

# Section 3:

## Restoration of ecosystems

### Ecological restoration priorities and opportunities in the Waikato region

The restoration priorities for the region are to protect, enhance and restore a representative range of biodiversity across the region to a level in which they are self sustaining, for instance:

- establish mountains to the sea corridors of both terrestrial and aquatic ecosystems
- reconnect fragmented ecosystems (on land and via waterways)
- return species that have been lost from the area such as kiwi
- buffer the edges of wetlands, rivers, lakes, geothermal areas, springs, coastal cliffs, dunelands, estuaries, and fragmented forest
- establish pest-free areas on islands and on the mainland to act as refuges and nurseries for native species
- reconstruct ecosystems currently removed from or now rare in the region.

### What is an ecosystem?

The focus of this document is the restoration of ecosystems. Ecosystems are communities of living things (animals, plants, fungi, bacteria and other micro-organisms) that interact with each other and their physical environment (soil, rock, minerals, air, water, temperature, salinity).

The roles of the animals and plants, and their abundance, are inseparably bound up with the numbers of other organisms and the amounts of materials available, and with the kinds of physical forces acting at any time. There are ceaseless exchanges of materials, and of energy between living things and their environment, following cyclic pathways which are perpetually repeated, for example the carbon and nitrogen cycles. These cycling systems are characteristic of ecological systems or ecosystems for short.

The system cannot continue functioning without a constant input of energy from the outside. Energy is input mainly in the form of light and almost all forms of life obtain their

high-energy organic nutrients either directly or indirectly from plant photosynthesis. Just as the human body relies on the circulation of blood and oxygen and the conversion of food to energy, an 'ecosystem' relies on the circulation or transfer of water, gases (such as oxygen, carbon dioxide), nutrients (such as nitrogen, phosphorus) and energy (sunlight, heat, food). However, ecosystems are even more complex than the human body and to restore or manage them requires good knowledge of their characteristics and processes.

Natural ecosystems are *dynamic*. They are constantly changing within their inherent range of natural variability as a result of internal and external processes such as:

- plant and animal population processes like mating, birth, growth, maturation, death and decay
- changes in plant or animal population size through birth, death, immigration, and emigration
- loss and gain of species through extinction (local or global) and evolution or emigration
- catastrophes such as volcanic activity, fire, landslide, earthquakes or disease epidemics
- gradual or rapid change in species make-up over time as the environment changes (succession, see box).

### Succession

Many ecosystems typically change in composition and structure from one form to another. This is called "succession". An example is the development of scrub into forest, or the infilling of shallow lakes with sediment to form a swamp.

Often human activities alter the rate of succession, for instance clearance of hillside vegetation may speed up the rate of infilling of swamps or repeated burning may stall or prevent the return of forest. Understanding succession can also help us to restore ecosystems on land, for instance, if we plant appropriate scrub species, over time this will develop into forest if there is a nearby seed source.

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### What is a healthy ecosystem?

A healthy ecosystem has the following features (see box):

- a typical *structure* (e.g. height, density, layers, zonation patterns), and
- a typical *composition* (mix) of species occurring in a relatively predictable proportion or abundance.

A healthy ecosystem also *functions* (works) correctly, for instance:

- **the water, food, and gas cycles are working 'normally'**  
e.g. a wetland is receiving sufficient water to support the species there, a peat bog is storing carbon in accumulating peat
- **animals can move between them**  
e.g. there are no unnatural barriers to stop fish moving between the headwaters and the sea
- **plants are able to regenerate**  
e.g. there are birds, lizards, bats, or insects around to pollinate the flowers (their flowers, fruit and seed is not all getting eaten by possums and rats)
- **native animals are able to reproduce**  
e.g. there are enough mature animals of both sexes for each to find a mate, they have enough food at the right time of year to breed, their eggs and chicks are not all eaten by pests
- **species food chains and relationships are intact**  
e.g. snappers are preying on kina, lizards are pollinating rata, bitterns are dispersing sedge seeds
- **the system has the ability to withstand or recover from stress or damage**  
e.g. periodic drought, storms, or localised fires.

