

A profile of Wellington's biodiversity

Wellington's biodiversity is maintained by habitats that can be broadly grouped into nine different categories.

Each of these habitats supports a unique community of species and faces a different range of threats; although habitat loss and pest species are common threats across all habitats.



LOWLAND FOREST

The forest cloak

Wellington was once cloaked by about 20,000 hectares of lowland broadleaf-podocarp forest. Trees such as northern rata, with its bright red flowers, would have been a common sight, along with rimu, matai, kahikatea and totara. These would have been emerging through a solid canopy of tawa, kohekohe, kamahi, titoki, pukatea and kowhai. The forest interior would have been thick with climbers like kiekie and supplejack, and the forest floor carpeted with ferns^{4, 5}.

Today, less than 5 percent of this forest remains, mostly in gullies and remote areas out of the reaches of development, fire and early logging. Some areas have also been preserved by early Wellingtonians. Otari-Wilton's Bush and the Wellington Botanic Garden native forest remnants are some of the best examples of these.

These relicts of ancient forest are now accompanied by regenerating forest dominated by the ever-present mahoe. These new forests are growing up through the gorse that colonised Wellington's retired farmland and are now a valued part of Wellington's open space⁶. They also have an important role in buffering the ancient forest from the effects of fragmentation.

The remnants of original forest are important seed sources for the regenerating areas. The regenerating areas are important for the health and eventual restoration of many forest species, including birds such as kaka, kakariki and bellbird, and even the long-tailed bat.

4 Gabites, Isobel (1993). *Wellington's Living Cloak: A Guide to the Natural Plant Communities*. Wellington Botanical Society/Victoria University Press, Wellington.

5 Boffa Miskell (1998). *Wellington's Native Vegetation: A Brief Survey of Early Historical Records*. Prepared by Boffa Miskell Ltd for Wellington City Council.

6 Park, Geoff (1999). *An Inventory of the Surviving Traces of the Primary Forest of Wellington City*. Prepared for Wellington City Council.

Photo left (top to bottom): Northern Rata in flower at Otari - Wilton's Bush, Photo: Neil Price, Wellington City Council. Land Snail, Photo: Rod Morris. Crown Copyright, Department of Conservation, 1986.

Tui at Otari - Wilton's Bush, Photo: Neil Price, Wellington City Council.

Photo Below: Green Gecko, Photo: Andrew Morrison, Crown Copyright, Department of Conservation.



Main Issues for lowland forest

Development pressure: Wellington is a growing city so there is still development pressure on a number of areas. In the past, development has been synonymous with forest clearance, and in some places clearance is still a threat to Wellington's forests. Fragmentation is another associated issue. Fragmentation occurs when the edges of forest are 'nibbled away' or what was a continuous tract of vegetation is broken up, and the resilience and viability of the forest is diminished. Maintaining ecosystem biodiversity is an important part of ensuring a healthy city, and must be managed alongside development. Low impact subdivision design is one tool available to help preserve natural ecosystems.

Introduced mammals: Possums, rodents, cats, goats, mustelids, pigs, deer, sheep and cattle have all had a huge impact on Wellington's forests over the years; eating palatable native plants, seeds, native insects, lizards and birds as well as disturbing their habitats. Extensive control programmes have made a big difference, particularly for reducing possum numbers. However, ongoing control and education is required and priority areas have been identified for control in the Wellington City Council Pest Management Plan (2005), as well as by Greater Wellington Regional Council and the Department of Conservation.

Weeds: Weeds are an on-going issue for Wellington's lowland forest. There are a huge number of problem weeds, many of which begin their life as attractive garden plants and then jump the fence, travelling by bird dispersal or through corridors such as reserves, railways and streams. They then out compete and smother native plants, eg climbing asparagus, old man's beard and banana passionfruit. Wellington City Council has two kinds of pest control programmes, weed-led and site-led. Weed-led programmes aim to eradicate problem weeds throughout the city (eg old man's beard, banana passionfruit). Site-led programmes focus on clearing a suite of weeds from important biodiversity sites called 'Key Native Ecosystems'.

Restoring the Town Belt forest: The inner Town Belt has a number of areas that are being restored and returned to native forest. Often these areas arise as a result of the removal of hazardous conifers. Restoration includes weed clearance, reintroduction of indigenous plant species through managed regeneration and planting, and potentially, the reintroduction of appropriate wildlife. There is also a vision to restore a continuous band of indigenous vegetation along Wellington's Outer Green Belt through a combination of planting both adjacent to and within existing key native areas.

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Action case study: Trelissick Park Group

Trelissick Park is a Wellington City Council reserve that follows the Kaiwharawhara Stream down Ngaio Gorge. The area was extensively milled for tawa and rimu in the mid-nineteenth century, however through natural regeneration, and with the support and encouragement of the Trelissick Park Group volunteers, elements of the original forest are being restored. Mature tawa, rewarewa and titoki are common, and with the ongoing care of volunteers and the City, the future of the reserve is looking good.

