biodiversity loss becomes critical when 70 to 90 per cent of habitat has been destroyed (see Table 6.1).

Table 6.1: Suggested criteria for assessing biodiversity loss.

Category	Criteria
Acutely threatened	< 10 per cent indigenous cover remaining
Chronically threatened	< 20 per cent indigenous cover remaining
At risk	< 30 per cent indigenous cover remaining
Critically unprotected	> 30 per cent indigenous cover remaining **but** < 10 per cent legally protected
Under-protected	> 30 per cent indigenous cover remaining **but** 10 – 20 per cent legally protected

The recently developed Land Environments of New Zealand (LENZ) system (see box) gives a valuable overview of our ecosystems by showing us the percentage of natural cover remaining in each type. By comparing this against the criteria in the table above, we can see which ecosystems most urgently need protection.

What is LENZ?

LENZ (Land Environments of New Zealand) classifies New Zealand landscapes using a set of climate, landform and soil variables chosen for their geographic and biological significance. These classes, called **environments**, identify areas of similar environmental conditions, regardless of where they occur in New Zealand.

Assuming that the composition of indigenous ecosystems is largely controlled by their "environmental drivers" (such as climate, slope and soils), the area covered by a particular type of land environment should contain a distinct ecosystem type.

This information is presented at four levels of detail containing 20, 100, 200 or 500 environments (levels one to four) nationally. In the Wellington region there are eight level one environments, 12 level two environments, 20 level three environments and 61 level four environments.

LENZ classifications are similar to the **ecological domains** approach promoted by Greater Wellington, with the added advantage of nationwide coverage. This means we can compare our region with the national picture.

Using the level three LENZ environments for our region, Figure 6.1 illustrates those that have less than the critical 20 per cent of their indigenous vegetation left.

LENZ shows us what's been lost;

- The C class land environments represent the fertile alluvial plains of Wairarapa, Kapiti Plains and Hutt Valley. Originally they would have nourished dense lowland podocarp forests of kahikatea, matai, tawa and pukatea. Today, less than 20 per cent of these forests remain. The C2 and C3 environments are acutely threatened, with less than 10 per cent of cover left.
- The hill country of the F environments shows patchy health. The F1 environments, representing moist hill country such as the Tararua foothills, are moderately intact, averaging 52 per cent indigenous cover. On the other hand, the F4.1 environment – the dry eastern Wairarapa hill country – is left with just 13.5 per cent of its original forest cover.

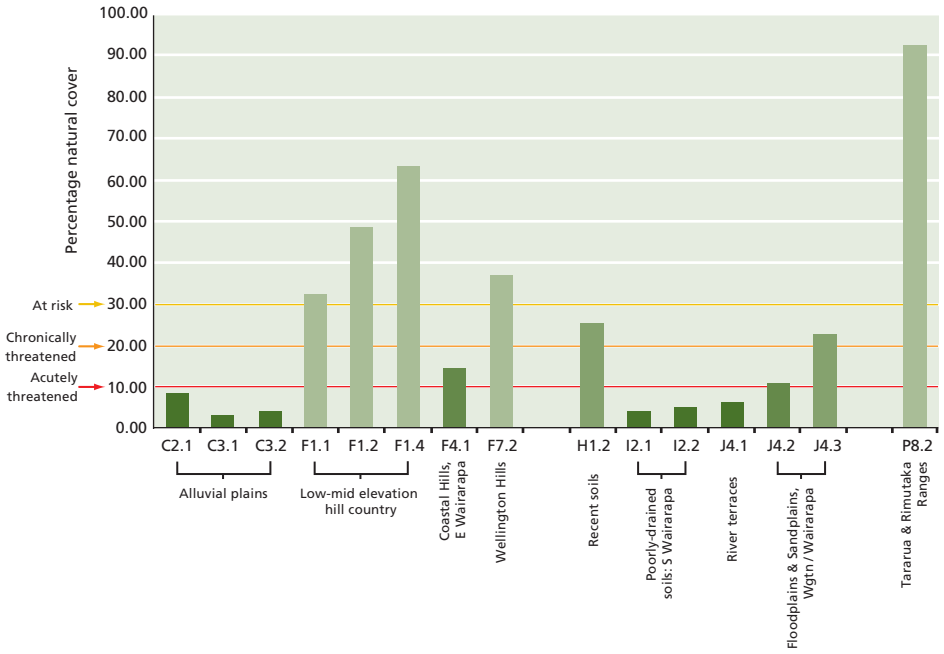


Figure 6.1:
Percentage of natural vegetation cover remaining in the region by LENZ Level three classes.

