

**Future marine trends**

Auckland's marine areas will decline in the coming decades in ways that won't be obvious until it is too late. In particular there will be less variety of life and some edible species will continue to decline and eventually disappear. Although coastal waters close to urban areas are already suffering, these effects may extend along the coast as sediment and nutrients running off rural land and developing urban areas harm the marine environment. The types of contaminants are changing, so keeping an eye on these is important. Although changes to technology may cut down contaminants produced per person, there will be more people. Greater awareness and control of contaminants may be one of the key ways to reduce pressures on Auckland's precious marine areas.

**What the ARC is doing to improve Auckland's marine areas**

By continuing the long term monitoring programmes, we can determine if things are getting better or worse and can then identify environmental issues that feed into policy, and assess if current policy is working.

Many of the issues for Auckland's marine areas relate to stormwater run off from surrounding land. As described in the freshwater section, the ARC uses catchment management plans, supports low impact urban design and provides a 24 hour pollution response team to help manage stormwater discharges.

Ongoing work with local councils to improve wastewater discharges has already improved beach water quality. Beach cleans ups such as those run by the Waitemata Clean Up Trust are supported by ARC and other agencies. The Trust works with schools to educate people about marine litter, as well as with the community to remove litter from the Waitemata harbour. About 1,806m<sup>3</sup> of rubbish (about 60 standard shipping containers) has been removed from the sea since 2002.

In the coastal area, the ARC has rules and regulations for structures such as moorings, marinas, boat ramps and jetties, and for dredging and other actions that affect the coast. The ARC works with local councils to maintain and protect the coast.

The ARC has a Coastal Enhancement Fund to support people who want to restore or protect areas of the coast. In 2009/10 the ARC granted \$336,000 to a range of projects including a study of the Bryde's whale in the Hauraki Gulf.

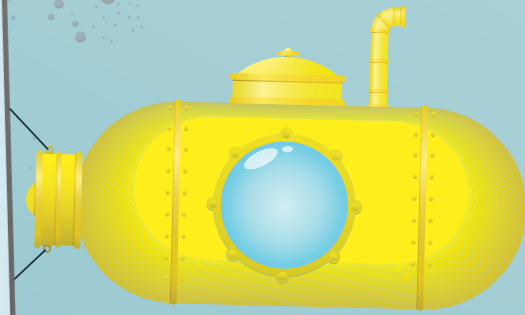
Since 2008 the ARC has been campaigning for greater control of vehicles on beaches to limit damage to sensitive areas and avoid dangerous practices.

The ARC recognises the special value of the Hauraki Gulf and takes it into account when considering works or activities within the region that could affect the area.

The ARC manages marine areas using the following: Proposed Auckland Regional Plan: Air, Land and Water; Integrated Catchment Management Plans (ICMPs); Auckland Regional Plan: Coastal; Coastal Compartment Management Plans (non-statutory) and the Hauraki Gulf Forum.

**What can you do?**

- Most things you do on land to help the environment will help the marine environment, too.
- Only water should go down stormwater drains because they lead directly to the sea untreated.
- Good land management like riparian (stream bank) planting and fencing streams can help reduce the amount of sediment and nutrients entering the marine environment.
- Coastal plantings can help protect the shoreline from erosion and filter out contaminants.
- Join a beach care group or start a shellfish monitoring programme with your community.
- Report water pollution to the 24-hour Pollution Hotline on 09 377 3107.
- Pick up litter you see on the beach or in the water.



# Terrestrial biodiversity

Biodiversity is commonly defined as the variety of life. The Auckland region, like the rest of New Zealand, is a terrestrial biodiversity hot spot due to the variety of forest, shrubland, wetlands, dune ecosystems and their associated species.

It is widely understood that native biodiversity in the Auckland region is under threat from:

- the continued loss and fragmentation of native land cover, including ecosystem types with less than 10 per cent of habitat remaining
- the continued impact and increasing threat of invasive species and diseases
- overharvesting
- pollution
- climate change.