Threatened species

Many animals that would have once occurred in Wellington's forests are now extinct in the region, while others, such as Wellington's green gecko are thought to be in critical decline. However, conservation efforts by the Karori Wildlife Sanctuary, Wellington Zoo and the Department of Conservation are helping to reintroduce some of these species. Birds such as the little spotted kiwi, hibi and saddleback can now all be seen at Karori Wildlife Sanctuary. Recently, tuatara have also been reintroduced to the Sanctuary, as have giant weta, and some lizards have been identified as having translocation potential. Invertebrates such as the giant pill millipede and large land snails may also be released in the Sanctuary one day.

Genetic biodiversity

Genetic biodiversity is the variability in genetic make up among individuals of the same species. As population size decreases, less individuals combine and genetic diversity is reduced. Genetic variability is important because it helps local populations cope with local conditions; particularly important in Wellington's wind swept conditions. We try to protect and maintain genetic diversity by making sure all the plants we use for ecosystem restoration and revegetation (from forests to wetlands to sand dunes) are Wellington eco-sourced plants. This means that seeds are collected from local wild populations of the plants and then grown in nurseries. Using plants that are not eco-sourced can threaten the integrity of the city's natural ecosystems.

SCRUB AND SHRUBLANDS

Wellington has two main kinds of scrub and shrubland communities; grey scrub and manuka/kanuka shrubland. These ecosystems are a special part of Wellington's biodiversity. They are important transitional communities in ecological succession and are essential habitat for lizards, insects and some birds.

Main Issues for Scrub and Shrublands

Lack of information: A combination of the transitional nature of scrub and shrubland, and difficulty identifying communities by aerial photography or satellite imagery, means that we have little information on current and historic cover. Addressing this lack of information presents an opportunity for better managing Wellington's biodiversity.

Animal pests and weeds: As with forest, pests such as possums, pigs, rodents and stoats are a problem in scrub and shrubland, where they eat palatable native trees, seedlings and prey on native insects and birds. Weeds such as gorse and Darwin's barberry are particular problems for shrubland and scrub ecosystems. In particular, gorse is an early coloniser and has out competed kanuka and manuka in this successional role.

Clearance: Because scrub and shrubland are often transitional communities, they tend to be more readily cleared than mature forest often as a result of development. However, this clearance must be balanced with the retention of ecological processes and biodiversity.

Fire: Scrub and shrubland are particularly vulnerable to fire damage, which is likely to be a combination of where they grow (eg retired farmland and growing in close association with gorse) as well as their largely woody nature. Manuka and kanuka are particularly flammable species.

Action case study: Darwin's barberry weed control

Darwin's barberry has been steadily creeping along Wellington's Outer Green Belt over the last few decades, particularly around Mt Kaukau and Wright's Hill. This prickly leaved and golden flowered small tree often grows in association with gorse, and is a problem around the edges of forest and in disturbed scrub. Because there's so much Darwin's barberry around, Wellington City Council is targeting priority areas for clearing, as determined by the Pest Management Plan. The first section to be cleared is along the Skyline Track above Otari-Wilton's Bush, and contractors started work on it in 2007.



Grey scrub

Grey scrub tends to occur in the relatively exposed environments of Wellington's south-west peninsula. Grey scrub is characterised by small-leaved divaricate shrubs (shrubs that have fine, right-angled branches with a woody tangled appearance), and climbers such as pohuehue (*Muehlenbeckia*). It is called grey scrub because it appears grey from a distance. In Wellington's grey scrub, you will generally find small leaved coprosmas (*Coprosma propinqua*, *C. crassifolia*), pohuehue, *Olearia solandri*, *Ozothamnus leptophyllus*, kowhai, manuka and bush lawyer. Grey scrub is also habitat for the nationally vulnerable plant, *Muehlenbeckia astonii*, and regionally threatened matagouri.

Manuka/Kanuka shrubland

Manuka/kanuka shrubland is generally found on previously forested land and lightly grazed hill country. It has become relatively rare in Wellington as gorse has taken over its ecological niche. Wellington's remaining manuka/kanuka shrublands are important to protect to maintain a natural process of forest succession. Research has found that forest growing up through gorse has less diversity of species than forest that grows up through kanuka/manuka, and that some plant groups, such as podocarps, orchids, and small leaved shrubs are less common in gorse than in manuka/kanuka shrubland ⁷.

COASTAL FOREST AND COASTAL SCARP

The wind buffeted and salt laden coastal escarpments facing the Cook Strait (Wellington's South Coast) as well as the harbour escarpments, were once covered with a mosaic of coastal forest, dense coastal scrub, flax and tussockland, and scree. The coastal forest was dominated by kohekohe, ngaio, northern rata, akiraho and kowhai, the dense coastal scrub was characterised by tauhinu, mingimingi, matagouri, prostrate kowhai, pohuehue and speargrass; both with a complex mosaic of scree, coastal flax and tussock.

Coastal forest

Today, less than 1 percent of coastal forest remains. Some small remnants can be found along the Harbour Escarpment, as well as some areas along the South Coast. Spooky Gully within Te Kopahou Reserve is a good example of a South Coast forest remnant, with its spectacular tree hebe forest interwoven with scramblers such as native jasmine and native clematis.

Coastal scrub

The scrub of the coastal scarp has fared a little better than the coastal forest but is still in serious decline⁸. Matagouri is now endangered in the Wellington area, however pohuehue, mingimingi, tauhinu and taupata are still a relatively common sight along the coast, as are the flax clad cliffs.