Ecosystem functions can be disrupted by things like:

- removal of habitat (such as clearance of vegetation, draining wetlands)
- removal of species (such as over-harvesting certain species of fish)
- grazing on plants by stock or animal pests or degradation of habitat
- predation of native animals by introduced pests
- barriers to migration (such as dams and culverts in waterways, cleared areas between forest)
- introduction of pollutants such as sediment, excess nutrients, or toxic substances
- introduced plant and animal species.

### What is ecosystem structure and composition?

A healthy lowland forest ecosystem, for instance, will have the typical forest structure, which means it will have a canopy, a few tall emergent trees, a dense shrub and treefern layer, and a dense ground cover. If the ground cover has been trampled and all been eaten out by stock, then the structure is not typical of lowland forest, and the forest is not healthy.

If the lowland forest is healthy, the plants will comprise native species, eg. mostly tawa and rimu trees with other tree species such as mangleo, northern rata, and rewarewa in the canopy, and shrubs such as kawakawa in the understorey, and a ground cover of ferns such as hen and chicken fern. It will also typically contain animal species such as tui, grey warbler, insects, and bats and animals and micro-organisms that are needed to pollinate plants, decompose dead material and perform other functions. In a healthy forest you won't find many non-native species, or native species that don't typically occur in that type of ecosystem.

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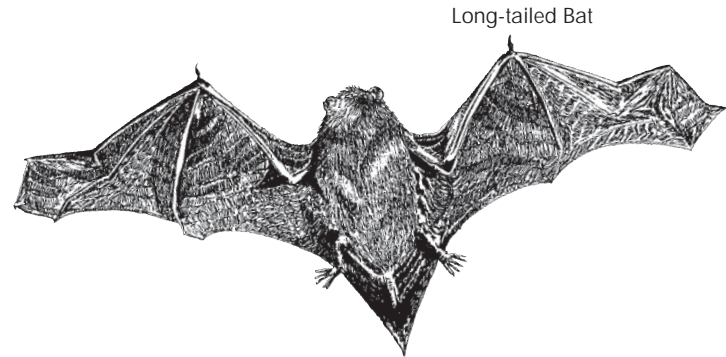
Ecosystem *integrity* is the degree to which an ecosystem has its typical structure and composition, is dominated by native species, and functions well. Ecosystem *viability* is the ability of the ecosystem to maintain itself into the future, in other words, the likelihood that it will still be there in reasonably good condition for our children and grandchildren to enjoy. An ecosystem might be currently of typical structure, composition and functioning, but it might not be viable. For instance, a peat bog may remain healthy for some time after its water table has been lowered by drainage, but without a permanently high water table it will eventually dry out and degrade.

### What is restoration?

*"Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed."*

To restore biodiversity in the Waikato region we need to do three things:

1. **Retain the ecosystems we still have** - stop further loss through clearance, drainage, etc.
2. **Restore degraded ecosystems** - get rid of pests, stop pollution, harvest plants and animals sustainably, replant or return species that have been lost from the ecosystem, reinstate key natural processes, such as shade over small streams.
3. **Reconstruct lost ecosystems** - start from scratch to rebuild natural areas.



Long-tailed Bat

Ecological restoration is any activity that kicks off or speeds up the recovery of ecosystem health, integrity and viability. Frequently, an ecosystem that requires restoration has been degraded, damaged, transformed or entirely destroyed through direct or indirect human activities such as forest clearance or wetland drainage.

In its broad sense, ecological restoration covers the full spectrum of repair and enhancement of ecosystems but it can be useful to distinguish different types of "restoration". Restoration in a strict sense is a process of repairing the composition, structure, function and dynamics of pre-existing ecosystems. Just as someone tries to undertake an authentic restoration of a classic car or an old house, the target is an original condition, however the "spare parts" may not always be available.