It is also increasingly clear that adverse impacts from one threat can be exacerbated by others. For example, habitat fragmentation combined with the effects of invasive species can degrade the health of small ecosystems.

## What is measured?

A number of monitoring programmes assess the condition of terrestrial biodiversity, identify the main issues, and determine the effectiveness of conservation management.

We have developed a more comprehensive and integrated monitoring programme to better enable us to assess the state of the environment and measure the efficiency and effectiveness of our policy and management initiatives.

We use the Land Cover Database to look at the changes to land cover (and hence habitats), we measure the fragmentation of existing areas, evaluate the health of High Conservation Value sites, and assess the vulnerability of threatened species and the extent and impact of pest flora and fauna.

## Results

- Before human settlement, 93 per cent of Auckland was native forest; this is now 27 per cent. This has caused a decline in biodiversity and an increase in the number of threatened ecosystems and species. Some ecosystems in Auckland are critically depleted, covering less than 10 per cent of their original extent. These are kauri forests (9 per cent), freshwater wetlands (4 per cent), coastal forests (3 per cent) and mainland lava forests (0.5 per cent). This decline has occurred because of human settlement and the associated loss and fragmentation of native land cover and habitats.

### Fragments and edges

Habitat fragmentation impacts native biodiversity because it reduces the size of the habitat, increases the degree of isolation, and increases the amount of edge habitat.

- Table 8 shows that the average habitat fragment size in the Auckland region is only 21ha compared with a national average of 110ha. Also, the proportion of edge habitat in the Auckland region is relatively high at 1.30km per km<sup>2</sup> compared with the national average of 0.81km per km<sup>2</sup>. Auckland and Northland are similar in terms of forest fragment size and proportion of edge habitat, but Waikato generally has larger forest fragments and a smaller proportion of edge habitat.

**Tab.8** Native forest and fragmentation across the country and region (Source: MfE and modified from Ewers, 2006).

Area	District size (ha)	Forest Fragments (ha)	Average fragment size (ha) (hectares)	Proportion of edge habitat (km per km <sup>2</sup> )
New Zealand	26,426,398	57,231	110	0.81
North Island	11,401,890	41,927	61	0.93
Auckland region	591,161	2264	21	1.10
Waikato	2,500,000	8207	196	0.83

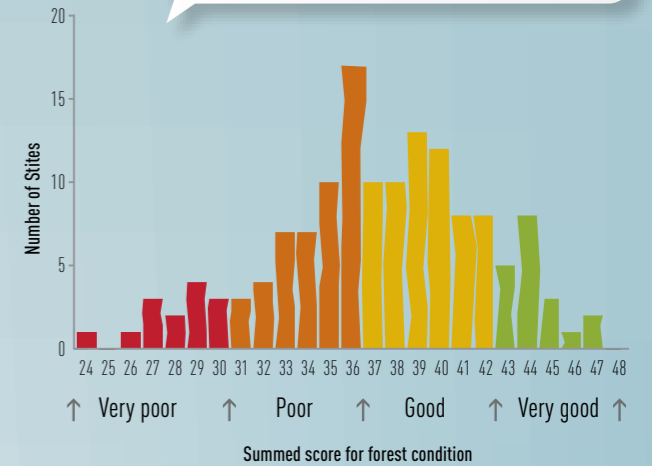
\*The Hauraki Gulf Islands are excluded from the Auckland analyses.

- Between 2004 and 2009 the condition of the forest at 202 High Conservation Value (HCV) forest sites was assessed to better understand the condition of remaining ecologically significant habitats (see Figure 19). Despite the level of habitat fragmentation, many HCV sites were in very good (13 per cent) or good (43 per cent) condition, although 34 per cent were in poor or very poor (10 per cent) condition.