- The former saline wetlands of southern Wairarapa – the small but significant I2 environments – carry only about 4 per cent of original cover.
- The H and J environments – areas of recent soils, river terraces and dunelands, have all lost at least 75 per cent of their original cover.
- The montane P8.2 environment – 90 per cent intact – is the least degraded environment in the region.

LENZ analysis confirms that the region's once rich diversity is now seriously diminished in the major lowlands and the eastern Wairarapa hill country. Many of these areas qualify as Acutely Threatened or Chronically Threatened.

As an interpretative tool, the use of LENZ is still in its infancy, but Greater Wellington will investigate its potential for providing benchmarks of our region's biodiversity. A recent report prepared for the Department of Conservation used LENZ to identify those land environments around New Zealand most vulnerable to biodiversity loss. Adapted to our region, a similar exercise could offer valuable guidance to our biodiversity programmes and may also be a useful monitoring tool for future reports.

Much of our ecologically rich lowland forest exists only as scattered remnants.

The health of our indigenous forests

We have already noted the dramatic forest loss since the arrival of humans. In the Wairarapa, native forest is still falling to make way for pasture or plantation trees.

However, in some western areas of the region, retired farms are reverting to scrub and forest, and throughout the region more and more landowners are protecting their native forest remnants through Queen Elizabeth II National Trust covenants, up from 99 in 1999 (covering 3,650 hectares) to 182 in 2005 (4,782 hectares).

This area might seem insignificant, but it shows that some landowners are open to voluntary protection – a trend that others can be encouraged to follow, particularly if some financial assistance is available.

We know that without possum control, native forests steadily decline and eventually collapse, so possum numbers can serve as a proxy measure of forest health. Residual trap catch (RTC) is a standard way of monitoring those numbers so that ecologists can gauge their impact. For instance, a high RTC of 30 per cent tells us that the forest is suffering significant possum damage, so much so that its species composition will be changing. In contrast, a low RTC, say five per cent, means that possums are too scarce to cause serious damage.

Possums are now controlled over more than 65 per cent of the region, mainly to combat Bovine tuberculosis (Tb). But the Tb programme is a major boost for biodiversity, too. It's estimated that the Tb offensive keeps RTC levels down to around five per cent – good news for forest remnants and scrublands that are unlikely to get possum control solely for ecological reasons.

We need to remember though, that possums are just one of a suite of animal pests destroying our forest ecosystems, and the Tb programme does little to halt the ravages of cats, rats, stoats and ferrets.

Tackling a suite of pest animals – and plants – is called "integrated pest management". It's expensive, but it gets impressive results. Greater Wellington undertakes integrated pest management in specially selected areas of high ecological value on private and public land, called Key Native Ecosystems.

A red-crowned parakeet, or kakariki, one of a number of native forest birds reintroduced to Wellington in recent years. Some species became locally extinct in Wellington more than a century ago after the arrival of stoats, cats, rats and possums.

Today, kakariki, kaka, whitehead (popokatea), tomtit (miromiro), and bellbird (korimako) are all found in neighbouring suburbs and bush reserves after being released into the Karori Wildlife Sanctuary, and the Department of Conservation (DoC) now believes they have established independent populations, thanks to possum and rat control undertaken by Greater Wellington Regional Council and DoC.

Further kakariki releases on Matiu/Somes Island have bolstered forest bird numbers in East Harbour Regional Park.

Greater Wellington's own forests have also come in for more attention in the last few years with big biodiversity gains.

Case study: Greater Wellington's forest

Greater Wellington manages more than 37,000 hectares of forests in water collection areas and Kaitoke Regional Park. We have monitored their health for many years with techniques such as vegetation plots, rata digital photography, fruit-fall plots, bird transects and pest plant surveys. Integrated pest control focuses on possums, goats and pest plants, and the results, especially in the last three years, have been tangible. A five-yearly 1080 possum control regime (which covers inaccessible or difficult terrain) helps curb other pests like rats as well. Intensive goat control protects native seedlings and the invasion of pest plants has been stopped. Measured benefits to indigenous forest health include:

- increases in native bird abundance after 1080 operations, thanks to lower rat numbers for at least one bird breeding season
- an improvement in rata tree health as measured by rata digital photography
- more seedlings growing past the browse layer owing to a drop in goat and deer numbers
- healthy mistletoe plants in Kaitoke Regional Park
- removal of pest plant species from high value ecological sites.