Ecological restoration has been defined as 'the return of an ecosystem to a close approximation of its condition prior to disturbance'. However, it is not always possible to achieve this because we don't always know what the original condition was, some of the original species have become extinct or because of potentially enormous costs involved. The potential to restore ecosystems varies over space and time and is dictated by the degree of degradation and the practicality of repairing that degradation.



Tui  
Image courtesy of Paul Schilov

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However, ecosystem restoration is much more than this because we are trying to ensure that the restored ecosystems are not static museum type examples, but that they can continue to change and the species they support are able to continue to evolve at the same rates as before. Many of the current community led projects in the Waikato region are restorations in the strict sense because they are attempting to return ecosystems to as close as possible to their original condition. Restoration can also incorporate rehabilitation of existing ecosystems or total reconstruction of lost ecosystems.



Green gecko  
Image courtesy of Neil B Fitzgerald

### What is rehabilitation?

Rehabilitation is like fixing up an old house without trying to stay true to its original state. Rehabilitation involves enhancing the ecological functioning of the system on a recovery pathway toward an improved target condition. The recovery pathway in rehabilitation will be on a similar trend to that of restoration but with a different end point that is likely to feature an altered species composition. For example, many riparian plantings on streams and rivers in the Waikato are undertaken to reduce nutrient inputs and improve water quality but the species composition may be different to the original composition.

### What is reconstruction?

Reconstruction is like building a new house after the original one has been removed or destroyed. Reconstruction involves recreating ecosystems from scratch by assembling the plant and animal components of the system using a target "original" composition and structure but recognising the goal of establishing dynamic, functioning systems. For example, converting exotic pasture back to ecosystems comprising indigenous plant and animal communities similar to those that originally occurred there. This might be through planting a nurse crop of hardy shrubs, with later planting of tree species to encourage the return of wildlife. This document focuses on restoring existing ecosystems. For more on ecosystem reconstruction see the hot tips boxes in the ecosystem description pages.

### The principles of restoration

The overall objective of our document is to help communities to achieve their goals of improving biodiversity in the region by restoring and reconstructing ecosystems across the region. Ecosystems are dependent on one another and do not exist in isolation, so restoration activities undertaken in one part of our region have the potential to influence, interact with, connect to or buffer those being undertaken elsewhere. Every small bit that you do contributes to a much greater whole. We want to encourage and assist the restoration of the whole of the Waikato region, regardless of whether the land and water is publicly or privately owned.

When undertaking restoration it is important to thoroughly investigate your proposed site, to understand what biodiversity resources you have and what problems you need to address. You need to know the types of ecosystems that were formerly present, their likely composition and whether the fundamental ecological processes are still operating and what potential there is to restore indigenous biodiversity. It is highly desirable that this understanding leads to the development of a restoration plan. Information on how to go about restoration and production of restoration plans can be found on the International Society for Ecological Restoration's website: [www.ser.org/content/ecological\\_restoration\\_wprimer.asp](http://www.ser.org/content/ecological_restoration_wprimer.asp)

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### Nine key principles of restoration

A core set of key principles that ensure successful restoration is explained below.

1. Identify the key processes leading to degradation or decline	→ e.g. are stock browsing the understorey, is the wetland drying out?
2. Develop methods to reverse or lessen the degradation or decline	→ e.g. fence stock out, reinstate the water table.
3. Determine realistic restoration goals, and understand timeframes for achieving success by recognising there may be ecological and economic limits or social barriers to your plans	→ e.g. ensure the actions identified in 1 and 2 above are realistic and that the community shares your goals for restoration.
4. Start small with achievable and measurable targets before attempting large-scale restoration	→ e.g. reduce possum numbers over five hectares to two per cent residual trap catch within three years.
5. Develop easily observable measures of success	→ e.g. increased understorey plant density, or flowering success of key species.
6. Develop practical techniques for implementing these restoration goals at a scale relevant to the problem	→ e.g. controlling weeds in the catchment rather than in individual sites.
7. Keep good records and tell others about successful techniques so that they can be used more widely	→ e.g. record the dates and numbers of trees planted, the spray and concentration used, assess survival or levels of control achieved.
8. Monitor important ecosystem trends and assess progress against the project goals	→ e.g. forest canopy health and regeneration trends.
9. Modify or change procedures depending on the rate and degree of success	→ e.g. change the pest bait, timing to improve rates of pest control, trial different tree species or check on planting technique if planting success has been poor.