Two HCV sites were lost because the vegetation had been cleared completely. A large proportion of HCV sites suffered from weeds at the forest edge and poor regeneration of native plants and understorey browsing by mammals. More positively, weeds in the forest interiors and possum damage were not a major issue, which presumably reflects the scale and effectiveness of possum control operations across the Auckland region. Although ungulates (pigs, goats, deer and livestock) were not as widely distributed as possums, where they did occur their impacts were often significant.

# Terrestrial biodiversity

**Fig.19** Summed scores for forest condition for HCV sites in the Auckland region, 2004-09 (Source: ARC)



- The Auckland region harbours 20 per cent of New Zealand's nationally threatened terrestrial vertebrates. This includes both species of native bat, 36 birds, 10 reptiles and one frog. Several of these threatened species are probably found nowhere else (e.g., black petrel, New Zealand storm petrel, and chevron skink).
- The region also has 169 species of plants that are classified as nationally threatened, including 35 now considered regionally extinct and seven that are found only in the Auckland region.
- Anecdotal evidence suggests that a number of threatened species, such as the Auckland green gecko and pingao continue to decline. However, a lack of information makes it difficult to ascertain species-specific or general trends.



# Terrestrial biodiversity

## Terrestrial pests

Invasive animals, plants and other organisms have played a major role in the decline of native biodiversity. Species become invasive when they spread rapidly and adversely impact their new environment. They pose an ongoing threat to native terrestrial biodiversity because they may compete with or prey on native plants and animals.

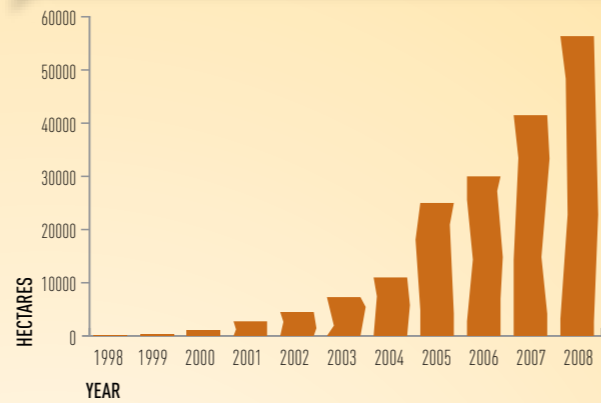
**Pest mammals** have had a profound effect on the natural environment. Native vegetation has been significantly altered by introduced mammalian herbivores and omnivores, such as pigs, deer, goats, possums, wallabies, rabbits and rodents, which have radically changed the structure and composition of native forest ecosystems. Possums, cats, mustelids, rodents, dogs and hedgehogs also threaten native biodiversity through predation. Some introduced reptiles, birds, and invertebrates (e.g. rainbow skink, common myna, Argentine ant and German and common wasps), are also known to have adverse impacts on native terrestrial ecosystems.

**Pest plant species** can also alter the structure, function and biodiversity of native ecosystems and have been implicated in the decline of a number of threatened plants. For example, shade tolerant species, such as tradescantia and wild ginger can transform the forest ground cover, suppressing and altering native seedling regeneration. On mainland dunes, marram and kikuyu grass have contributed to the local extinction of shore spurge in the Auckland region.

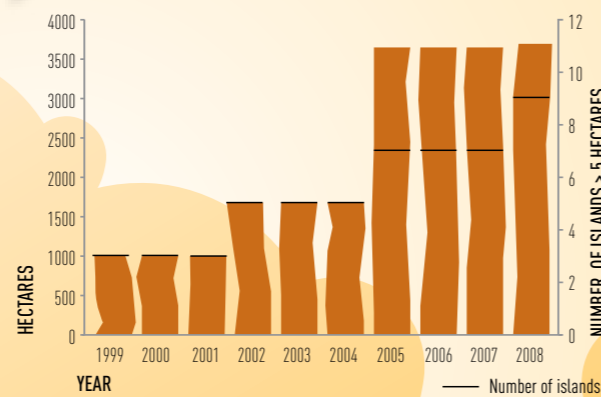
## What these results mean now

The main threats to terrestrial biodiversity in the Auckland region are alterations to habitats and pests. Overharvesting of native areas and pollution are also problems in certain places. Auckland is now a hot spot for threatened ecosystems, given it is home to such a wide variety of threatened plant and animal species. This means good management, including community involvement, is needed to help these species and ecosystems stay healthy. Fortunately there are still large areas supporting these species, including the Manukau and Kaipara harbours, Waitakere and Hunua ranges and protected offshore islands.