⁷ Sullivan, J.J.; Williams, P.A.; Timmins, S.A. (2007). Secondary forest succession differs through naturalised gorse and native kanuka near Wellington and Nelson. *New Zealand Journal of Ecology* 31.

⁸ Sawyer, J.W.D (2004). *Plant Conservation Strategy: Wellington Conservancy 2004-2010*. Department of Conservation, Wellington.

Photo left: Te Kopahou Reserve, Photo: Justine Hall, Wellington City Council.

Photo right (top to bottom): Coastal Escarpment at Wellington's South Coast, Photo: Justine Hall, Wellington City Council.

Speargrass Weevil, Photo: Andrew Morrison, Crown Copyright, Department of Conservation.



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Main Issues for Coastal Forest and Scarp

Quarrying: Although quarrying has ceased along the South Coast with the acquisition of the Owhiro Bay Quarry by Wellington City Council, it is still active along the harbour escarpment between Wellington City and the Hutt Valley. Future quarrying activity will need to take biodiversity values into careful consideration.

Development pressure: Whilst the steepness of the coastal scarp means that it hasn't seen a large amount of development pressure, this is still an issue for the future, bringing with it the associated threats of ecosystem clearance and fragmentation. Again this can be managed through careful consideration of land use and principles of low impact subdivision design.

Pests: Goats, pigs and possums are a particular problem in many of these areas, as are coastal weeds such as boneseed and evergreen buckthorn. However a number of coastal sites have been identified as priority areas for pest control in the Wellington City Council Pest Management Plan (2005) due to their ecological significance. The steep nature of many of these sites is an ongoing challenge.

Action case study: Te Kopahou animal pest control.

Te Kopahou historically had very high numbers of goats and pigs. Between 1990 and 1993 more than 3000 goats were shot in the area. In 2006, 364 goats were shot. From December 2006 until June 2007, the numbers of goats shot dropped to 134. This shows that definite progress is being made. Anecdotal evidence, such as no sightings, indicates that pig numbers are also down.

Threatened species

The coastal scarp is an important habitat for many species which are now threatened, due mainly to habitat loss. One example is the speargrass weevil. The speargrass weevil (*Stephanorhynchus insolitus*) and Hutton's speargrass weevil (*Lyperobius huttoni*) live on speargrass around the South Coast. However, speargrass has been decreasing due to grazing, pig rooting and out competition by weeds, and so the weevil's habitat is being lost. Department of Conservation have an active programme translocating the weevils to offshore islands to try and ensure their survival. Another example is the geometrid moth (*Notoreas 'wellington'*), a striking orange, black and white moth. Again, the main threat to this species is habitat loss, in this case the decrease of its host plant *Pimelea cf urvilleana*.

COASTAL FRINGE

Wellington's coastal fringe is a dynamic mix of rocky foreshore, coastal turf communities and coastal dunes.

Wellington's rocky foreshore defines the 'wild coast' experience, but on closer inspection the rocky foreshore is actually an intricate mix of coastal turf communities (or herbfields), coastal shrubland, sedges, grasses and rushes. A great example can be found at Hue-te-Taka (Moa Point).

Coastal turf

The unifying feature of Wellington's coastal communities is that they are adapted to tolerate very salty and windy environments. The coastal turf communities are characterised by low growing dense mats of herbs, often with very fleshy leaves that protect the plant from desiccation (eg NZ iceplant, shore bindweed, glasswort). Sedges, grasses and rushes growing in these areas are also specialists at withstanding salt and dehydration. Many also tolerate very low nutrient levels and shifting sands, good examples are pingao, spinifex and sand tussock. You can also find coastal shrubs in some of these areas, including tauhinu, sand pimelea and sand coprosma.

Coastal dunes

Coastal dunes form where there is shelter from strong waves, a supply of sand, and onshore winds⁹. The side closest to the sea (foredune) is very dynamic and sand binding plants have an important role. The two main native sand-binders are pingao (*Desmoschoenus spiralis*) and spinifex (*Spinifex sericeus*); however the introduced marram grass is now most commonly seen. Other native species of coastal foredunes are sand tussock (*Austrofestuca littoralis*), sand coprosma (*Coprosma acerosa*), and sand daphne (*Pimelea aff. arenaria*). An important site for coastal dunes in Wellington is from Owhiro Bay to Karori Stream. In the past, all five native foredune species have been recorded in this area, but in the last 10 years only sand tussock and pingao have been found. This area is one of the only sites in the North Island where 'Marlborough minimac' geckos occur. Common, brown and copper skinks and common geckos have also been recorded here¹⁰.

⁹ Milne, R. & Sawyer, J. (2002). *Coastal foredune vegetation in Wellington Conservancy*. Department of Conservation, Wellington.

¹⁰ *Ibid.*

Photo right (top to bottom): *Suaeda novae-zelandiae*, Photo: John Barkla. Coastal Dunes, Photo: Justine Hall, Wellington City Council. Cook Strait Little Blue Penguin, Photo: Rosalind Cole, Crown Copyright, Department of Conservation. Fur Seal, Photo: Gary Holz, Crown Copyright, Department of Conservation.