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Laying tracking tunnels to monitor animal pests  
Image courtesy of Tongariro Natural History Society

### Monitoring

Monitoring of the restoration site is very important so that success can be tracked. This can be quite an important motivator for you as you can see the benefit of your work and be encouraged by your successes. It is important to monitor and show other people and organisations what changes have occurred as a result of your work. These people could include organisations that fund your project.

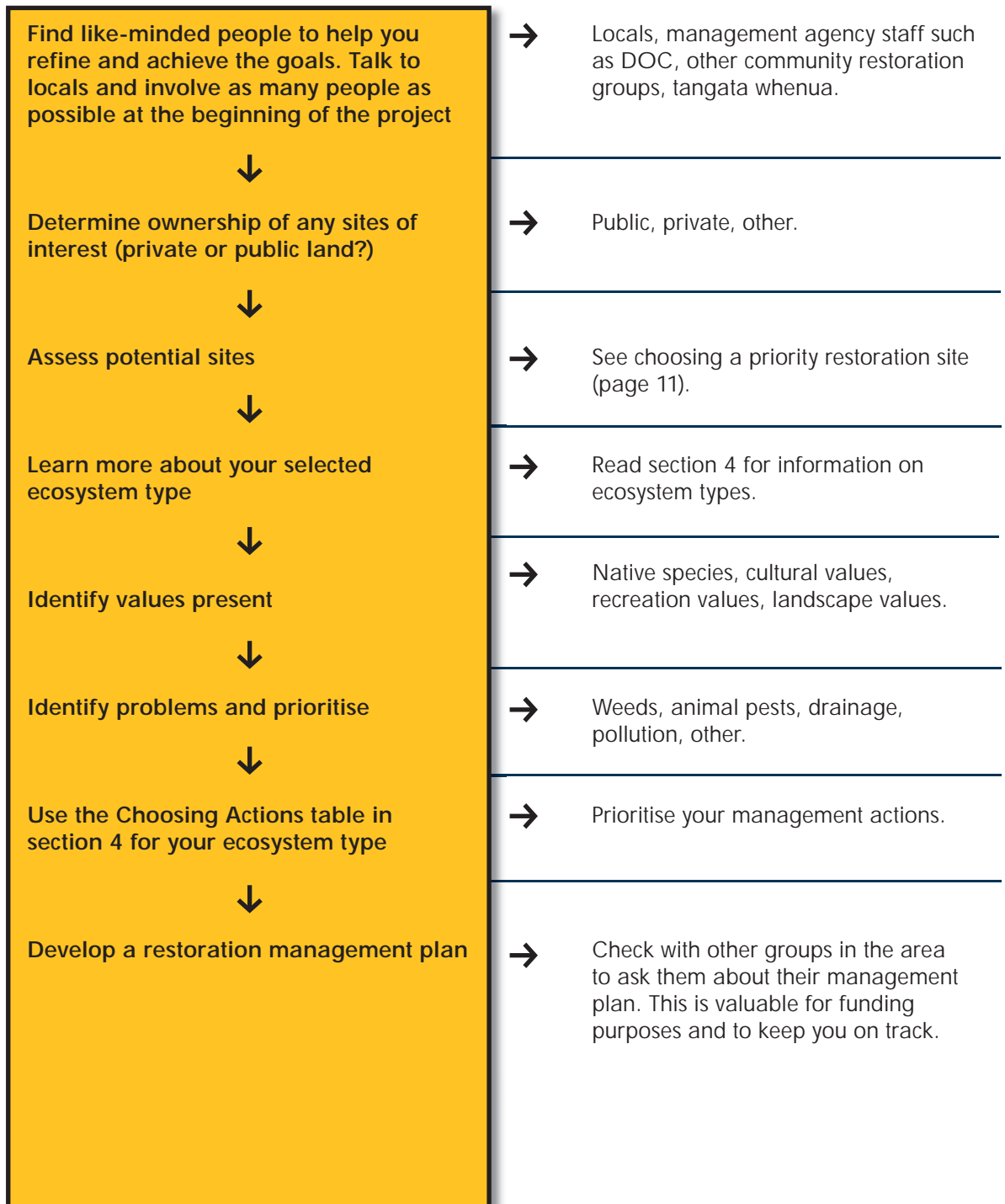
Photographs are a great way of showing the results over time of your activities. Keep written records of, for example, the reduction in possum and rat numbers in the restoration area after poisoning operations, the changes to understorey and forest floor once stock are removed or the increase in bird numbers at the site when canopy and understorey vegetation has recovered. The monitoring may vary from twice a year to annually or every two years depending on the type of work being carried out.