**Fig.20** Amount of hectares in the region under pest control by community groups, 1998 – 2008. (Source: ARC)



**Fig.21** Total area and number of islands free of mammalian pests in the Auckland region. (Source: ARC)

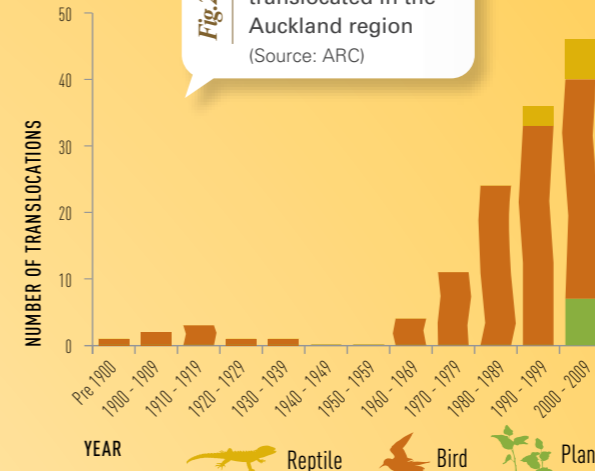


## Auckland's least wanted! pests

Rats, pigs, deer, goats, possums, wallabies, rabbits, rodents, cats, mustelids (e.g. stoats), dogs, hedgehogs, wasps, Argentine ants and rainbow skins.



**Fig.22** Numbers of species translocated in the Auckland region (Source: ARC)



## Future trends for life on land

The impact of ongoing habitat loss, fragmentation and invasive species will mean losses of native habitats and species will continue. Efforts by individuals, communities and the Department of Conservation will help, as will the use of regional parks as conservation and recovery areas. Good management is the key to reducing future losses.

## What the ARC is doing to improve Auckland's terrestrial biodiversity

Between the regional parks and legal protection of land by landowners, community groups and local councils, over half of land in native cover in the region is protected. The ARC monitors and helps tend these protected areas as well as offering advice and support.

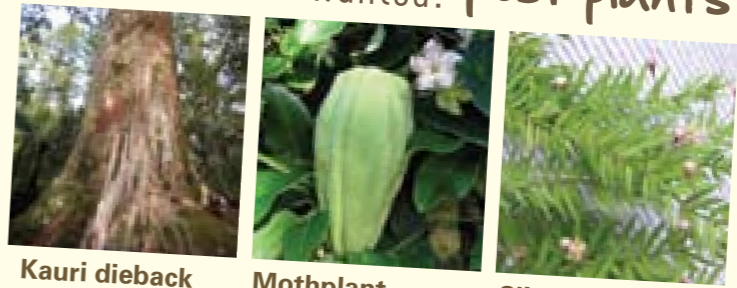
Auckland's regional parks offer protection to native biodiversity and threatened species, and the ARC continues to expand the region's park network. Community groups and land owners do a lot of work to protect and restore native biodiversity – between 1998 and 2008, the area under pest and weed management by private landowners and community groups increased from 100ha to 58,000ha (see Figure 20). The work these volunteers do is valuable to the region, and the ARC offers them advice and funding through the Environmental Initiatives Fund and the Biosecurity Community Pest Control Programme.

## What can you do:

Like all living creatures, native plants and animals depend on food, shelter and a safe place to reproduce. By looking after natural areas, and planting new ones, native species that live in the region are given a better chance of survival.