Coastal wildlife

The coastal fringe is an important place for many bird species; but for a number of reasons many of these bird species are now threatened. The banded dotterel is one example; this bird nests in soil, shingle or sand dunes using little, if any, nest material. This means that its breeding ground is easily disturbed by vehicles, people and pets. The little blue penguin is another example. The 'little blue' is the smallest penguin in the world, and adults come ashore in Wellington between May and June to prepare nests, laying eggs from August to November. The landscape has been modified, and their habitat destroyed as a consequence. While many of them have adapted to nest under houses or reserves around the coast, many are killed by vehicles, pets and ferrets and stoats.

Wellington's wild coast also has a number of seal 'haul-outs'; and the most accessible site is at Red Rocks or Sinclair Head. Between May and October, male fur seals rest up here between feeding. Fur seals are the most common seal around New Zealand and are slowly recovering from commercial sealing in the 1870s.

Main Issues for Coastal Fringe

Land use pressure: The coast is a popular place to live and visit, and so has always been under pressure from development and recreation. Land use that is sympathetic to the coastal environment is an important consideration and simple actions like keeping vehicles to formed tracks and not dumping rubbish can make a big difference.

Weeds: Weedy grasses, herbs and trees are a serious problem and threat for the coast. Plants like gazanias and garden arctotis, attractive enough in a garden setting, grow well in this salty environment and smother native coastal herbs. The introduced marram grass is now common along the coast and has largely displaced pingao, spinifex and sand tussock. Meanwhile weed trees and shrubs such as karo, boneseed, and evergreen buckthorn threaten to out compete many of the native shrubs.

Climate change and coastal erosion: The effects of climate change will increase coastal erosion and inundation in many areas. Although climate-change effects are very gradual, land-use planning decisions usually have long-term horizons because of the permanency of structures (e.g. buildings, roads, seawalls). Climate-change effects will therefore eventually have major implications for those decisions. It has been recognised that the coastal fringe provides a natural defence against the sea¹¹.

¹¹ Ministry for the Environment (2004). Coastal Hazards and Climate Change: A guidance manual for local government in New Zealand.

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Action case study: Oku Coast Care

This group works on the Island Bay Sand Dune, the last small remnant of a large dune area that originally extended right back to Severn Street. They became involved after noticing a bulldozer on the dunes clearing a path through the dune vegetation to put in a boardwalk. They worked with Wellington City Council to change this project into a dune restoration effort. The Council has since fenced the area to protect the dune plants. Since 2003 the group has held public working bees to carefully remove invasive weeds and plant the dune with native foredune plants, returning it to a more natural state. The group also plant a number of rare and endangered native dune plants.



OFFSHORE ISLANDS

The only island that sits within Wellington District is Tapu Te Ranga, the namesake of Island Bay.

Tapu Te Ranga is typical of Wellington's South Coast environment, and as an island potentially offers a safer place for nesting and roosting seabirds. Tapu Te Ranga is designated as a Conservation Site in the District Plan. It is characterised by flaxland, salt marsh and scrubland and is home to two rare plants found nowhere else in Wellington; *Crassula moschata* and *Suaeda novae-zelandiae*.

The islands Matiu (Somes), Makaro (Ward) and Mokopuna sit prominently in Wellington's harbour, but are within the Hutt City jurisdiction. The biggest of these, Matiu, was occupied by Maori for generations and its use in more recent times has included a quarantine station, internment camp and military defence position. It is now managed by the Department of Conservation and is a site of active restoration and home to a number of conservation species, including tuatara and kakariki (red crowned parakeet).

All of the harbour islands are important nesting sites for little blue penguins.

Photo above: Planting at Island Bay Sand Dune photo: Justine Hall, Wellington City Council.
Photo right (top to bottom): Kakariki, Photo: Crown Copyright, Department of Conservation.
Tapu Te Ranga island, Photo: Neil Price, Wellington City Council.

Main Issues for Offshore Islands

Weeds: As with the coastal environment, the indigenous ecosystems of Tapu Te Ranga Island are at serious risk from weeds. Weeds of concern include karo and pohutukawa (although both of these plants are native, neither occur naturally in Wellington), boneseed, buck's horn plantain, and wallflower (*Cheiranthus cheiri*).

Litter: Litter washes up on the island and is a risk to wildlife.

Fires: Fire is a huge threat to this ecosystem, and under no circumstances should people light fires on the island.



WETLANDS

Wetlands include swamps, bogs, shallow lakes and salt marshes – essentially any area of land covered by water for some period of time¹². Man-made ponds are not normally considered to be a wetland. Wetlands are important places for biodiversity – they support more bird species than any other ecosystem. Wetlands are also important places for water purification (trapping sediments and removing excess nutrients), for preventing flood damage, for healthy fisheries, and for recreation¹³.

All over New Zealand, wetlands have been drained, filled and built on. In Wellington, most of our wetlands have been lost and those that remain are mostly small swamps, usually characterised by raupo, purei and harakeke¹⁴. These include a raupo wetland in Opau Valley, a carex wetland in Hawkins Hill and a wetland in Takarau Gorge. There is also a small estuary at the mouth of the Kaiwharawhara Stream.