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### Practical considerations of restoration

Keeping the key principles in mind, there are also some basic practical considerations that should be addressed at the outset of a restoration project. See Appendix 3 for resources to help with restoration.



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## Organisational roles in ecological restoration

There are many groups and agencies who can help you plan your restoration project. See Appendix 4 for agency contact details.

### Community groups, hapu groups

- Provide support and advice to other community groups.

### Iwi

- Provide support to hapu groups undertaking restoration.
- Prepare environmental plans to give guidance for iwi in biodiversity protection.
- Collaborate and coordinate with community restoration groups.

### District councils

- May provide funding for community group restoration projects.
- Include criteria for identifying significant areas and prepare schedules of significant sites.
- Include rules in district plans to reduce biodiversity loss.
- May prepare a biodiversity strategy specific for district.
- Provide non-regulatory mechanisms for biodiversity protection in district plans such as education and advice, rates relief, covenants.
- Provide information on council owned and managed land, such as riparian areas and esplanade reserves.

### Regional councils

- Provide funding to community groups for restoration projects.
- Provide technical information and assistance to community groups.
- Motivate community groups to become involved in ecological restoration.

### Department of Conservation

- Provides technical information and assistance to groups.
- Provides funding to community groups for restoration projects.
- Motivates community groups to become involved in ecological restoration.

### Crown Research Institutes

- Provide technical information on ecological restoration.
- Provide research into biodiversity and ecological restoration.

### University of Waikato

- Provides technical information and courses on ecological restoration.
- Researches ecological restoration.
- Provides students to assist with restoration projects and monitoring.

### Non-governmental organisations (NGOs)

- Provide funding to community groups for restoration projects.
- Provide technical information and assistance to community groups.
- Motivate community groups to become involved in ecological restoration.
- Lobby government to provide biodiversity funding to carry out ecological restoration work.



Image courtesy of the Department of Conservation

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*Hebe scopulorum*  
Image courtesy of Bruce Clarkson

### Conclusion

The Waikato Biodiversity Forum hopes that this document will be widely used by management agencies and community groups, helping them focus on maintaining and enhancing native biodiversity in the Waikato region.

We hope it will provide an overall context for restoration and protection projects already underway, and for new projects being planned for the future.

It is also intended that this document informs community groups and management agencies' decisions when prioritising activities.

Finally, the document gives an outline of the many actions that can be taken to improve biodiversity in eight major ecosystem types in the Waikato region. If we all work together to restore the ecosystems in our local areas, it will be possible to achieve a regional restoration of our precious indigenous natural heritage.