The health of our wetlands

Wetlands are important because of the rich biodiversity – birds, fish, plants and insects – they support. But many wetland species have become increasingly rare as their habitat disappears. Wetlands also help protect against flooding, and store and purify water. Hungry for pasture, settlers started draining the region's wetlands in the mid 1800s, a practice that continued until the 1980s.

Results of recent surveys of the region have been recorded on a wetlands database, summarised in Table 6.2. The estimated historical wetland area is an approximation based on soil maps.

Number of wetlands	267
Total wetland area (hectares)	10,161 (Lake Wairarapa is 7,146 hectares)
Estimated historical wetland area (hectares)	83,658
Estimated wetland remaining	12 per cent (or 3.5 per cent if we exclude Lake Wairarapa)

Table 6.2:
Wetlands remaining in the Wellington region.

Many remaining wetlands are very small – half of them just two hectares or less. This compromises the way they function. Small wetlands are more susceptible to the detrimental effects of pest plants and animals, human induced changes to the catchment and local hydrology, and pollution. This means smaller wetlands need more intensive management to keep them healthy.

We have a way to go to ensure our remaining wetlands in the region are protected – only nine per cent of wetlands on private land are legally protected by covenant, and of the remainder a third still need fencing to keep stock out.

The end of government subsidies for flood control and drainage schemes in the mid-1980s finally stopped wholesale drainage and infilling, but wetlands continue to disappear. Parts of the lower Taupo Swamp near Plimmerton, for example, have been turned into sportsfields and industrial land.

Freshwater fish

The rivers, lakes and wetlands of the region are home to 22 species of native freshwater fish – one of New Zealand's most diverse assemblages. Seven exotic fish species are also present, mostly in lowland rivers and lakes. Brown trout, a highly prized introduced sport fish, is found in many of our rivers.

Fish known to live in the region's rivers are listed in Table 6.3. The information in the table is based on 80 years of records from the New Zealand Freshwater Fish database 1921-2001.

Table 6.3: Freshwater fish of the region. The species in **bold** are nationally threatened.

Native fish found at more than 50 sites	Native fish found at less than 50 sites	Exotic fish found at more than 50 sites	Exotic fish found at less than 50 sites
Longfin eel	Bluegill bully	Brown trout	Rainbow trout
Shortfin eel	Giant bully		Perch
Redfin bully	Crans bully		Rudd
Common bully	**Dwarf galaxids**		Tench
Upland bully	**Shortjaw kokopu**		Goldfish
Koaro	Lamprey		Koi carp
Inanga	Common smelt		
Banded kokopu	**Brown mudfish**		
Giant kokopu	Black flounder		
Torrentfish	Yellow flounder		
	Grey mullet		
	Unidentified triplefin		

Of the nationally threatened fish, the decline of the longfin eel is likely to be a result of commercial overfishing, while nationwide habitat loss is responsible for the decline of the others. Fortunately, our region has plenty of suitable habitat for shortjaw kokopu in the Tararua, Rimutaka, and Haurangi ranges, and the streams in these ranges are reasonably easy for the migratory fish to get to from the open sea – as long as they get past the whitebait nets! There are good populations of dwarf galaxias in the Pakuratahi River, the upper reaches of the Wainuiomata and the Waihora Rivers.

The giant kokopu and brown mudfish prefer lowland streams, where unfortunately much of their habitat has been degraded. We can improve their life chances by limiting disturbance to what is left of the streams they live in, cleaning up rivers and stepping up streamside planting projects.

Freshwater fish are not regularly monitored in this region, but surveys over the last four years have generally revealed the presence of the same species as were recorded in the 80 years up to 2001.

A specially developed **fish diversity index** from Massey University gives us a picture of the diversity of freshwater fish species living here now. The index shows us that the diversity of fish in this region is higher than in other regions in New Zealand.

Fish numbers and species diversity are declining in some streams though, with urban and lowland streams most at risk.

The banded kokopu is found in urban and rural streams throughout the region. The Owhiro Stream in Wellington city once had all five of the whitebait species living in it. Today, only the banded kokopu still lives there. Photo: Angus McIntosh.