- Several groups help care for native areas, doing hands-on work such as streamside and wetland plantings in rural areas, regional parks, and even some urban areas. See ARC website for a list or contact Forest and Bird, DoC or other agencies involved in caring for native areas.
- Keeping weeds and pests out of native areas helps them survive. Lists of invasive weeds and animals and advice on their control are available on ARC's website.
- The only mammals that should roam freely in native areas are native bats. Possums, pigs, deer, goats, cats, stoats, rats, hedgehogs, rabbits and uncontrolled pets and livestock are bad news for native plants and animals.
- Enjoy Auckland's beautiful regional parks and show children the valuable native plants and animals surviving there so they can appreciate how precious they are.

## Auckland's least wanted! pest plants



Kauri dieback Mothplant Climbing asparagus



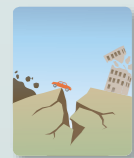
The ARC also undertakes intensive control and eradication of pest plants and animals on the regional parks and uses powers under the Biosecurity Act (1993) to control pests and weeds. Between 2004 and 2007, 42,803 hectares of high conservation value land received possum control. Since 1999, several offshore islands have been declared free of pest mammals (see Figure 21). This work continues – pest mammals are being removed from the 530 hectares Kaikoura Island (adjacent to Great Barrier Island) and Rangitoto and Motutapu Islands (3800ha). Pest-free sites are havens for threatened native plants and animals. Over the last decade many additional species have been translocated (reintroduced to areas) to help ensure their survival (see Figure 22).

The ARC uses the following to help protect terrestrial biodiversity: Auckland Regional Policy Statement; Regional Parks Management Plan; Auckland Regional Pest Management Strategy; Waitakere Ranges Heritage Area; Hauraki Gulf Forum.

The region is exposed to a range of geological, climatic and coastal hazards, some severe. At any time Aucklanders could experience a natural hazard that could cause injury or property damage, as well as job losses or economic disruption. By being prepared personally and at a community level we can mitigate the impacts of a natural hazard.

The ARC works with other organisations to monitor natural hazards in the region. Geological hazards are monitored through the Auckland Volcanic Seismic Network (AVSN) administered by GNS Science. The ARC monitors climatic and coastal hazards along with the NIWA. Monitoring information is supplemented by universities and consultants undertaking natural hazards research, often in collaboration with ARC and other councils.

## Geological hazards



Earthquakes, volcanic eruptions and landslides (when triggered by earthquakes) are all the Auckland region's geological hazards. They are rare, but when they do occur, they can threaten life, buildings and infrastructure, and cause major regional and national economic disruption.

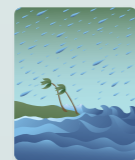
**Earthquake:** 27 earthquakes above Richter Scale (M) 2 were detected in the Auckland region between 2004 and 2008. That's small in comparison to other regions such as Wellington that are closer to the Indo-Australian and Pacific plate subduction zone. However, on 21 February 2007 a M 4.5 earthquake centred off Orewa caused approximately \$1.5 million of property damage. This was a reminder of the region's vulnerability to stronger earthquakes which could be centered along one of three major fault lines south of the urban area.

**Volcanic eruption:** Most of the Auckland urban area is located on the Auckland Volcanic Field (AVF) where 49 volcanoes have erupted in the last 200,000 years. The largest and most recent eruption formed Rangitoto Island about 600 years ago.

AVF eruptions are unpredictable, with each new event likely to occur at a new location. A Rangitoto Island-sized eruption located in the urban area would cause a mass evacuation and considerable economic and social disruption.

Falling ash from eruptions in the Taupo Volcanic Zone and Mt Taranaki could impact people's health and degrade the region's built environment. Models suggest even a small ash fall dispersed across the region could cause about \$140 million of non-structural damage to residential buildings alone.

## Climatic hazards



Cyclones, floods, droughts, tornados and landslides (triggered by rainfall) are climatic hazards that the Auckland region is exposed to. They occur frequently and can be severely damaging and disruptive to the people and communities affected.