Coastal wetland – Makara Beach Estuary

Wellington City has only one salt marsh estuary, and this is located at Makara Beach. Estuaries are incredibly rich biodiversity spots due to the combination of terrestrial and wetland plants, seashore life and wading birds. At Makara Beach Estuary there is a community of saltmarsh ribbonwood, as well as salt turf, sedges and rushes. It is an important area for blue heron, rare freshwater snails, and black flounder breeding. It is also the only area in Wellington suitable for inanga spawning¹⁵.

Main Issues¹⁶ for Wetlands

Draining and filling: Although this has slowed since the mid-1980s when the government ceased its subsidies for irrigation, flood control and drainage schemes; small scale losses, particularly of ephemeral wetlands, continue.

Changes to water levels: Wetlands are affected by the streams and catchments that feed them. When streams are filled and piped, then this can dry out a wetland, or if stormwater discharges into a wetland it may scour out a channel and so drain the wetland. Wetlands are excellent examples of the ecological principle that everything is interconnected.

Weeds and pest animals: Weeds such as grey willow and exotic grasses can replace wetland native plants and alter water flow and quality. Aquatic weeds, such as hornwort, are also finding their way into the region. These weeds choke out all light and take all oxygen from the water. Pest animals (possums, hedgehogs, mustelids, cats and rats) are a problem as they prey on native birds and their eggs. Herbivorous pests (rabbits, hares, possums) also eat wetland plants. Pest fish such as koi carp also cause trouble, outcompeting native fish and increasing sedimentation.

Pollution: While wetlands can be thought of as 'nature's kidney's', their ability to deal with pollutants is limited. Higher levels of nutrients can cause weed invasion; while increased sediment can be held in the wetland, causing it to fill up and become dry.

Loss of buffers and connections: Animals that live in wetlands often need well vegetated areas to nest in – these buffer areas seldom remain today. Similarly, few have intact corridors of vegetation that link them with the landscape.

¹² Greater Wellington (2003). Wetland Action Plan.

¹³ *Ibid.*

¹⁴ Greater Wellington (2003). A beginner's guide to wetland restoration.

¹⁵ Taylor, M.J. & Kelly, G.R. (2001) Inanga spawning habitats in the Wellington Region, and their potential for restoration. NIWA, report prepared for Wellington Regional Council.

¹⁶ Greater Wellington (2003). Wetland Action Plan.



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Action case study: Karori Wildlife Sanctuary wetland restoration

Karori Wildlife Sanctuary has carried out a wetland restoration project around the historic man-made dams (built in 1870 and 1906) within the Sanctuary valley. The Sanctuary now has a diverse range of freshwater habitats representative of what would once have occurred within the Wellington area. Their next step is the removal of exotic fish and the restoration of native fish communities.



STREAMS

Streams are one of the Wellington region's threatened ecosystems. The streams are also affected by what happens in their catchments, which is the area of land drained by that stream system. Wellington's streams can be described simply as rural streams and urban streams¹⁷. Rural streams include lower Karori Stream, Makara Stream and Ohariu Stream – as well as some of the more remote or 'wilderness' streams such as Oteranga Stream. Much of the country associated with these rural streams has a long history of farming and grazing, and these streams are often characterised by a lack of streamside (riparian) vegetation. Some rural streams (eg Waiariki and Opau Streams) also flow through areas of fragmented or regenerating forest.

Urban streams include Owhiro Stream, Kaiwharawhara, Ngauranga and the Porirua Stream system, as well as the 'lost streams' (now piped) of Te Aro, Houghton Bay, Miramar and the inner city. The Porirua Stream system, or catchment, is the largest in Wellington, running north from Johnsonville to exit at Porirua Harbour. Urban streams have been, and continue to be, heavily modified and influenced by residential development and urban living.

Streams provide habitat and food for hundreds of plants and animals – from algae to eels. They also provide freshwater for people and animals to drink and places for people to play¹⁸. Although many of Wellington's streams are small, and some are even dry at certain times of the year (ephemeral), their biological health is important both for the species they support and also for the harbour and sea they flow into.

Stream margins, or riparian areas, are an important part of stream biodiversity – providing riparian habitat as well as improving water quality and habitat by providing shelter for fish, lowering water temperature, removing sediment, filtering out some pollutants, preventing damage to stream banks, and increasing bird and insect life.

Threatened species

Nearly all of New Zealand's freshwater fish species migrate between freshwater and the sea during their lives and this is an important part of their breeding cycle. This means that if streams are lost, or if there are barriers to fish passage, then fish will become extinct from that particular stream. Giant kokopu, long finned eel and short jawed kokopu are all nationally threatened fish that are known to occur in Wellington.

¹⁷ WCC. Wellington Wet and Wild: Bush and Streams Restoration Plan.

¹⁸ Greater Wellington (2004). Mind the stream: a guide to looking after urban and rural streams in the Wellington Region.

Photo Left (top to bottom): Kaiwharawhara Stream, Photo: Justine Hall, Wellington City Council.

Giant Kokopu, Photo: Angus McIntosh, Natural Sciences Image Library.