The health of the marine environment

Greater Wellington's responsibilities for the coastal marine area (the region's boundaries extend 12 nautical miles out to sea) are set down in the Resource Management Act 1991. They cover environmental protection such as the control of discharges, reclamation works, noise, seabed disturbances and occupation. The control of the harvesting of plants or animals is the responsibility of the Ministry of Fisheries.

The last *Measuring up* in 1999 reported that our knowledge of marine biodiversity was piecemeal. Since this time, some work has been done. See **Coastal environment** for information about coastal ecosystems.

However, we do know that some populations of fur seals are increasing. The Wellington region supports a breeding colony at Cape Palliser and they regularly come ashore elsewhere around the region.

Twenty-three whale species (the term also includes dolphins, porpoises, orca and beaked whales) have been recorded around our coasts. Deep canyons and food-bearing currents in Cook Strait provide a rich food store and Wellington harbour offers a chance for rest and relaxation in warmer waters.

What's being done

Many businesses, schools, community groups, landowners and individuals have joined with Greater Wellington in rising to the biodiversity challenges in our region. The growth of the community environmental programme, *Take Care*, is proof positive, with a total of 33 groups now working to restore streams, dunes and wetlands. Many more projects exist outside the programme.

The Department of Conservation, local authorities and groups like The Royal Forest and Bird Protection Society all do valuable work, managing their own lands or assisting others with advice and expertise.

Table 6.4: Some of Greater Wellington's biodiversity initiatives

Programme	Targets	Delivers
Top 100	Native forest owners	Identifies the highest value native forest in the region (assistance is available for landowners wishing to protect and manage these).
Key Native Ecosystem (KNE)	High value ecosystems	Integrated pest plant and animal control in the region's highest value ecosystems on private land or in city or district council ownership. Monitoring is carried out to measure ecosystem health improvements.
Covenant protection assistance	Private landowners	Financial assistance for landowners entering into perpetual QEII National Trust covenants to protect any high value ecosystem (bush, wetlands, dunes).
Covenant pest control assistance	Landowners entering into QEII National Trust covenant	Expert advice and assistance with pest control.
Wetland incentive programme	Private landowners	Expert advice and targeted financial assistance for wetland protection.
Streams Alive	Landowners with streams in 12 high value catchments	Advice about streamside plants and financial assistance for plants and weed control in the 12 catchments.
Freshwater ecosystems	Knowledge gaps	Builds understanding of the region's native fish populations and their habitat requirements.
Take Care	Communities	Expert advice and financial assistance for community groups wishing to restore certain degraded ecosystems.
Take Action	Students and schools	Education to help students care for their local ecosystems and biodiversity.
Greater Wellington Parks and Forests Asset Management	Greater Wellington's land	Integrated pest plant and animal management supported by monitoring designed to improve ecosystem health.
Biodiversity booklets	Private landowners, community groups	Practical information on managing wetlands, native bush, stream margins, restoration planting and managing weeds.

More and more, Greater Wellington is taking an ecosystems approach to its work. Flood protection engineering, for instance, now accommodates environmental values.

Where to from here?

We know that many of the region's ecosystems are in trouble. Apart from our protected uplands – the Rimutaka, Tararua and Haurangi Forest Parks – our ecosystems are now small, isolated fragments, and pests have replaced many of their original native plants and animals. Greater Wellington's biodiversity programmes are a response to community concern about that decline.

But are we doing enough? The truth is we don't really know. Biodiversity health is difficult to measure beyond a very local level. We can measure broad changes in the quantity of say, native forest, using satellite imagery, but these trends tell us little about quality. It's now widely accepted that our ecosystems are under such stress that without our intervention they will continue to deteriorate rapidly.

Are we achieving the ecosystem objectives of the Regional Policy Statement? As noted in the last *Measuring up*, the objectives are so ambitious that we may never meet them, even though biodiversity protection, management and restoration efforts have increased significantly in the region.

There are many success stories – streamsides restored, estuaries cared for and the return of native birds after long absences – but whether this is enough to reverse the decline, we cannot tell.

Monitoring changes in the quality of biodiversity at a regional scale is difficult. The techniques used for monitoring specific sites such as bird counts and vegetation plots do not lend themselves to region-wide use. This is an issue faced by every city, district or regional council and, at a national level, by the Department of Conservation. However, techniques for broad-scale monitoring are starting to emerge (see *Where we are now* above) and these may enable us to report against the objectives of the Regional Policy Statement with some certainty in the future.

More information

Porteous, Tim. 2005. *Ecosystems background report*. Greater Wellington.