**Cyclone:** No cyclones reached the region between 2004 and 2008. Cyclones are more likely to occur during La Niña climate conditions when north-easterly storms are more common and create a number of hazards (wind, flooding, landslides, coastal erosion and coastal flooding) across a large area.

**Flood:** Storm events in 2007 and 2008 caused localised surface flooding across the Auckland region. No deaths were recorded though flood insurance claims for minor damage totalled about \$2 million.

**Drought:** This is the most underrated natural hazard experienced in the region due to its slow and unspectacular onset. Recent droughts impacted the rural areas of Waitangi and Waimauku in early 2003 lasting 135 days and 123 days respectively. The impacts of droughts are greatest on communities reliant on water for agriculture and horticulture.

**Tornado:** Seven tornadoes have made landfall since 2004 causing localised damage to approximately 40 homes.

**Landslide:** The Auckland region experienced hundreds of landslides during the winter of 2008 which cost Auckland residents millions of dollars in damage to property, remedial works, clean up and lost economic productivity. The greatest costs were sustained in urban areas where a number of deep-seated landslides led to the evacuation of 50 people from 21 houses on the North Shore and in Waitakere City. A large deep-seated landslide cut off the Clevedon-Kawakawa Bay road isolating 1,500 rural residents for 4 weeks until it was stabilised at an overall cost of over \$5 million (see picture). The winter of 2008 demonstrated how a number of localised hazards can amount to significant region-wide consequences.

## Coastal hazards



Beach and cliff erosion, coastal flooding and tsunami are the coastal hazards that the region is exposed to. Erosion occurs naturally along the region's coastlines and can become hazardous to coastal developments. Low-lying coastal land meanwhile, is vulnerable to flooding and tsunamis, particularly on the east coast which faces north-easterly storm tracks and tsunami source areas in the Pacific Ocean.

**Beach erosion:** The region's beaches have been relatively stable since 2004, despite short-term fluctuations in sand volume and beach width.

**Cliff erosion:** This hazard was highly publicised in 2003 and 2008 when east coast coastal landslides caused property evacuation and millions of dollars worth of property loss and damage. East coast cliffs experience regular landslides that will cause future loss and/or damage to cliff top properties.

**Coastal flooding:** Recent flooding incidents have been minor though models suggest low-lying coastlines in Rodney district and North Shore City could experience between 3 and 6 metres of flooding above mean sea level during what is known as a '1 in 100 year event'.

**Tsunami:** Following large earthquakes off Indonesia in 2004 and Solomon Islands in 2007, small tsunami waves of less than 0.35 metres were detected in the region. The region's geological record suggests the east coast has been hit by tsunamis with wave run-ups of over 5 metres above mean sea level in the last 2,600 years. East coast communities are most at risk as dense urban development is exposed to Pacific Ocean tsunami source areas.



The stabilisation of Turei Hill in Kawakawa Bay in 2008 cost over \$5 million.

## Implications

Natural hazards in the region can have major implications for human life and communities. For this reason the ARC has a legislative responsibility to lead the coordination of natural hazard management across the region. The goal is to avoid or mitigate the effects of natural hazards.

## Preparing ourselves

Many of us are unaware of our vulnerability to natural hazards. We are not well prepared for a significant event. A 2008 survey showed that Aucklanders are less prepared than those in other regions in New Zealand, with 59 per cent saying they are not well prepared or not at all prepared. Ensuring people are prepared for natural hazards is a crucial step towards reducing potential social and economic impacts.

Check out the Civil Defence website [www.getthru.govt.nz](http://www.getthru.govt.nz) to find out what you need to do be prepared.

The amount of advance preparation and disaster planning done by Auckland businesses is not currently known. Businesses should ensure they can withstand direct and indirect impacts from natural hazards by preparing alternative methods to maintain commercial activities during and after an event. Insurance also plays an important role in being prepared for natural hazards.