Photo far right (top to bottom): Wellington City, photo: Neil Price, Wellington City Council. Landscaping at Waitangi park, Photo: Neil Price, Wellington City Council.

Main Issues for Streams

Infilling, piping and culverting: Filling and piping streams (including ephemeral streams) leads directly to habitat loss for aquatic species, and causes barriers to fish passage. In addition, filling and piping is often associated with development and an increase in impermeable surfaces, leading to greater stormwater run-off that affects water quality. Stormwater run-off also causes stream bank erosion. Innovations for low impact development are helping protect stream ecosystems.

Water quality: Water quality and biodiversity go hand in hand. Water quality is affected by sediment and pollutants that get into streams by stormwater runoff, or directly leaching into streams. It is also affected by rubbish entering the stream. Stream biodiversity is in turn affected, and biodiversity measures such as the number of insects are important indicators of pollutants, water quality, and stream health.

Weeds: Weeds such as willow, blackberry and exotic grasses can replace riparian native plants and alter water flow and quality. Aquatic weeds, such as hornwort, are also finding their way into the region. These weeds choke out light and take all oxygen from the water.

Pest animals: Pest animals (possums, hedgehogs, mustelids, cats and rats) are a problem as they prey on native birds and their eggs. Herbivorous pests (rabbits, hares, possums) also eat riparian plants. Pest fish such as koi carp also cause trouble, outcompeting native fish and increasing sedimentation.

Action case study: Project Kaiwharawhara

Project Kaiwharawhara is a stream restoration programme that began in 2002, uniting community groups, councils and organisations, and incorporating multi-disciplinary design and planning. The vision of Project Kaiwharawhara is to protect and enhance the natural landscape, ecosystems, homes and recreation areas, and for the stream to be a local focus. This vision is being achieved through an innovative community catchment plan. Work so far has included riparian planting alongside Kaiwharawhara stream, stream bank stabilisation, and remedial works down the stream to allow fish passage.

URBAN AREA

Approximately 4,200 hectares of Wellington are in a built urban environment, compared with around 3,600 hectares of Council-owned open 'green' space. The urban environment also includes 1,200 kilometres of road reserve.

It is possible for an amazing amount of biodiversity to be found in this environment. There are about as many wild native plants in New Zealand cities (350–550 species or 14–22 percent of the flora) as in National Parks (440–660 spp. or 17–26 percent) (Given & Meurk 2000)¹⁹.

¹⁹ Given, D.; Meurk, C. D. (2000). Biodiversity of the urban environment: the importance of indigenous species and the role urban environments can play in their preservation. In: Stewart, G. H.; Ignatieva, M. E. ed. *Urban biodiversity and ecology as a basis for holistic planning and design*. Proceedings of a workshop held at Lincoln University 28–29 October 2000. *Lincoln University International Centre for Nature Conservation No. 1*. Christchurch, Wickliffe Press. Pp. 22–33.



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Much of Wellington's land environment²⁰ that has been identified as acutely threatened²¹ sits within the built urban area. The majority of this land is privately owned. Planning that protects and restores the indigenous remnants within this area is critical to the survival of many species, mitigating the effects typical of urbanisation²².

Private gardens can greatly contribute to the overall biodiversity of the city through suitable plant choice and gardening practices. This not only provides a habitat for the plants themselves, but also creating an attractive environment for indigenous birds, lizards and insects.

People's interaction with the natural environment also plays a key role; it is within the urban area that most people experience these interactions. An awareness of the value of biodiversity in our own backyards can lead to an appreciation of the ecological importance of the wider landscape. In this context, social objectives can be as important as ecological outcomes²³.

Main Issues for Urban Area

Nature of the land: Urban environments typically have highly disturbed natural systems which make a poor starting base for the seed sources, soil structures and networks of fragmented habitat systems needed to make the restoration of self-sustaining viable ecosystems a reality.

Infill housing: There is growing concern over the impact infill housing is having on the character of residential areas. It also impacts on biodiversity by creating less green open space and more impervious surfaces. Removing urban bush fragments reduces the areas which birds can use as stepping stones between reserves.

Weeds: The main weed concern in the urban environment is that of 'garden escapes'. About 75 percent of land weeds and 50 percent of freshwater weeds are garden escapes. On average, eight garden plant species each year become established in the wild in New Zealand.

Pest animals: Cats (both feral and domestic), rodents, possums and hedgehogs are commonly found in urban areas. Individually, and in combination, these pose a major threat to indigenous biodiversity. Dogs also pose a threat, particularly to our indigenous birdlife in urban coastal areas.

Community engagement: There is already a growing awareness and appreciation of indigenous biodiversity within the urban community. However this needs to be supported by leaders, for example, ensuring the provision of readily available local native plants. Our indigenous biodiversity must continue to become a common experience for all Wellingtonians, and not something to be found only outside the urban boundaries.

Action case study: Threatened species in roadside planting

Urban landscapes such as traffic islands and road reservations are now being used in Wellington City as an integral part of plant species recovery programmes. Threatened indigenous plants grown in urban plantings are used as 'insurance populations', research resources, seed sources and as an advocacy and education tool. They are valuable components of conservation programmes as well as being attractive parts of the urban landscape. Some examples of this are the use of the nationally threatened plants *Euphorbia glauca*, *Austrofestuca littoralis* and *Muehlenbeckia astonii* in traffic islands around Wellington City.



20 Leathwick, J; Morgan, F; Wilson, G; Rutledge, D; McLeod, M; Johnston, K. (2003). Land Environments of New Zealand: Technical Guide. Auckland: David Bateman Ltd.

21 Walker, S; Price, R; Rutledge, D. (2005). New Zealand's remaining indigenous cover: recent changes and biodiversity protection needs. Report no: LC0405/038 prepared for Department of Conservation, by Landcare Research.

22 Clarkon, B; Wehi, P; Brabyn, L. (2007). Bringing back nature into cities: Urban land environments, indigenous cover and urban restoration. CBER report No. 52. University of Waikato, Hamilton.

23 Kilvington, M; Allen, W. (2005). Social aspects of biodiversity in the urban environment. In Greening the City. Royal New Zealand Institute of Horticulture (Inc.).

THE HARBOUR & COASTAL WATERS

Wellington's coastal waters are home to marine mammals such as the common dolphin and orca, and Wellington Harbour has unique marine features including a giant kelp forest and a population of rare sponge (*Latrunculia brevis*). The waters of Wellington's South Coast support a rich and varied mix of plants and animals, due partly to a complex topography and wide variety of habitats. The high biodiversity is also due to the collision of three major oceanic currents, the result being a mix of warm Pacific and cold sub-Antarctic waters. The community of plants and animals found here is unique in New Zealand, with many species occurring at the northern and southern limits of their range. At least 100 different species of algae (seaweed) have been recorded on the South Coast, and sea horses, many fish species, crayfish and paua can all still be found. Even Wellington's intertidal zone is filled with a rich number of seaweeds, shellfish, and other invertebrates.

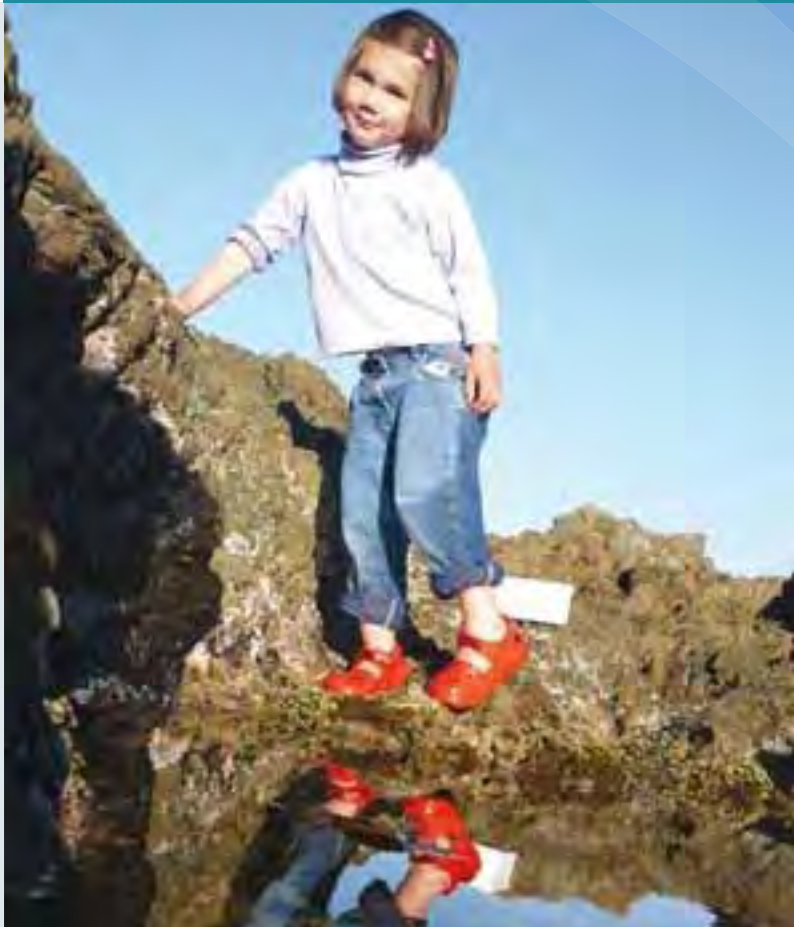
Nationwide, scientists estimate that as much as 80 percent of New Zealand's indigenous biodiversity may be found in the sea. Yet less than 1 percent has ever been surveyed. On average, seven new marine species are identified every fortnight.

The marine environment is also very important for many of our freshwater fish species. Almost half of them are diadromous and use both the streams and the sea to complete their life cycle. Our native eels are thought to breed in deep ocean trenches somewhere near Tonga. Their larvae return to New Zealand on the ocean currents and re-enter the stream systems. The adults never return as they die after spawning.

Wellington City Council's management extends only as far as the mean high water level. However there is no doubt that what happens on the land influences what happens to the harbour and coastal ecosystems. Land management practices have flow on effects down to the sea, especially via streams. Despite many environmental pressures, the general condition of Wellington's intertidal sandy beaches and estuaries is currently healthy ²⁴.

²⁴ Stevens, L., Robertson, B. & Robertson, B. (2004). *Broad-scale habitat mapping of Sandy Beaches and River Estuaries – Wellington Harbour and South Coast*. Report prepared for Greater Wellington, by Cawthron Institute, Nelson.

Photo Left (top to bottom) *Euphorbia glauca* at Lyall Bay, Photo: Justine Hall.
Planting at Lyall Bay, Arbor Day 2006, Photo: Neil Price, Wellington City Council.
Photo right (top to bottom): Exploring Wellington's rocky coast, Photo: Rachel Ahyong.
Blue Cod, Photo: Crown Copyright, Department of Conservation.
Sea Horse, Photo: W Farelly, Crown Copyright, Department of Conservation.



A profile of Wellington's biodiversity continued . . .

Main Issues for Harbour and Coastal Waters

Water pollution: The quality of the harbour waters is affected by landfill leachate, nutrient pollution, stormwater, sewage disposal and litter. All of which come from land based activities. High levels of pollution can harm aquatic life and marine mammals are particularly vulnerable to plastic rubbish.

Sedimentation: Sediment from land uses (such as catchment development and road building) and stream channel erosion often settles in coastal waters. Continual sediment delivery to inshore environments reduces light penetration, and prevents plants from growing. This affects bottom dwelling organisms such as worms, crabs and shellfish, the base of the marine food web.

Shellfish collection: The depletion of shellfish due to recreational gathering can be an issue if legal limits are not adhered to, particularly around the South Coast for species such as paua.

Structures: Structures in coastal areas may cause physical changes to the foreshore or seabed, and may detract from the natural character, ecology and landscape quality of the coastal marine area. Water and seabed sediment quality may also be affected.

Action case study: Wellington Harbour sediment sampling

The most significant medium to long-term impact of urban stormwater discharges on the Wellington Harbour environment is the accumulation of stormwater-related contaminants in the sediments. This is because the contaminants can, over time, build up to concentrations that are toxic to sediment-dwelling organisms. The Wellington Harbour sediment sampling project is being conducted to make an assessment of benthic community health and sediment quality and accumulation. Sampling and analysis is being funded by Greater Wellington, Wellington City Council and the Hutt City Council.

SURROUNDING DISTRICTS

Wellington's biodiversity does not end at the edge of Wellington City's boundaries, and neighbouring areas are very important. For example, many birds migrate to and from Kapiti Island in the northwest, the Tararuas to the north, and the Rimutakas to the east. Stream systems, such as that drained by the Porirua stream, can incorporate multiple districts within their catchment area. Although this action plan focuses on Wellington City's unique biodiversity, we must be aware that biodiversity is not confined to legal boundaries and ensure that we work with our neighbours to ensure local biodiversity protection.

Photo right (top to bottom): Wellington City showing Rimutaka Ranges in background, Photo: Neil Price, Wellington City Council. Wellington coastline showing across harbour to Hutt Valley and Tararua Ranges, Photo: Neil Price, Wellington City Council.



INTRODUCED SPECIES

New Zealand is characterised by a mix of native and introduced species which combined make up the country's total biodiversity. New Zealand has the highest number of introduced mammals of any country in the world and the second highest number of introduced birds. In the case of vascular plants, we now have more introduced species in the wild than native ones and this number is increasing all the time.

Many of the pressures on New Zealand's indigenous biodiversity are from plants and animals which were introduced with the arrival of humans. These species were introduced into Wellington from other parts of the country as well as from overseas. However, these introduced species are neither all 'good' nor all 'bad'.

Introduced species can threaten our indigenous biodiversity through processes such as out-competition, hybridisation, predation and browsing. But they can also provide benefits depending on the situation in which they are found.

Introduced species can provide complementary food for a range of indigenous species. For example, the presence of bottlebrush from Australia provides a feeding source for tui. A forest stand, whether indigenous or exotic, provides an extra dimension of habitat (height) in comparison with grassland. This is reflected in the indigenous insect and bird populations that find cover in these habitats.

Our primary production is dependent on introduced biodiversity in agriculture, horticulture and forestry. The revenue from this introduced biodiversity also enables us to further protect our indigenous biodiversity.

Introduced species can be used to effectively convey conservation messages and used as examples for education purposes, such as at Wellington Zoo and Wellington Botanic Garden. The messages of conservation and sustainability can be shared regardless of the provenance of the species involved. These places also run breeding and propagation programmes, safeguarding global genetic biodiversity in a controlled environment.

Wellingtonians value many introduced species for aesthetic, cultural and heritage reasons. Introduced species can enable the community to identify with the city by providing evidence of its past in the existing environment. For example Wellington Botanic Garden has some of the oldest radiata pine in the country (dating back to the 1860s), which went on to become New Zealand's main timber tree. One area of significance to local iwi is a karaka grove between Red Rocks/Pariwhero and Sinclair Head/Te Rimurapa, which is associated with a pre-European Maori settlement site. Karaka is thought to be native to the north of the North Island, but to have been introduced to Wellington. Pohutukawa, another introduction to Wellington from the north of the North Island, is also of cultural significance and contributes to Wellington's urban sense of place.

The challenge is to find a balance between the benefits provided by introduced species and the threats they may present to local biodiversity. This balance is best determined on a case-by-case basis.

